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Introduction to ElectricFlow

ElectricFlow™ is an enterprise-grade DevOps Release Automation platform that simplifies provisioning, build and release of multi-tiered applications. Our model-driven approach to managing environments and applications allows teams to coordinate multiple pipelines and releases across hybrid infrastructure in an efficient, predictable and auditable way.

Web-Based System

At its core, ElectricFlow automation platform is a web-based system for automating and managing the build, test, deployment, and release process. It provides a scalable solution, solving some of the biggest challenges of managing these "back end" software development tasks, including these challenges:

- Time wasted on script-intensive, manual, home-grown systems that
  - Are error prone
  - Do not scale well
  - Have little or no management visibility or reporting
- Multiple, disconnected build and test systems across locations, resulting in:
  - Redundant work
  - Inability to share or reuse code files across teams
  - Hard to manage build and test data
- Slow overall build and release cycles that directly impact:
Early Warning System

- Release predictability
- Time-to-market

**Automation Platform**

The automation platform has a three-tier architecture, AJAX-powered web interface, and first-of-its-kind build and release analytic capabilities for reporting and compliance. With this solution, your developers, release engineers, build managers, QA teams, and managers gain:

- Shared platform for disseminating best practices and reusing common procedures
- Ability to support geographically distributed teams
- Continuous integration and greater agility
- Faster throughput and more efficient hardware utilization
- Visibility and reporting for better project predictability
- Better software quality by integrating and validating against all target platforms and configurations

For examples of ElectricFlow architecture configurations, see [ElectricFlow Architecture](#) on page 37.

**What Makes ElectricFlow Unique?**

ElectricFlow provides enterprise-class speed and scalability for software build and release management. It is easy to install and use on a simple build, yet scales to support the largest and most complex build and test processes. ElectricFlow distributes jobs in parallel across multiple resources for faster overall cycle time.

ElectricFlow supports multiple teams, working in multiple locations, programming in multiple languages in an environment that can be centrally controlled and managed. Shared assets and reuse make individual teams more efficient by eliminating duplicate work, and gives organizations the power to deploy cross-company standards.

ElectricFlow's unique analytics provide visibility into one of the best indicators of project success: compiled, tested, working code. ElectricFlow's analytics database stores all build and test information for real-time and trend reporting giving your organization the power to collect pinpoint statistics and to gain visibility into important productivity metrics such as trends in error rates. Additionally, out-of-the-box reports provide information about cross-project status and build trends by project and resource utilization. ElectricFlow's integration with virtual lab automation (VLA) solutions also allows you to snapshot or reproduce a specific build for auditing or troubleshooting purposes.

ElectricFlow provides unified process automation across the entire build-test-deploy life cycle and across heterogeneous tools via integrations with leading ALM tools. Integrations with SCM tools enable continuous integration, triggering builds whenever code is checked into the specified repository/branch. When used with VMware Lab Manager, ElectricFlow can dynamically provision either physical or virtual resources without manual intervention. This feature delivers efficient, dynamic resource provisioning and reduces development and QA dependence on IT operations.
ElectricFlow Architecture

ElectricFlow was designed to support small, mid-range, or enterprise scale software production. Based on a three-tier architecture, ElectricFlow scales to handle complex environments. The ElectricFlow multi-threaded Java server provides efficient synchronization even under high job volume.

- The ElectricFlow server manages resources, issues commands, and generates reports.
- An underlying database stores commands, metadata, and log files.
- Agents execute commands, monitor status, and collect results in parallel across a cluster of servers for rapid throughput.

Simple Architectural Overview

This local configuration applies to all the use cases. The ElectricFlow server, web server, artifact cache, Artifact Repository server, workspace, command-line tools, resources, agents, and job steps are all in the automation platform.

In this local configuration:

- The ElectricFlow server manages resources, issues commands, and generates reports.
- Resources, agents, and databases are managed in the automation platform.
- An underlying database stores commands, metadata, and log files.
- Procedures, which include job steps, are defined in the automation platform.
- Job steps are executed on resources in the defined environments.
- Applications (which include procedures), components, and environments are defined for deployment automation.
- Pipelines, stages, and tasks are defined for pipeline management.
If you are only evaluating ElectricFlow, the ElectricFlow software, the database, the ElectricFlow server, the web server, and the repository server can reside on the same machine.

In a production environment, the database should reside on a separate machine from the ElectricFlow server to prevent performance issues. It is acceptable for the ElectricFlow server, web server, and repository server to reside on the same machine in a local configuration, but not required.

**Expanded Remote Configuration**

ElectricFlow is not limited by only the components shown in the previous configuration. This configuration applies to all the use cases.

The following shows a remote web server configuration and is an example for how you may set up a remote web server installation.
This type of remote web server configuration helps prevent network latency. If you have multiple sites, ElectricFlow can be configured to help you work more efficiently.

**Other Configurations**

Go to the ElectricFlow Installation Guide (http://docs.electric-cloud.com/eflow_doc/FlowIndex.html) for other architecture configurations:

- Proxy (universal) resources
- Remote database
- Multiple remote web servers
- Multiple remote repository servers
- Clustered configuration for horizontal scalability and high availability

**Roadmap to ElectricFlow**

Depending on what you want to do, go to the appropriate section.
<table>
<thead>
<tr>
<th>Use Case</th>
<th>Definition</th>
<th>Go to</th>
</tr>
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<tr>
<td>Build-test automation</td>
<td>Executing automated build and test processes, resulting in reduced costs, increase quality, reliability and traceability, and accelerated time to market. Build-test automation is a key enabler of continuous integration (CI).</td>
<td>Automation Platform on page 497</td>
</tr>
<tr>
<td>Deployment automation</td>
<td>Executing automated application deployment processes, resulting in reduced costs, increase quality, reliability and traceability, and accelerated time to market. Deployment automation is a key enabler of Application Release Automation (ARA) and continuous delivery (CD).</td>
<td>Deployment Automation on page 42</td>
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<tr>
<td>Pipelines</td>
<td>Executing automated end-to-end software development and delivery processes, resulting in reduced costs, increase quality, reliability and traceability, and accelerated time to market. Pipeline management is a key enabler of Application Release Automation (ARA) and Continuous Delivery (CD).</td>
<td>Pipelines on page 283</td>
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<tr>
<td>Release planning and management</td>
<td>The Release feature captures, executes, visualizes, and controls the life cycle of multi-application enterprise releases, where outputs from multiple teams are coordinated to produce a final release to be pushed to production. Releases allow you to execute and manage automated software release processes (including end-to-end software development and delivery processes), enabling Application Release Automation (ARA) and Continuous Delivery (CD). You can use the Release feature to deliver software releases through traditional methods and/or ARA and CD methodology. ElectricFlow manages all the releases, regardless of the release methodologies used by the release team.</td>
<td>Release Management on page 356</td>
</tr>
<tr>
<td>Automation platform</td>
<td>Where you create, configure, and manage the objects that make the build-test, deployment, and pipeline management possible.</td>
<td>Automation Platform on page 497</td>
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**Using Special Characters in ElectricFlow Object Names**

You should avoid using the following special characters when naming objects in ElectricFlow. These characters have special purposes or meanings within ElectricFlow or in the scripting language being used.

However, if any of these characters are used in object names, then your implementation must correctly escape them at runtime (meaning in context of the scripting language, such as JavaScript, Groovy, or Perl) to avoid errors or unexpected behavior.
<table>
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<tr>
<th>Character</th>
<th>Description</th>
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<tr>
<td>/</td>
<td>Used for absolute property paths in ElectricFlow. The path syntax is similar to a file system path specification.</td>
</tr>
<tr>
<td>[] or .</td>
<td>Used in JavaScript.</td>
</tr>
<tr>
<td>:</td>
<td>Might cause problems when used in job names. Some operating systems do not allow directories containing this character.</td>
</tr>
<tr>
<td>\</td>
<td>Used for escaping.</td>
</tr>
<tr>
<td>(space) or '</td>
<td>Should be enclosed in quotes when used in ectool or JavaScript. Otherwise, it should be escaped properly. Also, spaces might cause issues when used in resource pool names and should be avoided.</td>
</tr>
<tr>
<td>, or ;</td>
<td>Might cause issues when used in user names (such as in a list of approvers).</td>
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**Deployment Automation**

ElectricFlow™ DevOps automation accelerates development processes and simplifies operations. It accelerates the continuous delivery of software and makes software release processes more repeatable, visible, scalable, and efficient. It provides domain-specific capabilities to automate some or all phases of your software delivery process, including the build, test, integrate, deploy, and release processes. It gives distributed DevOps teams shared control and visibility into infrastructure, tool chains, and processes. It enables agility, availability, predictability, and security across many build-test, deployment, and release pipelines.

ElectricFlow uses a “model driven” approach to abstract the application architecture from the environment, infrastructure details so that the same application can be deployed to many environments using parameterized processes. ElectricFlow supports the creation, versioning, deployment, required middleware, and infrastructure details for a complete release package. You can model and version applications and environments to orchestrate the software release flow, and also to standardize and automate the deployment of applications between environments.

ElectricFlow Deploy makes deployments manageable, reproducible, and error-proof by modeling the application, the environments to which it will be deployed, and automating the workflow needed for the deployment. The model can be broken into these parts of your application deployment:

- **What**–You are deploying the application, which contains references to the files being deployed.
- **Where**–The application will be deployed to an ElectricFlow environment.
- **How**–You run processes that orchestrate deployment tasks to deploy the application to the environment.

<table>
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**Applications and Processes**

This section describes what you model (an application) and how you deploy it to an environment.
Applications are modeled by providing information about their components and defining the processes that orchestrate the deployment of those components. An application object in ElectricFlow consists of one or more application tiers. For example, MyApp is a three-tiered application with the Web, Application and database server (DB server) tiers.

An application tier is a logical grouping of components. Each tier contains components. A component is based on an artifact and contains a reference to that artifact. This can be through the file system or an artifact repository. The application tier also contains component processes. A component process is a set of actions to be taken on that specific component when the application is deployed. The set of steps in a component process can be defined as

- Direct commands
- Calls to ElectricFlow plugins, procedures, or utility functions
- Component operations based on the component definition
- Manual steps
Application processes are at the application (parent) level. These processes are invoked to orchestrate operations against the application. The steps in an application process can be defined as:

- Calls to component processes
- Direct commands
- Calls to an ElectricFlow plugin, procedure, or utility function
- Manual steps
- A rollback step to roll back to a previous state or to a specific snapshot

Properties and parameters allow the same application to be deployed to many environments in a repeatable, reliable, and scalable way. They are used extensively throughout ElectricFlow and can be dynamically passed to all operations, including application deployments.
- Properties provide a flexible and powerful mechanism to manage data during all operations. They can be attached to any ElectricFlow object, such as applications, processes, tiers, components, and credentials. Go to Properties on page 913 for more information.

- Parameters provide a way to get input from users at runtime to deploy the application to a variety of environments. Parameters can be attached to processes, process steps, components in the application. Go to Deployment Examples on page 130 and Parameter - create new or edit existing parameter on page 677 for more information.

Go to Deployment Examples on page 130 for examples of how to author and deploy an application in the UI.

In an application, you can also:

- Define process steps based on commands or scripts using the ElectricFlow DSL, ElectricFlow RESTful API, ElectricFlow Perl API, Groovy, or JRuby. See the ElectricFlow API Guide on the Electric Cloud Documentation page for the commands and code samples.

- Create a library of standardized reusable components to promote best practices across the enterprise and speed up application authoring with master components. Go to Master Components on page 75 for more information.

- Save snapshots of the application throughout the software release process. A snapshot is an immutable version of an application with specific artifact versions that can be used to optimize and troubleshoot the application. Go to Snapshots on page 275 for more information.

- Track changes for non-runtime objects such as projects, applications, environments, processes, components, artifacts, resources, and properties in the Change History. Go to Configuring Change Tracking on page 861 for more information.

## Environments

This section describes where applications are deployed.

<table>
<thead>
<tr>
<th>Deployment Fundamentals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

Environments are modeled using resources that are statically defined on the system, dynamically spun up at deployment time, or a combination of both. An environment object in ElectricFlow contains one or more tiers. These tiers should map with the tiers in the application and are logical groupings of resources. Each tier defines the resources in that tier, which could be static resources in the ElectricFlow system or dynamic configurations that are spun up on deployment. An environment also contains an Environment Inventory that details the current versions of each component or snapshot deployed in that environment.
Once you have defined your application and environment, they must be connected with a tier map. This is a mapping of the application tiers to the corresponding environment tiers where the application will run. Tier maps provide a level of indirection, allowing you to freely add or remove resources from an environment without having to make any changes to the automation.

Go to Creating Environments on page 156 for more information about modeling static environments.

Go to Deploying Applications in Dynamic Environments on page 202 for more information about modeling dynamic environments.

**Property Reference Use Case**

Property referencing is one of the most powerful features in the ElectricFlow product suite. Mastering property referencing will let you extend ElectricFlow to meet your organization’s deployment needs.
This use case shows how to leverage properties to create a flexible deployment model. It assumes that you are developing an ElectricFlow application for a web application deployment to production. The deployment process requires that the application is properly tested in the DEV and QA environments before deploying it to the production. Each of these environments uses different database connections for certifying various aspects of the web application. The QA environment uses a database that is created specifically to test the scalability aspects of the application. The challenge is to determine how to manage the database configuration across these environments.

Start by modeling three environments under a project called Banking:

- DEV
- QA
- PROD

Then create the appropriate database (DB) credentials in the Banking project for each database used with these stages. Each credential is identified by a name:
For each environment, create a property called `DB_credential` and initialize it with its corresponding DB credentials name.

To leverage these properties in an application or component process step, use `@[myEnvironment/DB_credential]` to identify and access the DB credential information as described in these following knowledge base articles:


Using this credential information, you can connect ElectricFlow to the appropriate database and populate the necessary test data. In this use case, myEnvironment refers to the currently running environment. There are similar shortcuts available for other deploy objects, such as myApplication or myEnvironmentTier. You can extend this concept to store environment- or environment-tier specific attributes such as port numbers or URLs.

**Deployment Strategies**

ElectricFlow provides several ways to deploy applications, including deployment policies (such as rolling deployments, blue/green, canary, and dark launch) and deployment options (such as smart deploy, staging artifacts, and error handling). By default, applications are deployed to all resources in the environment at once, and process steps are run sequentially. You can customize how an application is deployed using the options described in Application Deployment Options on page 64. For example:

- When authoring processes, you can define the error handling method for a process step or use rollback.
- Before the running an application, you can stage artifacts to ensure that all the artifacts are available at runtime, reducing the deployment time.
- At runtime, you can deploy everything (full run), only changed objects (smart deploy), specific objects (partial run), and/or snapshots.

In some situations, instead of deploying an application to all machines in the environment at once, it is better to deploy the application in batches.

As you get closer to production environments, reducing the downtime and risk while releasing newer versions becomes business critical. This is especially critical in production environments with live end-user traffic all the time. In some cases, the applications are the backbone of a website and are critical to the business, such as a banking or investment website. Any downtime on the production website can adversely affect the business. ElectricFlow allows modeling the various deployment strategies described in the following sections. The end goals of all these strategies are very similar – reducing the downtime and risk. ElectricFlow also allows modeling strategies such that they can be practiced in lower environments like QA or Pre-Prod to ensure success during production rollouts.

**Rolling Deployments**

One way to reduce the downtime and the risk associated with application deployments is to use rolling deployments. The goal is to minimize downtime to zero or as low as possible without impacting the availability of business critical applications. Rolling deployments are release patterns where the application is gradually deployed to the machines one at a time or in batches. Rolling deployments can be run throughout the release, but they are especially useful near the end of the release process, close to the production environment.

The Rolling Deployment strategy is applicable when the environment caters to end-user traffic and the environments being upgraded is the same.

This is an example of a rolling deployment in a load-balanced environment. When a new version needs to be added to both nodes, it is deployed to the first node while the second node is actively handling the end-user traffic. After the new version is successfully installed on the first node, it starts to handle the end-user traffic while the new version gets applied to the second node. After the new version is successfully installed on the second node, both nodes can actively handle traffic.
Rolling deployment is an excellent strategy for reducing downtime when you have environments with large numbers of static resources. It is also a cost-effective strategy as no additional resources are required, unlike other strategies. A Rolling deployment generally requires thinking about backward compatibility across the application components.

ElectricFlow natively supports the modeling of rolling deployments for the desired environments. For an environment, you can choose if rolling deployment is enabled. For environments in which you want to run a rolling deployment, you can choose between a phased-based or batch-based deployment.

- Rolling deployment using phases: This rolling deployment strategy is useful where there is a deterministic mapping between resources and the phase to which they belong. You can either assign resources to phases manually or dynamically using expressions.

- Rolling deployment using batches: This rolling deployment strategy is useful for environments with large numbers of resources where deterministic mapping between resources and batches is not necessary.

  You can decide batch sizes by specifying a number or percentage per tier. Examples are deployment to two resources at a time for the Web tier or to 25% of the resources at a time in the application server tier.

  You can also specify a property reference ([property]). This is useful when you want to apply a property reference to control the batch size based on applications, external configuration files, and so on.

  Go to Rolling Deployment Use Case on page 52 for an example of modeling rolling deployment.

**Blue/Green Deployments**

This technique reduces downtime and risk by running two identical production environments referred to as blue and green. The key difference between rolling deployment and blue/green deployment is that there are two physically separate environments. At any time, only one of these environments is live, serving all of the production traffic. While new versions of the applications are deployed to the second (blue) environment, the first environment (green) is serving production traffic. When the new versions are satisfactorily deployed to the second (blue) environment, all of the end-user traffic (100%) is diverted to it to make it live. After the switch, the green environment becomes inactive and next release can be applied to it and the process can be repeated.
The blue/green deployment strategy is especially useful with dynamic cloud environments. If environments are automatically spun up for every new deployment, the blue/green deployment strategy becomes compelling as the older environment can be decommissioned easily. The blue/green strategy is also useful when it is mandatory to maintain a separate mirrored environment for disaster recovery, as required by some financial companies.

While blue/green deployment makes it much simpler to recover from unforeseen deployment errors, as there are two separate environments, it comes with a higher cost. Because the blue/green strategy requires more than one environment and resource duplication, the overall costs might be higher than rolling deployments.

ElectricFlow allows modeling blue/green deployments with multiple options, but the most logical option is to create separate blue and green environments in the product. These environments are identical for all practical purposes. They can be created before the deployment if they are using static resources, or they can be created dynamically at the deployment runtime using environment templates. Modeling blue and green as separate environments also allows keeping track of the component inventory independently so that users can always know what is deployed to the blue vs green environments at any time.

Go to Blue/Green Deployment Use Case on page 61 for an example of modeling a blue/green deployment.

Canary Deployments

This technique is an advanced variation of the blue/green deployment. Similar to blue/green deployments, there are two separate environments. In steady state, only one environment is handling the production traffic. During deployment time, new versions are applied to the second inactive environment similar to a blue/green deployment. Once the second environment with the newer version is satisfactorily tested, a portion of the end-user traffic is diverted to it. The first environment runs the old production version of the applications and bears the majority of the traffic while the second environment runs the new version of the applications and caters to a small portion of the traffic. This is a great way to test the new version with live traffic, and if everything looks fine, all the traffic can be diverted to the new version, or if there are issues with the new version, the older version can be kept instead.
ElectricFlow allows modeling canary deployments similar to blue/green deployments by creating separate environment objects. They can be created before the deployment if they are using static resources, or they can be created dynamically at deployment runtime using environment templates. Modeling them as separate environments also allows keeping track of the component inventory independently so that users can always know what is deployed to which environment at any time.

The canary strategy is quite similar in purpose and implementation to strategies like Dark Launch where the purpose is to launch a new feature to a subset of users. These features can be either partially visible or not accessible at all, and that can be controlled using feature flags. Modeling such a deployment strategy in ElectricFlow is similar to a canary or blue-green strategy.

**Other Deployment Strategies**

Deployment strategies can be named differently, but they all serve the core purpose of reducing downtime and risk. While modeling such a deployment strategy in ElectricFlow, the best practice is to ask a question—does this strategy require a single environment or multiple environments logically? Based on that answer, you can choose to model using a rolling deployment style, blue/green style, or even a combination. ElectricFlow allows the flexibility to model most of these scenarios.

**Rolling Deployment Use Case**

Rolling Deployment is one of core strengths of the ElectricFlow. You can develop your application model independent of the deployment strategy and the environment model. When you model an environment, you can enable rolling deployment. You can also enable rolling deployment on an environment by selecting the rolling deployment option when you deploy an application.

In the list of application run details, ElectricFlow filters out any component process step that has no resource to execute in a particular phase of the rolling deployment. (The platform job details page continues to show all steps in the process.)

This example shows how an e-Commerce company uses the rolling deployment strategy to deploy its shopping cart application to production. The shopping cart application consists of three tiers, the Web, App and DB tiers. The company wants to deploy this application to the PROD environment in four phases:

- First phase: Deploy only to the DB tier and verify the DB upgrade.
- Second phase: Deploy to a few resources in the App and Web tiers and verify that the application was deployed successfully.
Third phase: Deploy to a few more resources in the App tier based on some rules.

Fourth phase: Deploy to the remaining resources.

Modeling this rolling deployment consists of the following:

1. Creating the "ShoppingCart" application with three tiers that map to the corresponding components.
2. Creating an environment named PROD with tiers matching applications tiers.
3. Configuring the PROD environment to support rolling deployment.
4. Defining the rolling deployment phases.
5. Running the application on the PROD environment using rolling deployment.
6. Viewing the application deployments details.
7. Summary

**Creating the "ShoppingCart" Application**

Create the "ShoppingCart" application with three tiers that map to the following components.

**Note:** In ElectricFlow, you can develop your application model based only on business requirements without having to give any special considerations to the deployment strategy.

**Creating the PROD Environment**

Create an environment named PROD with tiers corresponding to the applications tiers.

**Configuring the PROD Environment**

Configure the PROD environment to support rolling deployment.

To enable rolling deployment on the environment:
Click in the upper right corner of the Environment Visual Editor, and select Rolling Deploy.

The Rolling Deploy dialog box opens.

There are two rolling deployment strategies that are supported out of the box:

- **Phasing**: Phases are the preferred option when you want to control the resources and specify the order in which they are used.

- **Batching**: Batch Sizes are the preferred option when you do not need to control the resources. The resources are selected at random based on the specified batch size.

You can configure both these strategies on the environment, but only one can be active at a time.

**Defining the Rolling Deployment Phases**

In this example, the phasing strategy will be used during the rolling deployment.

What you need to know about phases:
• Phases are ordered, and rolling deployment relies on this phase order.

• There are three types of phases:
  • Tagged: Tagged phases are useful when you want to explicitly control the resources used during a rolling deployment.
  • Expression: Expression is useful when you want to pick resources for a phase dynamically at run time using conditions. This is done using JavaScript expressions. This is useful when you do not want to tag individual resources and instead want to apply an expression to pick the resources.
  • Broadcast: This type of phase can be used where you want the deployment to run on all the unused resources in environment.

While not mandatory, the broadcast phase will most likely be the last phase in the phase order. The broadcast phase combined with the expression will provide flexibility during the rolling deployment.

There can be only one broadcast phase for an environment.

In this example:
  • PHASE1 is a tagged phase.
  • PHASE2 is a tagged phase.
  • PHASE3-EXP is an expression phase.
  • PHASE3-BC is the broadcast phase.

To add phases:
  1. In the Rolling Deploy dialog box, click Phases to use phasing as the rolling deployment strategy.
  2. In the Phases dialog box, click Add+ in the upper right corner to add a phase.
  3. Enter the name of the first phase (PHASE1) and click Save.
  4. Enter the name of the second phase (PHASE2) and click Save.
  5. Enter the name of the third phase (PHASE3-EXP) and click Save.
  6. Enter the name of the fourth phase (PHASE-BC) and click Save.

To assign resources to the phases
In PHASE1, assign the only resource in the DB tier to PHASE1.

1. Select PHASE1.

2. Click Assign Phases to this Environment Resources.

A dialog box showing all the resources across all the tier opens.

3. Select the resources that you want for this phase, and then click Assign Phase in the upper right corner.

For PHASE1, select the DB resource:

4. Select PHASE1.

5. Click OK.

In PHASE2, repeat the same steps described for PHASE1 and assign a few resources from the App and Web tiers to PHASE2.
• For PHASE3-EXP, enter an expression to deploy a few more resources in the App tier based on the some rules.

1. Select PHASE3-EXP and click to define the phase with an expression phrase.
2. Enter the expression phrase.

Note: When you click ?, a pop-up window opens and shows sample code for phase conditions.

3. Click Save.
For PHASE3-BC, click to make this a broadcast phase to deploy to the remaining resources.

- Click Save to save the definition.

**IMPORTANT:** You can name the phases in your rolling deployment any name you want, such as ORANGE, YELLOW, EAST, WEST, and so on. What is important when defining the phases is the order and type of the phases.

At this point, rolling deployment is enabled on the environment with phasing as the default strategy, and phases are defined as follows:

**Note:** This is an example setup explaining the available options. It is not necessary to use all the different types of phases. For your deployment, choose the phase types that apply to your use case.

*Running the Application on the PROD Environment Using Rolling Deployment*

When you are ready to run the application, go to the dialog box to set the runtime settings for the deployment:

When you select the PROD environment, the option to enable Rolling Deployment is available because rolling deployment was enabled on the PROD environment. If you select another environment where Rolling Deployment is not enabled, the rolling deploy option will not be available. This way, the same application process can automatically behave in different ways based on the chosen environment, giving you the benefit of the model-driven approach.
Rolling deployment is now enabled.

Clicking shows the rolling deployment details.

You can enable or disable phases and to insert a manual step after each phase. When you click **Insert Manual Step after each Phase**, the options to run the manual step and the field to assign users who can perform the step are available.
Viewing the Application Deployment Details

Once the rolling deployment starts on the PROD environment, you can view the job details to see the breakdown and progress of the deployment. You will notice the job step breakdown corresponding to PHASE1, PHASE2, PHASE3-EXP, and PHASE3-BC. You will also see the automatically inserted manual step after each phase.

Note: Any phase that is skipped because there is no resource associated with it is not shown.

You can also use property references to access the current rolling deployment type or the iteration that is in progress:

- To return the rolling deployment type (phase or batch), use $[/myJob/rollingDeployType].
- To return the rolling deployment iteration that is in progress (such as PHASE1, PHASE2, and so on for batch rolling deployment strategy or phase name for phase strategy), use $[/myJob/currentRollingDeployIteration].
Summary

This example shows how to deploy an application to the PROD environment using the rolling deployment strategy and meet these conditions:

- The deployment ran in four phases.
- In the first phase, deploy only to the DB tier and verify the DB upgrade.
- In the second phase, deploy to a few resources in the App and Web tiers and verify that the application was deployed successfully.
- In the third phase, deploy to a few more resources in the App tier based on some rules.
- In the fourth phase, deploy the remaining resources.

Blue/Green Deployment Use Case

Blue/green deployments are very straightforward to implement in ElectricFlow. Because blue and green are two physically separate environments, they can be easily configured in the ElectricFlow environment model. Once these models are defined and mapped to applications, the blue/green deployment can be executed like other deployments in ElectricFlow.

This example shows how an e-commerce company can use the blue/green deployment strategy to deploy its shopping cart application to production. The current deployment process mandates that the application be tested in development and QA environments before the application is deployed to the production environment where the blue/green strategy is used.

Modeling this blue/green deployment consists of the following:

1. Creating four environments
2. Mapping the environments to the ShoppingCart application
3. Creating a pipeline with three stages
4. Creating three tasks for the PROD stage
5. Running the pipeline
6. Summary

Creating Four Environments (DEV, QA, BLUE, and GREEN)

Create four environments called DEV, QA, BLUE, and GREEN.
Note: BLUE and GREEN are names for the environments in this use case. You can use any names you want for them as long as it is clear how they map to BLUE and GREEN.

**Mapping the Environments to the ShoppingCart Application**

Select the ShoppingCart application, and map the application tiers to the corresponding environment tiers in DEV, QA, BLUE, and GREEN.

**Creating a Pipeline with Three Stages**

Create a pipeline with three stages called DEV, QA and PROD.

**Creating Three Tasks for the PROD stage.**

In PROD stage, create three tasks:
These are the task details:

<table>
<thead>
<tr>
<th>Number</th>
<th>Task Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DeployShoppingCart</td>
<td>This is another process task similar to what is in the DEV and QA stages that the environment name is parameterized. The system will automatically switch deployments between the BLUE and GREEN environments.</td>
</tr>
<tr>
<td>2</td>
<td>CertifyDeployment</td>
<td>This is a manual step to review and certify the deployment.</td>
</tr>
<tr>
<td>3</td>
<td>completePostCertificationTasks</td>
<td>This is an automation task to run any post certification tasks such as updating the load balancer and switching the environment in preparation for the next pipeline run (for example, update the TargetEnv parameter)</td>
</tr>
</tbody>
</table>
**Running the Pipeline**

In a blue/green deployment, before you run the pipeline, the GREEN environment is serving all of the production traffic, and the BLUE environment is ready to be upgraded to the new software version.

Before starting the deployment, set the `RollingDeploy/TargetEnv` property on the project to the first environment to which you want to deploy. `RollingDeploy/TargetEnv` will be set to BLUE because the GREEN environment is currently catering to end-user traffic.

When the pipeline starts:

1. The pipeline will start at the DEV stage and continue to the PROD stage.
2. Once the deployment reaches the PROD stage, the application process task will deploy to the BLUE environment based on the property value `$/myProject/RollingDeploy/TargetEnv`, which was set to BLUE at the beginning of the run.
3. Once the deployment task has completed, there is a manual step to functionally verify the deployment. If there was a need for some automated testing, those tasks can easily be added to the pipeline stage.
4. Once the deployment completes successfully, switch the user traffic to the BLUE servers, and update the `RollingDeploy/TargetEnv` property to GREEN.

Setting the property value to GREEN will ensure that the next deployment will happen to the GREEN environment while the BLUE environment serves all of the production traffic.

**Summary**

This example shows that blue/green deployments is very straightforward and easy to implement in ElectricFlow.

**Canary Deployment Use Case**

The purpose of a canary deployment is to deploy an application to a small set of servers for validation by a subset of users. Once user validation is complete, the application is rolled out to a larger set of servers. This is very similar to blue/green deployments where you can model separate environments and use pipelines to control deployments to higher-order environments. To implement this use case, see the Blue/Green Deployment Use Case on page 61. The key difference with canary deployments is that part of the traffic is routed to the environment with the latest version. You can achieve this by interacting with load balancers using plugins such as F5's BigIP at the right time in a pipeline task or process step.

**Application Deployment Options**

ElectricFlow supports the following out-of-the-box options to deploy applications:

- When authoring processes or procedures:
  - When defining a step for an application or component process, you must select the actions if a step fails:
    - **On Error**: Select **Stop running** to stop the process or **Continue running** to go to the next step in the process. The default is **Continue running**.
Run if: When there are conditions to be met before going to the next step, select one of the following options. The default is all.

- **all**: All conditions must be met before the step proceeds.
- **any**: At least one condition must be met for the step to proceed.

You can also attach parameters that affect how the step is executed at runtime. Depending on the type of step that you selected, different sets of parameters or fields are displayed.

Go to Example: Modeling and Deploying Applications on page 133 for examples of how to define component and application process steps.

- When defining a step for an application process, you can select one of these options:
  - **Components**—Use this to run a component process when the step is executed.
  - **Plugins**—Use this to run a third-party plugin.
  - **Command**—Use this to run one or more commands or a script.
  - **Procedure**—Use this to run a set of best practices, subroutines, modules, or functions that you can create and reuse at the platform level.
  - **Utilities**—Use this to run a higher-order operation than a third-party plugin for application modeling.
  - **Manual**—Use this when a manual step is to be performed by a designated assignee.
  - **Rollback**—Use this to restore the deployment model to a previous state before a deployment failed.
When defining a step for a component process, you can select one of these options:

- **Component Operations**—Use this to run a component operation.
- **Plugins**—Use this to run a third-party plugin.
- **Command**—Use this to run one or more commands or a script.
- **Procedure**—Use this to run a set of best practices, subroutines, modules, or functions that you can create and reuse at the platform level.
- **Utilities**—Use this to run a higher-order operation than a third-party plugin for application modeling.
- **Manual**—Use this when a manual step is to be performed by a designated assignee.

You can use *process branching* to specify the path through an application or component process based on transition conditions other than out-of-the-box options. Decisions about the next step in the flow are made while the process runs. This is similar to the transition conditions for workflows in the automation platform (see **Workflow Overview** on page 1058 and **Workflow Details** on page 801).

Go to **Process Branching** on page 117 for more information about process branching states and conditions and how to set them in a process.
When defining a step for a procedure, you must select the **Error handling** action if the step fails.

You can set the parameters for subprocedure steps.

You can also set run conditions and preconditions for command and subprocedure steps. Go to Step - create new or edit existing step on page 666 on how to set these options.

- When modeling environments:

  *Environment tiers* in the environment model represent groups of targets defined by their purpose, such as web servers, databases, and artifact repositories. For example, an environment may have environment tiers for the different types of web servers called "Apache," "Tomcat," and "MS SQL," which contain all the files for your company's website in one or more locations. The resources in the Apache environment tier are the Apache servers in each location.

  *Environment Reservation and Calendaring* allows you to manage and reduce deployment conflicts and risk when deploying applications, pipelines, or releases. You can schedule blackout periods for planned maintenance work and reserve environments to ensure that resources are available when you need them. The Calendar view makes it easy to visualize planned deployments and conflicts.

- When staging artifacts before the runtime:

  *Artifact staging* retrieves artifacts that will be deployed before the deployment run starts. This ensures that all the artifacts are downloaded and available during runtime. It also reduces the application runtime. Artifact staging is enabled by default. Go to Artifact Staging on page 113 for more information.
• At runtime, select one of the following ways to deploy the application. Go to Example: Modeling and Deploying Applications on page 133 for deployment examples.

  • Smart deploy
    This deployment method reduces risk and time by only deploying changed objects. ElectricFlow automatically detects the differences between what is about to be deployed and what has already deployed to an environment. It deploys only those objects not yet deployed to a specific resource or to resources where the object version is different. You can use this method throughout the software release life cycle.

  • Full run
    The system deploys the application with all the application processes, components, and artifacts.

  • Partial run
    The system deploys the application with only the selected application processes, components, and artifacts.

  • Selecting artifacts with specific versions to deploy
    The system runs the application with only the selected versions of the artifacts.

  • Snapshot
    The system deploys a snapshot of the application. Also go to Example: Creating, Deploying, and Comparing Snapshots on page 277 for an example using snapshots.

  • A combination of these ways:

<table>
<thead>
<tr>
<th></th>
<th>Smart Deploy</th>
<th>Full Run</th>
<th>Partial Run</th>
<th>Artifacts with Specific Versions</th>
<th>Snapshot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Deploy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Full Run</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Partial Run</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Artifacts with Specific Versions</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Snapshot</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>n/a</td>
</tr>
</tbody>
</table>
• Artifact Staging

ElectricFlow retrieves the artifacts that will be deployed in an application run before the deployment starts. This ensures that all the artifacts are downloaded and available on the target. It also minimizes the time it takes to retrieve artifacts and reduces downtime during the deployment. Go to Artifact Staging on page 113 for more information.

• When an action fails in the process

When an application deployment fails, you can use rollback to restore the deployment to a previous state before the failure occurred. This operation is supported only in application processes in the deployment model. Go to Rollback on page 115 for more information.

Automated Environment Discovery

Automated Environment Discovery, also referred to as auto-discovery, makes it easier to create models using your existing resources and environments for deployment automation. You need to set up the resources and environments before creating the deployment model and authoring processes in ElectricFlow. When deployments have large numbers of resources and environments, automated environment discovery speeds up application authoring by:

• Providing resource discovery using middleware plugins, such as EC-WebSphere, on existing resources and environments.
• Allowing the use of discovered resource configurations to accelerate process authoring and deployment automation.

You can initiate the discovery operation on resources from the following pages in the UI:

• At the platform level, go to the Cloud > Resources page.
• From the Environments Visual Editor for a specific environment.
• From an environment tier in the Environments Visual Editor.

Resources Page

Starting from the Cloud > Resources page:

1. Select one or more resources.

   Example:
2. Click the Resource Discovery button ( ) in the upper right corner. The Resource Discovery dialog box opens.

3. In the Discover Using field, select the plugin to use to run the Discover procedure for the selected resources.

4. (Optional) If the plugin requires a configuration for the Discover procedure, select the configuration from the drop-down list in the Configuration Name field.

Example:

5. Click OK.

If the discovery request was successfully submitted, a message appears in the dialog box:
If the discovery could not be run because the user does not have the appropriate permissions or because there were errors, an error message appears describing the error.

**Environment Visual Editor**

Starting from the Environments List:

1. Click on an environment name to select it.

   The Environments Visual Editor opens.
2. Click the button and select **Resources Discovery**.

**Example:**

The Resource Discovery dialog box opens.

**Example:**
3. In the **Discover Using** field, select the plugin to use to run the Discovery procedure for the selected resources.

4. (Optional) If the plugin requires a configuration for the Discovery procedure, select the configuration from the drop-down list in the **Configuration Name** field.

**Example:**

![Configuration Name drop-down list](image)

5. Click **OK**.

If the discovery request was successfully submitted, a message appears in the dialog box:

*Successfully initiated the Configuration Discovery for the Environment Resources*

If the discovery could not be run because the user does not have the appropriate permissions or because there were errors, an error message appears describing the error.

**Environment Tier**

Starting from an Environment Tier:

2. Click the button for the tier, and select Resource Discovery.

   **Example:**

   ![Resource Discovery](image)

   The Resource Discovery dialog box opens.

3. In the Discover Using field, select the plugin to use to run the Discovery procedure for the selected resources.

4. (Optional) If the plugin requires a configuration for the Discovery procedure, select the configuration from the drop-down list in the Configuration Name field.

   **Example:**

   ![Resource Discovery Configuration](image)

5. Click **OK**.

   If the discovery request was successfully submitted, a message appears in the dialog box:

   ![Configuration Discovery Message](image)
If the discovery could not run because the user does not have the appropriate permissions or because there were errors, an error message appears describing the error.

**Master Components**

Master components promote component reuse. They provide an easy way to create new components by reusing existing component definitions and the underlying process definitions. Master components are components that can be created and managed independent of any application. A master component consists of a component definition and one or more component processes. Master components are then leveraged to create application components either by referencing or copying them.

You can use master components to create a library of standardized reusable components which can help to promote best practices across the enterprise (such as a standard WebSphere component, standard IIS component, and so on). When deployments have large numbers of similar components, this can be used to speed up application authoring by leveraging prebuilt component and component-process logic.

A component has two parts:

- The component details describe the artifact on which the component is based. It can include where the artifacts are stored (the source or repository server), artifact name, artifact version, the directory where the artifact can be retrieved, and so on. You can parameterize part of the artifact definition to account for variations in the artifact details every time you deploy the application. This allows you to reuse the master component in multiple deployment scenarios. For example, you can create a master component that has a standard process to deploy and undeploy, and the only thing that changes is which specific artifact to use based on parameters.

- **Component processes** are used to define the automation steps to perform on the artifact defined in the component details. These processes can be used to deploy, undeploy, or do any other action. Each master component can have one or more component processes, and each process can have specific automation steps. These steps can describe how to perform specific tasks such as publish or retrieve an artifact, stop a server process, copy files, restart the server, and so on. A master component must have at least one component processes. You can parameterize the master component processes so that certain behaviors can be achieved when master components are used in an application definition. For example, you can have port number as a component process parameter for a master component, and have different values for the port number in different application models where this master component is used.

After creating the master component, you can reference or copy it to create a new component in an application.

- You can reference a master component when authoring an application. The new application component will have the same properties as the master component. Any changes made to the master component will affect all the application components that reference it.

Use the reference method when you want to maintain lineage with the master component so that the application component continues to inherit definitions from the master component. Before making a change to a master component, check how many applications reference it and determine the impact of changing it.
You can also copy a master component when authoring an application. The new application component will have the same properties as the master or existing application component when it is created.

Use the copy method when you want to use a master component just as a baseline for your application component. After an application component is created from a master component, any subsequent changes to the master component will not affect the application component. To get the latest changes in the application component, you delete and recreate the application component, and copy the latest master component to create a new application component.

You can also take an existing component that was originally copied from a master component, modify it, and then save it as a new master component that can be reused and shared by other users.

Master Component Examples

This example shows how to create a master component, create parameters for the artifact definition, define the component processes, create parameters for the component processes, and use the master component in an application, promoting the component reuse throughout your organization. It does not include how to author applications and environments or how to deploy the application. For information about these tasks, see the example in Example: Modeling and Deploying Applications on page 133.

In the following steps, you will learn how to:

1. Create a master component and parameters for the artifact definition.
2. Author component processes and parameters.
3. Use the master component in an application.

Creating a Master Component and Parameters for the Artifact Definition

This section shows how to create a new master component and create parameters for the artifact definition.

Example:

By default, the master components for all projects are displayed.

If you want to see only the objects for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

If there are no matches, a message appears stating that there are no resource templates in the selected projects.
Starting from the Master Components List:

1. Click the **Add +** button.

   The **New** dialog box opens.

2. Click **Master Component > Create New** to create a new master component.

3. Enter the name of the new master component and select a project to which the master component belongs.

   **Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

   **Example:**

   ![Image of the New Component dialog box]

   4. Click **Next**.

      The **Component Details** page dialog box opens.

   5. Click the down arrow in the **Content Location** field.
6. Select an artifact repository where artifacts are stored, which is represented as a plugin.

**Example:**

Select **EC-Maven**.
7. Enter the information about the artifact.

The information that you enter depends on the artifact repository (plugin) that you selected.

**Example:**
For **EC-Maven**, enter the following information.

- Server URL: http://repo-demo.jfrog.org/artifactory/
- Repository: jboss-releases
- Artifact: org.jboss.el:jboss-el
- Version: Exact
- Artifact extension: jar

We will be parameterizing the artifact name and replacing **jboss-el** with a variable. For now, enter the information in the **Artifact** field above because it is required and the component cannot be created without this required information.

If you had selected another plugin, you may not have to do this.

8. Click **OK**.

The component that you created now appears in the list.

9. Go to the row for the master component that you just created, and click the **button**.
10. Select **Parameters**.
11. In the Parameters dialog box, click **There are no Parameters yet. Add one +**, or click **Add +**.

**Example:**

![Parameters dialog box](image)

12. In the New Parameter dialog box, enter the parameter settings.

**Example:**

In the **Name** field, enter **artifactName**.

In the **Label** field, enter **Artifact Name**.

Keep the rest of the fields as is.

![New Parameter dialog box](image)

This parameter has default value and is required. The user must enter a value for this parameter when this master component is used in an application.
13. Click **OK**.

**Example:**
The Parameters dialog box now shows that there is one required parameter for the master component called Artifact Name and that the user has to enter the text (the artifact name) for it.

![Parameters dialog box with one required parameter](image)

14. Go to the row for the master component that you created, and click the **button**.

15. Select **Details** to modify the artifact definition with the artifact-name parameter.

16. In the Component Details dialog box, go to the **Artifact** field and replace **jboss-el** with **$[artifactName]**.

**Example:**

![Component Details dialog box with artifact field](image)

17. Click **OK**.

You have now created a master component with one parameter for the artifact definition.

**Note:** The other ways to create a master component are:
- Create it from an existing master component by selecting an existing component from the "Create from existing component" list in the dialog box.
- Create from an existing application component by selecting an application and an application tier associated with that application and then an existing component in that application and application tier.

The next step is to add processes to the master components and create parameters for the processes.
**Authoring Component Processes and Creating Parameters**

This section shows how to author component processes for the master component created in the previous section and create parameters for those processes.

Starting in the Master Component list:

1. Go to the row for the master component that you created, and click the button.
2. Select Add process.
   
   The Component Process dialog box opens.
3. Enter the component process details, and click OK.
4. Define the component process in the Component Process Visual Editor.
   
   For detailed instructions and examples, go to Authoring Component Processes on page 137.
5. Select the Deploy process.
   
   The Component Process Visual Editor for it opens.
    
   **Example:**

   ![Component Process Visual Editor](image)

6. Click the button on the right side, and select Parameters.
7. In the Parameters dialog box for the Deploy process, click There are no Parameters yet. Add one +, or click Add +.
8. In the New Parameter dialog box, enter the parameter settings, and click **OK**.

   **Example:**
   
   In the **Name** field, enter `portNumber`.
   
   In the **Label** field, enter `Port Number`.
   
   Keep the rest of the fields as is.

   ![Parameter Dialog Box](image)

   This parameter has no default value and is required. The user must enter a port number when this master component is used in an application.

9. Click **OK**.

   **Example:**
   
   The port number parameter is created for the Deploy process.
   
   The Parameters dialog box shows that the port number parameter is required for the Deploy process.

   ![Parameters Dialog Box](image)

10. Close the Parameters dialog box.
11. Reference the master component in an application, or copy it to an application.

- To reference the master component in an application, go to Referencing a Master Component in an Application on page 85.
- To copy the master component to an application, go to Copying a Master Component to an Application on page 90.

After you add the component to an application tier, a dialog box appears prompting you to enter values for the parameters for the master component process, starting with this step.

You have now authored component processes for the master component and have created a parameter for it.

**Viewing the Master Component Details**

You can ensure that the artifact definition and component process step defined by the master component are correct by viewing the master component details in the following places.

They first appear in the artifact definition:

![Component Details](image)

They also appear in the component process step details. When you view the component process details for the Deploy process in the Component Process Editor, you can see that the Deploy process consists of one step called Retrieve, which is defined by the jboss-mc-prod master component.
Using a Master Component in an Application

After master components have been defined, they can be used in application models. There are two ways to leverage master components in an application:

- Reference the master component in an application.
- Copy the master component to an application.

To review the implications of these methods, go to Master Components.

Referencing a Master Component in an Application

When you reference a master component in an application, it is added to the application as an application component with the same definition, processes, parameters, and properties as the referenced master component. Any changes made to the master component will affect all the application components that reference it. Use the reference method when the component is used in multiple applications and you want to ensure that these application components continue to inherit all changes made to the master component.

This section shows how to author a new application that references the master component created in the previous sections.

Starting in the Applications List:

1. Click the Add + button.

   The New dialog box opens.

2. Click Application > Create New to create an application.
3. Enter the pipeline name, select a project where the applications in the pipeline will be deployed, and enter a description of it.

   **Example:**

   ![Pipeline Configuration Window]

4. Click **OK**.

   The Applications Visual Editor for your application opens. This is where you will author the application.

   Notice that there is an undefined application tier (Tier 1) with an undefined component in it.

5. Click the **button** in the application tier and select **Details** to open the Applications Tier Details dialog box.

6. Change the tier name to **Data** in the Name field, and click **OK** to rename the application tier.

   The Applications Visual Editor now shows one environment tier called **Data**.

   **Example:**

   ![Applications Visual Editor]

7. Click the **+** button in the component to add a component to the application tier.
8. Select **Create from existing master component**.

A list showing all available the master components opens.

You can also create a new application component using one of these options:

- **Create a new application component**—Clicking this creates a new component as described in Creating a New Application on page 134.

- **Create from existing application component**—Clicking this opens the Create from existing component dialog box. Click in the Select Application field and select an application. Then click in the Select Tier field and select an application tier. A list of components in the selected application and application tier appears. Select a component from this list.

9. In the **Create a reference to a master** list, select a master component.

   In this example, select the master component called **jboss-mc-prod**.

10. Click **Next**.

    The Create from existing component dialog box opens.

11. In the **New** dialog box, change the name to **jboss-mc-results**, and click **Next**.

12. Click **Next**.

    If the master component has parameter for its artifact definition, you are prompted to enter values for those parameters in the next step.

    **Example:**

    ![Image of New dialog box](image)

    If the component does not have parameters for its artifact definition, click **OK**. Then go to the Component Process Visual Editor and add a parameter to the component, starting at Step 9 in Creating a Master Component and Parameters for the Artifact Definition on page 76Authoring Component Processes and Creating Parameters on page 82
13. Enter the values for the parameters, and click **OK**.

**Example:**
The jboss-mc-results component has one parameter called Artifact Name.
Enter **jboss-prod** in the Artifact Name field.

14. Click **OK**.

The Applications Visual Editor now shows that the application has an application tier with a referenced master component.

**IMPORTANT:** If you want to edit the master component, you need to do this in from the Master Component list. (There is no button in the lower right corner where you can access the component processes.) The UI also lets you know that this is a master component because the icon is different than that for a normal component.

**Example:**
The Applications Visual Editor now shows that the application has an application tier called Data with a referenced master component called jboss-mc-results.
15. Define the application process to include a step that references the master component.

   a. The first step is defined by the jboss-mc-results component and its Deploy process.

      After you select the Deploy process, you are prompted enter to a value for the port number. Then click OK.

      **Example:**
      
      This is the parameter that is created for the master component process.

      ![Define Step]

      b. The second step prints the port number that you entered in the previous step.

      **Example:**
      
      This is the application process:

      ![Result summary]

      Now you can deploy your application as described in Deploying and Troubleshooting Applications on page 161.
**Copying a Master Component to an Application**

When you copy a master component to an application, it becomes an application component with the same definition, processes, parameters, and properties as the master component on which it is based. After an application component is created from a master component this way, any subsequent changes to the master component will not affect the application component. Use this method when you want to use a master component just as a baseline for your application component.

For details about how to create master components and parameters for them, see Creating a Master Component and Parameters for the Artifact Definition on page 76 and Authoring Component Processes and Creating Parameters on page 82.

This example describes how to copy a master component in an application.

Starting in the Applications list:

1. Click the **Add +** button.
   The **New** dialog box opens.

2. Click **Application > Create New**.

3. Enter the name of the new master component and select a project to which the master component belongs.
   In this example, we will create a new application called “Your Group Summary” that will include the master component called jboss-mcjc.

4. Click **OK**.
   The Applications Visual Editor for your application opens. This is where you will author the application.
   Notice that there is an undefined application tier (Tier 1) with an undefined component in it.

5. Click the **+** button in the application tier and select **Details** to open the Applications Tier Details dialog box.

6. Change the tier name to **Data** in the Name field, and click **OK** to rename the application tier.

7. Click the **+** button in the application tier to add a component to it.

8. Select **Create from existing master component**.
   A list showing all available the master components opens.

9. In the “Create a reference to a master” list, select a master component.
   Select the master component called **jboss-mcjc**, select **Use a copy**, and select a project to which the master component belongs.
10. Click Next.

The Create from existing component dialog box opens.

**Example:**

<table>
<thead>
<tr>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create from existing component</td>
</tr>
<tr>
<td>jboss-mcej_copy</td>
</tr>
<tr>
<td>Description</td>
</tr>
</tbody>
</table>

11. Change the name of the component to something that gives it more context.

**Example:**

After changing the component name to **jboss-mcej** and clicking OK, the Data tier now has a new application component called jboss-mcej, where "ec" refers to a software version:

12. If the master component has parameters for the artifact details, modify the artifact details of the new application component and remove the parameter reference.

   a. Go to the Component Details dialog box.
   
   b. Replace the parameter (\$[artifactName]) in the artifact details section with a specific value.

      In the example, replace \$[artifactName] with **jboss-5-maintenance**, where software versions starting with lower case letters are maintenance releases.

   c. Click OK.
13. Define the application process to include a step that references the new application component.
   a. The first step is defined by the jboss-mcec component and its Deploy process.
      After you select the Deploy process, you are prompted to enter a value for the port number.
      Then click OK.
      
      **Example:**
      This is the parameter that is created for the component process.

      ![Diagram of the first step](image1)

      b. The second step prints the port number that you entered in the previous step.
      
      **Example:**
      This is the application process:

      ![Diagram of the second step](image2)

14. Make other modifications to the application component and its component processes within application.
Now you can deploy your application as described in the Guidelines for Modeling and Deploying Applications in ElectricFlow on page 130.

**Creating Master Components Based on Existing Application Components**

Starting from the Master Components List:

1. Click **Add +**.
   
   The **New** dialog box opens.

2. Click **Master component > Copy Application Component**.
   
   A list of existing applications opens. It shows the list of available applications. The default is to show the applications for all projects. If you want to see only the applications for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more applications by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no applications in the selected projects.

**Example:**

![Master Components List Example](image-url)
3. On the left side of the dialog box, select an existing application.

A list of existing components in that application appears on the right side.

**Example:**

![Image of dialog box with list of existing components on the left and a selected component on the right.]

4. Select an existing application component.

The Create from existing component dialog box opens with the name of the selected component highlighted.

**Example:**

![Image of Create from existing component dialog box with the name of the selected component highlighted.]

5. Change the name of the component, and enter an optional description.

You can also change the project to which the master component belongs.
6. **Example:**

![Create from existing component](image)

7. Click **OK**.

The Master Component List now includes master component you just created. It shows the list of available master components. The default is to show the master components for all projects. If you want to see only the master components for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the **Search** field. The projects that match the criteria appear in the list. You can also search for one or more master components by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no master components in the selected projects.

**Example:**

![Master Components List](image)

**Creating Master Components Based on Existing Master Components**

Starting from the Master Components List:

1. Click **Add +**.

   The **New** dialog box opens.
2. Click **Master component > Copy Master Component**.

A list of existing master components opens. It shows the list of available master components. The default is to show the master components for all projects. If you want to see only the master components for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more master components by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no master components in the selected projects.

**Example:**

![Example Image]

3. Select an existing application component.

The **Create from existing component** dialog box opens with the name of the selected component highlighted.

**Example:**

![Example Image]

4. Change the name of the component, and enter an optional description.

You can also change the project to which the master component belongs.
5. **Example:**

![Master Component List Image]

6. Click **OK**.

The Master Component List now includes master component you just created. It shows the list of available master components. The default is to show the master components for all projects. If you want to see only the master components for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways: Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more master components by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no master components in the selected projects.

**Example:**

![Master Components List Image]

---

**Master Components List UI**

**How to get here:**

One of these ways:

- From the Home page:
  1. Click the **Applications** launch pad to open the Applications List.
  2. Click the **Master components** tab.
- Click the **Main menu** button, and then click **Applications > Master Components**.

This is a Master Components List:
| 1 | Breadcrumb identifying the object you are viewing and the total number of master components. |
| 2 | Search field. |
| 3 | It shows the list of available master components. The default is to show the master components for all projects. If you want to see only the master components for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:  
  - Click on the name of one or more projects.  
  - Enter the search criteria in the Search field. The projects that match the criteria appear in the list.  
You can also search for one or more master components by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no master components in the selected projects. |
| 4 | Name of the master component. |
| 5 | Name of the project to which the master component belongs. |
| 6 | Date and time when the master component was created. |
| 7 | Number of applications dependent on this master component reference. |
| 8 | Number of component processes for the master component. |
| 9 | Hide or show the applications that reference the master component. |
Click the Menu button to open the context menu. You can get more details about the master component:

- **Details**—The name and description of the object.
- **DSL Export**—Click this to quickly and easily generate and export a DSL script from the ElectricFlow UI.
- **Add Process**—Add a component process. The Component Process dialog box opens.
  
  A master component can have one or more component processes.
- **Parameters**—The parameters defined for the master component.
- **Properties**—The properties in the object.
- **Access Control**—The access control configuration in the automation platform for the object.
- **Track Changes**—The change history of the object.
- **Delete**—Delete this object.

Applications that reference the master component. This allows you to perform quick impact analysis to understand which applications would be impacted if a referenced master component is changed.

Clicking the i button shows information about the element.

This shows the description of the master component.

Clicking on the down arrow next to number of component processes (number 9 above) shows the list of processes for this master component.

---

**Environment Reservations**

Environment Reservation equips the operations team with capabilities that allow it to impart control on environments or environment teers, making application deployments more reliable and predictable.

Every environment has an *enable* or *disable* flag that you can leverage to control the deployment, acting as an ON/OFF switch for the environment. Once enabled, an environment is open for deployments 24 hours a day. An additional option called Reservation Required can be used to restrict deployments on enabled environments. Deployment to environments that require reservation are permitted only if the application, pipeline, or release has a valid reservation. This is a good way to control deployments to controlled environments, such as production environments.

There are two main types of environment reservations:

- **Blackouts**
These are times during which all deployments are prohibited to the environment. They are useful when an environment needs to be brought down for system upgrades or maintenance tasks or to reflect restricted time periods based on business needs such as trading windows for financial institutions.

- Environment reservations for applications, pipelines, and releases

  Environment reservations can be exclusive or nonexclusive.

  Exclusive reservations are useful when you want to control deployment conflicts. Only one application, pipeline, or release can have an exclusive reservation on an environment at any time. This helps to avoid conflicts due to double booking. Exclusive reservations can be set by not allowing overlap.

  Nonexclusive reservations are useful when it is acceptable for reservations to overlap at the same time.

**IMPORTANT:** Environment reservation rules are only validated and enforced at the beginning of application deployments. If you try to run an application when the reservation exists in the future, the job will wait for the reservation window to open before it is executed. This will relieve you of having to wait for the reservation period to open before the application is deployed.

This is a summary of the business rules for environment reservations that are validated when you try to run an application.

- Check whether the environment is **ENABLED**.
  
  If **TRUE**, continue.

- Check whether the deployment falls within a **BLACKOUT** period.
  
  If **TRUE**, the job will wait until the blackout period is over (given that the maximum job wait time is not exceeded).
• An environment reservation is not required.

  Look for **EXCLUSIVE reservations**.

  • Check whether a **RESERVATION** exists for a different application.
  
    • If **TRUE**, the job will not run.

  • Check whether a future **RESERVATION** exists for the application.
  
    • If **TRUE**, the job will wait till the reservation time.

  • Check whether an **ACTIVE RESERVATION** exists for the application or if no other application has an **EXCLUSIVE reservation**.
  
    • If **TRUE**, start the deployment.

• An environment reservation is required.

  • Check for an application reservation.
  
    • If **TRUE**:
  
      • If the reservation is currently active, the deployment starts.

      • If the reservation is in the future, ElectricFlow waits for the reservation period to open.

    • If **FALSE**:
  
      • The job will not run.

In a pipeline, execution starts immediately. However, when an application deployment task begins, ElectricFlow looks for the pipeline reservation on the environment. A release follows the same pattern as the pipeline. The release will start immediately. However, when the Deployer task begins deploying the application, the system will validate the reservation to make sure the appropriate environment reservation exists for that release. In both of these scenarios, the rules previously mentioned for application deployments apply to each of the applications that are deployed by the pipeline task and the Deployer task.

**Environment Reservation Use Case**

*ABC Bank* is one of the leading banks that pride themselves for their cutting edge transaction processing system, which is leveraged by major businesses. Keeping systems up and running at all times is paramount to their business. This describes how environment reservations can be leveraged to streamline deployments by reducing deployments conflicts and improving system uptimes.

These are the main business rules for the production environment:

1. No deployments can happen to production environments without proper approval. Approval is required primarily to make sure the deployment window is properly planned to reduce deployment conflicts and downtime.

2. No deployments can happen on Sunday between noon and midnight. This is when all the transaction settlements (batch processing) happen, and the bank does not want any interruption or degradation of system performance during these critical times.
3. Maintenance windows are on Friday nights from 10:00 P.M. to midnight. The bank has an application process for patching production machines.

4. No deployments can happen between midnight and 6:00 P.M. on Monday through Friday because these times are considered critical business hours.

5. At 7:00 P.M. on Friday, the "Online Banking" application needs an exclusive reservation to upgrade to newer version. No other deployments are allowed during this time because avoiding conflicts for this critical rollout is important.

To implement these rules, starting with the most restrictive clause:

1. First implement the fourth rule by creating a recurring blackout from Monday though Friday between midnight and 6:00 P.M. This will ensure that no one will be able to deploy during this time period.

2. Implement the second rule next by creating a recurring blackout on Sundays from noon to midnight. This will prevent anyone from deploying during the transaction settlement window.

3. For the third rule, create a recurring exclusive reservation starting on Friday from 10:00 P.M. to midnight to deploy the application process used for system patching.

4. For the fifth rule, create a recurring exclusive reservation for the "Online Banking" application starting on Friday at 7:00 P.M.

5. For the first rule, start by setting the Reservation Required attribute on the production environment. This will prevent any unscheduled deployments to production. Then enhance the approval process to create an environment reservation during the available open deployment time periods for the application you want to deploy. It also makes sense to create an application run schedule to match the reservation.

The following are visual representations of the schedule for the production environment on Friday.
This is the monthly view of the environment reservations for the production environment:

This shows the details for August 11 and 12 and also for August 18 and 19.

This is the daily view of the environment reservations for the production environment.
Conflict Resolution

If you try to deploy during the blackout or exclusive reservation windows in the previous section, the job will wait until the blackout period is over (given that the maximum job wait time is not exceeded).

When you try to create a reservation that conflicts with existing exclusive reservation, the job will also fail with an error.
This is the error message:

Environment Reservation UI

*Restricting Deployments to Enabled Environments*

You can restrict deployments to environments by selecting the *Reservation Required* option for an environment. In the Environment Details dialog, select *Reservation Required* and click OK. Deployment to this environment permitted only if an application, pipeline, or release has a valid reservation.
Adding Environment Reservations

This example shows how to add environment reservations to the PROD environment.

Starting from the Environments list:

1. Select the environment to which you want to add reservations.

2. In the Environments Visual Editor, click in the upper right corner, and select Reservations.

The dialog box showing the list of environment reservations opens.

3. Click Add+ to add an environment reservation.

The Environment Reservation Details dialog box opens.
4. To create a blackout:
   a. In the **Reservation name** field, enter the name of the reservation.
   b. In the **Start** field, select the start date and enter the start time.
   c. In the **End** field, select the end date and enter the end time.
   d. In the **Once** field, select the frequency: **Once, Daily, Weekly, or Monthly**.
   e. (Optional) If you select **Daily, Weekly, or Monthly**, select the date when the reservation ends in the **Recurrence Ends** field.
   f. (Optional) Change the time zone.
   g. (Optional) Select **Allow Overlap** to make the reservation nonexclusive.
h. Click Next.

The Reservation for dialog box opens.

![Reservation for dialog box]

i. (Optional) Select Only for a Tier if the reservation only applies to an environment tier.

j. Select Blackout.

![Reservation for dialog box with Blackout selected]

k. Click OK.

The Environment Reservations list returns and has been updated with the reservation you just created.

![Environment Reservations list]

l. (Optional) Click Add + to add another reservation.
5. To create an exclusive invitation:
   a. In the **Reservation name** field, enter the name of the reservation.
   b. In the **Start** field, select the start date and enter the start time.
   c. In the **End** field, select the end date and enter the end time.
   d. In the **Once** field, select the frequency: **Once, Daily, Weekly, Monthly**.
   e. (Optional) If you select **Daily, Weekly, or Monthly**, select the date when the reservation ends in the **Recurrence Ends** field.
   f. (Optional) Change the time zone.
   g. (Optional) Select **Allow Overlap** to make the reservation nonexclusive.

   ![Environment Reservation Details](image)

   h. Click **Next**.

   The **Reservation for** dialog box opens.

   i. (Optional) Select **Only for a Tier** if the reservation only applies to an environment tier.
j. Select the object that will have the reservation (Application, Pipeline, or Release) and the object's project and object name.

![Reservation for...]

k. Click OK.

The Environment Reservations list returns and has been updated with the reservation you just created.

![Environment Reservations list]

**Viewing Environment Reservation Calendars**

There are two ways to access the environment reservation calendars:

- From the Environment Reservations list, click ![calendar icon] for the calendar view.

- From the Environments List, select an environment and click ![environment icon] to view the Environment Reservations list. Then click ![month icon] at the upper right of the dialog box.

This is the **Month** view:
Click **Week** to see the **Week** view:

Scroll down to see more:
Click **Day** to see the **Day** view:

For examples of conflict resolution, go to **Conflict Resolution** on page 105

**Artifact Staging**

You can use artifact staging to retrieve artifacts that will be deployed in an application run before the deployment starts. This ensures that all the artifacts are downloaded and available on the target, either the artifact cache (the default) or a directory specified in the component definition. Staging artifacts minimizes the time it takes to retrieve artifacts and reduces downtime during the deployment.

Artifact staging is enabled by default in the UI. However, when you use the API commands in the command line interface or in a script, make sure to enable artifact staging when modeling the application.
Go to Deploying and Troubleshooting Applications on page 161 for how to use artifact staging when deploying an application.

At the Application Level

When artifact staging is enabled in a deployment model, ElectricFlow dynamically creates and executes a job step to stage the artifacts. If the application process being deployed includes process branching, the staging job step retrieves all artifacts in the application process in parallel to reduce the staging time. In addition, the deployment processes, including the staging job step, are skipped on disabled resources.

You can deploy applications with the artifact staging enabled and following options:

- With smart deploy enabled, the staging job step retrieves artifacts only for those objects that have not been deployed to specific resources.
- With full deploy enabled, the staging job step retrieves artifacts only for all artifacts in the application.
- With partial deploy enabled, the staging job step retrieves artifacts only for artifacts in the application.
- With a selected snapshot, the staging job step retrieves artifacts only for artifacts in the selected snapshot.

Note:
For a component process, the process step to retrieve an artifact is optional because the component process is referenced in the application process. If you author a component process, the process type should be “Deploy” to ensure that the artifacts defining the component can be staged.

If an artifact staging for a component fails, it will then be retried when the process execution continues and when the actual component process execution happens.

You can view the progress of the staging job step in the Application View Run page.

- When the staging job step is successful, the artifact is retrieved and staged before the deployment run starts.
- When the staging job step fails, the application process automatically retrieves the artifact during the component retrieval step in the application run.

The environment inventory is updated as the job step runs. In addition to viewing the status of the resources in the environment, you can also view the state of other objects including the application processes, components and component processes, and artifacts being deployed.

At the Pipeline and Release Levels

Artifact staging is supported in pipelines and Releases.

- When you define the tasks in a pipeline stage, you can select application processes with artifact staging. The staging job step is executed as part of the application in the pipeline run as described in the previous section. Go to Tasks on page 286 for more information about stage tasks in a pipeline.
- The Release definition includes the pipeline and applications that you want to run in the Release. Go to Release Definition on page 367 for more information about the release definition.
Rollback

When an application process has a predefined rollback step and the application deployment fails, you can restore the deployment model to a previous state before the failure occurred. ElectricFlow provides these ways to do this:

- Automatic rollback—ElectricFlow automatically reverses what was deployed up to the point of failure in the process flow. See Rollback on page 115 and Example: Modeling and Deploying Applications on page 133 for more information.

- Snapshots—You manually create and save snapshots of previous successful deployments and run a snapshot the next time the application is deployed. See Snapshots on page 275 for more information.

- A component process defined as an undeploy process—When defining a component process, select Undeploy as the process type.

Application rollback occurs only for components that were not skipped (because of branching) in the application process.

Guidelines for Using Rollback

- You must enable change history.
- Rollback will not work after a full import until you redeploy an application successfully after the import.
- You should use environment snapshots for rollback (not application snapshots).
- If you rename the application process after a successful deployment, and if rollback to the previous state is configured, ElectricFlow cannot determine the last successful deployment. In this case, rollback will fail. (The undeploy process will still occur.)
- You can define multiple rollback steps in an application process.

Triggering Rollback Even if Undeploy Fails

You can trigger rollback even if undeploy fails. To do so, use the Continue running option in the Application Process Step dialog box when configuring a rollback step.

Enabling Rollback Only on Components that Successfully Undeployed

You can limit rollback to those components that undeployed successfully. To do so, use the Rollback only successfully undeployed components option in the Define Step dialog box when defining a rollback step.

Enabling Rollback Only on Failed Components

You can activate rollback only on those components that failed. To do so, use the Component Level Rollback option in the Define Step dialog box for defining a rollback step.

ElectricFlow automatically tracks all components that failed during application deployment and will rollback only those components. This option is useful when the components do not have version dependencies. You can use Component Level Rollback with automatic rollback and with snapshots.
Automatic Rollback

ElectricFlow supports a rollback step in application processes. This allows an automatic rollback to the environment before an erroneous deployment or to any previous environment snapshot. This reduces the time to author the rollback logic. For an example of how to add a rollback step to an application process, see this step in Example: Modeling and Deploying Applications on page 133.

During an application deployment, the predefined rollback operation is invoked when the rollback step is executed. ElectricFlow reverses what it executed in the process flow up to the application process step where the failure occurred. This operation is supported only in application processes. It puts the deployment in the same state as the last successful deployment, which is usually the same as the previous deployment state.

If the Roll back to previous state option is enabled and no last good deployment exists (for the restore point), the rollback step is skipped. The undeploy step (if configured) will still run.

When defining an application process step as a rollback step, the application can roll back to the previous state up to where the deployment failed (the default) or to a specific snapshot. Also, you can specify how the application will be rolled back.

- By default, the Smart Deploy option is enabled. If you want to ElectricFlow to execute a full or partial run the next time the application is deployed, disable this option.
- When the Undeploy Application before Rollback option and the application process that you want to undeploy (in the Select Process field) are selected, the environment inventory record is removed before the rollback operation is executed. This allows dirty files in the erroneous deployment to be automatically removed from the system. When you use the Undeploy Application before Rollback option with the Component Level Rollback option, failed components are undeployed and then rolled back.

When a specific snapshot is selected for rollback, ElectricFlow tries to determine the last successfully-deployed process and then tries to execute it from the snapshot.

While a native rollback step is available, ElectricFlow also gives you complete control over creating a custom rollback handling operation and using that as part of the error handling logic.

Note: If the last successful deployment was a partial deployment and the rollback job is reverted, ElectricFlow reverts only the components included in the partial deployment.

For an example of how to add a rollback step to an application process, see this step in Example: Modeling and Deploying Applications on page 133.

Manual Tasks and Steps

You can define manual steps and tasks in application or component processes and in release delivery pipelines. They describe the actions that must be taken by a human to complete the process step and/or pipeline task. In application and component processes, these actions are referred to as manual steps. In pipelines, they are referred to as manual tasks. Any time a manual task or step is reached in the process flow, an email notification is sent to all users in the assignee list.

Manual steps and tasks consist of user-specified instructions and assignees.
**Note:** Email notifications for manual process steps are sent to assignees whether or not notifications are enabled at the application or process level. If a user does not want to receive an email notification, their name should be removed from the assignee list.

- **To set up a manual task or step:**
  - Enter instructional text to help the approvers. This text can include URLs.
  - You can also define optional parameters to collect information during the approval step.
  - Specify who can approve. You can define the step or task to accept either user or group IDs or variables using the `{{ }}` notation to represent assignees as property references, but not both.

- **To attach a parameter to a manual task or step:**
  - Use the `{{ }}` notation as a property reference to access other user-specified parameters at runtime, such as evidence and status.
  - For a pipeline manual task, use `{{javascript myFlowRuntime.flowRuntimeStates[0].evidence}}` to collect the user’s response in subsequent tasks. This command using (0) assumes that the manual task is the first task in the stage.
  - For an application process, use `{{myJobStep/comment}}` or `{{myJob/jobSteps/stepName/comment}}` to access the instructional text, which is usually in the notification emails sent to the users who perform the actions or who approve the completion of the manual step.
  - Put hyperlinks in the instructions and comments fields in the GUI. You can create a file on a server or other storage device and add the URL to that file in the GUI.

- **To specify a default email template:**
  - For a manual task in a pipeline, use `/ec_deploy/ec_pipelineNotifierTemplates/ec_default_pipeline_manual_task_notification_template`.
  - For a manual process step in an application, use `/ec_deploy/ec_notifierTemplates/ec_default_manual_process_step_notification_template`.

For examples showing how to define manual tasks and steps:

- Go to Example: Authoring a Pipeline with Manual and Utility Tasks on page 310 for how to define a manual task in pipeline stage.

- Go to this step in Example: Modeling and Deploying Applications on page 133 for an example showing how to define a manual step in a component process. The steps to define a manual step in an application process are the same.

**Process Branching**

You can use process branching to specify the path through an application or component process based on transition conditions other than out-of-the-box options. Decisions about the next step in the process are made while the process runs. This is similar to the transition conditions for workflows in the automation platform. If the application or component process applies to multiple use cases, you can design one process with two or more branches instead of designing multiple processes for each use case. You can also define steps that run in parallel.
For example, to install or upgrade software, you can define one process for multiple use cases and use the same steps except for the following:

- The source files can be in .zip or .tar format. The steps to extract the files depend on the format.
- The operating system can be Linux or Windows. The steps to download the files, install them on the server, and enter commands depend on the operating system.

ElectricFlow supports the following branching conditions. The default is **Always**.

- Completion status of the previous process step
- A property set in another part of the system, not the in the previous step
- Custom validation rules

**Using Process Branching**

You define process branching when authoring an application or component process.

**Process Branching Example**

This example shows an application process with process branching that deploys a .war file.

Clicking a connector in a link opens the branching conditions menu. Depending on the location of the connector, some or all of these options may be available (enabled):

- **Always**—Always go to the next step, referred to as the target.
- **Successful**—Go to the next step if the previous step, referred to as the source, is successful.
- **Failure**—Go to the next step if the previous step fails.
- **Add Condition**—Add a custom condition that must be met before going to the next step.
- **Add Connector**—Add a connector from the source of the link to a new target by selecting one of the highlighted eligible steps. You can only select an eligible step.
- **Change Source**—Change the source by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Change Target**—Change the target by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Delete**—Delete the selected connector and link.

When you select the connector between the Start step and first step after it, only some of conditions appear and only some are available. The condition between the Start and the next step is **Always**, the default branching condition.

When you select the connector between subsequent steps, all of the conditions are available.

**Usage Guidelines**

Follow these guidelines when the process includes process branching:

- When you add a step, you must define it before adding another step.
- You can only configure branching conditions on a connector between two process steps.
• You cannot configure branching conditions between these objects:
  • The start of the process and the steps immediately after it.
  • The end of the process and the steps immediately before it.
• When defining a step in an application or component process, you configure what ElectricFlow does when an error occurs. *This setting overrides any job-step-level branching condition.*

You can select **Stop running** or **Continue running** in the **On Error** field in the Define Step dialog box.

If an error occurs in a job step and **Stop running** is selected, ElectricFlow aborts the process even if the branching condition is set to **Failure**.

**Process Branching States and Conditions**

**State of the Branching Condition Connectors in the UI**

In the ElectricFlow UI, the status of the link is based on the shape and color of the connector.

<table>
<thead>
<tr>
<th>Shape</th>
<th>Color</th>
<th>Link Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond</td>
<td>Light gray</td>
<td>Always</td>
</tr>
<tr>
<td>Diamond</td>
<td>Dark gray</td>
<td>Disabled</td>
</tr>
<tr>
<td>Square</td>
<td>Green</td>
<td>Successful</td>
</tr>
<tr>
<td>Circle</td>
<td>Red</td>
<td>Failure</td>
</tr>
</tbody>
</table>

**Examples of Branching Conditions**

These are examples of branching conditions that you can apply in your processes.

• Based on the status of the previous step

  Follow the branch based on the result of the previous step: Successful, Failure, or both (Always).

  Example:
  • **Successful**—If the file is downloaded successfully, the next step is to extract the files.
  • **Failure**—If the file was not downloaded properly, the next step is to abort the process.
  • **Always**—The next step is to always extract the files.
• Based on a value of an operation during the step

Follow the branch that matches the result of an operation such as calculating a value or processing data during the step.

Example: The result of an operation is a file type.
  - If the result is an XML zip file, the next step is open an XML text editor.
  - If the result is a .htm file, open a web browser.
  - If the result is a .mov, open an application to play the movie.

• Based on a property in another part of the system

Follow the branch based on a property set in another part of the system, not in the previous process step.

Example:
  - If the property `os_type = linux` is set on a resource, always follow the branch for Linux steps.
  - If the property `release_type` is set to minor in the application, always follow the branch for minor releases when running the process.

**Custom Conditions in Process Branching**

In a component or application process with branching, when you click the connector on a link between two steps, the Condition dialog box opens.
When you click the connector between the "Deploy War" and "Start Server" steps, these conditions appear:

- **Always**—Always go to the next step, referred to as the target.
- **Successful**—Go to the next step if the previous step, referred to as the source, is successful.
- **Failure**—Go to the next step if the previous step fails.
- **Add Condition**—Add a custom condition that must be met before going to the next step.
- **Add Connector**—Add a connector from the source of the link to a new target by selecting one of the highlighted eligible steps. You can only select an eligible step.
- **Change Source**—Change the source by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Change Target**—Change the target by selecting one of the highlighted eligible steps, which has a red outline. You can only select an eligible step.
- **Delete**—Delete the selected connector and link.

When you configure a **Property based** condition, the fields in the Condition dialog box remain the same.

When you configure a **Custom** condition, the fields change.
After you configure your conditions, they appear near the affected connectors in the process.

**Full-Stack Dependency View**

The full-stack dependency view helps you to visualize and manage dependencies in application models. In distributed environments, different teams can be responsible for authoring applications and managing the infrastructure, and managing dependencies across the stack is crucial. This view shows the mapping between application tiers and environment tiers, ensuring that infrastructure capabilities can support the minimum application requirements.

**Viewing Dependencies and the Stack Comparison**

**Stack Definition**
Viewing Dependencies and the Stack Comparison

The full-stack dependency view shows the mapping of application tiers to environment tiers in an application model. There are two ways to access this view:

From the Applications List, click ...

The mapping of application tiers to environment tiers appears.

Click in either the application or environment tier for each mapping pair. The stack comparison view appears. Go to the "Stack Definition" section for more information.

Stack Definition

When you are modeling an application, you have a target environment in mind. You may be modeling an application that is compute-intensive or data-intensive. For optimal performance, the application should run in an environment with 4 cores and 32 GB of RAM. If the application is deployed to an environment with one core and 8 GB of RAM, the application deployment may take a long time to run or may fail due to timeout errors.

You can define application requirements and environment capabilities such as:

- Supported platforms
- Hardware requirements
- Database requirements
- Disk usage
- Memory usage

**Modeling Application Requirements**

You can define requirements per application tier.

Starting in the Applications Visual Editor:

1. Click in an application tier, and select **Requirements**.

The **Tier Requirements** dialog box opens.
2. In the **Tier Capabilities** dialog box, enter the capabilities for the tier.

![Tier Requirements](image)

3. Click **OK**.

4. Repeat these steps to define the requirements for other application tiers.

**Modeling Environment Capabilities**

You define capabilities per environment tier.

Starting in the Environments Visual Editor:

![Capabilities in Environments](image)

1. Click in an environment tier, and select **Capabilities**.

The **Tier Capabilities** dialog box opens.
2. In the Tier Capabilities dialog box, enter the capabilities for the tier.

3. Click OK.

4. Repeat these steps to define the capabilities for other environment tiers.

**Modeling Infrastructure and Middleware Capabilities**

ElectricFlow also allows the modeling of infrastructure and middleware capabilities for resource templates as well as environment tiers.

1. Go to Resource Templates list and select any resource template.

   If no resource template exists, create one.
2. Click for the resource template, and select **Capabilities**.

The **Resource Template Capabilities** dialog box opens that allows you to capture the infrastructure and middleware details.
3. You can model many attributes for the resource template. Some examples of these attributes are:

- **Application Server:**
  - Product
  - Vendor
  - Version

- **Database Server:**
  - Product
  - Vendor
  - Version

- **Host:**
  - Architecture
  - CPU
  - Disk size
  - Memory (RAM)
  - Number of CPUs
  - Public IP
  - Private IP

- **Operating System:**
  - Operating System
  - Operating System Type
  - Vendor
  - Version

- **Virtual Image:**
  - CPU
  - Virtual Image Name
  - Memory (RAM)
  - Public IP
  - Private Subnet Mask
  - Private IP

This list is extensible and more modeling attributes can be added.

These attributes allow you to model Infrastructure and Middleware as well as hardware capabilities.

These can then be used to compare with the requirements defined on the application tier level.
**Configuration Drift**

Throughout the software release process, ElectricFlow tracks changes in the release to ensure that the applications are repeatedly and reliably deployed and that the release is successfully completed. ElectricFlow uses snapshots and change tracking to track the changes and identify differences, and then can notify users about them.

Snapshots are a version of the application at a point in time, encapsulating the specific state of the application, its environment states, its components, and the artifacts and artifact versions that define the components. You can manually take snapshots and compare two to determine the differences between them. You can also automate a procedure that takes snapshots on a schedule, create custom reports, and send them to users, making it easier to identify differences between deployments and resolve issues in the release. Go to [Snapshots](#) on page 275 for more information about snapshots.

Change tracking is another way to track differences between deployments. Change tracking can track the changes between every state of non-runtime objects and allows you to revert to any previous state of the objects, such as applications, application processes, components, artifacts, procedures, workflows, resources, and workspaces. In the Change History, you can find what changed for a specific object, such as an artifact, and when the change occurred. Go to [Change Tracking](#) on page 860 for more information about this feature and how to use it.
Deployment Examples

This section has examples of application deployments and includes:

- How to identify ElectricFlow objects—These are easily identified by icons and colors in the Visual Editors (such as the Applications Visual Editor, Environments Visual Editor, and Application Process Visual Editor) and lists (such as the Applications List and the Environment List).

- How to view details about the objects
  
  In the Applications Visual Editor and Environments Visual Editor, you can view details and other information of the application tiers, components, environment tiers, and resources.

  In the Application Process Visual Editor and Component Process Visual Editor, you can view details about the process steps.

- How a process can take different paths in the deployment based on parameter inputs.

- What to expect with different deployment options.

- How to model dynamic environments that provision (commission) environments and spin them up at runtime.

- How to use master components.

- How to use snapshots.

Guidelines for Modeling and Deploying Applications in ElectricFlow

When Modeling Applications

Keep the following in mind:

- By default, change tracking is enabled for all ElectricFlow Deploy projects.

- When authoring a component process, you specify the process type. The default is Deploy.

  In the Component Process dialog box, select one of these values in the Type field:

  - **Deploy**—Enables Inventory Tracking. The ElectricFlow server tracks the artifacts deployed to environments.

  - **Undeploy**—The next time that the process is run, the ElectricFlow server removes information about the artifacts deployed to environments.

  - **Other**—Disables Inventory Tracking.

- You can also create a library of standardized reusable components to promote best practices across the enterprise and speed up application authoring with **master components**. This is an easy way to reuse existing definitions and their underlying process definitions. Go Master Components on page 75 for more information.
• After creating an application, you can version the entire application model by taking a snapshot of it. A snapshot is an immutable version of an application with specific artifact versions.

You can save more than one snapshot of an application during the software release life cycle. You can compare snapshots to optimize and troubleshoot the application. You can also deploy a snapshot even if the latest version of the application has been modified.

Go to Snapshots on page 275 for more information.

• You can include hyperlinks as part of an object description for any ElectricFlow object.

• Known issues:
  • If an application tier has two components that cannot be deployed to the same host, the components need to be in different application tiers.
  • If a formal parameter in a manual process step is renamed, the formal parameter properties are not updated.

• Go to Inventory Tracking on page 271 for more information.
• Go to Environment Inventory for more information.
• Go to Example: Modeling and Deploying Applications on page 133 for an example of the Application Inventory in the Application View Run page.

When Modeling Environments

You can optimize how resources are used in application deployments. You can model dynamic environments that are automatically spun up when an application is deployed. These environments can have cloud and static resources. Cloud resources are provisioned using resource templates, which are specified in environment templates.

Using dynamic environments allows you to:
  • Provide ways to optimize how cloud resources are used.
  • Reuse provisioned resource pools.
  • Track how provisioned cloud resources are used.
  • Provide the status of the provisioning process.
  • Verify the credentials of cloud resources before provisioning them.
  • Configure the middleware of cloud resources on an on-demand basis.

When Deploying Applications

How an application is deployed depends on what you want to deploy. You can select the following deployment options.

• New run—Specify the runtime parameters and settings in the dialog box.

• Last run—Use the parameters from a previous run. You can modify one or more of these parameters as described in the dialog box where the runtime parameters and settings are set.

  Note: The option does not appear the first time an application is deployed.
- **Schedule**—Set the application to run on a schedule as described in *Running Applications with Schedules*.

You can also deploy the application with these options and methods:

- **Full deploy**—ElectricFlow deploys all the objects (including application processes, components, and artifacts) in the application. When you deploy an application for the first time, you must do a full deploy. Later, you can use this method to verify that the software is ready to be released.

- **Smart deploy**—This deployment method reduces risk and time by only deploying changed objects. ElectricFlow automatically detects the differences between what is about to be deployed and what has already deployed to an environment. It deploys only those objects not yet deployed to a specific resource or to resources where the object version is different. You can use this method throughout the software release life cycle.

- **Partial deploy**—The system deploys only objects that you select. You can use this method to verify incremental changes.

- **Partial deploy with specific artifact versions**—The system deploys only the artifacts with selected versions. You can use this method to verify incremental changes.

- **Schedule**—You can create schedules to deploy applications on a one-time, daily, weekly, or monthly basis. You can schedule nightly builds so that the developers and quality always have a new version to work on every day.

- **Snapshot**—You select a snapshot to deploy. A snapshot is an immutable version of the application with specific artifact versions. You can save and compare snapshots throughout a Release life cycle. Use this method to create a new environment. You can also use this method to create a new version of an environment. When you click the **Create** button, you create a new environment and it becomes your current environment. You can also use this method to deploy a specific version of an environment.

  **Note:** If you select a snapshot and modify it, it is no longer a snapshot and becomes a different version of the application, which you can save as a new snapshot.

- **Based on custom parameters defined in application processes**—Set these parameters when you deploy the application or when you define an application process step. They determine how the application should be deployed.

- **Artifact staging**—ElectricFlow retrieves the artifacts that will be deployed in an application run before the deployment starts. This ensures that all the artifacts are downloaded and available on the target. It also minimizes the time it takes to retrieve artifacts and reduces downtime during the deployment. Go to *Artifact Staging* on page 113 for more information.

- **Rollback**—When an application deployment fails, you can use the rollback functionality to restore the deployment model to a previous state before the failure occurred. This operation is supported only in application processes. Go to *Rollback* on page 115 for more information.

You can deploy applications by combining methods, such as:

- Smart deploy and partial deploy

- Smart deploy, artifact staging, and a partial deploy with specific artifact versions

- Full deploy and artifact staging with a snapshot

- Smart deploy and artifact staging

- Artifact staging and partial deploy

For example, this sequence is an example of how you may deploy your software over time:
• When you create an application in ElectricFlow and deploy it for the first time, you must do a full deploy. By default, smart deploy is disabled the first time that you run an application.

• Throughout these deployments, you can schedule the deployments to occur on a daily or weekly basis to provide builds that can be tested and installed on a regular basis.

• You can also save snapshots of the software at regular intervals or milestones. When you need to troubleshoot the software or want to do performance testing, you can use one of these snapshots for comparison.

• If the application does not deploy successfully, you can redeploy parts of it to troubleshoot the application or component processes that failed.

You can do a partial deploy and redeploy the application with only the objects that failed.

You can also do a partial deploy only with specific versions of artifacts to determine if one or more specific versions of artifacts are causing problems.

• Later, after successfully deploying the application, you can redeploy parts of the application when new versions of artifacts or new resources are available.

• When a new version of an artifact is released, you can deploy only the artifact by selecting the new version and doing a partial deploy.

• When you add artifacts and resources to the application, you deploy the new artifacts to resources and specific versions of selected artifacts to the new resources, a combination of smart deploy and partial deploy with specific artifact versions.

Getting the Real-Time Status of Application Runs and Troubleshooting

Use the Environment Inventory and Application Inventory to view the progress of the application as it runs and the results of previous runs. They show detailed results that can be used to troubleshoot the application. Go to Inventory Tracking on page 271 for more information.

• In the Application Inventory (on the Applications Run View page), you can get information about the application, its application processes, components, and job steps and about the status of these objects.

• In the Environment Inventory, you can get more details about the environment, the applications mapped to it, number of deployed artifacts in the applications, where the artifacts are deployed, and the status of these objects.

Use Change Tracking to troubleshoot a failed job, look for more information about non-run object, and/or look for differences between objects. Go to Change Tracking on page 860 for more information.

Compare snapshots to refine and troubleshoot an application. Go to Snapshots on page 275 for more information.

Example: Modeling and Deploying Applications

Applications consist of components and the processes that orchestrate the deployment of these components. Each application object has one or more application tiers, where a tier is a logical group of components. A component is based on an artifact, and the component definition contains a reference to this artifact.

When defining a component, you specify the artifact repository (plugin) and the artifact version that you want to use. ElectricFlow supports artifacts from a variety of Artifact Repositories, such as the EC-Artifact repository, Maven based repositories like Nexus or Artifactory (using EC-Maven), or artifacts on any file system (using EC-
These artifacts could point to any build outputs, configuration scripts, database, scripts, and so on. The information that you enter in the component definition depends on the artifact repository that you select. For more information about artifacts, go to Artifact Management on page 835 and Artifacts on page 610.

You can use Change Tracking to track all the changes for non-runtime objects such as the application model, components, artifacts, resources, the environment model, and projects. Go to Configuring Change Tracking on page 861 for more information.

This example shows how to model and deploy an application in ElectricFlow.

Creating a New Application

This example shows how to create an application consisting of multiple application tiers with multiple components.

In the Applications List:

1. Click Add + to add an application.
2. In the New dialog box, click Application > Create New.
3. Select a project to which the new application will belong in the Select Project field, enter a description of the application, and click OK.

   **Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

Example:

The Applications Visual Editor opens.
4. Define an application tier and the components in it.

In Tier 1, click and select Details to edit the details in the Application Tier Details dialog box.

a. Rename the application tier to "App Server" and click OK.

b. To define the component:

i. Click + under the Component.
ii. Click Create new application component.
iii. Enter "Config" as the component name, and click Next.
iv. In the Content Location field, select EC-FileSysRepo.
v. Enter the required Source and Artifact.
vi. Enter the artifact Version. In this example, select Exact, and enter 1.
vii. Click OK.
viii. Depending on the value that you select in the Content Location field, different fields appear.
ix. Enter the information to define the component.

Example:
c. In the "App Server" tier, click + in the lower right corner to add another component. Define another component similar to how to defined the first component in this step:

Example:

5. In the Applications Visual editor, click to add another tier to the application, and define the first component in it. The new tier is called "Tier 1." Repeat the procedure in this step to define application tier and the components in it. This tier will be called "DB" and will have two components.

Example: Name it "Cleanup DB" with the following definition.
6. To add a master component to the DB tier:
   a. Click + under the **Component** to define the component.
   b. Click **Create from existing master component**.
   c. Select **dataload_mc** from the list of master components, and click **Next**.

The Applications Visual Editor now shows the two application tiers with two components each.

Example:

![Diagram showing two application tiers with components](image)

**Authoring Component Processes**

In a component process, you define a set of actions that will be executed on a specific component during the deployment. A component process step can be defined as a call to an ElectricFlow plugin or procedure, a direct command or script in any scripting language, a manual task, or a utility function (a higher-order operation than a plugin).

This example shows how to author a component process with a manual step and a step defined by a utility function.

In the Cleanup DB component of the "DB" tier:

1. Click ![Manual Step Icon](image) to start authoring a component process.

   The **Component Process** dialog box appears:
2. In the Component Process dialog box, enter the following details:
   - Enter “Start server” in the Name field.
   - Enter an optional description in the Description field.
   - Keep the selection as Deploy in the Type field. This value determines track what is built, tested, and deployed during the application deployment. The default is Deploy.
     - **Deploy**—Enables Inventory Tracking. The ElectricFlow server tracks artifacts deployed to environments.
     - **Undeploy**—After the first successful job step in a component process with this setting, the automation platform removes the environment inventory record.

   If you choose Undeploy, the Skip undeploying this component if it was not deployed before option appears:

   ![Component Process](image)

   If you choose this option, the undeploy process is not performed if the component inventory does not exist.
   - **Other**—Disables Inventory Tracking.

   - Specify who can run the component process in the Credential field. Clicking displays a dialog box where you select a project and then a credential (user name and password) in that project for the process, which are created and managed at the platform level. You can only impersonate one credential. To set the credential type, see Adding Credentials.
• Select a workspace from the drop-down list of workspaces in the ElectricFlow platform in the **Workspace** field, where the files and results of the job step are stored (optional).

• Set a time limit in the **Time limit** field, the maximum amount of time that the step is allowed to run. After the time specified, the step is aborted. Enter the time, and select the unit of time: seconds, minutes, or hours. Go to the Job Step Details on page 645 for information how time limits work in procedure job steps.

3. **Click OK.**

The Component Process Visual Editor opens.

The process model shows a process with **Start** and **Finish** steps with a **New Step** in between them.

**Note:** Clicking i under the step name displays the details about the process step.

Example:

4. **Click + in the first step.**
5. Define the first step in the Component Process Step dialog box:
   a. Enter "Retrieve" in the Name field.
   b. Enter "Retrieve the new DB file" in the Description field.
   c. Use the Continue Running setting in the On Error field. Go here for more information.
   d. Use the all setting in the Run if field. Go here for more information.
   e. Specify who can run the component process in the Credential field. Clicking displays a dialog box where you select a project and then a credential (user name and password) in that project for the process step, which are created and managed at the platform level. You can only impersonate one credential. To set the credential type, see Adding Credentials.
   f. Click Next.

Example:
6. To define the first step in the Component Process Step dialog box as a manual step, select **Manual** as the **Step Type**, and enter the details about it:
   
   a. Enter the users or groups who can perform and approve this task in the **Assignees** field. Email notifications are sent to assignees who perform the task and to those who approve the task before the process can proceed to the next step.
      
      - As you type the user or group name, ElectricFlow displays the possible matches. You can select one or more of the suggested users or groups or type the entire name to complete the entry.
      
      - You can also use the "$[]" notation for parameter substitution to dynamically assign users or groups to perform and approve manual tasks at runtime.
   
   b. Enter the instructions for the manual task.
      
      The instructions can include property references using the "$[]" notation for file links, which is needed when referencing a task instruction in an email notification template. For example, a manual task could have this instruction:
      
      Please check the Clover report, and make sure there is at least 80% code coverage before you approve.
      
      http://myserver.com/reports$/[myPipelineRuntime/ec_summary/report_name]
      
   c. Click **OK**.

   **Example:**

   ![Example Image]

   **Note:** Inventory merely captures the version of the software that is installed on a resource. This means that if an approver rejects a manual step as part of the component process, the software that was installed is not removed, and the inventory is not marked as being in error. If you intend to roll back the software, you must add a rollback step, which will uninstall the software and roll it back to the older version.

7. Click **+** on the bottom of the first step to add a new step below it.

8. Click **+** in the second step.
9. Define the second step in the Component Process Step dialog box:
   a. Enter "Submit IT ticket" in the Name field.
   b. Enter "Track this task" in the Description field.
   c. Use the Continue Running setting in the On Error field. Go here for more information.
   d. Use the all setting in the Run if field. Go here for more information.
   e. Click Next.

10. To define the second step in the Component Process Step dialog box based on a component operation, select Component Operations as the Step Type. The parameters for this process step are automatically inherited from the "Cleanup DB" component.

Example:

```
+-----------------+-----------------+-----------------+-----------------+
| Component       | Parameters       | Parameters       |
| EC-FileSysRepo/ | inherited from  | inherited from  |
| Retrieve File   | component        | component        |
| Artifact        |                  |                  |
| Parameters      |                  |                  |
| Source:         | /net/f2home/dkarpenko/heatcln | Required |
| Artifact:       | cleandb.sql      | Required         |
| Version:        | Latest           |                  |
| Retrieved       | Exact 1           |                  |
| Directory:      |                  |                  |
```

11. Add a third step to the process as described in the previous steps. The step type is Command. You can enter a command or script when defining this step.
12. Add a fourth step called "Tear down environment" as described in the previous steps, and define the fourth step in the Component Process Step dialog box as a Utility step. This is also referred to as a utility function that is a higher-order operation than a third-party plugin.

   a. Select Utilities as the Step Type

   b. Select EF-Utilities - Decommission Environments and click .

      Example:

      ![Utility Step](image)

      EF-Utilities - Decommission Environments

   c. Enter the parameter values for the parameters for utility, and click OK.

      Example:

      ![Utility Step](image)

      EnvironmentList: Dev

13. Repeat the previous steps to author component processes for other tiers in the application.

This is the component process:
You can get details about each step by clicking i under the step name.

It has one manual step, which is differentiated from the automated steps by color. Manual steps are blue while automated steps are orange.

Each step has an icon indicating the step type.

The first step is a manual step.
The second step is based on a component operation.
The third step is a command or script.
- These steps are deployed in series. The second step can only start after the first step is completed.

- Clicking displays menu where you can select options:
  - Details—View step details
  - Properties—View step properties.
  - Access Control—View access control settings.
  - Add Connector—Add another connector to the step.
  - Track Changes—View the Change History.

**Authoring Application Processes**

At the application (parent) level, you author application processes. When deploying an application, the application process that you select is executed to orchestrate operations against the application. An application process step can be defined as a call to an ElectricFlow plugin, procedure, or component process as well as a direct command, script, a manual task, or a utility function (a higher-order operation than a plugin).

This example shows how to author an application process with process branching and a rollback step.

In the Applications Visual Editor for the Upgrade application:
1. Click to start authoring an application component process.

2. In the Application Process Details dialog box, enter the following details:

   - Enter "Run" in the Name field.
   - Enter an optional description in the Description field.
   - Keep the selection as Deploy in the Type field. This value determines what is built, tested, and deployed during the application deployment. The default is Deploy.
     - Deploy—Enables Inventory Tracking. The ElectricFlow server tracks artifacts deployed to environments.
     - Undeploy—After the first successful job step in a component process with this setting, the automation platform removes the environment inventory record.
     - Other—Disables Inventory Tracking.

   - Specify who can run the application process in the Credential field. Clicking displays a dialog box where you select a project and then a credential (user name and password) in that project for the process, which are created and managed at the platform level. You can only impersonate one credential. To set the credential type, see Adding Credentials.

   - Select a workspace from the drop-down list of workspaces in the ElectricFlow platform in the Workspace field, where the files and results of the job step are stored (optional).

   - Set a time limit in the Time limit field, the maximum amount of time that the step is allowed to run. After the time specified, the step is aborted. Enter the time, and select the unit of time: seconds, minutes, or hours. Go to the Job Step Details on page 645 or information how time limits work in procedure job steps.

Example:
3. Click **OK**.

   The Application Process Visual Editor opens.

   The process model shows a process with **Start** and **Finish** steps with a **New Step** in between them.

   **Note:** Clicking i under the step name displays the details about the process step.

   Example:

   ![Diagram](image)

4. Click + in the first step.
5. Define the first step in the Application Process Step dialog box:
   a. Enter "Check" in the Name field.
   b. Enter "Check the database version" in the Description field.
   c. Use the Continue Running setting in the On Error field. Go here for more information.
   d. Use the all setting in the Run if field. Go here for more information.
e. Add the root user in the **Credential** field. Only root user can run the application process.

    ![Image]

Clicking **Next** displays a dialog box where you select a project and then a credential (user name and password) in that project for the process step, which are created and managed at the platform level. You can only impersonate one credential. To set the credential type, see [Adding Credentials](#).

Example:

This shows the process step has one credential.

f. Click **Next**.
6. To define the first step as a command or script, select **Command** as the **Step Type**, and enter the command or script.

   **Example:**

   ![Command Example](image1)

   ```
   /etc/init.d/tomcat7 stop
   webapps-$HOME/myEnvironment/tomcat_home/webapps/*-t/-f $webapps/mycompany*
   ```

7. Click + on the bottom of the first step to add a new step below it.

8. Click + in the second step.

9. Define the second step in the Application Process Step dialog box as follows, and click **Next**:

   ![Application Process Step](image2)

10. To define the second step in the Application Process Step dialog box based on a component, select **Components > Heatclinic> Deploy**. The step is defined by the component Deploy process for the Heatclinic component.

   ![Define Step](image3)
11. Click + on the bottom of the first step to add a third step below it. This step will run in parallel to the second step.

12. Define the third step as described in the previous steps.

The step type is **Components**. Select **Components > Cleanup DB > Deploy**.

The step is defined by the component Deploy process for the "Cleanup DB" component.

13. Repeat the previous steps to add more steps to the application process.

**Note:** Starting in ElectricFlow 6.3, you can also define an application or component process step as a utility function, a higher-order operation than a third-party plugin, for application modeling. Go [here](#) for example of how to define a utility step.
14. After the "start server" step, add a rollback step:
   a. Click + at the bottom of the "start server" step.
   b. Click + in the New Step to define it.
   c. Click Next.
   d. Select Rollback as the Step Type.
   e. Define the rollback process.

The Continue Running setting in the On Error field. Go here for more information.
f. Click **Next**.

![Define Step](image)

Enabling **Component Level Rollback** activates rollback only on those components that failed. You can use component-level with automatic rollback and with snapshots. For more information about rollback, see the **Rollback** on page 115 section in the "Deployment Automation" chapter.

Enabling **Rollback only successfully undeployed components** limits rollback to those components that undeployed successfully.

Enabling **Undeploy Application before Rollback** lets you choose **Undeploy** as the process. You can trigger rollback even if undeploy fails. To do so, use the **Continue Running** setting in the **On Error** field when configuring a rollback step. Go here for more information.

g. Click **OK**.

15. Complete the process by creating success and failure branches after the "start server" step.

- Click on the connector between the "start server" step and the Rollback step, and change the condition from **Always to Failure**.
- Click on the connector between the "start server" step and the "Send notification" step, and change the condition from **Always to Successful**.

This is the application process called Run:
- You can get details about each step by clicking i under the step name.
- It has one rollback step, which is differentiated from the automated steps by color.
  The rollback step is orange-red while automated steps are green.
- Each step has an icon indicating the step type.
  Two steps are defined by commands or scripts.
  Three are defined by components.
  One is for rollback.
- Some steps are deployed in parallel.
  The second and third steps are both deployed after the first step.
• After the "start server" step is completed, the next step depends on the its outcome:

If the step completed successfully, the "Send notification" step is run where interested users and groups receive emails that the upgrade was completed successfully.

If the step failed, the rollback step is run and the step rolls back to its previous state.

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Menu" /></td>
</tr>
<tr>
<td>Displays menu where you can select the options:</td>
</tr>
<tr>
<td>- Details—View step details</td>
</tr>
<tr>
<td>- Properties—View step properties.</td>
</tr>
<tr>
<td>- Access Control—View access control settings.</td>
</tr>
<tr>
<td>- Add Connector—Add another connector to the step.</td>
</tr>
<tr>
<td>- Track Changes—View the Change History.</td>
</tr>
</tbody>
</table>

### Creating Environments

Environments are logical grouping of machines to which various applications can be mapped and deployed. Using environments and templates, you can model the infrastructure and the middleware available for various applications. Environments consist of logical groups of resources with a similar function or role called environment tiers. An environment tier can be a group of machines with a similar function or role, such all the web servers or application servers or database servers for an environment. Resources are actual target end point machines (such as physical servers), virtual machines, or mobile devices.

Environments can be static, dynamic, or hybrid. A static environment has resources that are already provisioned and managed at the platform level. Each resource has its own logical name to identify it from the other resources in the system. It also can be assigned to one or more resource pools or to a zone (a collection of agents). Several resources can correspond to the same physical host or agent machine. Resources can also be configured as standard or proxy. Standard resources are machines running the ElectricFlow agent on a supported agent platform while proxy resources (agents and targets) are on remote platforms or hosts that exist in your environment and requires SSH keys for authentication. The ElectricFlow agent does not need to run on the remote platform or host. Go to Resources on page 701 for more information about to create, configure, and manage resources.

This example shows how to model a static environment to which the application will be deployed. For information about dynamic environments and how to model them, go to Deploying Applications in Dynamic Environments on page 202.

In the Environments List:

1. Click Add + (in the upper right corner) to add an environment.
2. In the New dialog box, select Environment > Create New.
3. Select a project to which the new environment will belong in the *Select Project* field, enter a description of the environment, and click **OK**.

   **Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

Example:

![Environment Visual Editor](image)

The Environments Visual Editor opens.
4. Define an environment tier and assign resources it.

In Tier 1, click and select Details to edit the details in the Environment Tier Details dialog box.

a. Rename the application tier to "App" and click OK.

b. To define the resource:

   Click + under the Resource.

   Click Add resources.

   Select the resource that you want to assign to the environment tier, and click OK. A resource is available if it is enabled.

Example:

![Image of resource selection](image)

The Environments Visual Editor now has an environment tier called "App" with one resource.

Example:

![Image of environment tier](image)

5. In the Environments List, click Add + (in the upper right corner) to add another environment.

6. In the New dialog box, select Environment > Create New.
7. Select a project to which the new environment will belong in the **Select Project** field, enter a description of the environment, and click **OK**.

**Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

Example:

![Environment selection interface]

The Applications Visual Editor opens.

8. In the Environments Visual Editor, define the environment tier and assign resources to it.

   a. In Tier 1, click and select **Details** to edit the details in the **Environment Tier Details** dialog box.
   b. Rename the application tier to "mysql" and click **OK**.
   c. To define the resource:
      i. Click + under the **Resource**.
      ii. Click **Add resources**.
      iii. Select the resource that you want to assign to the environment tier, and click **OK**. A resource is available if it is enabled.

Example:

![Resource selection interface]

The Environment Visual Editor now has an environment tier called "mysql".
9. In the Environments Visual editor, click ![add tier](image) to add another tier to the environment, and assign resources to it. The new tier is called "Tier 1."

Repeat the procedure in this step to define the environment tier and the resources in it. This tier will be called "tomcat" with the resource called "heatclinic-res" assigned to it.

The Environments Visual Editor now has two environment tiers, each with one resource.

Example:

![Environment tiers](image)

**Defining Tier Maps**

Before deploying applications, a tier map must be defined associating the application with an environment.

In the Applications Visual Editor for the application that you want to deploy:

1. Click ![add tier](image).

   The Tier Map dialog box opens.

2. Select **Environment**.

3. From the list of environment that you have permission to view, select an environment. You can search for environments by project name or enter the search criteria in the **Search** field.

   Example: Select QA.
4. Map the application tiers to the environment tiers:

a. For each application tier, click in the corresponding **Environment Tiers** column, and select an environment tier. Select one from the list or enter the search criteria in the **Search** field.

Example:

![Tier Map](image-url)

b. Click **OK** when each application tier have been mapped to an environment tier.

These are examples of tier maps.

- For the QA environment:

![Tier Map](image-url)

- For heatclinic-qe environment:

![Tier Map](image-url)

**Deploying and Troubleshooting Applications**

This example shows how to deploy the application multiple times with different runtime conditions.
First Run

In the Applications List, clicking **New Run** opens the dialog box where you can set the runtime settings.

- In the Select Process field, select **Run**.
- In the Select Environment field, select **QA**.
- You can select a snapshot in the **Select a Snapshot** field if you have one or more.
- For the first run, all artifacts will be deployed.
- **Smart Deploy** and **Stage Artifacts** are enabled.

Click **OK** to start the application run.

The Applications View Run page shows the progress of the application run:
• The blue steps are running (in progress).
• The green steps were completed successfully.
• The red steps failed.

Clicking opens the Job Details page where you can begin the troubleshoot the step.

• The gray steps were skipped.

Subsequent Runs

After the first application run, you can deploy the Run process to the QA environment with other deployment options.
**Based on the Last Run**

Clicking and selecting **Last Run** opens the dialog box where you can set the runtime settings. It displays the runtime settings from the previous. You can deploy the application using the same settings as the previous run or you can modify one or more them for the current run.

**Based on Schedules**

Clicking and selecting **Schedule** opens the list of schedules for the application. If there are no schedules, the list looks like this:

![There are no Run Schedules. Add one](image)

Clicking **There are no Run Schedules. Add one** (or **Add +**) opens the Run Schedule dialog box.

- Select **Create new** to create a new schedule, and then enter the schedule details.
- Select **from Previous Runs** to create a schedule based on a previous application run.

A list of the last five application runs appears:

![Last 5 Runs](image)

Select an application run, and then enter the schedule details.

In the **Run Schedule Details** dialog box, enter the schedule details:

- In the **Schedule name** field, enter the schedule name.
- In the **Frequency field** field, click the down arrow and select **Once, Daily, Weekly, or Monthly**.
- In the **Country** field, click the down arrow and select a value in the drop-down list.
- In the **City** field, click the down arrow and select a value in the drop-down list.
In the Start field, click if you want to change the start date, and click in the hh:mm box to set the start time using the 24-hour clock.

In the End field, click and select the end date from the pop-up calendar. The end time is the same as the start time.

Click Next.

The dialog box where you can set the runtime settings appears. You can also modify the runtime settings at this time.

Click OK.

This message appears:

Click OK to close it.

When you view the list of schedules for the application again, the schedule that you created appears in the list.

<table>
<thead>
<tr>
<th>Run Schedules</th>
<th>Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Process</td>
</tr>
<tr>
<td>Schedule A</td>
<td>Run</td>
</tr>
</tbody>
</table>
**Runtime Settings**

In the dialog box where you can set the runtime settings, the **Artifacts** field looks like this for a full run:

![Full Run Artifacts](image)

- Partial deploy with smart deploy and artifact staging are enabled:

  ![Clicking](image)

  Clicking opens the list of artifacts to be deployed in the application process.

  ![Partial Run Artifacts](image)

  If you want to only deploy the DB artifact (cleanup.sql), click in the "1 App Server" column to deselect (disable the selection of) the Config and Heatclinic components (based on the env.sh and mycompany.war artifacts), and click **OK**.

  The **Artifacts** field now looks like this for a partial run:

  ![Partial Run Artifacts](image)
• Partial deploy with specific artifact versions and with smart deploy and artifact staging are enabled:

In the list of artifacts to be deployed in the application process, click in the "2 DB" row to deselect (disable the selection of) the "Cleanup DB" component (based on the cleanup.sql artifact), select the Latest version of the mycompany.war artifact, and click OK.

The Artifacts field now looks like this for the partial run:
- Snapshot with partial deploy and with smart deploy and artifact staging are enabled:

In the Select a Snapshot field, click the down arrow and select the Upgrade_latestMC snapshot.

In the list of artifacts to be deployed in the application process, click in the "1 Config" row to deselect (disable the selection of) the Config component (based on the env.sh artifact) and click OK.

The Select a Snapshot and Artifacts fields now look like this for the partial run:

Viewing the Real-Time Progress of Deployments

This example shows the job details for a specific step. Clicking in the "cleanup db" step opens the Job Details page:
This example shows that the rollback step has not run yet:

Clicking in the rollback step opens the Job Details page, showing that the status is Waiting for Precondition. This step will not run until the precondition is met.
Troubleshooting Deployments

This example shows that the "start server" step was Completed with Errors.

Clicking in the "start server" step opens the Job Details page.
Clicking in the Diagnostics tab can provide more information about the errors.

**Example: Manual Steps with Runtime Parameters**

This topic describes manual steps with parameter inputs and how the parameter inputs influence the process flow to take different paths. You can define manual steps in an application process or component process.

In the following example, an application process called Deploy has the following steps. When deployed, this process updates the website for an online store.

- The first step is a command step to retrieve a .war file that will be deployed to the website.
- The second step is a manual step to log into a terminal where you can enter CLI commands to update the website.
  
  If you have admin privileges, you can update the home (parent) page.
  
  If you do not have privileges to update the home page, you can update only the product (child) pages.
  
  Depending on your privileges, the parameter input to the manual step is either pass (you have the privileges to update the home page) or fail (you can only update the product pages).

- The parameter inputs to the manual step are the preconditions to the third and fourth steps.
  
  - condition1 is fulfilled if the input to the manual step is pass.
  
  - condition2 is fulfilled if the input to the manual step is fail.

  These preconditions determine the step that is executed after the manual step.

- The next step is either the third or fourth step.

  If the parameter input for the manual step is pass, the process continues to the “Update the home page” step.

  If the input is fail, the process continues to the “Update a product page” step.
Process Flow Details

After starting the deployment, the .war file is automatically retrieved in the first step.

In the second step, email notifications are sent to one or more assignees. One of the required assignees performs the manual task, which is to log into a terminal and enter the appropriate CLI commands to set up the website update. After clicking on the link in the email, the assignee goes to the ElectricFlow UI and provides input to the manual process step using the pass_fail_value parameter.

- If the assignee has admin privileges, the value of the pass_fail_value parameter is pass. The process continues to the “Update the home page” step.
- If the assignee does not have admin privileges, the value is fail. The process continues to the “Update a product page” step.

In the third and fourth steps:
• The **OnError** setting is **Continue running**.

  If the process encounters an error while the web page is being updated, it completes the step with errors and then continues to next step.

  The default is **Stop running**, where the process will abort if the process encounters an error.

• The **Run if** setting is **all** (the default). All the preconditions to the step have to be met before the process goes to the next step.

  If **any** is selected, only one of the conditions has to be met before the process continues running.

---

**Application Process Step**

- **Update the home page**

  - **Home page web update**

  **On Error:**
  - Continue running
  - Stop running

  **Run if:**
  - All
  - Any

---

**Deployment Scenarios**

These are possible deployment scenarios.

**Assignee has admin privileges and the deployment is completed successfully**

The home page is updated in this scenario.

When the Deploy application process is deployed to the QA environment, you can view the progress of the deployment in the "Applications / View Run" page.

**Clicking** opens the Manual dialog box. **Clicking** in the Parameters row displays the required parameters on the right side of the dialog box.

If you enter **pass** in the **pass_fail_value** field, select **Completed** as the **Outcome**, and click **OK**, the process continues to the "Update the home page" step.
The parameter value (pass) is used in the precondition to determine the next step in the process flow. It is also passed to the next step.

The step to update the home page is successfully completed. Notice that the "Update a product page" step is skipped.

In the top row, clicking  takes you to the Job Details page.
Clicking in the runCommand row takes you to the log file for that step, which displays the parameter value from the manual step that was passed to the "Update the home page" step.

Assignee does not have admin privileges and the deployment is completed successfully

A product page is updated in this scenario.

When the Deploy application process is deployed to the QA environment again, you can view the progress of the deployment in the "Applications / View Run" page.
When the process reaches the second step, clicking opens the Manual dialog box.

Clicking in the Parameters row displays the required parameters on the right side of the dialog box.

If you enter fail in the pass_fail_value field, select Completed as the Outcome, and click OK, the process continues to the "Update a product page" step.

The parameter value (fail) is used in the precondition to determine the next step in the process flow. It is also passed to the next step.

In this deployment, both the Deploy process and the step to update product page are completed successfully.

In the top row, clicking takes you to the Job Details page.
Clicking in the runCommand row takes you to the log file for that step, which displays the parameter value from the manual step that was passed to the "Update the home page" step.

Assignee does not have admin privileges and the deployment is completed with errors

A product page is updated in this scenario.

When the Deploy application process is deployed to the QA environment again, you can view the progress of the deployment in the "Applications / View Run" page.

When the process reaches the second step, clicking opens the Manual dialog box.

Clicking in the Parameters row displays the required parameters on the right side of the dialog box.

If you enter fail in the pass_fail_value field, select Failed as the Outcome, and click OK, the process continues to the "Update a product page" step.
The parameter value \textit{(fail)} is used in the precondition to determine the next step in the process flow. It is also passed to the next step.

In this deployment, the step to update the product page is completed successfully even though the Deploy application was completed with errors. The error is in the second step where the outcome is \textbf{Failed}.

In the top row, clicking \textbf{ } takes you to the Job Details page.

Clicking \textbf{ } in the runCommand row takes you to the log file for that step, which displays the parameter value from the manual step that was passed to the "Update the home page" step.

\textbf{Setting Up Custom Parameters for Application and Component Processes}

Parameters are used throughout the release planning and management process. They provide an easy way to model releases, pipelines, and applications. They can be inputs to procedures, workflows, applications, pipelines, and releases. You can use parameters in place of predefined credentials, property paths, user or group names for notifications, runtime conditions. Parameters are created and managed independent of any object at the platform level.
These examples show how to add custom parameters and setting the parameter labels in the GUI.

**Adding Custom Parameters**

In the Application Process or Component Process Visual Editor:

1. Click [ ] on the upper right corner of the Visual Editor.

2. Click **Parameters**.

   The **Parameters** dialog box opens.

   Example:

   ![Parameters dialog box](image)

3. Click **Add +** or if no parameters have not yet defined for the object, click **There are no Parameters yet. Add one +** to add a parameter.

   The **New Parameter** dialog box opens.

   Example:

   ![New Parameter dialog box](image)
4. Enter the following information:
   
   - **Parameter Name**—Name of the parameter.
   - **Description**—This is optional.
     
     *Note:* You can include hyperlinks as part of an object description for any ElectricFlow object.
   - **Label**—Label that appears on the GUI. This is optional.
   - **Text Entry**—How the user selects the value for this parameter. Valid options are **Text Entry**, **Test Area**, **Dropdown Menu**, **Radio Selector**, **Checkbox**, or **Credential**.
   - **Default Value**—Default value for the parameter. This is optional.
   - **Required**—If the parameter is required, select the **Required** check box.
   - **Defer Expansion**—If the parameter value contains $[ ]$ and you want ElectricFlow to interpret it literally (not as a parameter reference), select the **Defer Expansion** check box.
   
   Depending on the parameter type that you select, other fields appear in the dialog box. Go to the following appropriate step to complete setting up the parameter.

5. If you select **Text Entry** as the parameter type, the **Default Value** field appears. You can enter a default value but it is not required, and then click **OK**.

6. If you select **Text Area** as the parameter type, the **Default Value** field appears. You can enter a default value but it is not required, and then click **OK**.

**Example:**

![Example Diagram](image-url)
7. If you select **Dropdown Menu** as the parameter type, the **Default Value** field and ways to add the menu options appear. You can enter a default value but is not required.

   a. On the right side of the dialog box, enter the menu options.
   
   b. Click **OK**.

   **Example:**

   ![Dropdown Menu Example](image)

8. If you select **Radio Selector** as the parameter type, the **Default Value** field and ways to add the menu options appear. You can enter a default value but is not required.

   a. On the right side of the dialog box, enter the menu options.
   
   b. Click **OK**.

   **Example:**

   ![Radio Selector Example](image)
9. If you select **Checkbox** as the parameter type, the **Default Value** field and values for the check box appear. You can enter a default value but it is not required.

   a. On the right side of the dialog box, enter the values.
   
   b. Click **OK**.

   Example:
10. If you select **Credentials** as the parameter type, the **Default Value** field appears. You can enter a default value but is not required, and then click **OK**.

Example:

![Parameter Dialog](image)

After completing these steps, the **Parameters** dialog box opens and shows the new parameter in the list.

Example:

![Parameter List](image)

**Setting and Modifying the Parameter Label**

In the **New Parameter** dialog box:

Example:
1. Add a label in the **Label**. This is optional.

Example:

If you enter a label, it appears in the UI form when you deploy the application. If you do not enter a label, the parameter name appears in the UI form when you deploy the application.

2. Click **OK**.
3. To modify the label:
   a. Open the **New Parameter** dialog box.
   b. Clear the **Label** field.
   c. Enter a new label.
      
      **Example:**
      
      ![New Parameter dialog box]
      
      d. Click **OK** to save the change.
4. To delete the label:
   a. Click **Delete** next to the **Label** field.

   Example:

   Notice that the text in the **Label** field changes.

   Example:
b. Click in the **Label** field.

The label disappears.

Example:

```
<table>
<thead>
<tr>
<th>Parameters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>QA Verification Required</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>Label</td>
<td></td>
</tr>
<tr>
<td>Checkbox</td>
<td></td>
</tr>
<tr>
<td>Default Value</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

![Image of parameter dialog box]

Example:

```
<table>
<thead>
<tr>
<th>New Parameter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value when unchecked</td>
<td>No</td>
</tr>
<tr>
<td>Value when checked</td>
<td>Yes</td>
</tr>
<tr>
<td>Initially checked</td>
<td></td>
</tr>
</tbody>
</table>
```

c. Click **OK**.

The **Parameters** dialog box opens. The parameter name now appears in the name column.

**Looking Up Parameters in Application and Component Processes**

To apply parameters to an application or component process step, starting in the Application Process or a Component Process Visual Editor:

1. Add a new step to the process.
2. Define the process step in the **Define Step** dialog box.
3. When you define the process step with a plugin (Plugins), command or script (Command), or project (Procedure), click the Lookup button to open the Parameter Lookup dialog box.

Example:

![Parameter Lookup dialog box](image)

The **Parameter Lookup** dialog box opens.

4. Choose a parameter and click the **Copy** button to copy the path reference.

   A message appears in the row: `<Parameter Name>` has been copied.

   The **Define Step** dialog box now has a Parameter field.

5. Click in the **Parameter** field and paste the path reference that you copied in it.

6. Repeat the previous two steps to apply another parameter to the process step.

7. Click **OK**.

**Attaching Credentials to Application and Component Processes**

This topic describes how to add credentials and parameters to a component processes and apply custom parameters to them. These parameters are required at runtime when the application is deployed.

When defining an application or component process step:
1. Click in the Credentials row in the dialog box where you can set the runtime settings.

The Credentials dialog box opens and shows the list of credentials for this process step. If there are no credentials, the dialog box looks like this:

2. Click + Add Credentials Impersonate Attach to add a credential.

3. Select Attach to attach a credential to the process step. This credential is created and managed at the platform level.

The other ways to add credentials to a process step are:

- If you want to impersonate one credential, select Impersonation, select the project to which the credential belongs, and the credential that you want to use for impersonation.
- If you want to attach a credential parameter to the process step, select Attach Parameter. Click in the Select credential parameter field to set the parameter.
4. Select the project to which the credential belongs in the Select Project field, the credential in the Select Credential field, and click Next.

The list of credentials now shows the credential you added:

5. Click Next.

The dialog box where you can set the runtime settings now shows that one credential is attached to the process step.

6. Repeat the previous steps to attach another credential or use impersonation.

**IMPORTANT:**
When you impersonate a credential, make sure that the impersonated user has the absolute path to the bin directories in the $PATH environment.
If you define a process step with a command, you must enter the absolute path in the Post Processor and Shell fields in the "Define Step" dialog box.

**Plugin Process Steps**

Plugin steps allow you to orchestrate third-party tools at the appropriate time in your component or application process. The following third-party tools can be used with ElectricFlow:

- Application Servers—Examples are IIS, JBoss, and Tomcat.
- Builds—Examples are EMake, Maven, or Visual Studio.
- Code Analysis—Examples are Clover CMD, Coverity, or Klocwork.
- Databases—Examples are DBI, Oracle, or SQLServer.
• Defect Tracking—Examples are Bugzilla, JIRA, or Rally.
• Notification—An example is Twitter.
• Reporting—An example is Reports.
• Resource Management—Examples are Chef, EC2, or OpenStack.
• Scripting/Shell operations—Examples are Groovy, Python, or Ruby.
• Source Code Analysis—Examples are ECSCM-ClearCase, ECSCM-Git, or ECSCM-Perforce.
• System—Examples are Artifact or FileSysRepo.
• Test—Examples are HPQualityCenter, Jasmine, or Selenium.
• Utility—Examples are FileOps or SendEmail.

You can access these options from the Plugin Category dialog box:

![Plugin Category](image)

**Plugin Steps in a Component Process**

This example shows how to define a test plugin step in a component process.

In the Applications Visual Editor for the eShoppingCart application, select the "install config" process for the database.conf component in the MySQL application tier.
In the Component Process Visual Editor, add a step after the "log config contents" step. The "New Step" appears after this step.

Click + in the "New Step" to define it. Name the step "Verify configuration", use the default values, and click **Next**.

In the Step Type dialog box, select **Plugins**.
In the Plugins Category dialog box, select **Test**.

In the Test dialog box, select **Selenium**.
Select the **Selenium - Test** procedure.

Enter the required parameters for the procedure, and click **OK**.

The Component Process Visual Editor now shows this step:
Plugin Steps in an Application Process

This example shows how to add a test plugin step in an application process.

In the Applications Visual Editor for the eShoppingCart application, select the "Deploy" application process.

The Application Process Visual Editor opens.
Add a step after the "Create Link to application" step.

Click + in the "New Step" to define it. Name the step "Verify setup", use the default values, and click Next. In the Step Type dialog box, select Plugins.
In the Plugins Category dialog box, select Test.

In the Test dialog box, select TestNG.
Select the **TestNG - Run TestNG** procedure.

Enter the required parameters for the procedure, and click **OK**.

The Application Process Visual Editor now shows this step:
Adding Process Steps

**How to get to the Application Process Visual Editor:**

- In an existing application process:
  - From the Applications Visual Editor, click the down arrow next to the number-of-application-processes button and select an application.
  - The Application Process Visual Editor for that application process appears.

- In a new application process:
  - From the Applications Visual Editor, click the *Add process* button, set the details in the *Application Process Details* dialog box, and click *OK*.
  - The Application Process Visual Editor for the application appears.

**How to get to the Component Process Visual Editor:**

- In an existing component process:
  - From the Applications Visual Editor, click the down arrow next to the number-of-component-processes button in a component, and select a component process in the drop-down list.
  - The Component Process Visual Editor for that component process appears.

- In a new component process:
  - From the Applications Visual Editor, click the *Add process* button in a component, set the details in the *Component Process* dialog box, and click *OK*.
  - The Component Process Visual Editor for the component process appears.

To drag and drop a new step in a component or application process:
1. Click the **Add step** button in the upper right corner of the Component Process Visual Editor or Application Process Visual Editor.

A new undefined step appears.

2. Select the new step.
3. Drag the step to where you want to add it in the process.

When you are near where you want to add the step in the process, notice that the icon changes shape and the text in it changes to "Dropping this Step in the Process."

4. Drop the step in the process.

The **Component Process Step** dialog box appears.
5. Enter information about the step.
   The new step is in the process.

Deploying Applications in Dynamic Environments

This section describes dynamic environments and how to model them.

Environments can be static, dynamic, or hybrid. Any dynamic environment is automatically spun up when the application is deployed. Environments can have a combination of static and cloud resources that will be provisioned and configured dynamically. Go here for more information about static environments and how to model them.
Using dynamic environments allows you to:

- Provide ways to optimize how cloud resources are used.
- Reuse provisioned resource pools on an on-demand basis.
- Track how provisioned cloud resources are used.
- Provide the status of the provisioning process.
- Verify the credentials of cloud resources before provisioning them.

You provision cloud resources by creating a resource template and adding it to an environment template. When the application deployment that includes a dynamic environment begins, the environment is spun up at runtime with the required cloud resources, and the application is deployed there.

Resource templates allow you to

- Define the cloud provider details to provision of machines at the appropriate time and the configuration management tools to install the appropriate middleware.
- Configure the resources for optimal performance.

About Resources

Each resource in an environment has its own logical name to identify it from the other resources in the system. It also can be assigned to one or more resource pools or to a zone (a collection of agents). Several resources can correspond to the same physical host or agent machine. Resources can also be configured as standard or proxy. Standard resources are machines running the ElectricFlow agent on a supported agent platform while proxy resources (agents and targets) are on remote platforms or hosts that exist in your environment and requires SSH keys for authentication. The ElectricFlow agent does not need to run on the remote platform or host. Go to Resources on page 701 for more information about to create, configure, and manage resources.

Examples

Infrastructure in ElectricFlow is modeled by configuring the cloud provider for dynamic environments. This configuration is versioned when you name and save the resource template. For an example of an Amazon EC2 infrastructure configuration, go to . For an example of an OpenStack infrastructure configuration, go here. Example: Resource Template for Infrastructure using Amazon EC2 on page 212 and Example: Resource Template for Infrastructure using OpenStack on page 219. For examples of infrastructure configurations, go to Example: Resource Template for Infrastructure using Amazon EC2 on page 212 and Example: Resource Template for Infrastructure using OpenStack on page 219.

Middleware is modeled by configuring the configuration management tool for dynamic environments. This configuration is versioned when you name and saved the resource template. For an example of a middleware configuration, go to Example: Resource Template for Middleware Using Chef on page 224.

Modeling Dynamic Environments

This is the high-level process to provision cloud resources that can be dynamically spun up during the application deployment.
1. Create and define one or more resource templates.

The resource template has the information required to spin up the resources on an on-demand basis and to provision dynamic resource pools. It has the following information:

- Cloud provider and cloud instance details
- Configuration management settings
- Both cloud provider and configuration management settings
- Environment capabilities (see Full-Stack Dependency View on page 122 for more information)

2. Create and define one or more environment templates.

When modeling an environment template, you define the environment tiers and then add resources to the tiers. You can either add static resources or a resource template to an environment tier.

When adding static resources, you can select one or more resources to add to the tier.

When adding resource templates, you can select only one to add to the tier and then enter the number of resources to provision.

Environment templates have this information:

- Name and description
- Environment tier details and properties
- Resources assigned to the environment tiers
- Cloud resource details from the resource templates

Usage Guidelines and Best Practices

Review the following information before creating and using dynamic environments.
This matrix shows the resource types that are allowed in environments and environment templates.

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Origin</th>
<th>Environment Tier</th>
<th>Environment Template Tier</th>
<th>Use Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static resources</td>
<td>–</td>
<td>Yes</td>
<td>Yes</td>
<td>You may only add them to one environment. You cannot reuse them in more than one environment. You can add one or more static resources to an environment tier or an environment tier template.</td>
</tr>
<tr>
<td>Static resource pool</td>
<td>–</td>
<td>Yes</td>
<td>No</td>
<td>You may only add it to one environment. You cannot reuse it in more than one environment. You can add only one resource pool to an environment tier.</td>
</tr>
<tr>
<td>Resource Type</td>
<td>Origin</td>
<td>Environment Tier</td>
<td>Environment Template Tier</td>
<td>Use Rules</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>------------------</td>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Resource pool provisioned in the resource template</td>
<td>Platform</td>
<td>Yes</td>
<td>No</td>
<td>You may only add it to one environment. You cannot reuse it in more than one environment. You can add only one resource pool to an environment tier.</td>
</tr>
<tr>
<td>Resource pool provisioned in an environment template</td>
<td>ElectricFlow</td>
<td>No</td>
<td>No</td>
<td>You cannot reuse the resource pools provisioned in an environment template. You can only use it in the dynamic environment created by the environment template.</td>
</tr>
<tr>
<td>Resource template</td>
<td>–</td>
<td>No</td>
<td>Yes</td>
<td>You may only add one resource template to an environment template tier.</td>
</tr>
</tbody>
</table>

In environments and environment templates, you can create a tier with static resources, a static resource pool, or a static resource template. When you are editing the tier, ElectricFlow maintains the initial resource-type association.

For example, if you initially add static resources to an environment tier, you can add only static resources to it. You are not allowed to add a resource this environment tier.

- ElectricFlow validates the information you provide for configuring and provisioning the cloud provider.

For instance, when you configure Amazon EC2 as the cloud provider, ElectricFlow validates the Service URL using the Access ID and Access Key. The configuration information that you provide is also used to retrieve and display the available options from the cloud provider service for the provisioning parameters such as the Image or the Security group to use.

However, if your ElectricFlow server is unable to access external services such as the Amazon EC2 service, you may disable this validation and the dynamic options retrieval capability for the cloud provider plugin by setting the plugin property `ec_disable_dynamic_operations` to 1.
Creating AMIs

Before creating a resource template, you must create an Amazon Machine Image (AMI) with a pre-installed agent for the cloud provider. In ElectricFlow 5.4, Amazon EC2 and OpenStack are the supported cloud providers.

AMIs with ElectricFlow Agents

1. Install agents on ElectricFlow server node machines.

   See the following sections in the ElectricFlow Installation Guide for detailed instructions:
   - System Requirements and Supported Platforms > Agent Platforms
   - System Requirements and Supported Platforms > Server and Agent Compatibility
   - Installing ElectricFlow > Interactive Command-line Installation Method > Express Agent Command-Line
   - Installing ElectricFlow > Non-Server Platform Agent Installation Method
   - Configuration > Environment Proxy Server Configuration > Configuring Proxy Agents

2. Create the AMI on the Amazon EC2 or OpenStack platform.

   Go to http://docs.openstack.org/image-guide/content/index.html for OpenStack.

3. Create a resource template in ElectricFlow.

   When you set the cloud provider, you can select Amazon or OpenStack and enter information in the fields in the dialog boxes. The fields that you see depend on the cloud provider that you select.

   For detailed Amazon EC2 instructions, go to Configuring Amazon EC2 as the Cloud Provider.
   For detailed OpenStack instructions, go to Configuring OpenStack as the Cloud Provider.

AMIs with ElectricFlow Agents and Chef Configuration Management

1. Install agents on ElectricFlow server node machines.

   See the following sections in the ElectricFlow Installation Guide for detailed instructions:
   - System Requirements and Supported Platforms > Agent Platforms
   - System Requirements and Supported Platforms > Server and Agent Compatibility
   - Installing ElectricFlow > Interactive Command-line Installation Method > Express Agent Command-Line
   - Installing ElectricFlow > Non-Server Platform Agent Installation Method
   - Configuration > Environment Proxy Server Configuration > Configuring Proxy Agents

2. Configure a Chef server with run-lists that will be applied to your cloud resources.

   Go to http://docs.chef.io/.
3. Create the AMI on the Amazon EC2 or OpenStack platform.
   Go to http://docs.openstack.org/image-guide/content/index.html for OpenStack.

4. Create a resource template in ElectricFlow.
   a. When you set the cloud provider, you can select Amazon or OpenStack and enter information in the fields in the dialog boxes. The fields that you see depend on the cloud provider that you select.

      For detailed Amazon EC2 instructions, go to Configuring Amazon EC2 as the Cloud Provider.
      For detailed OpenStack instructions, go to Configuring OpenStack as the Cloud Provider.
   b. When you set the configuration management tool, select Chef.

      For detailed instructions, go to Configuring Chef as the Configuration Management Tool.

Creating Resource Templates

1. Go to the Resource Templates List.
   If there are no defined resource templates, the Resource Templates List is empty.

   Example:
2. Add a resource template.
   
a. If the Resource Templates List is empty, click **There are no Resource Templates yet. Add one** or click the **Add** button.

   In the New dialog box, click **Resource Template**.

   **Example:**

   ![Resource Templates List](image1)

   The **New** dialog box opens.

   **Example:**

   ![New dialog box](image2)
b. If the Resource Templates List is not empty, click the **Add +** button.

   The New dialog box opens.

   **Example:**

   ![New dialog box](image)

3. Click **Create New** to create a new resource template.

   The New dialog box opens.

   **Example:**

   ![New dialog box](image)
4. Enter a name for the environment template, select a project to which it belongs, and enter an optional description.

   **Example:**

   ![Resource Template Name](image)

5. Click **Next**.

6. Enter the cloud provider settings in the **New Cloud Provider** dialog box.

   - To use Amazon EC2 as the cloud provider, go to Example: Resource Template for Infrastructure using Amazon EC2 on page 212 for detailed instructions.

     **IMPORTANT:** Before configuring the cloud provider, you must have an Amazon Machine Image (AMI) with a pre-installed agent available.

   - To use OpenStack as the cloud provider, go to Example: Resource Template for Infrastructure using OpenStack on page 219 for detailed instructions.

7. (Optional) Enter the configuration management settings in the **New Configuration Management** dialog box.

   To use Chef as the configuration management tool, go to Example: Resource Template for Middleware Using Chef on page 224 for detailed instructions.

After completing these steps, the Resource Template List now shows the template that you created. The breadcrumb in the upper left corner shows the object hierarchy.

![Resource Templates](image)

By default, the resource templates for all projects are displayed.

If you want to see only the objects for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.
If there are no matches, a message appears stating that there are no resource templates in the selected projects.

**Example: Resource Template for Infrastructure using Amazon EC2**

This section describes how to configure Amazon EC2 as the cloud provider for a resource template.

**IMPORTANT:** Before configuring the cloud provider, you must have an Amazon Machine Image (AMI) with a pre-installed agent available.

In the **New Cloud Provider** dialog box, "account" refers to the cloud provider setup. Select one of these options to enter the setup information:

- Click **Select cloud provider** to enter the cloud provider settings. Go to Select Cloud Provider on page 212 for the detailed instructions.
- Click **Select account** if you want to use an existing plugin configuration. Go to Select account on page 218 for the detailed instructions.

**Select Cloud Provider**

To enter the cloud provider settings:
1. Click **Select cloud provider > Amazon.**
2. Enter the following values:

- **Configuration Name**—A unique name for the EC2 connection. (Required)
- **Description**—A description for this configuration. The default is *EC2 integration*.
- **Access Key ID**—The Access Key ID that is required for communicating with Amazon EC2. The configuration stores this Access Key ID in the **User Name** field of the credential.

- **Secret Access Key**—The Secret Access Key that is required for communicating with Amazon EC2. The configuration stores this value in the **Password** field of the credential.
- **Retype Secret Access Key**—The Secret Access Key in the **Retype Password** field of the credential.
- **Service URL**—The service URL for the EC2 service. The default is *https://ec2.amazonaws.com*. (Required)

When you provide the Access Key values and the Service URL, the system will validate that the provided values are valid for connecting to Amazon EC2.

- **Resource**—The resource or pool on which the integration steps can run. The default is *local*.
- **Workspace**—The workspace to use for resources dynamically created by this configuration. The default is *default*.
- **Attempt Connection**—If the check box is selected, the system tries to connect to Amazon EC2 using the provided Access Key values and the Service URL to check credentials before creating the configuration.
- **Debug Level**—The debug level for the output. The default is 1.

  The possible values are
  
  - 0 – Errors only.
  - 1 – Normal headers and responses.
  - 2+ – Debugging information included.
3. Click **Next**.

The **Provision Parameters** fields appear.

The Configuration field is prepopulated with the name you entered in the previous dialog box.

ElectricFlow tries to retrieve the provision parameters for this configuration:

```plaintext
<table>
<thead>
<tr>
<th>Configuration:</th>
<th>EC2config</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Instances:</td>
<td>1</td>
</tr>
<tr>
<td>Security Group:</td>
<td></td>
</tr>
<tr>
<td>Image:</td>
<td></td>
</tr>
<tr>
<td>Instance Type:</td>
<td>Small(m1 small)</td>
</tr>
<tr>
<td>Key name:</td>
<td></td>
</tr>
<tr>
<td>Results Location:</td>
<td></td>
</tr>
</tbody>
</table>
```

```
<table>
<thead>
<tr>
<th>Configuration:</th>
<th>EC2config</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Instances:</td>
<td>1</td>
</tr>
<tr>
<td>Security Group:</td>
<td></td>
</tr>
<tr>
<td>Image:</td>
<td></td>
</tr>
<tr>
<td>Instance Type:</td>
<td>m1 small</td>
</tr>
<tr>
<td>Key name:</td>
<td></td>
</tr>
<tr>
<td>Results Location:</td>
<td></td>
</tr>
</tbody>
</table>
```
4. Enter the **Provision Parameters** settings:

- **Number of Instances**—The number of instances to start. The default is 1.
- **Security Group**—The default is *default*.
- **Image**—Select the EC2 image to deploy. The drop-down menu displays the images that you own in your current region. (Required)

![Image Selection](image)

- **Instance Type**—You get the list of instance types at runtime. The default is **Small** *(m1.small)*.
- **Key name**—Select the name of the key pair to use. (Required)

![Key Name](image)

- **Results Location**—Location where the output properties will be saved. If not specified, it defaults to `/myParent/parent`.
- **User Data**—Extra user data to pass to the API_runInstances procedure.
- **Availability Zone**—The zone where the instance will be created. (Required)
  Selecting a zone causes ElectricFlow to find a subnet in the selected zone.

![Availability Zone](image)

- **Resource Pool**—The name of the resource pool. If you enter a name, a new resource pool is created, and new resources are added to the pool for the instances created in Amazon EC2.

![Resource Pool](image)

- **Commander Workspace**—If you specify a resource pool name in **Resource Pool** field, this is the workspace that will be used when creating the resource.
- **Subnet Id**– The ID of the subnet in which the instances are launched. This parameter is used with VPCs.

After selecting the zone where the instance will be created, you can select a subnet in that zone.

- **Private IP**– The private IP address to assign. If you specify a value, it must be from the IP address range of the subnet. If no value is specified, an available IP address from the IP address range of the subnet is selected. This parameter is used with VPCs.

- **Use Private IP for subnet?**– If this check box is selected, the private IP address assigned to the instance will be used for the newly created resource. This is enabled by default.

- **Resource Port**– If you specify a resource pool name in 'Resource Pool' field, this is the port that will be used when creating the resource. If no value is specified, port 7800 will be used by default when creating the resource.

- **Resource Zone Name**– The zone to which the newly created resources will belong. The default zone is *default*.

5. Click **Next** to enter the configuration management settings.

6. Go to this step in *Creating Resource Templates* on page 208 to continue creating the resource template.

7. If you do not want to set the configuration management settings, click **OK**.

The Resources Templates list now shows the resource template that you created.

**Select account**

Select the **Select account** option to use an existing plugin configuration. ElectricFlow automatically retrieves the cloud provider settings and puts them in the appropriate fields.

1. Click **Select account**

2. Select an existing plugin.

3. Click **Next**.

The dialog box shows for the settings for the selected plugin configuration.

4. If you want to edit any of these settings, make your changes and then enter the password to save your changes.

5. Click **Next** to enter the configuration management settings.

6. Go to this step in *Creating Resource Templates* on page 208 to continue creating the resource template.

7. If you do not want to set the configuration management settings, click **OK**.

The Resources Templates list now shows the resource template that you created.
Example: Resource Template for Infrastructure using OpenStack

This section describes how to configure OpenStack as the cloud provider for a resource template.

Prerequisites and Configuration Guidelines

Review the following information before creating a resource template using OpenStack as the cloud provider:

- **Prerequisite:**
  
  **IMPORTANT:** Before configuring the cloud provider, you must have an image with a pre-installed agent on OpenStack.

- When creating a resource template using OpenStack as the cloud provider, only one security group can be selected.
  
  To select more than one security group, the workaround is to disable the `serverOptions` flag for the `security_groups` parameter in the EC-OpenStack plugin. In the plugin procedure called `_DeployDE`, edit the XML form as follows:

  1. Go to the Custom Procedure Properties section.
  2. Click `ec_parameterForm`.
  3. In the `Edit Property / ec_parameterForm` dialog box, set the `security_groups` formElement called `serverOptions` to 0.

In the New Cloud Provider dialog box, "account" refers to the cloud provider setup. Select one of these options to enter the setup information:

- Click **Select cloud provider** to enter the cloud provider settings. Go [here](#) for the detailed instructions.

- Click **Select account** if you want to use an existing plugin configuration. Go [here](#) for the detailed instructions.

Select cloud provider

To enter the cloud provider settings:
1. Click Select cloud provider > OpenStack.
2. Enter the following values. As you enter them and click in an empty field, ElectricFlow tries to retrieve the cloud provider settings.

- **Configuration Name**–A unique name for the OpenStack configuration. (Required)
- **Description**–A description for this configuration. The default is *OpenStack configuration*.
- **Login as**–The OpenStack account username and password. It must have enough privileges to perform API functions. (Required)

![Configuration Details](image1)

- **Identity Service URL**–The service end-point URL for the Identity Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)

![Identity Service URL](image2)

- **Keystone API version**–The version of the Keystone Service API. The default is 3. (Required)
- **Tenant ID**—The ID of the OpenStack tenant to use. (Required)

When you click in the next empty field, ElectricFlow tries to retrieve the rest of the cloud provider settings for the selected configuration.

- **Compute Service URL**—The service end-point URL for the Compute Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Compute API version**—The version of the Compute Service API. The default is 2.0. (Required)
- **Block Storage URL**—The service end-point URL for the Block Storage Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Block Storage API version**—The version of the OpenStack block storage API. The default is 1. (Required)
- **Image Service URL**—The service end-point URL for the Image Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Image API version**—The version of the Image Service API. (Required)
- **Orchestration Service URL**—The service end-point URL for the Orchestration Service for OpenStack. Do not include the API version or the tenant ID in the URL. (Required)
- **Resource**—The name of the resource or pool on which the integration steps can run. The default is `local`. (Required)
- **Debug Level**—The debug level for the output. The default is 1.

The possible values are
- **0** – Errors only.
- **1** – Normal headers and responses.
- **2+** – Debugging information included.

3. **Click Next.**

The **Provision Parameters** fields appear.

The Configuration field is prepopulated with the name you entered in the previous dialog box.

ElectricFlow tries to retrieve the provision parameters for this configuration.
4. Enter the **Provision Parameters** values.

- **Number of Instances**—The number of servers to deploy. If there is more than one, a suffix (\_#) is added to the server names. The default is 1. (Required)
- **Image**—Select the image to use in OpenStack. (Required)
- **Flavor**—Select the flavor to use in OpenStack. (Required)
- **Key Pair Name**—Select the key pair to use in OpenStack. (Required)
- **Security Group(s)**—Select the security group to use in OpenStack.
- **Availability Zone**—Select the availability zone in OpenStack in which to launch the server.
- **Customization script**—Configuration information or scripts to execute when the server starts.
- **Results Location**—Location where the output properties will be saved. If not specified, this defaults to /myJob/OpenStack/deployed.
- **Resource Pool**—Name of the resource pool. If you enter a name, a new resource pool is created, and new resources are added to the pool for the servers created in OpenStack.
- **Resource workspace**—If you specify a resource pool name, this is the workspace that will be assigned to the created resources.
- **Resource Zone Name**—The zone to which the newly created resources will belong. The default zone is *default*.

5. Click **Next** to set the configuration management settings.

6. Go to this step in Creating Resource Templates on page 208 to continue creating the resource template.

7. If you do not want to set the configuration management settings, click **OK**.

   The Resources Templates list now shows the resource template that you created.

### Select account

Select the **Select account** option to use an existing plugin configuration. ElectricFlow automatically retrieves the cloud provider settings and puts them in the appropriate fields.

1. Click **Select account**
2. Select an existing plugin.
3. Click **Next**.

   The dialog box shows for the settings for the selected plugin configuration.

4. If you want to edit any of these settings, make your changes and then enter the password to save your changes.
5. Click **Next** to enter the configuration management settings.
6. Go to this step in Creating Resource Templates on page 208 to continue creating the resource template.
7. If you do not want to set the configuration management settings, click **OK**.

   The Resources Templates list now shows the resource template that you created.
Example: Resource Template for Middleware Using Chef

This section shows how to configure Chef as the configuration management tool for a resource template after you have entered the cloud provider settings.

In the New Configuration Management dialog box, "account" refers to the configuration management setup. Select one of these options to enter the setup information:

- Click Select configuration management to enter the configuration management tool settings. Go here for the detailed instructions.
- Click Select account if you want to use an existing plugin configuration. Go here for the detailed instructions.

Select configuration management

To enter the configuration management settings:

1. Click Select configuration management > Chef, and select Next.
   The Converge Parameters fields appear.
2. Enter these settings:
   - **Configuration**—Name of the Chef configuration. This is required.
   - **Chef-client Path**—The path to the chef-client executable. The default value is /usr/bin/chef-client. *(Required)*
   - **Run as user with full system privileges**—If this check box is selected, chef-client is run as a user with elevated privileges on Unix systems (using sudo).
   - **Run List**—The ordered list of Chef recipes to run. This is required.

![Configuration settings screenshot]

- **Node Name**—Unique name for the node that will be maintained by the chef-client. If not specified, Chef will use the Fully Qualified Domain Name of the node as the node name. *(Required)*
• **Additional Arguments**—Any additional arguments that need to be passed to the chef-client.

![Image](image.png)

3. Click **OK**.

The Resource Templates List now shows the resource template that you created.

**Select account**

Select the **Select account** option to use an existing plugin configuration. ElectricFlow automatically retrieves the configuration management settings and puts them in the appropriate fields.

1. Click **Select account**
2. Select an existing plugin.
3. Click **Next**.

The dialog box shows for the settings for the selected the plugin configuration.

4. If you want to edit any of these settings, make your changes and then enter the password to save your changes.
5. Click **Next**.

The Resource Templates List now shows the resource template that you created.

**Viewing and Editing Resource Templates**

You can view and edit this information about resource templates:

• [Resource Template Details](#) on page 227
• [Resource Template Properties](#) on page 228
• [Access Control Settings](#) on page 230
• [Change Tracking](#) on page 231
Resource Template Details

Starting in the Resource Template List, follow these steps to view and edit the resource template details:

1. Choose a resource template and click the Menu button.

A list of menu options appears.

Example:

If you want to see only the objects for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

If there are no matches, a message appears stating that there are no resource templates in the selected projects.

2. Select Details.

The Edit Resource Template Details dialog box opens.

Example:

3. In the Details tab, edit the name and description of the resource template.

4. In the Cloud Provider tab, edit the cloud provider account information.

5. In the Provision tab, edit the information about the provision settings for the cloud provider.

6. In the Configuration tab, view and edit the configuration management details.
7. In the **Converge** tab, view and edit the details about how the virtual instances are converged in the defined configuration.

8. Click **Next** to go to the next tab.

9. Click **OK** to save your changes.

**Resource Template Properties**

Starting in the Resource Template List, follow these steps to view and edit the resource template properties:

1. Choose a resource template and click the **Menu** button.
   
   A list of menu options appears.

2. Select **Properties**.
   
   The **Properties** dialog box opens.

   **Example:**

   ![Properties Dialog Box](image)

   - **Name**: rt-aws-chef1
   - **Value**: rt-aws-chef1
3. To add a property:
   a. Click the Add + button.

   The Property Details dialog box opens.

   If Expandable is selected, the property value can contain property references using the "$[ ]" notation.

   **Example:**

   ![Property Details Dialog Box](image-url)
b. Enter the details and click **OK** to save them.

**Example:**

![Property Details dialog box]

The **Property Details** dialog box now shows the new property that you added.

**Example:**

![Property Details table]

**Access Control Settings**

Clicking **Access Control** opens the Access Control page in the automation platform.

**Example:**

![Access Control page]
Change Tracking

Clicking **Track Changes** opens the Change History for the resource template.

**Example:**

![Change History](image)

Accessing the Resource Templates in the Automation Platform

You can generate new resource pools in ElectricFlow by accessing the resource templates from the automation platform UI.

1. Go to **Cloud > Pools**.
   
   **Example:**
   
   ![Resource Pool](image)

2. Click **Resource Templates**.
   The **Resource Templates** list opens.

   **Example:**
   
   ![Resource Template](image)
3. (Optional) To view details about a resource template, choose a template and click the Menu button ( ) for it. The Context menu opens.

4. Click one of these options:
   - **Details**—The Edit Resource Template Details dialog box opens. The tabs that appear in the dialog box depend on the cloud provider specified in the resource template.
   - **Properties**—The Properties dialog box opens. You can view and edit the properties that apply to the resource template.
   - **Access Control**—The Access Control page opens.
   - **Track Changes**—The Change History for the resource template opens.

5. To provision the resource template, choose a resource template, click the Menu button ( ), and select **Details > Provision**. The Provision Cloud Resources dialog box opens.

**Example:**

![Provision Cloud Resources dialog box](image-url)
6. Enter the resource pool name, an optional description, and the number of resources in the pool, and then click OK.

**Example:**

![Provision Cloud Resources](image)

You go to the Job Details page in the automation platform.

**Creating Environment Templates**

You can create a new environment template from scratch or create one based on an existing template.

- [Creating a New Environment Template](#) on page 233
- [Creating an Environment Template Based on an Existing Template](#) on page 241

**Creating a New Environment Template**

Starting from the Environment Templates List, follow these steps to create an environment template from scratch:

1. Go to the Environment Templates List.
   
   If there are no defined environment templates, the Environment Templates List is empty.

   **Example:**

   ![Environment Templates](image)
2. Add an environment template.
   
a. If the Environment Templates List is empty, click **There are no Environment Templates yet. Add one** + or click the **Add** + button.

   In the **New** dialog box, click **Environment Template**.

   **Example:**

   ![Environment Template](image)

   The **New** dialog box opens.

   **Example:**

   ![Environment Template](image)
b. If the Environment Templates List is not empty, click the **Add +** button.

The **New** dialog box opens.

**Example:**

![Diagram showing the New dialog box]

3. Click **Create new** to create a new environment template.

The **New** dialog box opens.

**Example:**

![Diagram showing the Create new environment template dialog box]
4. Enter a name for the environment template, select a project to which it belongs, and enter an optional description.

**Example:**

![Environment Template Diagram](image)

5. Click **OK**.

The Environment Templates Visual Editor opens. The environment template has one tier with no assigned resources. The breadcrumb in the upper left corner shows the object hierarchy.

**Example:**

![Environment Template Visual Editor](image)

6. In Tier 1, click the **button and select Details.**
7. In the **Environment Tier Details** dialog box, enter a new name for the environment tier and an optional description, and then click **OK** to save the settings.

   **Example:**

   ![Diagram of Environment Tier Details]

8. In the tier, click the + button to add a resource to it.

   The **New** dialog box to add resources opens.

   **Example:**

   ![Diagram of Tier with New dialog box]

9. Click **Add resource template** to select a resource template.

   The **Resource Templates List** opens.
10. **Select a resource template, and click OK.**

The dialog box to select a resource template opens.

It shows the list of available environment templates. The default is to show the environment templates for all projects.

If you want to see only the environment templates for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more environment templates by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environment templates in the selected projects.

**Example:**

![Image of the dialog box to select a resource template]

The **New** dialog box to select the number of resources to provision opens.

**Example:**

![Image of the dialog box to select the number of resources to provision]
11. Enter the number of resources to provision, and click **OK**.

You must provision at least one resource (1).

**Note:** You cannot override the number of resources when deploying an application with an environment template.

**Example:**

![Image of resource provisioning dialog]

The Environment Templates Visual Editor now shows that the tier (Tier 1) has 10 dynamic cloud resources set to be provisioned when the application is deployed.

**Example:**

![Image of tier with 10 resources]
12. To add static resources to an environment template:
   a. Click the **Add tier** button to create a new tier.
      
   b. Rename the new environment tier.
   c. Click the + button in the new tier to add resources to it.
      
      The **New** dialog box opens.
   d. Click **Add resources** to add static resources to the environment tier.
      
      A list of static resources opens.

      **Note:** You cannot override the setting for the number of static resources when deploying the application with an environment template

**Example:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Platform</th>
<th>Up/Down</th>
<th>Used In...</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROD-res</td>
<td>linux</td>
<td>![up]</td>
<td>PROD</td>
</tr>
<tr>
<td>QA-res</td>
<td>linux</td>
<td>![up]</td>
<td>QA</td>
</tr>
<tr>
<td>heatclinic-dsl-res</td>
<td>linux</td>
<td>![up]</td>
<td>heatclinic-dsl</td>
</tr>
<tr>
<td>heatclinic-res</td>
<td>linux</td>
<td>![up]</td>
<td>heatclinic-qe</td>
</tr>
<tr>
<td>jpetstore</td>
<td>linux</td>
<td>![up]</td>
<td>jpetstore-qe</td>
</tr>
<tr>
<td>local</td>
<td>linux</td>
<td>![up]</td>
<td></td>
</tr>
<tr>
<td>resource-01</td>
<td>linux</td>
<td>![up]</td>
<td>hi-store-dev</td>
</tr>
</tbody>
</table>
e. Select one or more resources in the list, and click **OK**. The Environment Templates Visual Editor now shows that the "Web server" tier has two static resources.

**Example:**

![Environment Templates Visual Editor](image)

**Creating an Environment Template Based on an Existing Template**

Starting from the Environment Templates List, follow these steps to create an environment template that is based on an existing one:

1. Go to the Environment Templates List.
2. Add a resource template.

   For detailed instructions, go to Add an environment template. on page 234
3. Click **Copy existing** to create a template based on an existing one.

The list of existing templates opens.

It shows the list of available environment templates. The default is to show the environment templates for all projects.

If you want to see only the environment templates for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more environment templates by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environment templates in the selected projects.

**Example:**

![Environment Template List](image-url)
4. Select an environment template.

The **New** dialog box opens.

**Example:**

![Diagram of the New dialog box with environment template options]
5. Rename the environment template, and enter an optional description of it.

You can also change the project to which the environment template belongs.

Click **OK** to save these settings.

**Example:**

![Environment Template]

The Environment Templates Visual Editor now shows that the same environment tiers as the original version. The breadcrumb in the upper left corner shows the object hierarchy.

You can now modify the environment template and its objects (resources and resource templates) for your deployments.

**Example:**

![Environment Template]

**Viewing and Editing Environment Templates**

Starting in the Environment Templates List, follow these steps to view and edit the environment template details:

1. Choose an environment template and click the **View Details** button ( ).

**Example:**
The Environment Templates for the selected template opens.

The breadcrumb in the upper left corner shows the object hierarchy.

**Example:**

2. Click to **Menu** button ( ) to open the context menu for the environment template.
   - Click **Details** to view or edit the name and description of the environment template.
   - Click **Properties** to view or edit the environment template properties.
   - Click **Access Control** to go to the Access Control page in the automation platform.
   - Click **Track Changes** to open the Change History of the environment template.
   - Click **Delete** to delete this template.

3. To view and edit an environment tier with dynamic resources, click the **Menu** button ( ) for the resources.
   The context menu opens with these options:
   - Click **Details** to view and edit the resource details for the environment tier.
   - Click **Remove** to remove the resources from the environment tier.
4. To change the resource template used by the environment tier, click **Details** and select a different resource template.

The list of available resource templates opens.

It shows the list of available resource templates. The default is to show the resource templates for all projects.

If you want to see only the resource templates for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more resource templates by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no resource templates in the selected projects.

The template being used is selected.

**Example:**

```
<p>| | | | | | |</p>
<table>
<thead>
<tr>
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</tbody>
</table>
```
5. Select a different environment template.

A message appears. Select Yes if you want to continue.

**Example:**

![Image of a dialog box showing the number of provisioned dynamic resources.]

The Edit dialog box number box opens and shows the number of provisioned dynamic resources.

**Example:**

![Image of an edit dialog box showing the number of resources to provision.]

6. To change the number of provisioned dynamic resources, enter a new number or use the up/down arrows.

7. Click OK.

The Environment Templates Visual Editor now shows the changes that you made.

**Example:**

![Image of the Environment Templates Visual Editor showing deployed applications.]

**Deploying Applications With Provisioned Cloud Resources**

**About the example in this topic:**
The example in this topic consists of an application called "Hello World" application with one application process called Test1, which has two steps.

Test1 will be deployed in a dynamic environment called CloudEnv. You model the CloudEnv environment using the AWSTest environment template.

The AWSTest environment template has three tiers:

- Tier 1 and Tier 3 have cloud resources defined in resource templates. These resource can be provisioned when you deploy the application.
- Tier 2 has static resources, which cannot be provisioned.

Starting in the Home page:

1. Go to the Applications List.
   - Starting from the Main menu, click the Menu button, and then select Applications.
   - Starting from the Home page, click Applications.

The Applications List opens.

**Example:**

This example uses the "Hello World" application.
2. Choose an application, and click the Run process button for that application.

   Example:

   ![Deployment Examples](image1)

3. Click New Run.

   The New dialog box to deploy the application opens.

   See the messages in this dialog box for hints about what you need to do to deploy the application.

   Example:

   ![Deployment Examples](image2)

4. Select the application process to deploy.
5. Click Map to Environment + to create a tier map for the application.

The Tier Map dialog box opens.

**Example:**

![Tier Map dialog box]


The Tier Map dialog box to select an environment tier opens.

**Example:**

![Select Environment Template]

7. Select an environment template.

The <Environment template>/Tier Map dialog box opens.
8. For each application tier, click the **Menu** button to select an environment tier to which the application tier is mapped.

**Example:**

![Diagram](image)

**Example:**

![Diagram](image)

9. Click **OK**.

The **New** dialog box to deploy the application re-opens.

**Example:**

![Diagram](image)
10. Click **Select Environment** to select an environment template. A list of available environments and environment template based on the tier map opens.

   **Example:**

   ![Select Environment Example](image)

11. Select **1 Templates**. A list of available environment templates appears.

   **Example:**

   ![1 Templates Example](image)

12. Click the environment template that you want to use.
13. Enter a name for the dynamic environment that will be created from the selected environment template.

The New dialog box to deploy the application now shows the environment template name below the application process name. It also shows the number of cloud resources provisioned in the environment templates.

Example:

![Image of New dialog box]

14. Click in the Cloud Resources row.

The Cloud Resources dialog box opens.

Example:

![Image of Cloud Resources dialog box]
15. Change the number of cloud resources to provision

**Example:**

In this example, Tier 1 and Tier 3 have one or more resources to provision because they have cloud resources. You cannot provision resources in Tier 2 because it has only static resources.

![Cloud Resources Image]

16. Click **OK**.

The **New** dialog box now shows the new number of resources to provision.

The message "This application does not yet have an Environment to Run on" still appears.

When you click **OK**, ElectricFlow first attempts to create the dynamic environment. If this is successful, it deploys the application.

**Example:**

![Applications List Image]

The Applications List opens.
17. To view the job details, click the **View Details** button to open to the Job Details page. ElectricFlow first runs the job to create the dynamic environment. If this job is successful, it deploys the application.

**Example:**

![Job Details](image)

You can also see the status of jobs as they progress in the Applications List.

**Example:**

This example shows the Application List when the job starts.

![Application List](image)

If you provision resources that are not available, such as 20 cloud resources in Tier 1 and 3 static resources in Tier 2, the job to create the dynamic environment fails and the application is not deployed.

**Retiring Dynamic Environments**

After you have deployed your application in a dynamic environment, you can retire it and destroy (decommission) the resources, which makes them unavailable for any future deployments.

Starting in the Environments List:

1. Choose a dynamic environment.

**Example:**

![Environments List](image)
2. Click the **Tear down** button for that environment.

   A message appears.

   **Example:**

   ![Retire this Environment?]

   ![ATTENTION]

   The provisioned resources will be removed from the cloud and will no longer exist.

   ![Cancel OK]

3. Click **OK** to verify that you want to retire (decommission) the environment.

   The Job Details page opens.

   **Example:**

   ![Job Details]

4. View the results in the Job Details page.

**Dynamic Environment Example with Amazon and Chef**

This example shows what you see in the ElectricFlow UI when your dynamic environment is configured with Amazon as the cloud provider and Chef for the configuration management.

**Resource Templates**

In resource templates, you define cloud resources that will be provisioned for dynamic environments. Examples of cloud resources are a HAProxy server, MySQL server, PHP-FPM server, and Resque server.

This is the Resource Template List.
These are the cloud provider settings for a resource template. It is defined by cloud provider account credentials and by an Amazon Machine Image (AMI).

These are the configuration management settings for a resource template. It calls a Chef recipe to configure the cloud resources. You can configure the resources with other recipes or predefined configuration, such as a MySQL stack configuration or a HAProxy load balancer configuration.
Environment Templates

When you create a new environment template, you can add one resource template to an environment tier. These are the resource templates from which you can select.

After you select a resource template and click OK, you enter the number of resources to provision in an environment tier.
This is an environment template with four tiers. Each tier is configured with a resource template, and resource template has a provisioned resource.

**Deploying Applications to Dynamic Environments**

After you select an application to deploy, you select the application process to run and the environment in which to deploy the application.
To deploy the application in a dynamic environment, you can select an environment template. A dynamic environment is created with the provisioned cloud resources. After the resources are provisioned and the dynamic environment is created, the application is deployed.

You can view the status of the provisioning process.

Retiring Dynamic Environments

After the provisioning process completes, the new dynamic environment appears in the Environments List.

You can retire (decommission) dynamic environments on an on-demand basis to prevent excessive use of cloud resources and reduce costs.

You click the Tear down button to retire the selected dynamic environment.
Developer Task: Creating Custom Plugins

ElectricFlow uses third-party plugins to provision cloud resources in resource templates for Dynamic Environments. Amazon EC2 (EC-EC2) and Openstack (EC-OpenStack) are supported as out-of-the-box cloud provider plugins, and Chef (EC-Chef) is supported as an out-of-the-box configuration management plugin.

ElectricFlow provides a number of bundled plugins. For a complete list, see Plugins That are Bundled with ElectricFlow on page 1138.

To view the supported cloud provider plugins, open the New Cloud Provider dialog box and click Select cloud provider to view the drop-down menu of cloud providers.

To view the supported configuration management plugins, click Select configuration management to view the drop-down menu of configuration management tools.

If you have an existing procedure that you would prefer to use instead of an out-of-the-box third-party plugin to provision cloud resources, you can create a custom plugin based on your deployment scenario.

The process to create custom cloud provider and configuration management plugins uses metadata to loosely couple them to the application you want to deploy. The custom plugins define specific known properties that are automatically recognized by Dynamic Environments.
To create your own plugin for other cloud platforms, go to https://electric-cloud.github.io/index.html to get started. This website describes how to create open source plugins and has this information:

- For an introduction to the process of building and developing open source plugins, go to the Quick Start.
- To build and deploy your plugin, go to Build and Deploy.
- For more information, go to More information.
- Go to Creating Custom Cloud Provider Plugins on page 262 for the details to create custom cloud provider plugins.
- Go to Creating Custom Configuration Management Plugins on page 267 for the details to create custom configuration management plugins.

Creating Custom Cloud Provider Plugins

This section applies to developers who want to create custom cloud provider plugins for Dynamic Environments in ElectricFlow.

How to Create a Custom Cloud Provider Plugin

This procedure assumes that you already have a plugin and want to use it with ElectricFlow. It describes how to define properties in your plugin that ElectricFlow can read.

1. To convert your procedure to a plugin, define the name of the plugin and the ElectricFlow project to which the plugin belongs.

Later in this procedure, you will use these properties to create pre- and post-hooks to the plugin in ElectricFlow.
2. Define the following properties in your plugin under a top-level plugin property called `ec_cloudprovisioning_plugin`, which the system will read to Dynamic Environments.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>ec_cloudprovisioning_plugin/</code></td>
<td>Top-level plugin property directory</td>
</tr>
</tbody>
</table>

### Properties defined by the custom plugin under `ec_cloudprovisioning_plugin`

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>displayName</code></td>
<td>Name of the plugin that appears in the New Cloud Provider dialog box.</td>
</tr>
<tr>
<td></td>
<td>Example: Amazon for the EC-EC2 plugin</td>
</tr>
<tr>
<td><code>hasConfiguration</code></td>
<td>&lt;Boolean flag - 0</td>
</tr>
<tr>
<td></td>
<td>- Set this property is set to 0 if the plugin does not have any configuration procedures (CreateConfiguration and DeleteConfiguration).</td>
</tr>
<tr>
<td></td>
<td>- Set this property is set to 1 if the plugin has configuration procedures.</td>
</tr>
<tr>
<td><code>configurationLocation</code></td>
<td>Name of the property sheet used by the plugin to store the saved configurations.</td>
</tr>
<tr>
<td></td>
<td>This value is relative to the plugin's top-level properties.</td>
</tr>
<tr>
<td></td>
<td>For example, if this value is set as <code>ec2_cfgs</code>, the plugins configurations are read from <code>/plugins/&lt;PLUGIN_KEY&gt;/project/ec2_cfgs</code>.</td>
</tr>
<tr>
<td><code>operations/</code></td>
<td>Property sheet for the specific operations required by the Dynamic Environment system.</td>
</tr>
<tr>
<td>Properties under <code>operations/</code></td>
<td>These operations are mapped to the plugin operations through the following child properties.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>createConfiguration/</code></td>
<td>Properties for the procedure that creates the plugin configuration. It is usually called createConfiguration.</td>
</tr>
<tr>
<td><code>deleteConfiguration/</code></td>
<td>Properties for the procedure that deletes the plugin configuration. It is usually called deleteConfiguration.</td>
</tr>
<tr>
<td><code>provision/</code></td>
<td>Properties for the procedure that provisions virtual instances.</td>
</tr>
<tr>
<td>Property Name</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>retireResource/</td>
<td>Properties for the procedure that tears down (decommissions) a previously provisioned virtual instance backing the specified resource.</td>
</tr>
<tr>
<td>retireResourcePool/</td>
<td>Properties for the procedure that tears down (decommissions) all previously provisioned virtual instances for the specified resource pool.</td>
</tr>
</tbody>
</table>

Properties for the previously listed operations defined in the `operations` property sheet

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>procedureName</td>
<td>Name of the procedure name in the plugin to which the operation is mapped.</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>Property sheet that references the <code>ui_forms</code> properties defined under the plugin's top-level properties.</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>Property sheet for the input parameters to the procedure that can be used by the Dynamic Environment system. The parameter list is operation-specific.</td>
</tr>
</tbody>
</table>

Go to Example: Property Structure for a Cloud Provider Plugin on page 265 for an example of the properties for the EC-EC2 (Amazon) plugin.

3. Save the plugin file in the appropriate location on your ElectricFlow server.

4. To import the plugin file to the automation platform:
   a. In the automation platform, go to Administration > Plugins to open the Plugin Manager page.
   b. Click the Install from File/URL tab.
   c. In the File Install field, click Choose file to select the plugin file.
   d. Click Upload to install it.
      The plugin file appears in the Currently Installed tab.
   e. Find your plugin and click Promote in the Actions column to make it available for use by ElectricFlow.

5. In ElectricFlow, to create a resource template:
   a. Go to Creating Resource Templates on page 208 for the details.
   b. In the Select cloud provider field, select your plugin as the cloud provider.
   c. Enter the plugin settings in the form.
   d. (Optional) Set the configuration management tool.
      Go to Creating Resource Templates on page 208 for the details.
6. In the ectool API, enter the following commands to set pre- and post-hooks linking the plugin to an application that you later deploy in a dynamic environment.

   a. To create a pre-hook, enter

   ```
   ectool createHook postConfigurationHook --hookType POST_CONFIGURATION --
   procedureName <hookProcedureName> --procedureProjectName
   <hookProjectName> --resourceTemplateName <resourceTemplateName> --
   projectName <resourceTemplateProjectName>
   ```

   where `hookProcedureName` is the plugin procedure name, `hookProjectName` is the name of the project to which the plugin procedure belongs, `resourceTemplateName` is the name of the resource template you created, and `resourceTemplateProjectName` is the name of the project to which the resource template belongs.

   b. To create a post-hook, enter

   ```
   ectool createHook preConfigurationHook --hookType PRE_CONFIGURATION --
   procedureName <hookProcedureName> --procedureProjectName
   <hookProjectName> --resourceTemplateName <resourceTemplateName> --
   projectName <resourceTemplateProjectName>
   ```

   where `hookProcedureName` is the plugin procedure name, `hookProjectName` is the name of the project to which the plugin procedure belongs, `resourceTemplateName` is the name of the resource template you created, and `resourceTemplateProjectName` is the name of the project to which the resource template belongs.

7. Create an environment template with the resource template that you created.

**Example: Property Structure for a Cloud Provider Plugin**

This is the EC-EC2 (Amazon) plugin property structure.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Property Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>ec_cloudprovisioning_plugin/</td>
<td></td>
</tr>
<tr>
<td>displayName</td>
<td>Amazon</td>
</tr>
<tr>
<td>hasConfiguration</td>
<td>1</td>
</tr>
<tr>
<td>configurationLocation</td>
<td>ec2_cfgs</td>
</tr>
<tr>
<td>operations/</td>
<td>createConfiguration/</td>
</tr>
<tr>
<td></td>
<td>deleteConfiguration/</td>
</tr>
<tr>
<td></td>
<td>provision/</td>
</tr>
<tr>
<td></td>
<td>retireResource/</td>
</tr>
<tr>
<td></td>
<td>retireResourcePool/</td>
</tr>
<tr>
<td>ec_cloudprovisioning_plugin/createConfiguration/</td>
<td></td>
</tr>
<tr>
<td>Property Name</td>
<td>Property Values</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>procedureName</td>
<td>CreateConfiguration</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td></td>
</tr>
<tr>
<td>ui_formRefs/parameterForm</td>
<td>ui_forms/EC2CreateConfigForm</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td></td>
</tr>
<tr>
<td>parameterRefs/ configuration</td>
<td>config</td>
</tr>
<tr>
<td>ec_cloudprovisioning_plugin/deleteConfiguration/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>DeleteConfiguration</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>–</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>configuration called config</td>
</tr>
<tr>
<td>ec_cloudprovisioning_plugin/provision/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>API_RunInstances</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>parameterForm called ec_parameterForm</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>configuration called config</td>
</tr>
<tr>
<td></td>
<td>resourcePool called res_poolName</td>
</tr>
<tr>
<td></td>
<td>count called count</td>
</tr>
<tr>
<td>ec_cloudprovisioning_plugin/retireResource/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>API_TearDownResource</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>–</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>resourcePool called res_poolName</td>
</tr>
<tr>
<td>ec_cloudprovisioning_plugin/retireResourcePool/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>API_TearDownResource</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>–</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>resourcePool called res_poolName</td>
</tr>
</tbody>
</table>
Creating Custom Configuration Management Plugins

This section applies to developers who want to create custom configuration management plugins for Dynamic Environments in ElectricFlow.

How to Create a Custom Configuration Management Plugin

This procedure assumes that you already have a plugin and want to use it with ElectricFlow. It describes how to define properties in your plugin that ElectricFlow can read.

1. To convert your procedure to a plugin, define the name of the plugin and the ElectricFlow project to which the plugin belongs.

Later in this procedure, you will use these properties to create pre- and post-hooks to the plugin in ElectricFlow.
2. Define the following properties in your plugin under a top-level plugin property called `ec_configurationmanagement_plugin`, which the Dynamic Environment system can access.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ec_configurationmanagement_plugin/</td>
<td>Top-level plugin property directory</td>
</tr>
</tbody>
</table>

Properties defined by the custom plugin under `ec_configurationmanagement_plugin`:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>displayName</td>
<td>Name of the plugin that appears in the Dynamic Environment UI</td>
</tr>
<tr>
<td></td>
<td>Example: Chef for the EC-Chef plugin</td>
</tr>
<tr>
<td>hasConfiguration</td>
<td>`&lt;Boolean flag - 0</td>
</tr>
<tr>
<td></td>
<td>- When this property is set to 0 or false, the plugin does not have any configuration procedures (CreateConfiguration and DeleteConfiguration).</td>
</tr>
<tr>
<td></td>
<td>- When this property is set to 1 or true, the plugin has configuration procedures.</td>
</tr>
<tr>
<td>configurationLocation</td>
<td>Name of the property sheet used by the plugin to store the saved configurations. This value is relative to the plugin's top-level properties. If this value is set as <code>chef_cfgs</code>, the configurations are in <code>/plugins/&lt;PLUGIN_KEY&gt;/project/chef_cfgs</code>.</td>
</tr>
<tr>
<td>operations/</td>
<td>Property sheet for the specific operations required by the Dynamic Environment system.</td>
</tr>
</tbody>
</table>

Properties under `operations/-` These operations are mapped to the plugin operations through the following child properties:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>createConfiguration/</td>
<td>Properties for the procedure that creates the plugin configuration. It is usually called createConfiguration.</td>
</tr>
<tr>
<td>deleteConfiguration/</td>
<td>Properties for the procedure that deletes the plugin configuration. It is usually called deleteConfiguration.</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>converge/</td>
<td>Properties for the procedure that converges the virtual instances to the defined configuration (including policies and roles).</td>
</tr>
<tr>
<td>teardown/</td>
<td>Properties for the procedure that deletes the configuration details on the specified dynamic resource or resource pool. For Chef, properties for the procedure that deletes the Chef API client and Chef node on the specified dynamic resource or resource pool.</td>
</tr>
<tr>
<td></td>
<td>Properties for the previously listed operations defined in the operations property sheet</td>
</tr>
<tr>
<td>procedureName</td>
<td></td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>Property sheet that references the ui_forms properties defined under the plugin's top-level properties.</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>Property sheet for the input parameters to the procedure that can be used by the Dynamic Environment system. The parameter list is operation-specific.</td>
</tr>
</tbody>
</table>

Go to Example: Property Structure for a Configuration Management Plugin on page 270 for an example of the properties for the EC-Chef plugin.

3. Save the plugin file in the appropriate location on your ElectricFlow server.

4. To import the plugin file to the automation platform:
   a. In the automation platform, go to Administration > Plugins to open the Plugin Manager page.
   b. Click the Install from File/URL tab.
   c. In the File Install field, click Choose file to select the plugin file.
   d. Click Upload to install it.
   e. The plugin file appears in the Currently Installed tab.
   f. Find your plugin and click Promote in the Actions column to make it available for use by ElectricFlow.
5. In ElectricFlow, to create a resource template:
   a. Go to Creating Resource Templates on page 208 for the details.
   b. In the **Select cloud provider** field, select a cloud provider.
   c. Enter the account settings for the selected cloud provider.
   d. Enter the **provision parameters** on the next page.
   e. In the **Select configuration management** field, select your plugin as the configuration management tool.
   
   Go to Creating Resource Templates on page 208 for the details.

6. In the ectool API, enter the following commands to set pre- and post-hooks linking the plugin to an application that you later deploy in a dynamic environment.
   a. To create a pre-hook, enter
   
   ```
   ectool createHook postConfigurationHook --hookType POST_CONFIGURATION --procedureName <hookProcedureName> --procedureProjectName <hookProjectName> --resourceTemplateName <resourceTemplateName> --projectName <resourceTemplateProjectName>
   ```
   
   **where** **hookProcedureName** is the plugin procedure name, **hookProjectName** is the name of the project to which the plugin procedure belongs, **resourceTemplateName** is the name of the resource template you created, and **resourceTemplateProjectName** is the name of the project to which the resource template belongs.

   b. To create a post-hook, enter
   
   ```
   ectool createHook preConfigurationHook --hookType PRE_CONFIGURATION --procedureName <hookProcedureName> --procedureProjectName <hookProjectName> --resourceTemplateName <resourceTemplateName> --projectName <resourceTemplateProjectName>
   ```
   
   **where** **hookProcedureName** is the plugin procedure name, **hookProjectName** is the name of the project to which the plugin procedure belongs, **resourceTemplateName** is the name of the resource template you created, and **resourceTemplateProjectName** is the name of the project to which the resource template belongs.

7. Create an environment template with the resource template you created.

**Example: Property Structure for a Configuration Management Plugin**

This is the EC-Chef plugin property structure.

<table>
<thead>
<tr>
<th>Name</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>ec_configurationmanagement_plugin/</td>
<td></td>
</tr>
<tr>
<td>displayName</td>
<td>Chef</td>
</tr>
<tr>
<td>hasConfiguration</td>
<td>1</td>
</tr>
<tr>
<td>Name</td>
<td>Values</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>configurationLocation</td>
<td>chef_cffs</td>
</tr>
<tr>
<td>operations/</td>
<td>createConfiguration/</td>
</tr>
<tr>
<td></td>
<td>deleteConfiguration/</td>
</tr>
<tr>
<td></td>
<td>converge/</td>
</tr>
<tr>
<td></td>
<td>teardown/</td>
</tr>
<tr>
<td>ec_configurationmanagement_plugin/createConfiguration/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>CreateConfiguration</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>parameterForm called forms/CreateConfigForm</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>configuration called config</td>
</tr>
<tr>
<td>ec_configurationmanagement_plugin/deleteConfiguration/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>DeleteConfiguration</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>-</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>configuration called config</td>
</tr>
<tr>
<td>ec_configurationmanagement_plugin/converge/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>_RegisterAndConvergeNode</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>parameterForm called ec_parameterForm</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>configuration called config</td>
</tr>
<tr>
<td>ec_cloudprovisioning_plugin/teardown/</td>
<td></td>
</tr>
<tr>
<td>procedureName</td>
<td>_DeleteNode</td>
</tr>
<tr>
<td>ui_formRefs/</td>
<td>-</td>
</tr>
<tr>
<td>parameterRefs/</td>
<td>resourceName called resource_name</td>
</tr>
</tbody>
</table>

**Inventory Tracking**

Electric Flow uses Inventory Tracking to track what is built, tested, and deployed by the application, including artifacts, artifact versions, resources on which the applications are run, and environments to which the
resources are assigned. If there is an issue when an application is deployed you can find the details about what was deployed.

- Use the Environment Inventory to track and view details of the objects that were deployed and artifacts in the application. It shows the status of the application deployment at a point in time. Go to Example: Modeling and Deploying Applications on page 133 and Environment Inventory on page 272 for more information.
- Use the Application Inventory (on the Applications Run View page) to track and view the deployment results. It shows more details about the application at a point in time. Go to the Applications Run View page in the GUI to see these details. Go to Example: Modeling and Deploying Applications for an example.

**Tracking at the Component Process Level**

Inventory Tracking occurs at the component process level.

When defining a component process, you select one of these process types:

- **Deploy**—Enables Inventory Tracking. The ElectricFlow server tracks artifacts deployed to environments. This is the default.
- **Undeploy**—After the first successful job step in a component process with this setting, the automation platform removes the environment inventory record.
- **Other**—Disables Inventory Tracking.

**Environment Inventory**

The Environment Inventory is the state of the environment at a point in time.

- When an application is running, you can see its progress as it runs.
- After an application runs, you can see the details for the objects in application.

This example shows the Environment Inventory for the heatclinic-qe environment to which the HeatClinic application is deployed. The application has two application processes called Run and Stop.

In the Environments List, choose an environment and click the **Inventory** button to open the Environment Inventory.

Clicking in the row for an object in the Environment Inventory displays more details about that object, such as:

- Environment name
- Application mapped to this environment
- Number of deployed artifacts in the application
- When the artifacts were deployed
- Status of the deployment: success or failure
1. Go to the heatclinic-qe row, and click to open the Environment Inventory.

![Environment Inventory](image1)

This is the Environment Inventory.

![Environment Inventory](image2)

2. Click to view the list of components in the Run process of the HeatClinic application.

![Environment Inventory](image3)
3. Click the **Process** button in any of the component rows to view the Run application process runs in the heatclinic-qe environment.

The results of running the Run application process, application process steps, and component process steps now appear in the inventory. An application process step can be based on a component (defined by component processes), a plugin, a command, or a procedure.

The Run application process consists of four process steps: Check, deploy war, cleanup db, and start server.

- The Check step is defined by a command.
- The remaining steps are defined by components in the HeatClinic application.

4. To open the Job Details page for an application process, an application process step, or component process step, do one of the following:

- Click the object name to open the Job Details page for that object.
- Click the **View details** button at the end of the row.
5. For a process step, click to view the results of deploying process steps.

**Snapshots**

In a software release process, the goal is to have a consistent deployment process that can be run often throughout the release life cycle. When the deployments are run in production, there are no unexpected results. Snapshots are used to implement these deployments.

A snapshot captures both the component versions and the process that were used for deployments. These snapshots make the deployments repeatable and stable.

ElectricFlow supports these types of snapshots:

- Environment snapshot: An environment snapshot is created from an environment where the application is deployed and tested. A snapshot will capture the exact artifact versions, process versions, configuration parameters, and so on used for the deployment to ensure repeatability. This is considered the reliable version of a snapshot for reliability and repeatability.
Application snapshot—An application snapshot is created directly from the application model and does not depend on any environment deployment. When a snapshot is captured from the application model, it locks the application architecture, components, and process versions. If you specify the “Latest” artifact version as part of the component definition in the snapshot, the latest artifact versions will be used every time it is used for deployment. The main purpose of an application-based snapshot is to allow the creation of user-defined versions of the models. The application snapshot name can be used to indicate a specific user-defined version.

For example, in a software delivery process, the developer checks in code, the components are built automatically by a continuous integration system, and the objects in the resulting build are published to a binary artifact management system. When the full complement of component artifacts is available, a release candidate pipeline is initiated. The first stage is to deploy to a development environment. From this deployment, a snapshot is created and used as the model for subsequent deployments to other environments. There will be some differences between the development, QA and production environments, such as database connection strings, credentials, and debug-vs-production artifacts. ElectricFlow can manage these differences in the application model using parameters and properties in templates, only modifying the deployment process flow in a controlled manner.

The process described in the example avoids some of the pitfalls encountered in traditional release scenarios. For example, configuration teams often perform their own builds. This means that the binaries supplied by the CM team may be different than what has already been tested. Release teams may also manually edit configuration files to adjust for differences in the deployment environments. Both of these practices are prone to error and can negatively impact the quality of the final software release.

In ElectricFlow, you can deploy snapshots for more reliable and repeatable software releases. Here are some of the use cases snapshots can serve:

- You can model and save a version of your software release with specific artifact versions and rerun it later, even if the latest release version of it has changed.
- If you save snapshots during development and test phases, you can ensure that the components that were deployed and tested are the same as those in the release candidate. You can redeploy the snapshot any time.
- You can create and save more than one snapshot for different deployment scenarios.
- You can use an application snapshot to capture a version of the model. This can be used to define a future or desired state of the application model as well.
- You can view the snapshots in the Snapshot List. From this list, you can manage all your snapshots, compare two snapshots, or get more information about them.
- Comparing snapshots helps you to deploy releases with reliable and repeatable results during ongoing software release cycles. You can build and test releases using snapshots, and do not have to design new applications for each release. Comparing snapshots also allows you to compare a future or desired state of the application model to any saved version of the model. Go to Comparing Snapshots on page 280 and Comparing Results on page 281 for more information.
- You can use snapshots to refine and optimize applications that fit your deployment scenario and ensure that this version is properly developed, tested, and released.
Example: Creating, Deploying, and Comparing Snapshots

This example shows how to create application and environment snapshots, deploying snapshots, and comparing them during the software release life cycle.

Creating Application Snapshots

1. In the Applications List, choose an application and click the button.
2. Select Snapshot List.
   The Snapshot List appears.
3. To add a new snapshot, click There are no Snapshots. Add one +.
   The New Snapshot dialog box appears.
4. Enter the name for the snapshot that must be unique within the application and enter an optional description of it.
   This name can be used to indicate the user defined version of the model. For example, in the figure below, see HeatClinic v1.2.
   Application snapshots can be used for various purposes like creating a baseline version of the model or even for modeling a future state or desired state of the model.
5. Click Next.
6. The New/Preview dialog box opens.

You can toggle between the **Component** and **App Process** views to see the components and application processes for the selected application.

Example:

In the **Component** view, change the version of the Config component to **Latest**.

![Component View](image)

This is the **App Process** view.

![App Process View](image)

7. Click **OK**.

A messages appears stating that the snapshot has been created, and the Snapshot List is updated:

![Snapshot List](image)
Deploying Application Snapshots

1. In the Applications List, choose an application and click the button (the Run process button).

2. Select New Run.

   The dialog box to select the settings for the application run opens.

3. Select these settings for the application run:

   - In the Select Process field, select Run.
   - In the Select Environment field, select heatclinic-qe.
   - In the Select a Snapshot field, select HeatClinic v1.2.

   ![New Run Options](image)

   Note: Clicking next to Compare shows the comparison of the selected snapshot to last deployment of the Run process in the heatclinic-qe environment.

4. To deploy the snapshot, click OK.
Creating Environment Snapshots

1. In the Environments List, choose an environment and click the button.

2. Click the Inventory button to open the Environment Inventory.

   **Example:**

3. Choose an application, and click the button.
4. Click **New Snapshot**.
   The New Snapshot dialog box opens.
5. Enter the name and a description of the snapshot.
   The name of this environment snapshot is *Heatclinic_QE2*.
6. Click **Next**.
   The New/Preview dialog box opens. You can view the snapshot settings in the Component and App Process tabs but cannot change them because the application has been deployed to the heatclinic-qe environment.
7. Click **OK**.

Comparing Snapshots

This example shows how to compare an application snapshot to an environment snapshot.
1. In the Snapshot List, select two snapshots that you want to compare.

![Snapshot List Image]

2. Click the button (Compare button).

The Snapshot Comparison page opens.

**Comparing Results**

In the Snapshot Comparison page, the Component and App Process views show the differences between the snapshots, Heatclinic v1.2 (the application snapshot) and Heatclinic_QE2 (the environment snapshot). Heatclinic_QE2 is the more reliable, repeatable, and update-to-date version of the application.

The Component view shows that the Config component is different. Heatclinic v1.2 uses the "Latest" version of the artifact that may not be the same as the artifact version in Heatclinic_QE2, the more reliable and repeatable version of the snapshots.

![Component View Image]

The App Process shows one difference. Heatclinic v1.2 has one less application process than Heatclinic_QE2.

![App Process Image]
**Note:** Clicking the pull-down button next to the snapshot name allows you to select a different snapshot.
Pipelines

A pipeline is a representation of your software delivery process on its journey to production, enabling Application Release Automation (ARA) and Continuous Delivery (CD). It takes the software through the hops and milestones (stages) of the software release life cycle, however you define it. You can model and execute one or more applications, procedures, or workflows in a pipeline.

Pipelines are a way to orchestrate the flow of the software release process. You can choose what part of the process in the pipeline to automate, based on your needs. Some examples are:

- From code check-in to production: After developers check in code, it is run through a pipeline that includes build, test, pre-production, and production stages, running various automation tasks in each of the stages like deploying the applications, running test automation suites, and so on, ending when the software is delivered to the production server.

- From system test to production: After the software passes the system tests, it is run through a pipeline to integrate the code from multiple teams, run user acceptance tests, and deploy the software to for beta testing and then all the way to the production.

Starting in ElectricFlow 6.2, multiple project support has been extended to ElectricFlow objects in application deployments, pipelines, and Releases. These objects as well as the objects belonging to them can be in any project within ElectricFlow. (In releases earlier than ElectricFlow 6.2, these objects were limited to the Default project.)

All objects in ElectricFlow have these capabilities for better management and maintenance of end-to-end software releases:

- Projects are top-level security containers that provide access control at the project level. All objects in a project inherit the access control settings from the project to which they belong.

- Projects are also ways to provide logical groupings of objects. If your deployment is large and has many production environments, you can organize production environments by project, with each project having its own access control settings. This makes it easier to manage and maintain multiple environments during the software delivery process.

In this section, you will learn:

- About pipeline models—See Pipeline Concepts on page 284.

- How to author and run a pipeline—See Example: Authoring and Running Pipelines on page 319.

- About pipeline stage summaries—See Pipeline Stage Summary on page 295.

IMPORTANT: When you export a project while a pipeline is in progress, only the full export includes flow runtimes that have been completed. If you want to include in-progress pipeline runs in the path-to-production view and the visual indicators showing their percentage completed in the Release dashboard, set the excludeJobs argument to 0 or false in the export command. When the XML file is imported, the in-progress pipeline runs in the imported project are displayed in the path-to-production view and the Release dashboard. The jobs might be incomplete once the XML is imported.
**Pipeline Concepts**

A pipeline allows you to model the complete software delivery process. You can create multiple milestones, referred to as stages, in a pipeline. Examples of stages are development (Dev), QA, user acceptance test (UAT), pre-production, production, and so on. Most of the time, these stages will map closely to the environments where applications will be deployed, but do not have to be.

![Pipeline Diagram]

Each stage consists of an entry gate, an exit gate, and the automation tasks to complete the stage.

- An entry gate controls the approvals required before a pipeline can enter a stage. The entry gate ensures all the checks and balances are met before tasks in that stage can begin.
- The exit gate allows you to control when a pipeline can exit a stage and what approvals are needed.
- The tasks allow you to execute the automation logic. This is where you specify what to do.
  
  For example, if your stage is a test stage, it contains the tasks that must be executed to ensure that the test automation for your software delivery process is successfully completed.

- Parameters can be created for various objects and automation tasks in the stage. This makes the pipeline reusable, allowing orchestration of the inputs and outputs for the stage and of the properties passed between stages.

- **Run if** and **Wait until** conditions can be set on pipeline objects. Go to "Run if" and "Wait until" Conditions on page 288 for more information.

**Pipeline Start and End Stages and Stage Skipping**

You can choose start and end stages in a pipeline. You can also skip pipeline stages. Following are specific examples of how you can use this feature.
Running or Re-Running a Stage Independently

In traditional release styles, when a deployment to a release stage fails, release management or operations often must fix the issue (such as with the code or environment) and start again from the failed stage to avoid running earlier stages unnecessarily. For example, if stage 2 requires hours of testing, but stage 3 fails because a required server went offline. This functionality lets them determine if the error requires an entire pipeline rerun. Other examples are as follows:

- You can rerun a stage independently to redeploy a stage to update to a newer application release candidate that came out since the last stage run (successfully or not).
- Release management or operations running a release stage can to rerun a failed stage to recover from stage errors (such as a bad process step, failed server, or unavailable resource) that do not affect the final output, so that they can fix the problem and move forward without potentially rerunning potentially expensive stages that do not require a rerun.
- A release stage owner participating in a release with traditional characteristics can rerun the stage that they own with a different application version, because they received an update from the application team that needs testing in the release stage owner's environments.

Selecting a Subset of Pipeline Stages to Run

This functionality lets you start a pipeline and run stages only to a certain point or from a certain point without it being considered failed or left running and requiring an abort. For example:

- Beginning to middle—Consider a release pipeline that starts with continuous output of release candidates from the development team. In the first two weeks of a release, they continuously deploy different development outputs and test them in the first few stages of the pipeline, but they want it to stop and be considered a success after the test stage. Once the results are satisfactory, they change the target state to "production" and rerun all stages.
- Middle to end—You can recover from a stage failure by fixing the problem and then rerun the fixed stage to continue to production from the failure point. You can also start after the stage that you fixed manually (such as when a failed manual step to update the documentation was fixed).
Running Multiple Pipeline Stages at Once

This feature allows stages to run at the same time. With traditional releases, separate teams working on a release will work on their stages at the same time (and often in parallel), but their work still must be tracked and aggregated into the final release status. For example, if stage 4 is production, the operations department can start a time-consuming database backup before stage 3 (UAT) even begins. Other examples are as follows:

- The integration stage is being run to deploy and test the latest work from the developers, who might not test it. At the same time, the test stage is already running functional testing on the previous release candidates.
- The testing stage runs performance tests at the same time that the UAT stage is running user acceptance tests. The release manager examines the outcome of both before approving to move further down the pipeline.

Pipeline Scheduling

You can create schedules for pipeline runs. You can set a start date and can also make a run recurring (for example, daily or weekly).

Tasks

Each task can specify automation logic defined by an application process, procedure, or workflow. You can also call integrations to third-party tools using plugins, or you can specify manual tasks performed by one or more users.

- Application process: Use this to deploy applications at the right time in a pipeline.
  
  When artifact staging is enabled for an application, ElectricFlow tries to retrieve artifacts that will be deployed before the application run starts. This ensures that the artifacts are downloaded and available on the target (either the artifact cache (the default)) or a directory specified in the component definition. This minimizes the time to retrieve artifacts and reduces downtime during the application deployment. For details about artifact staging, seeArtifact Staging on page 113.
  
  For an example of how to deploy applications, go to Example: Modeling and Deploying Applications on page 133.

- Procedure: Use this to run a set of best practices, subroutines, modules, or functions that you can create and reuse at the platform level. Examples are scripts, command sets, or other automation logic objects. For details, see Pipeline Task Definitions on page 293.

- Manual task: Use this when a task should be performed manually. The appropriate notifications are sent to the user or group who performs that task and to the user or group who responds when the task is completed. For more information about completing a manual task and restarting its pipeline, see Example: Visibility in a Release Pipeline from the Release Dashboard on page 363.
• Workflow: Use this to run a set of procedures in CI life cycles at the platform level. A workflow can combine all procedures for a build-test-deploy life cycle. For details, see Workflow Overview on page 1058.

After the workflow is completed, it returns the workflow state to the pipeline as ERROR or SUCCESS:

- **ERROR:** This means that the ERROR_LOG has entries, /myWorkflow/outcome or /myWorkflow/result is error, the workflow ended in a state that includes Error or Fail in its name, or it has any failed jobs.

- **SUCCESS:** /myWorkflow/outcome or /myWorkflow/result exist and are not equal to error.

• Plugin: Use this to run third-party procedures that interface with external systems. Plugin tasks are a perfect way to integrate and orchestrate your third-party tools. For example, you can run Selenium automation at the right time by using the Selenium plugin. For details about plugin tasks, see Plugin Pipeline Tasks on page 315.

• Utility: Use this to run a utility function, which is a higher-order operation than a third-party plugin, as a stage task. You can also define an application or component process step as a utility function. For information about defining an application process step or a component process step as a utility function, see Authoring Application Processes on page 146 or Authoring Component Processes on page 137.

You can skip specific tasks at runtime by using the **Enabled** check box for those tasks in a task list. This check box is checked by default.

You can also select a Deployer task, which is a special type of task used when you want to deploy applications in a Release but will provide the details in the Release definition. For details, see Release Management on page 356.

When using Deployer tasks, the system automatically knows the applications to deploy, which are provided as part of a Release definition instead of separate Deploy tasks for each application.

When defining a task, you must specify whether the pipeline continues or stops if the task fails because of an error. To do so, you must select either **Continue running** or **Stop running** under the **On Error** field.

- **Continue running:** If the task fails, the pipeline continues to the next gate or stage task.

- **Stop running:** If the task fails, the pipeline aborts. This is the default behavior. This behavior is usually used in Continuous Delivery pipelines.

For a manual task, the pipeline determines whether it stops running or continues running based on the rejection or completion of the task. If the task is rejected and **Continue running** is selected, the pipeline continues to the next gate or stage task.

### Entry and Exit Gates

Gates at the entries and exits of the stages control the pipeline's progress. Specific users or groups can be allowed to manually approve the criteria at a gate. During a pipeline run, you can see the progress of the pipeline at each stage using the pipeline stage summary. You can review the user-generated information in the pipeline stage summary to make approve or reject decisions at a gate.
An entry gate controls if a stage may begin and its tasks may be executed.

An exit gate controls if the stage may be completed and the pipeline may progress.

You can set the approvals so that approval from only one of the approvers is sufficient for the pipeline to progress. In this case, you can have one approval rule and have all the approvers assigned to that rule.

Instead, if you want all the key individuals to approve sequentially, you can specify multiple approval rules, each for a specific user.

In addition to specific users, approval rules support groups. Approval or rejection from any user in the group allows the pipeline to progress or stop.

When defining a gate, you must specify whether the pipeline continues or stops if the gate approval is rejected. To do so, you must select either Continue running or Stop running under the On Error field.

- **Continue running**: If the user rejects the gate approval, the pipeline still completes the task and then continues to the next gate or stage task with a known error.

- **Stop running**: If the user rejects the gate approval, then the pipeline aborts. This behavior usually occurs in Continuous Delivery pipelines.

If a gate has approvals, one or more of these actions occurs:

- Email notifications are sent to the specified approvers.

- If the approver approves the request, the pipeline's progress continues.

- If the approver rejects it, the pipeline ends with an appropriate error (except if On Rejection is set to Continue running).

Approval gates are optional, and if a gate has no approvals, the pipeline's progress continues.

For example, if your pipeline has multiple stages for testing, you may want to set entry and exit criteria for each stage to ensure that the code is testing properly in the software delivery life cycle.

- In the system test stage, the QA engineer needs to approve the start of the system testing workflow. The same user or someone else in the QA group can review the system test results before approving the exit criteria.

- Before anything can enter the production stage, you may want to have entry gate approvals by various individuals.

"Run if" and "Wait until" Conditions

Before ElectricFlow 6.5, pipelines ran sequentially from the first stage to the last stage, without skipping a stage, task, or approval gate. When there was an error, the pipeline had to restart from the beginning. Starting in ElectricFlow 6.5, the pipeline runs can start or end at any point as well as skip a specific stage, task, or gate using Run if and Wait until conditions.

In the UI, you can set run the Run if and Wait until conditions on pipeline stages, tasks, and gates.

You can also set the Run if and Wait until conditions on pipeline stages, tasks, and gates using API commands through the command-line interface or through the DSL IDE while authoring pipelines.

- A Run if (run condition) is a property reference that the pipeline evaluates before executing the next stage, task, or approval gate. The pipeline waits until one or more dependent run conditions are met.
In an API command, this condition is "fixed text" or text embedding property references that are evaluated into a logical TRUE or FALSE. An "0" or "false" is interpreted as FALSE. An empty string or any other result is interpreted as TRUE. By default, this condition is not set and is FALSE. The property reference can be a JavaScript expression, for example, this expression could test whether the name of a step is equal to the value of a property called "restartStep":

```javascript
/***/javascript (myStep.stepName == myJob.restartStep)
```  

- **A Wait until condition (precondition or wait condition)**, is a property that allows a stage, task, or gate to be created with "pause", which then pauses the pipeline at that point. The pipeline waits until one or more dependent conditions are met. When the pipeline status is eligible to transition from pending to runnable, this condition is evaluated.

In an API command, this condition is fixed text or text embedding a property reference that is evaluated to TRUE or FALSE. An empty string, a "0" or "false" is interpreted as FALSE. Any other result string is interpreted as TRUE. The pipeline does not progress until the condition is TRUE. By default, this condition is not set and is FALSE.

**Run if** and **Wait until** conditions can be used to:

- Control a stage task based on the previous task.
- Skip some pipeline states based on some specific conditions, such as if a Linux installer file was not successfully built, tested, and verified.
- Execute certain approvals only if certain conditions are met. For example, during a functional test suite, the pipeline meets a rule or gate approval criteria if 90% of the functional tests have passed. If not, the pipeline waits for manual approval by assigned users before it can progress.

For examples of how to set Run if and Wait until conditions on pipeline objects, go to Pipeline Objects and Conditions on page 300.

**Pipeline UI**

This section shows how pipelines are represented in the ElectricFlow UI.

All of the information described in the previous sections is summarized in the pipeline definition in the Pipelines List.

**Pipelines List**

The Pipelines List shows all the pipelines that you have permission to view.

To open it from the Home page, click **Pipelines > All Pipelines**.

This is a Pipelines List:

![Pipelines List](image)

Each row in the list is a pipeline definition, consisting of the pipeline name, the project to which the pipeline belongs, and the number of stages in the pipeline.

For each pipeline, you can perform these actions:
• Clicking the green Run pipeline button (number 7) starts a pipeline run.
• Clicking the Expand button (number 8) shows the previous pipeline runs.
• Clicking the View Details button (number 9) opens the Pipelines Visual Editor.
• Selecting All or None and then clicking the Delete button removes the selected pipelines from the list.
• Clicking the Add+ button adds a pipeline.

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<tbody>
<tr>
<td>1</td>
<td>Breadcrumb identifying the object you are viewing and the total number of pipelines.</td>
</tr>
<tr>
<td>2</td>
<td>Clicking i shows information about the object. In this example, clicking i shows the pipeline description:</td>
</tr>
<tr>
<td>3</td>
<td>Name of the pipeline.</td>
</tr>
<tr>
<td>4</td>
<td>The default is to show the applications for all projects.</td>
</tr>
<tr>
<td></td>
<td>If you want to see only the objects for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:</td>
</tr>
<tr>
<td></td>
<td>• Click on the name of one or more projects.</td>
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<tr>
<td></td>
<td>• Enter the search criteria in the Search field. The projects that match the criteria appear in the list.</td>
</tr>
<tr>
<td></td>
<td>If there are no matches, a message appears stating that there are no resource templates in the selected projects.</td>
</tr>
<tr>
<td>5</td>
<td>The project to which the pipeline belongs.</td>
</tr>
<tr>
<td>6</td>
<td>Number of stages in the pipeline.</td>
</tr>
<tr>
<td>7</td>
<td>Click the Run pipeline button to run the pipeline when the button is green.</td>
</tr>
<tr>
<td>8</td>
<td>Click the Expand button to view the previous pipeline runs.</td>
</tr>
<tr>
<td>9</td>
<td>Click the View details button to go to the Pipelines Visual Editor.</td>
</tr>
</tbody>
</table>

**Pipelines Visual Editor**

In the Pipeline Visual Editor, you can author and edit a pipeline as well as view the underlying platform-level details.

This is a pipeline with two stages: QA and PROD.
You can perform these actions:

- Clicking the **Add new stage** button (number 7) will add a new stage to the pipeline.
- Clicking the **Menu** button (number 8) will open a menu where you can get more details about the pipeline and take actions on the pipeline.
- Clicking the **Run pipeline** button (number 9) will start a pipeline run.
- In a stage, clicking the **Define stage tasks** button (number 6) will open a dialog box where you can define tasks for the stage.

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>1</td>
<td>Breadcrumb showing the object hierarchy, path to the pipeline, and the pipeline name.</td>
</tr>
<tr>
<td>2</td>
<td>Stage in the pipeline, a milestone or checkpoint in the software delivery process.</td>
</tr>
<tr>
<td>3</td>
<td>Tasks in a stage, the automation logic for a stage. See <em>Tasks</em> on page 286.</td>
</tr>
<tr>
<td>4</td>
<td>Entry gate, consisting of the approvals to enter a stage. See <em>Entry and Exit Gates</em> on page 287.</td>
</tr>
<tr>
<td>5</td>
<td>Exit gate, consisting of the approvals to exit a stage. See <em>Entry and Exit Gates</em> on page 287.</td>
</tr>
<tr>
<td>6</td>
<td>Click the <strong>Define stage tasks</strong> button to open the task list for the stage.</td>
</tr>
<tr>
<td>7</td>
<td>Click the <strong>Add new stage</strong> button to add a stage.</td>
</tr>
</tbody>
</table>
Click the **Menu** button to open the menu where you get more details about the pipeline and take actions on the pipeline.

- Clicking **Details** opens the **Pipeline Details** dialog box where you can edit the pipeline name and description.
- Clicking **Properties** opens the **Properties** dialog box where you can view, add, and delete the properties associated with the pipeline.
- Clicking **Parameters** opens the **Parameters** dialog box where you can view, add, and delete the parameters attached to the pipeline.
- Clicking **Access Control** opens the Access Control page where you can view, add, and edit the privileges for the pipeline.
- Clicking **Track Changes** shows the **Change History** for the pipeline and the objects in it. ElectricFlow tracks the changes to tracked objects including applications, procedures, workflows, workspaces, resources, and project-owned components such as library components and records a Change History of the historical states of the system and the changes between them.
- Clicking **Delete** deletes the pipeline after you verify that you want to do this.

Click the **Run pipeline** button to run the pipeline. The Pipeline Runs List shows the real-time progress of the pipeline run. Clicking in a stage will open the Stage Summary where you can view task details and progress of each task.

You can also view the results of previous pipeline runs.

The task list for the stage shows all the tasks for the stage that are executed in sequential order.

| 1 | Breadcrumb showing the object hierarchy, path to the pipeline, and the pipeline name. |
| 2 | Name of the task. |
| 3 | Name of the stage. |
Pipelines

<table>
<thead>
<tr>
<th>4</th>
<th>The task type and the specific details for it. See Tasks on page 286. This task is defined by an application process called Deploy from the &quot;Shopping Cart&quot; application. The application process is deployed in the QA environment.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Click the Add task button to add a task to the to the stage.</td>
</tr>
<tr>
<td>6</td>
<td>The task type and the specific details for it. See Tasks on page 286. This task is defined by a procedure called TakeSnapshot in the Default project. Clicking on the Project button shows the project to which the procedure belongs.</td>
</tr>
</tbody>
</table>

**Pipeline Task Definitions**

Tasks are defined in the Task Definitions dialog box described in this section.

There are two ways to get to this dialog box:

- When you want to add a task, click the Add task button.

- When you want to view or edit a task in the task list, select a task and click the button in its row.

Depending on the task type that you select, different fields appear on the right side of the dialog box.

If you want to deploy an application, select App Process. You need to select an application, a snapshot, an application process, and the environment where the application process will run. If the parameters were created for application process, the Parameters field is enabled. You can also enable or disable Smart Deploy, where the system deploys only the artifacts that have not been deployed to a resource, specific versions of the artifacts, or artifacts that have not yet been deployed to new resources.

This example shows how to use a parameter to specify the snapshot. When you click in the "Select a Snapshot" field, these options appear:
There are two ways to specify a snapshot:

- Select a specific snapshot for the application, such as **SC-S1**.

  ![Diagram showing options for selecting a snapshot](image)

- Enter the snapshot as a parameter.

  **Enter this parameter:** $[/myPipelineRuntime/snapshotName].

  ![Diagram showing input parameter](image)

If you want to run a set of best practices, subroutines, modules, or functions that you can create and reuse (such as a script), select **Procedure**. You need to select a project and a procedure in that project. If the parameters were created for procedure, the Parameters field is enabled.

This example shows that the task is a procedure called **TakeSnapshot** in the **Utilities** project.
A pipeline stage summary shows various status and metrics relevant to the pipeline when a pipeline stage is executed. For example, the summary could be the scan results from the code coverage tool or links to reports that are generated during the pipeline run. You can view the pipeline stage summaries during the pipeline run or for completed pipeline runs.

From the Pipeline Runs view, you can click on a specific stage to see that stage's summary. The stage summary shows two sets of stage-specific information.

- Deployment summary consisting of:
  - A system-generated deployment summary.
  - Applications deployed through the pipeline and the environments where they are deployed.

- User-generated summary consisting of:
  - Links to web sites for reports and other information about the deployed artifacts.
  - Property information about the pipeline stage and the objects in it.

Creating User-Generated Data for the Stage Summary

If the task in a stage is defined by a procedure, a workflow, or an application process that includes a procedure as a process step, you can create user-generated data using ectool.

**Stage Summary Information as Links to a Web Site**

To create links to web site:
1. Create a procedure and the underlying steps with commands like the following:


2. Call this procedure from a task in the stage.

**Generic Property Information**

1. Create a procedure and the underlying steps with commands like the following:

   To create a summary property:

   `ectool setProperty "/myPipelineStageRuntime/ec_summary/testCoverage" "test value"`

   To create a property entry:

   `ectool setProperty "/myPipelineStageRuntime/ec_summary/testCoverage" --value "80%"`

2. Call this procedure from a task in the stage.

   Go to the following sections to see examples of user-generated data in the stage summary.

**Viewing the Stage Summary During a Pipeline Run**

To view the stage summary of a stage during its pipeline run, start the pipeline run by selecting a pipeline in the Pipelines list and clicking the button:

![Pipeline Run Button](image)

This pipeline requires input before the applications to be deployed through the pipeline. Enter the required parameters for pipeline, and click **OK**.

![Pipeline Parameters](image)

The pipeline runs. You can view its progress on the Pipeline Run page.

When manual approvals are required at the entry and exit gates to a stage, the system waits for the approvers to approve or reject before proceeding to the next step in the pipeline.
As the pipeline progresses through a stage, you can view its progress by clicking in the stage, which opens the pipeline stage summary.

For the QA stage, the stage summary shows this information:

- **Environment summary**—The first two tasks (numbers 1 and 2 above) show what application processes were deployed and where they were deployed. The summary consists of the application, the application process being deployed, and the environment to which the application is deployed.

- **User-generated summary**—You can create two types of summary data, property information (consisting of text and/or numbers) and links to web sites (number 3 above).

  In this example, the property information is testCoverage at 80%, and the link to the report is Global Report. When you click Global Report, the web site http://www.myreportserver.com opens.

The stage summary also shows information about the tasks:
The first task is QA-Stage-Deploy. It is defined by the ShoppingCart application. The Deploy application process was deployed in the QA environment. The green check mark means that the task was successfully completed.

The second task is QA-Stage-Deploy-with-Snapshot. It is also defined by the ShoppingCart application. The "Deploy" application process was deployed in the QA environment. The green check mark means that this task was also successfully completed.

The third task is QA-Stage-TakeSnapshot. It is defined by a procedure called TakeSnapshot.

When you click on the task name or click the button, the Job Details page opens, showing that the procedure consists of two steps. Both steps were successfully completed.

You can dig deeper by clicking on the Log button in the Log column on the Job Details page.

Viewing the Stage Summary for a Completed Pipeline Run

To view the stage summary of a stage in a completed pipeline run, start by selecting a pipeline in the Pipelines List and clicking the button:

Clicking on the name of pipeline shows the list of current and completed pipeline runs.
To troubleshoot the pipeline, select the pipeline run that completed with errors. Click the name of the pipeline run to view a representation of the pipeline, and then click in a stage to view the stage summary for that stage.

This is an example of a stage summary:

To find out why the pipeline was completed with errors, click the button (number 1 above) in the stage summary.

The summary of the Exit Gate for the QA stage shows that one of the required approvals were rejected, so the pipeline stopped with errors.
Credentials in Pipelines

Credentials are passed to pipelines through applications in pipeline stages. If an application has required inputs (parameters) and any of the inputs is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (Parameter Credential) or a credential binding to a pipeline task (Credential binding), or select a user-defined credential that is attached to the project associated with the pipeline.

A credential must be explicitly attached to the object using it so the server can perform an access control list (ACL) check at the definition time and limit the visibility of the password. To support accessing credentials at the pipeline task level, these tasks need to have the appropriate credentials attached. This is done implicitly by the UI when you are binding credentials to the pipeline tasks. If you are using ectool, use the `attachCredential` API command to perform the same operation.

Pipeline Objects and Conditions

You can set Run if and Wait until conditions in pipelines through the UI or using API commands.

- The Run if condition, also referred to as a run condition, allows a stage, gate, or task to run only if the condition is satisfied. If not, the stage, gate, or task is skipped.

  Examples:

  - A quality gate has these Run if conditions:
    - If 90% or more of the test cases pass, the pipeline continues running.
    - If 70% to 90% of the test cases pass, human intervention is required.
    - If less than 70% of the test cases pass, the error handling condition of the gate (Stop running (the default) or Continue running) determines what happens next.
  - The performance testing task can be skipped if it was executed in a specific environment.
• The **Wait until** condition, also referred to as a **precondition**, means that a stage, gate, or task will not run (is not runnable) unless the condition is satisfied.

Example:

• A stage, gate, or task cannot be run until approval from an external ticketing system or change management system is received.

This topic describes how to set **Run if** and **Wait until** conditions:

• **In the UI**
• **Using API commands**

**In the UI**

You can set **Run if** and **Wait until** conditions for pipeline stages, gates, and tasks. Setting these conditions for a pipeline stage, gate, or task consists of the following:

1. **Modeling a pipeline**
2. **Setting the "Run if" and "Wait until" conditions for the stage**
3. **Setting the "Run if" and "Wait until" conditions for a task**
4. **Setting the "Run if" and "Wait until" conditions for a gate**
5. **Running the pipeline**

**Modeling a Pipeline**

Create a pipeline called deployCheckOut, and define the stages for it. Then define tasks for each stage.

**Setting the "Run If" and "Wait until" Conditions for the Stage**

In the PROD stage, click the **Define stage tasks** button in the lower right corner of the stage.
The task list opens.

To set the Run if and Wait until conditions for the PROD stage, click in the upper right corner of the task list, and select Conditions.

The Conditions dialog box opens.

Enter the Run condition in the Run if field and the Wait condition in the Wait until field.
Click OK to save the conditions.

**Setting the "Run If" and "Wait until" Conditions for a Task**

Return to the task list for the PROD stage.

Click in the row for the first task (PROD-Stage-Deploy), and select **Conditions**.

In the Conditions dialog box, enter the Run condition in the **Run if** field and the Wait condition in the **Wait until** field, and click OK to save your entries.
Setting the "Run If" and "Wait until" Conditions for a Gate

Setting Gate Conditions

Return to the Pipelines Visual Editor.

Click the Edit button ( ) in the entry gate to the PROD stage.

The list of rules for the entry gate opens.

Click in the upper right corner of the rule list, and select Conditions to define the Run if and Wait until gate conditions.
In the Conditions dialog box, enter the Run condition in the **Run if** field and the Wait condition in the **Wait until** field, and then click **OK**.

---

**Setting the "Run If" and "Wait until" Conditions for a Rule in a Gate**

Return to the Pipelines Visual Editor.

---

Click the **Edit** button ( ) in the entry gate to the PROD stage.
The list of rules for the entry gate opens.

Click in the row for the PRE-PRODStage-Approval rule, and select Conditions to define the Run if and Wait until gate conditions.

In the Conditions dialog box, enter the Run if condition in the Run if field and the Wait until condition in the Wait until field, and then click OK.
Running the Pipeline

When the pipeline runs, it waits until the Run if and Wait until conditions are met before the pipeline can progress to the PROD stage. Before the first task in the PROD stage starts, the pipeline again waits until the Run if and Wait until conditions are met before starting the task.

Using API Commands

You can set the Run if and Wait until conditions using the API commands through the command-line interface or through the DSL on pipeline stages, tasks, and gates.

Stages

To create the Run if and Wait until conditions in a stage, use these API commands:

```
$ectool createStage <projectName> <stageName> \[<condition>\]
$ectool createStage <projectName> <stageName> \[<precondition>\]
```

To set a Run if condition where the name of the next stage is "Preflight", enter:

```
$ectool createStage "Default" "Preflight" --condition "$\{javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.Preflight)\}"
```

To set a Wait until condition where the "Automated Tests" stage is completed before running the "Preflight" stage, enter:

```
$ectool createStage "Default" "Preflight" --precondition "$\{javascript (myPipelineRuntime/autoTestCompleted)\}"
```

To modify the Run if and Wait until conditions in a stage, use these API commands:

```
$ectool modifyStage <projectName> <stageName> \[<condition>\]
$ectool modifyStage <projectName> <stageName> \[<precondition>\]
```

To modify a Run if condition where the name of the next stage is "UATdemo", enter:

```
$ectool modifyStage("Default", "Preflight", \{condition => "$\{javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.UATdemo)\}\}));
```
To modify a **Wait until** condition so that the "Automated Tests" stage is completed before running the "UAT demo" stage, enter:

```
$ec->modifyStage("Default", "UAT demo", [precondition => "/myPipelineRuntime/autoTestCompleted"]);
```

When you use DSL to model the pipeline, the DSL script includes this content. The **Run if** and **Wait until** conditions are defined in the stage object. This example shows that the dev stage has a **Run if** condition and a **Wait until** condition. The **Run if** condition is that "/myPipelineRuntime/rundev" is TRUE for the dev stage to start. The **Wait until** condition is that "/myPipelineRuntime/qaready" is TRUE for the pipeline to progress to the next stage.

```
pipeline ('heatclinic_pipeline') {
...
stage ('dev') {
...
  condition = "/myPipelineRuntime/rundev"
  precondition = "/myPipelineRuntime/qaready"
...
  task ('uninstall') {
...
  }
...
}
```

**Tasks**

To create the **Run if** and **Wait until** conditions in a task, use this API commands:

```
ectool createTask <projectName> <taskName> [condition]
ectool createTask <projectName> <taskName> [precondition]
```

To create a task with **Run if** and **Wait until** conditions, enter:

```
ectool createTask "Default" "Deploy WAR file" --condition "[/javascript (myTask.taskName == myTask.deployWar)" --precondition "[/myTask/autoTestComplete]"
```

To modify the **Run if** and **Wait until** conditions in a task, use these API commands:

```
ectool modifyStage <projectName> <taskName> [condition]
ectool modifyStage <projectName> <taskName> [precondition]
```

To modify **Run if** and **Wait until** conditions for a task, enter:

```
ectool modifyStage "Default" "Preflight" --condition "[/javascript (myTask.taskName == myTask.deployWar)" --precondition "[/myTask/autoTestComplete]"
```

When you use DSL to author the pipeline, the DSL script includes this content. The **Run if** and **Wait until** conditions are defined in the task object. This example shows that the uninstall task has a **Run if** condition and a **Wait until** condition defined within the dev stage task.
Pipelines

```plaintext
pipeline('heatclinic_pipeline') {
  ...
  stage('dev') {
    task('uninstall') {
      condition = "${javascript myFlowRuntime.flow.RuntimeStates[taskName=1].param == 1}"
      precondition = "${javascript new Date().getHours() > 15}"
      subprocedure = 'build'
      subproject = 'default'
    }
    ...
  }
}
```

**Gates**

To create **Run if** and **Wait until** conditions in a gate, use these API commands:

- `ectool createGate <projectName> <stageName> [condition]`
- `ectool createGate <projectName> <stageName> [precondition]`

To create a gate with **Run if** and **Wait until** conditions, enter:

- `ectool createGate "Default" "Preflight" --condition "${javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.Preflight)}" --precondition "${/myGate/autoTestCompleted]"

To modify **Run if** and **Wait until** conditions in a gate, use these API commands:

- `ectool modifyGate <projectName> <stageName> [condition]`
- `ectool modifyGate <projectName> <stageName> [precondition]`

To create a gate with **Run if** and **Wait until** conditions, enter:

- `ectool modifyGate "Default" "Preflight" --condition "${javascript (myPipelineRuntime.pipelineName == myPipelineRuntime.Preflight)}" --precondition "${/myGate/autoTestCompleted]"

You can define more than one task in a gate by using the API commands.

When you use DSL to author the pipeline, the DSL script includes this content. The **Run if** and **Wait until** conditions are defined in the stage object. This example shows that the build stage has two gates, an entry gate (PRE) and an exit gate (POST). The tasks for each gate are embedded within each one.
pipeline ('heatclinic_pipeline') {
  ...
  stage('build') {
    ...
    gate ('PRE') {
      condition = '[$/myPipelineRuntime/runqa]
      task ('pre-gate-task1') {
        ...
      }
    }
    gate ('POST') {
      precondition = '[$/myPipelineRuntime/qaready]
      task ('post-gate-task1') {
        ...
      }
    }
    task ('stage-task1') {
      }
    ...
  }
}

**Note:** Before ElectricFlow 6.5, gates are implicitly created when you create a stage. You can define tasks for a stage. If you want to define an approval task for a gate, you have to define a task with a gate type (PRE or POST) and a task type of APPROVAL. DSL scripts created before ElectricFlow 6.5 will still work, but Run if and Wait until conditions cannot be applied to them.

**Example: Authoring a Pipeline with Manual and Utility Tasks**

This example shows how to add tasks to a pipeline while defining a stage. The tasks include a manual task and a utility task. You add a manual task to a pipeline while defining a stage.

1. Choose a stage in the pipeline.
2. Click the **Define stage tasks** button in the lower right corner of the stage.
   
   The task list opens. When the task list has one or more items, it shows the tasks in sequential order for the stage.
3. Add a task to the stage.
4. Enter the name of the new task in the Name field, and enter an optional description in the Description field.
5. Set the position of the task.
   a. Select **Before** or **After**.
   b. Click the down arrow to select the task that the new task will precede or follow.

   **Example:**

   ![Diagram showing the task positions and selection process]

6. If you want to add another task, click **+ Add another** and repeat the previous two steps to add it.
7. If you do not, click **Done**.

   The list shows the tasks in the order that they will be executed.

   **Example:**

   ![Diagram showing the list of tasks in order]

8. Click **Requires Definition** for the task you added.

   The dialog box to define the task opens.
9. Enter the settings to define the task as a manual task, and click OK to save the task definition.

Example:

a. Select **Manual** to define the task as a manual task requiring human action in the **Instruction** field.

The instructions can include property references using the "$[]" notation for file links, which is needed when referencing a task instruction in an email notification template. For example, a manual task could have this instruction:

Please check the Clover report, and make sure there is at least 80% code coverage before you approve.

http://myserver.com/reports/$[myPipelineRuntime/ec_summary/report_name]

b. Click in the **Assignees** field.

c. Enter the name of the users or groups assigned to the task, and select the one or more users or groups.

Example:

You can also use the $[] notation to specify the parameter
d. Click **OK** to save the task definition. The task list now shows the task as a manual approval requiring human intervention. Example:

![Task list showing manual approval]

10. Click ![Add task icon] to add another task to the stage.
11. Enter the name of the new task in the Name field, and enter an optional description of it in the Description field.
12. Set the position of the task.
   Example:
   ![Task list with new task set in position]

13. Click **Done**. The task list now shows the new task.
   Example:
   ![Task list with new task added]

14. Click **Requires Definition** for the task you added.
15. Enter the settings to define the task as a utility task, and click OK to save the task definition. A utility task, also referred to as a utility function, is a higher-order operation than a third-party plugin, that you can use in pipeline modeling.

   a. Select Utility to define the task as a utility task.

   b. Click the down arrow in the "Select procedure" field and select Decommission Environments.

   c. Click in the Parameters field to enter the parameters for the selected utility function.

   Example:

   ![Diagram of utility task](image)

   The dialog box to enter the parameter values opens.
d. Enter the parameter values and **OK**

The task list now shows a manual task as the first task and a utility task as the last task in the stage.

Example:

### Plugin Pipeline Tasks

Plugin tasks allow you to orchestrate third-party tools at the appropriate time in your pipeline. The following third-party tools can be used with ElectricFlow:

- **Application Servers**—Examples are IIS, JBoss, and Tomcat.
- **Builds**—Examples are EMake, Maven, or Visual Studio.
- **Code Analysis**—Examples are Clover CMD, Coverity, or Klocwork.
- **Databases**—Examples are DBI, Oracle, or SQLServer.
- **Defect Tracking**—Examples are Bugzilla, JIRA, or Rally.
- **Notification**—An example is Twitter.
- **Reporting**—An example is Reports.
- **Resource Management**—Examples are Chef, EC2, or OpenStack.
- **Scripting/Shell operations**—Examples are Groovy, Python, or Ruby.
- **Source Code Analysis**—Examples are ECSCM-ClearCase, ECSCM-Git, or ECSCM-Perforce.
- **System**—Examples are Artifact or FileSysRepo.
- **Test**—Examples are HPQualityCenter, Jasmine, or Selenium.
- **Utility**—Examples are FileOps or SendEmail.

### Plugin Tasks

This example shows how to add a task to a pipeline stage and define it using a test plugin.
In the Pipelines Visual Editor for the deployCheckout pipeline, click the **Define stage tasks** button in the lower right corner of the PROD stage.

In the task list for the PROD stage, add a task named "PROD-Stage-Test-Snapshot" after the "PROD-Stage-Takes-Snapshot" task, and click **Done**.

The task list is updated. Click **Requires Definition** to define the task.

In the dialog box to define the task, select **Plugin** as the task type and then click in the **Select Category** field to view the list of available plugin types.
Select **Test**, and then click in the **Select Plugin** field to view the list of available test plugins.
Select **EC-Selenium**, and then select **runSelenium** in the Procedure field. There are four required parameters for this procedure.

![Diagram](image)

Click to go to the dialog box where you enter the plugin parameters, enter the parameters, and click **OK**.  

![Diagram](image)

The task list for the PROD stage now shows three tasks, including the plugin task.
Example: Authoring and Running Pipelines

This example shows how to create a new pipeline, define it, and view the pipeline run results.

In the following steps, you will learn how to

1. Create a pipeline.
2. Edit the stage details.
3. Define the stage.
4. View and edit the pipeline definition.
5. Run the pipeline.
6. Approve the entry to or exiting from a stage
7. View pipeline runs.

This is a Pipelines List:
Clicking the down arrow next to All Projects opens a drop-down menu that shows the list of available pipelines. The default is to show the pipelines for all projects.

If you want to see only the objects for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

If there are no matches, a message appears stating that there are no resource templates in the selected projects.

The pipeline definition that includes a description of the pipeline, the project to which it belongs (Default), and the number of stages in the pipeline.

Clicking i next to the pipeline name shows a description of the pipeline.

Clicking i next to the number of stages shows a list of the stage names in the pipeline.

Clicking starts a pipeline run.

Clicking shows the list of pipeline runs.

Clicking shows the details of the pipeline run.

This is the pipeline two stages: QA and PROD.
Creating a Pipeline

There are two ways to create a pipeline:

- Create a pipeline from scratch.
- Create a pipeline based on an existing pipeline.

To create a pipeline component from scratch, start in the Home page and:

1. Go to the Pipelines List one of these ways:
   - Click on the Main menu button in the upper left corner, and then select Pipelines > All Pipelines.
   - Click Pipelines.

The Pipelines List opens.
2. Click **Add +** to add a pipeline.
   
a. To create a new pipeline:
   
   i. Click **Create new pipeline**.
   
   ii. Enter the pipeline name, select a project where the applications in the pipeline will be deployed, and enter a description of it.

**Example:**

![Pipeline creation example](image-url)

![Pipeline example](image-url)
iii. Click **OK**.

The Pipelines Visual Editor re-appears.

It shows a pipeline with one stage.

**Example:**
b. To create a pipeline based on an existing pipeline:

i. Click **Create from Existing**.

   A list of existing pipelines opens.

   It shows the list of available pipelines. The default is to show the pipelines for all projects. If you want to see only the pipelines for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:Click on the name of one or more projects. Enter the search criteria in the Search field. The projects that match the criteria appear in the list. You can also search for one or more pipelines by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no pipelines in the selected projects.

   **Example:**

   ![Pipeline from Existing](image)

   i. Select a pipeline.
iii. Enter the pipeline name, select a project where the applications in the pipeline will be deployed, and enter a description of it.

**Example:**

![Pipeline Creation Example](image-url)
iv. Click **OK**.

The Pipelines Visual Editor re-appears and shows a pipeline with the same stages, tasks, and gates as the existing pipeline.

**Example:**

The new pipeline that has the same settings as the deployPipeline pipeline:

![Pipeline Diagram](image1)

This is the deployPipeline pipeline:

![Pipeline Diagram](image2)

**Editing the Pipeline Details**

When a pipeline is created from scratch, it initially has one stage with the default stage name (Stage N) and no description of it. To provide meaningful information about it, change the stage name and description.
1. Click the **Edit** button next to the stage name:
   
   **Example:**

   ![Image of Edit button](image1)

2. Enter the stage name and a stage description.

   **Example:**

   ![Image of stage details](image2)

3. Click **OK**.

   The pipeline now shows that the stage name is QA.

   **Example:**

   ![Image of QA stage](image3)
Defining the Stage

This section describes how to define a task in a stage.

Starting in the Pipelines Visual Editor:

1. Choose a stage in the pipeline.
2. Click the Define stage tasks button in the lower right corner of the stage.

Example:

The task list opens. When the task list has one or more items, it shows the tasks in sequential order for the stage.
3. If the stage has no tasks, do the following in a empty row:
   a. Enter the name of the task in the Name field.
   b. (Optional) Enter a description for the task in the Description field.
   c. Select the On Error condition. When the stage task fails, the pipeline either continues running and proceeds to the next task (Continue running) or stops running and aborts (Stop running). This gives you more control in the pipeline. The default is to Stop running.

   **Example:**

   ![Pipeline configuration interface](image)

   Enter **QA-Stage-Deploy** in the Name field.

   ![Pipeline configuration interface](image)

   d. Click + Add another.

   The task you just added is saved, and a new task is automatically added after it.

4. Enter the name of the new task in the Name field.
5. (Optional) Enter a description for the task in the Description field.
6. Set the position of the task.
   a. Select Before or After.
   b. Click the down arrow to select the task that the new task will precede or follow.

7. Select the On Error condition. When the stage task fails, the pipeline either continues running and proceeds to the next task (Continue running) or stops running and aborts (Stop running). The default is to Stop running.

   **Example:**

   ![Pipeline configuration interface](image)

8. If you want to add another task, click + Add another and repeat the previous three steps to add it.
9. If you do not, click **Done**.

**Example:**

The list shows the tasks in the order that they will be executed.

**Example:**

10. Click **Requires Definition** for the first task in the list.

The dialog box to define the task opens.

For more information about the task types, see **Tasks** on page 286.
11. Enter the settings to define the task, and click **OK** to save the task definition.

   Example:
   
   a. Select **App Process** to define the task as an application process.
   
   b. In the **Select Project** field, select the **Default** project.
   
   c. Select the **ShoppingCart** application and **Use Snapshot**
   
   d. When you click in the **Select a Snapshot** field, a Search field opens where you can enter the criteria to search for a snapshot as well as the names of existing snapshots.
   
   e. Select **SC-S1** as the snapshot to use.
   
   f. Select the **Deploy** process and the **QA** environment where application will be deployed.

   **Example:**

   ![Diagram](image-url)

   Go [here](link) for more information about the different ways to define a stage task. **Pipeline Concepts** on page 284
g. The Parameter field is disabled because the **Deploy** process does not have any required parameters.

**Example showing the Parameter field enabled:**

![Parameter field enabled example](image)

If the process has a required parameter for the pipeline run, such as a credential parameter, a message with the number of required parameters (such as **1 Required**) appears in the Parameter field. You can enter the path to the credential, browse to it, select the **Parameter Credential** or **Credential** binding, or select a user-defined credential that is attached to the project associated with the pipeline.

![Credential field example](image)

12. Click **Requires Definition** for the second task in the list, define the task, and click **OK** to save the task definition.

The dialog box to define the task opens.

**Example:**

a. Select **App Process** to define the task as an application process.

b. In the **Select Project** field, select the **Default** project.

c. Select the **ShoppingCart** application.

d. Select the **Deploy** process and the **QA** environment where the **ShoppingCart** application will be deployed.

e. If the **Deploy** process has one or more required parameter for the pipeline run, the Parameter field is enabled. Go [here](#) for more information.
13. Click **Requires Definition** for the third task in the list, define the task, and click **OK** to save the task definition.

Example:

a. Select **Procedure**.

b. When you click in the **Select Project** field, a drop-down list of available projects opens. Select the **Utilities** project.

c. When you click in the **Select Procedure** field, a drop-down list of available procedures opens. Select the **TakeSnapshot** procedure.

**Example:**

![Diagram of pipeline tasks]

If the **TakeSnapshot** procedure has required parameters for the pipeline run, the Parameter field is enabled. Go here for more information.

14. (Optional) Change the order in which the tasks will be executed. Go to **Pipeline Concepts** on page 284 for instructions.

**Viewing and Editing the Pipeline Definition**

To view the pipeline definition:
1. Go to the Pipelines List.
2. Choose a task and click the **Menu** button on the end of the row.

**Example:**

![Image](image1.png)

3. Click **Task Definition**.
   
The task definition appears.
4. Change the settings that you want to modify, and click **OK** to save them.

**Defining Gate Approvals**

This section describes how to create approval rules on the entry and exit gates.

**Gates for Pipelines**

This example shows entry and exit gates in a pipeline in the ElectricFlow UI.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="edit.png" alt="Edit button" /></td>
</tr>
<tr>
<td></td>
<td>Click the <strong>Edit</strong> button ( <img src="edit.png" alt="Edit button" /> ) to add an approval to the gate or edit them..</td>
</tr>
<tr>
<td>2</td>
<td>Number of approvals in the gate.</td>
</tr>
</tbody>
</table>
In this situation, this gate will require attention when the pipeline gets to this entry gate. The hand icon means "needs attention."

To add approvals to a gate that does not have any, click + in that gate:

### Creating One Approval Rule in a Gate

This example shows how to create one approval rule with many approvers, where only one of them needs to take action.

Starting in the Pipelines Visual Editor:

1. Go to the gate where you want to add the approval rule.
2. Click + to add a gate approval rule.

   The page to add or edit approval rules for the gate opens.

   This is an undefined approval rule:

   ![Approval Rule Page](image)

3. In the **Name** field, enter **PRE-PRODStage-Approval**.
4. In the **Approvers** field, add the users named **john** and **bob** and the group called **SCMAAdmins**. Start typing the user or group name to find available users or groups.
5. Keep the **Default Pipeline Notification** as is (do not change it).
6. Click **Done**.

For the gate, there is one approval rule that one of the approvers (bob, john or the SCMAAdmins) must approve for the pipeline to progress.
Creating Multiple Approvals in a Gate

This example shows how to create multiple sequential approval rules where sequential approvals from everyone is needed.

Starting in the Pipelines Visual Editor:

1. Go to the gate where you want to add the approval rules.
2. Click + to add a gate approval rule.
   The page to add or edit approval rules for the gate opens.
   This is an undefined approval rule:

   ![Approval Rule Screen](Image)

3. In the Name field, enter POST-QAStage-Approval 1.
4. In the Approvers field, add the user named john. Start typing the user or group name to find available users or groups.
5. Keep the Default Pipeline Notification as is (do not change it).
6. Click + Add Another.
7. In the Name field, enter POST-QAStage-Approval 2.
8. In the Approvers field, add the user named bob. Start typing the user or group name to find available users or groups.
9. Keep the Default Pipeline Notification as is (do not change it).
10. In the Name field, enter POST-QAStage-Approval 3.
11. In the Approvers field, add the group named DefectTrackingAdmins. Start typing the user or group name to find available users or groups.
12. Keep the Default Pipeline Notification as is (do not change it).
13. In the Name field, enter POST-QAStage-Approval 4.
14. In the Approvers field, add the group named SCMAdmins. Start typing the user or group name to find available users or groups.
15. Keep the Default Pipeline Notification as is (do not change it).
16. Click Done.

For the gate, there are multiple approval rules where each approvers needs to approve for the pipeline to progress. The approvers must approve in this order:

1. john
2. bob
3. DefectTrackingAdmins
4. SCMAdmins
Running Pipelines

This section shows how to run a pipeline. It also has examples showing different pipeline run scenarios.

Starting from the Pipelines Visual Editor:

1. Click the Run pipeline button ( ) to start a pipeline run.
   
   You can optionally select a previous pipeline run to use the parameters from that run. You can modify one or more of these parameters as described in the dialog box where the runtime parameters and settings are set.

2. If the pipeline has required parameters to run the pipeline, enter the parameter values.
3. View the real-time progress of the pipeline run.

**Note:** These are the "Attention Needed" icons:

The following example shows that exit gate of the QA stage and/or the entry gate of the PROD stage has gate approvals that need to be approved before the pipeline can enter the PROD stage.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Click the button to see the gate approvals and the required reviewers.</td>
</tr>
<tr>
<td>2</td>
<td>Click to see who the required reviewers are at the entry gate to the PROD stage.</td>
</tr>
</tbody>
</table>

For the entry gate of the QA stage, the required approvers are the user named john and then the group named DefectTrackingAdmins.
For the exit gate of the QA stage, the required approvers are a user named bob (user) or a group named SCMAadmins and then a user named john.

4. Click in a stage to see the details of the pipeline stage summary.
   For examples of pipeline stage summaries, see Pipeline Stage Summary on page 295.

5. Click View previous Pipeline Runs to see the previous runs of this pipeline.
   For an example, see Example: Viewing Previous Pipe Runs on page 340.

Examples: Viewing the Details of a Pipeline Run

While a pipeline is running, you can click a stage to view its progress and open the pipeline stage summary.

For a task, click the ( ) button to see the Job Details page:
Example: Viewing Previous Pipe Runs

Click **View previous Pipeline Runs** to see the previous runs of this pipeline.

The previous pipeline runs appear.

Click the button for one or more previous pipeline runs.

In this example, the pipeline was not completed successfully. The approval at the exit gate of the PROD stage was rejected because a Sev 1 bug was found in the software release.
Viewing Pipeline Runs

The Pipeline Runs List summarizes the pipeline runs. Each row is an pipeline instance that has an icon and is color-coded to indicate the status. You can use filters and the Search field to find certain pipeline runs. See What's in the Pipeline Runs List on page 341 and Searching the Pipeline Runs List on page 344 for more information.

When you expand a row, you can view the details about the pipeline runs as well as the stage and task summaries for a pipeline instance. See Running Pipelines on page 337 for more details.

Opening the Pipeline Runs List

Click on the Main menu button on the Home page, and then click Pipelines > Pipeline Runs to open the Pipeline Runs page.

By default, the list shows all the running or completed pipeline runs that you have the permission to view.

What's in the Pipeline Runs List

Each row shows the status of the pipeline run, the pipeline ID and name, the user running the pipeline, when the pipeline was run, and how long the pipeline run lasts.

For each pipeline run, you can take the these actions:

- Clicking the Expand button ( ) shows the pipeline run details and results of previous runs.
- Entering part or all of a pipeline name in the Find field (number 8 below) starts the search for pipelines matching the criteria. See Searching the Pipeline Runs List on page 344 for how to search in the Pipeline Runs List.
- Clicking on one of the filters (number 9 below) shows the pipeline runs whose status matches the filter. See Searching the Pipeline Runs List on page 344 for how to search in the Pipeline Runs List.

This is the Pipeline Runs List:

![Pipeline Runs List Image]
<table>
<thead>
<tr>
<th></th>
<th>Breadcrumb identifying the object you are viewing and the total number of pipeline runs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td><strong>Find</strong> field. Enter the search criteria to find specific pipelines.</td>
</tr>
<tr>
<td>Filters presenting the status of the pipeline run.</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Stop" /></td>
<td>Needs attention. Manual approval may be required to complete the current stage and go to the next stage.</td>
</tr>
<tr>
<td><img src="image" alt="Exclamation" /></td>
<td>Completed with errors</td>
</tr>
<tr>
<td><img src="image" alt="Reload" /></td>
<td>Running</td>
</tr>
<tr>
<td><img src="image" alt="Checkmark" /></td>
<td>Completed with success</td>
</tr>
<tr>
<td><img src="image" alt="Dots" /></td>
<td>Completed with warnings. The pipeline run could still be running, or it may have completed running.</td>
</tr>
<tr>
<td><img src="image" alt="X" /></td>
<td>Pipeline aborted. When you click the <strong>Abort</strong> button during a pipeline run, the pipeline will be aborted after the currently running tasks finish and no new tasks will be started.</td>
</tr>
</tbody>
</table>
Clicking the down arrow next to **All Projects** opens a drop-down menu. It shows the pipeline runs for a specific pipeline. The default is to show the pipeline runs for all projects.

If you want to see only the pipeline runs for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more pipeline runs by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no pipeline runs in the selected projects.

Clicking the **Abort** button causes the current task to complete. No new tasks are started, and the current pipeline run stops.

Click the button to show more details about the pipeline run. Clicking it in this rows shows results in displaying more details about the pipeline run.

This pipeline run is in progress. This shows that the pipeline is currently in the QA stage, an approver needs to do something to keep the pipeline running, when the pipeline is running and how long, and the percentage complete. You can abort the pipeline (number 5 above) and also see more details about this pipeline run (number 6 above).

The pipeline run was completed successfully.

The pipeline run was completed with errors.

The pipeline run was aborted.

**Searching the Pipeline Runs List**

To focus on specific pipeline runs, ElectricFlow provides several ways to quickly filter and search for pipeline runs, using a combination of filters and the **Find** field. You can also use these methods with the search operations on other ElectricFlow features.
- Filtering with Filter Icons on page 345
- Searching With the Find Field on page 346
- Filtering by Projects on page 346
- Filtering and Searching With the All Methods on page 347

When no filter icons are selected, the Find field is empty, and All projects is selected, all of the pipeline runs appear in the list, such as:

![Pipeline Runs List](image)

**Filtering with Filter Icons**

When you select a filter, the Pipeline Runs List is updated and shows only the pipeline runs with a status matching the filter. These examples show how to filter pipeline runs using the filter icons:

- Running

![Running Pipeline Runs](image)

- Competed with success

![Competed Pipeline Runs](image)
ElectricFlow

- Completed with errors

- Pipeline aborted. When you click the **Abort** button during a pipeline run, the pipeline will be aborted after the currently running tasks finish and no new tasks will be started.

**Searching With the Find Field**

Start typing the name of the pipeline in the Find field.

For example, if you enter "my" as the search criteria, there are no pipelines that match the search criteria. The Pipeline Runs Lists returns with nothing in the list.

To find a pipeline starting with "deploypip" in the Pipeline Runs List, start to enter "deploypip" and notice that ElectricFlow updates the list and shows the pipelines with names that match the search criteria.

**Filtering by Projects**

Clicking the down arrow next to the **All projects** opens a drop-down list of all the projects you have permission to access.
You can select the pipelines for specific projects one of these ways:

- Select one or more specific projects in the drop-down list, and then click outside the drop-down list.

- Enter search criteria to find a specific project, and then click outside the drop-down list.

The pipeline runs for the pipeline in the Electric Cloud project now appear in the Pipeline Runs List.

**Filtering and Searching With the All Methods**

You can use all three methods to search for specific pipeline runs.
This example shows how to do this:

- Select (Completed with success).
- In the Find field, enter "deployPipeline-EC".
- Select the "Electric Cloud" project.

The pipeline runs that were completed successfully, start with "deployPipeline-EC", and are in the "Electric Cloud" project now appear in the Pipeline Runs List.

![Pipeline Runs List](image)

Troubleshooting Pipelines

This section shows how to troubleshoot your pipeline runs. If your pipeline result is not green, you may have a problem that you want to resolve. This topic describes some of the common steps that you may need to use when determining where there are issues in the pipeline process.

**Example: Error Due to Gate Approvals**

Starting in the Pipelines List:

1. Choose a pipeline to troubleshoot.
   
   In the example in this topic, choose the deployPipeline.
2. To view details about a specific pipeline run, choose a run and click the View Details button in the row.

Clicking the View Details buttons on any task will show you the details of the underlying work that was done to complete the task.

The pipeline run summary appears. There is an error in the exit gate of the PROD stage.

3. To get more information about the exit stage, click in the exit gate.

Clicking in the exit gate will show the approval status of gate.

In this example, the pipeline was not completed successfully. The approval at the exit gate of the PROD stage was rejected because a Sev 1 bug was found in the software release.

**Example: Error in a Pipeline Stage**

Starting in the Pipelines List:
1. Choose a pipeline to troubleshoot.

2. To view details about a specific pipeline run, choose a run and click the View Details button in the row.

Clicking the View Details buttons on any task will show you the details of the underlying work that was done to complete the task.

The pipeline run summary appears. There is an error in the Post-PROD stage.
3. To get more information about the Post-PROD stage, click in the stage.

Clicking in the Post-PROD stage will show the Stage Summary and Task Error details.

The Stage Summary shows the task definition.

In this pipeline, the task is an application process.

The Task Error information appears.

The error occurred in the "Run deploy" task. The problem is that the environment to which the application is mapped does not exist.
4. Click **Drill down** to see more stage details.

Notice that the "Run deploy" task failed and that the "Final build" task never ran because of the "Run deploy" task.

5. Click the **View details** button.

The Job Details page opens and shows that the "Run deploy: tasks was completed with errors. The problem is that the environment in the task definition does not exist.
6. Click **View previous Pipeline Runs** to see the previous runs of this pipeline.

7. Choose a pipeline in the Previous Pipeline Runs list, and click the **Expand** button.

The pipeline run summary for that pipeline appears.

8. Repeat Step 3 to Step 7 to do more troubleshooting.
Examples: Task List in a Stage

These examples show other actions you can perform in a task list.

Change the Order in Which the Tasks Are Executed

This section describes how to quickly move a task to a different position in the sequentially ordered task list and change the order in which the tasks will be executed.

Starting in the task list:

1. Choose the task that you want to move.
2. Click and hold the up/down arrow next to the task name to move the task row to its new position in the list.

The task is now in the first in the list.

Sample Task List for a Stage

This example describes the information in a sequentially ordered task list.

<table>
<thead>
<tr>
<th></th>
<th>Breadcrumb showing the path to the pipeline.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Name of the stage.</td>
</tr>
<tr>
<td></td>
<td>When you click the down arrow, a list of the stages in the pipeline opens. Select a stage to quickly to go to a different stage and view the task list for it.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Click the <strong>Select</strong> button to select <strong>All</strong> or <strong>None</strong> of the items in the list. Click the <strong>Delete</strong> button to delete the selected items.</td>
</tr>
<tr>
<td>4</td>
<td>Number of tasks in the stage. Click the <strong>Add task</strong> button to add a task to the stage.</td>
</tr>
<tr>
<td>5</td>
<td>Click the <strong>Menu</strong> button to open the menu where you get more details about the stage and take actions on the stage.</td>
</tr>
<tr>
<td>6</td>
<td>Task definition consisting of the task defined by an application process. It consists of a task named QA-Stage_Deploy and an application process called Deploy, which is part of the ShoppingCart application that is mapped to the QA environment. Clicking the <strong>Menu</strong> button opens the menu where you get more details about the task and take actions on the task.</td>
</tr>
<tr>
<td>7</td>
<td>Task definition consisting of the task defined by a procedure. It consists of a task named QA-Stage_TakeSnapshot and a procedure called TakeSnapshot in the Utilities project. Clicking the project button shows the project to which the procedure belongs. Clicking the <strong>Menu</strong> button opens the menu where you get more details about the task and take actions on the task.</td>
</tr>
<tr>
<td>8</td>
<td>Determines whether to skip the task at run time. This lets you skip tasks that were executed successfully in the prior run. This check box is checked by default.</td>
</tr>
</tbody>
</table>
Release Management

The Release module captures, executes, visualizes, and controls the life cycle of multiple application enterprise releases. Using the Release capability, outputs from multiple teams can be coordinated to produce a final release to be pushed to production. You can create a Release model consisting of multiple applications deployed on different systems, such as traditional, cloud, mainframes, and remote servers. You can then run the Release pipeline reliably and repeatedly until the software release is complete.

You can use the Release feature to deliver software releases through traditional methods where changes from multiple applications are bulked up and are released together as a unit through a pipeline on a regular cadence (schedule) such as weekly, monthly, quarterly, or other frequency. In such traditional scenarios, the Release capability allows you to manage dependencies between multiple applications. In addition, you can even use the Release feature to cater to Continuous Delivery-style releases where code check-in from a developer can traverse all the way to production through various pipeline stages and approval gates. The Release feature allows ElectricFlow to manage all the releases in one platform, regardless of the release methodologies used by the release team. Anyone can quickly get a status of a release and then access the Release details. This information can also be used to troubleshoot and improve the software release process.

- Visibility and coordination

  The Release Dashboard, also referred to as the Release List, allows the release team to get a bird’s eye view of all the releases that are planned, active, or completed. For a specific release, you can easily see its status, what the milestones are, if the release is blocked for some human intervention, and the Release’s progress.

- Path to Production (or what is where)

  For each stage in the Release pipeline, the Path-to-Production view shows the applications deployed in the release, the deployed versions, and the environments to which they are deployed. The details in this view include the application versions, the snapshots, and the environments that are not in compliance with the bill of materials throughout the Release.

- Control

  ElectricFlow keeps track of the data from the multiple teams involved in the release. The Release feature captures, validates, coordinates, and tracks all the details in one place, where everyone can access the Release definition, bill of materials (which applications to release), the pipeline controlling the release process, and environment to use across stages, approval conditions, release configurations, and so on.

  When the Release is run, ElectricFlow automatically coordinates the pipeline information needed to deploy applications in each stage. If you need to add an application, change an application version, or deploy to a different environment, you need to change only the bill of materials. You do not need to revise the pipeline definition or pipeline tasks.

  You can reuse the pipeline to deliver multiple releases of the same software.

The Release manifest, also referred to as the Release definition, specifies the release process flow for the application or applications to be released, which include:

- The pipeline controlling the process.

- The applications in the pipeline for multiple-tiered deployments.
How to deploy tasks and processes using run-time parameters and other settings, such as smart deploy and artifact staging.

- Where versioned objects will be deployed (multiple-tiered environments).
- The approvers for manual process steps, manual tasks, and pipeline gates.

**Multiple Pipeline Runs in a Release**

You can launch multiple instances of a pipeline associated to a release:

You can navigate through multiple pipeline runs:

You can pass pipeline parameters when starting a release:
You can also select the pipeline stages to run in a release:

### Release Scheduling

You can create schedules for releases. For example, where teams are responsible for each stage and they want to execute only the releases for their stage. With the ability to schedule releases and configure stages to
run, each team can set up their own independent schedules that run on a particular stage. They can set a start date and can also make a release recurring (for example, daily or weekly).

**Release Concepts**

Releases allow you to orchestrate multiple applications across multiple environments and to manage the software release life cycle using one platform. It brings together everything you need to take your software through its journey to production, regardless of your software release processes. You can manage traditional release processes (culminating in one big software release at the end of the software delivery life cycle), CI scenarios (build-test automation), CD scenarios (deployment automation), or a combination of these methods using a single platform. Dependencies can also be managed and controlled with this platform.

**Modeling Releases**

You can model a Release by defining the Release process that consists of

- The bill of materials consisting of the multiple applications that you want to deploy.
- One or more environments where the applications will be deployed or installed during the Release run.
- Pipelines and any inputs to the applications (parameters created for them) specifying how the applications will be deployed. Pipelines are the paths to production, and all the other objects in the Release are linked to the selected pipeline.
- The pipeline approval gates that determine when tasks in the stage can start or when the pipeline can enter or exit a stage.
- Approvers and task assignees perform specific activities as the Release runs. Individual users and teams are notified when an action needs to be taken.

The Release feature leverages the pipeline capability and a special type of pipeline task called **Deployer** to truly deliver an **auto-flexing** mechanism where the same pipeline can be used across multiple releases. For example, you have a standardized process for your major releases, and the only thing that normally changes are the applications and their released versions. In this case, you do not want to specify the exact applications to deploy as part the pipeline tasks, which do not allow for pipeline reusability. This is where a Deployer task in the pipeline and Release capability work together to provide reusability.

The Deployer task, previously mentioned in **Pipelines** on page 283, is a special type of task specified in the task list of a pipeline stage. It gets the actual list of applications (and the number of applications) to deploy from the bill of materials in the Release definition. This list is considered the payload of the Release. At runtime, the list of applications to deploy is passed to the pipeline through the Release object. The pipeline then deploys the applications in sequential order. So you can create one pipeline that works for different software releases.

In a pipeline stage, you can define a task using a out-of-the-box third-party integrations, also referred to as plugins, such as:

- Artifact repositories products such as Git, Perforce, Subversion, Microsoft Team Foundation Server (MS TFS), Accru, ClearCase, Repo, and Vault.
- Issue tracking products that provide application developers with requirements tracking such as HP Application Lifecycle Management (HP ALM), Bugzilla, ClearQuest, Fortress, JIRA, HP Quality Center (HPQc), Rally, IBM Rational Team Concert, TeamForge, and TestTrack.
- IT service management (ITSM) products such as ServiceNow.
• Project management products such as Rally.

For a complete list of supported plugins, go to the Electric Cloud Plugins Directory.

For more information about tasks in pipeline stages, go to Tasks on page 286, Defining the Stage on page 328, and Viewing and Editing the Pipeline Definition on page 333.

ElectricFlow provides multiple project support for objects in application deployments, pipelines, and Releases. These objects as well as the objects belonging to them can be in any project within ElectricFlow.

All objects in ElectricFlow have these capabilities for better management and maintenance of end-to-end software releases:

• Projects are top-level security containers that provide access control at the project level. All objects in a project inherit the access control settings from the project to which they belong.

• Projects are also ways to provide logical groupings of objects. If your deployment is large and has many production environments, you can organize production environments by project, with each project having its own access control settings. This makes it easier to manage and maintain multiple environments during the software delivery process.

Setting Up Releases

This section describes only how to set up releases. To get started defining the Release process, you select a pipeline on which the process is based. This pipeline needs to have a Deployer task in its stages. Then you select the applications that you want to deploy (the bill of materials), the environment where the applications will be deployed, and any inputs to the applications. To see how to do this in the ElectricFlow UI, go to Release Definition on page 367.

To get a bird's eye view of all the releases that are planned, active, or completed, go to Release Dashboard on page 384.

To view the bill of materials, go to Path-to-Production View on page 389.

To view the pipeline's progress during the Release run, go to Pipeline Stage Summary on page 295.

For instructions on how to set up objects in a release:

• Go to Example: Modeling and Deploying Applications on page 133 to set up applications.

• Go to Master Component Examples on page 76 for examples of how to create and add parameters to your applications. The steps apply to applications with master and normal components.

• Go to Pipelines on page 283 to set up pipelines.

ElectricFlow supports resource exclusivity at the platform level. This allows a procedure to lock a resource for a job step and execute the tasks. The job step acquires and retains exclusive use of a resource, ensuring that the resource is always available for the step. Go to Reserving a Resource for Job Step Duration on page 1113 for more information.

**IMPORTANT:** When an application, pipeline, or release is cloned across different projects, you may have to fix the references after the objects are cloned. For example, if a pipeline with an application reference in "default" project is cloned to a different project, the application reference needs to be fixed after the pipeline is cloned.
**IMPORTANT:** When you export a project while a pipeline is in progress, only the full export includes flow runtimes that have been completed. If you want to include in-progress pipeline runs in the path-to-production view and the visual indicators showing their percentage completed in the Release dashboard, set the `excludeJobs` argument to 0 or false in the `export` command. When the XML file is imported, the in-progress pipeline runs in the imported project are displayed in the path-to-production view and the Release dashboard. The jobs might be incomplete once the XML is imported.

**Controlling the Releases**

ElectricFlow provides these ways to ensure that the Release runs are successful:

- **Manual gates:**

  For each stage in the Release pipeline, an entry gate controls when the tasks can start. If the conditions and approvals are met, the process flow can proceed and the tasks can be executed. The process flow can complete the stage and proceed to the next stage when the exit conditions and approvals are met.

  ElectricFlow sends notifications to the appropriate approvers, users, and/or groups.

  Go to Visibility and Status of Release Pipelines on page 361 for an example process flow.

- **Preconditions:**

  You can set **Run if** and **Wait until** conditions on stages, tasks, and gates in pipelines. Go to Pipeline Concepts on page 284 for more information.

  You can set conditions in process branching when authoring application and component processes. These conditions determine the path that the Release takes through the process flow. Go to Process Branching on page 117 for how to set conditions on the transitions between process steps.

  You can set preconditions on procedure steps. Go to Step - create new or edit existing step on page 666 for how to set preconditions in procedure steps.

- **ServiceNow integration:** Use the ServiceNow plug to integrate IT service management (ITSM) with ElectricFlow.

- **Plugins:** You can use third-party plugins to execute the conditions and rules for approvals and quality gates.

- **Postp:** You can use postp to get data from the log files, make it appear on the Job Details page, and use it to take action on the Release run. Go to Postp on page 362 for more details.

**Visibility and Status of Release Pipelines**

**From the Release Dashboard**

The Release dashboard orchestrates all the information about the planned, active, or completed releases and displays the releases that you have permission to view in one place. At any time, you can quickly see the current status of the release, where it is in the process flow, any errors during the runtime, when human intervention is required to take some action or perform a task, approvals, and the start and end dates for the release. Go to Release Dashboard on page 384 for more information, and go to Example: Visibility in a Release Pipeline from the Release Dashboard on page 363 for an example how to drill down from the top Pipeline Run view to the specific job details of the release tasks.
For a Release that is in progress or has been completed, clicking the Release status opens the Pipeline Run view. You can view the Stage Summary for the latest Release or view previous pipeline runs. The Stage Summary shows the pipeline’s progress through each stage and evidence that the tasks were executed. Clicking in a stage task or a gate displays its Stage Summary. Go to Pipeline Stage Summary on page 295 for more information.

- When the Release is in progress, you can view the progress of the pipeline as it runs. Go to Viewing the Stage Summary During a Pipeline Run on page 296 for an example of this.

- You can also view a completed pipeline run. Go to Viewing the Stage Summary for a Completed Pipeline Run on page 298 for an example of how to do this.

- Clicking View previous Pipeline Runs displays the last five pipeline runs. After selecting one of these runs, you can view the Stage Summary to view more details about the pipeline run.

- If the pipeline has errors, you can also view what the error is and where it occurred in the pipeline in the Task Error view.

For example, you can view the progress and evidence of the Deployer task run. Clicking displays the payload of the Release. This is the actual list of applications (and the number of applications) to deploy that is specified in the bill of materials in the Release definition.

From the Release dashboard, you can go to the Path-to-Production view for a running or completed release. This view shows the bill of materials for the release. You can easily see the artifacts and snapshots that are in compliance with the Release manifest. Go to Path-to-Production View on page 389 for more information.

From the Environment Inventory

The environment inventory shows what is deployed in an environment at any time. Go to Environment Inventory on page 272 for more information.

From the Change History

The Change Tracking feature tracks the changes between every state of non-runtime objects, such as environments and resources. ElectricFlow records a Change History of the historical states of environment objects, including environment tiers and resources, and records changes between them. Go to Change Tracking on page 860 for more information.

Postp

Postp, a postprocessor included with ElectricFlow, is used for data collection and for report generation. For visibility in a Release run, you can get live streaming data from the log files using the standard output settings. Using postp commands in pipeline tasks (defined by application processes, procedures, or workflows), you can make this data appear in the Job Details page in ElectricFlow.
This example shows:

- During the Compile step, there were 955 compiles.
- In the "Command tests" step, 2982 tests were run.
- For the "Server tests (junit)" step, 14410 tests were run with 4 errors and 1 warning. Clicking on the links in this step provides details and evidence about how the job ran and what actions to take next.

Clicking on the log button for any of these steps will display the log file details.

For more information about using postp:

- Go to Defining the Stage on page 328 and Viewing and Editing the Pipeline Definition on page 333 to define, view, and edit pipeline tasks in the pipeline definition.
- Go to Postprocessors: Collecting Data for Reports on page 998 and Postp extension on page 1110 to set up data collection, generate reports, and display data from the log files.

**Example: Visibility in a Release Pipeline from the Release Dashboard**

*For an In-Progress Release*

You can view the progress of the pipeline during the Release run starting in the Release Dashboard:

1. In the Release dashboard, clicking on the status of an in-progress or completed Release opens the Pipeline Run view for the Release pipeline.

   Example: Clicking **Release in progress** for the second pipeline shows the progress of a currently running Release.
2. When human intervention is needed at a gate (indicated by the hand icon), clicking **Approval waiting for john** displays the Stage Summary for an entry gate.

The Stage Summary for the enabled entry gate shows the required approvals.

After the approval rules or conditions are approved, the pipeline continues.
3. When a pipeline stage is running, it is enabled. Clicking in it displays the Stage Summary, which shows the tasks in the stage and their progress.

   ![Stage Summary Diagram]

   a. In the Stage Summary, the top section shows information about the tasks deployed in the pipeline stage, which you can show or hide. You can also display user-generated information such as:
      
      - Links to websites for reports and other information about the deployed artifacts
      - Property information about the pipeline stage and the objects in it

   b. The next section shows the tasks in the pipeline stage. If the pipeline is in progress, click or the down arrow in the row to view details for the manual task:
c. After completing the manual task, click **Complete** as the outcome, add a comment, and click **OK** in the Manual dialog box.

   To view details about a completed manual task, click **to view the details. The Manual dialog box opens. When the manual task has required input, click **in the Parameters row to view the manual task details. The Manual dialog box now shows the **action** and **evidence** fields. The **action** field describes what was done to approve the manual task, and the **evidence** field describes what was done to approve it.

4. When human intervention is needed at the exit gate (indicated by the hand icon), an exit gate is enabled.

   Clicking in the exit gate displays the approvals required to complete the pipeline stage.

5. If the entry gate to the next stage has approval conditions before the tasks in it can start, this entry gate is enabled. Clicking in the entry gate displays the approvals required to start the tasks in a pipeline stage.

6. The sequence continues as the pipeline progresses.

7. Click **View previous Pipeline Runs** to view the previous five runs.

   Clicking **displays the pipeline, where you can click in a gate or stage to view more details.**

   Clicking **hides this pipeline.**

   To view details about a manual task, click **to view the details of the manual task. The Manual dialog box opens. When the manual task has required input, click **in the Parameters row to view the manual task details. The Manual dialog box now shows the **action** and **evidence** fields. The **action** field describes the what was done to approve the manual task, and the **evidence** field describes what was done to approve it.

   To view details about the other pipeline tasks, click **to view the Job Details**

**For a Completed Release**

Go to **Running and Completing Releases** on page 393 for an example of running and completing a Release.
Release Definition

The Release process is defined in the Release definition, which consists of the underlying pipeline, the applications to deploy (the payload), where the applications will be deployed (the environments), and any inputs (parameters) to the application (referred to as configurations). The Release definition also includes notes that can be entered by team members, task assignees, and approvers as well as planned start and end dates for Releases.

This section has examples of Release definitions and shows how to define a Release.

Example: Completed Release Definition

This release definition shows:

- The Release called "Q1 2016 Release - OB" is based on the pipeline called "Quarterly Online Banking Release Pipeline."

- The Applications field shows that there are three applications to be deployed in this release. Clicking in the Applications field displays the list of applications to be deployed, which is passed to the Deployer task in the pipeline by the Release.

When artifact staging is enabled for an application, ElectricFlow tries to retrieve artifacts that will be deployed before the application run starts. This ensures that the artifacts are downloaded and available on the target (either the artifact cache (the default) or a directory specified in the component definition). This minimizes the time to retrieve artifacts and reduces downtime during the application deployment. For details about artifact staging, see Artifact Staging on page 113

- The Environments field shows that the applications will be deployed in three environments. Clicking in the Environments field displays the environments where the applications in each stage will be deployed.

- Clicking in the Configurations field displays the inputs to the applications (parameters) to be entered at runtime.

- Two notes have already been added to the Release definition.

Example: Traditional Multiple Application Release

This example shows how to define a multiple application Release.

1. From the Home page, click Releases.
2. In the Release Dashboard, click Add+ to add a Release.
3. In the New dialog box, click **Create new release**.

   **Note:** You can include hyperlinks as part of an object description for any ElectricFlow object.

4. Enter the name of the new Release and select a project to which the Release belongs.

5. Click **OK**.

   The Release Dashboard displays the new Release at the top.

6. In the Release Dashboard, click the new Release name.

   The Release Definition page is displayed:
7. Click **Pipeline**.

A list of pipelines opens.

![Pipeline list](image.png)

It shows the list of available pipelines. The default is to show the pipelines for all projects.

If you want to see only the pipelines for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more pipelines by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no pipelines in the selected projects.
8. Select a pipeline.

The pipeline called "Quarterly Online Banking Release Pipeline" is selected.

After the pipeline is selected, the **Next** button is enabled because the applications in the pipeline have required inputs (parameters), as indicated by . This means that there are two required inputs to deploy the applications through the pipeline. If any input is a credential parameter, you can enter the path to the credential, browse to it, select the Parameter Credential or Credential binding, or select a user-defined credential that is attached to the project associated with the pipeline.

Enter the required inputs, and click **OK**.

If the applications did not have any required inputs, the **OK** button would be enabled instead.

**More about this pipeline:**

This pipeline has a Deployer task, as shown in the task list for the pipeline.

Remember that the Deployer task is specified in the task list of a pipeline stage but gets the actual list of applications to deploy from the Release payload (the bill of materials of the Release definition). At runtime, this list is passed to the pipeline through the Release object, and the pipeline deploys the applications in sequential order.
9. If the applications in the selected pipeline have inputs, a dialog box showing the inputs to the pipeline will be displayed.

If any input is a credential parameter, you can enter the path to the credential, browse to it, select the Parameter Credential or Credential binding, or select a user-defined credential that is attached to the project associated with the pipeline.

If any of required parameters do not have values, enter the appropriate values and click **OK**.

![Parameters Table](image)

The Application field is now enabled in the Release Definition page.

10. **Click Applications**.

    The dialog box where you specify the applications to be deployed through the pipeline opens.
11. Select the applications that you want to deploy in the release, and then click the button to move them to the right side of the dialog box, which is the list of applications to be deployed through the pipeline.

These applications are selected:

Clicking button moves the selected applications to the right side and displays the number of required parameters at run time and the application process to be deployed.
It shows the list of available applications. The default is to show the applications for all projects.

If you want to see only the applications for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more applications by entering the search criteria in the Search field next to the All projects field. If there are no matches, a message appears stating that there are no applications in the selected projects.
12. Click < to set how you want the applications to be deployed during the Release run.

For each application, you can select these settings:

- **Stop on Error**: Select this error handling setting to abort the Release run when the Deployer task fails. The default is **Stop on Error**. If the application fails, the release pipeline aborts.

  When this setting is not selected (continue on error, which is similar to the **Continue running** option in a pipeline stage or gate), the Deployer continues to the next application with a known error if the current application fails. This allows the release to continue running when an application run has errors and fails. For example, in a release with multiple applications, some applications can fail and not be deployed with other that were successfully deployed as delivered in the release.

- **Smart Deploy**: Select this setting if you want the Release to deploy the application only with artifacts that have not been deployed to a resource or with selected versions of the artifact have not been deployed to new resources since a previous run.

- **Stage Artifacts**: Select this setting if you want the Release to retrieve artifacts that will be deployed in an application run before the deployment starts.

In this example, all the settings are selected for the selected applications. The Release will stop if any of the applications fails.

![3 Applications Selected](image)

**Note**: The default is that ElectricFlow uses smart deploy to deploy the applications in the pipeline. If you want to use smart deploy for all the applications, you do not need to change the settings.

![3 Applications Selected](image)
13. If the applications have snapshots, click the down arrow next to ____, and select a specific snapshot for each application, and click **OK**.

Using a snapshot as part of the Release definition is a best practice. Using snapshots, you can lock the exact versions of the artifacts to be deployed, which provides consistency and predictability. But you do not have to select a specific snapshot for an application. If a snapshot is not selected for an application here, the exact artifact versions to use would be based on how that application is modeled. That is, if the application model uses the *latest* artifact version for a component, the latest version would be used every time the Release runs when a snapshot is not selected.

When the Release runs, this list of applications (the payload) is passed to the Deployer task in the pipeline, and the applications are deployed through the pipeline sequentially. You can change the order in which the applications will be deployed by reordering the application input in the payload.

14. Click **Environments** to select where the applications in each stage will be deployed.

The "Environment selection" dialog box opens.

Each cell in the table represents an environment where application in a stage will be deployed.

**About the filters in the "Environment selection" dialog box:**

When you mouse over the filter icons, the tool tip text appears, from left to right:

- View only cells with missing environments.
- View only cells with missing tier maps.
- View only cells marked "N/A".
- View only empty cells.

15. Select one or more cells in the table one of these ways:

- For one cell (one application-stage combination)–You can select one cell by clicking in it. This allows you to select the environment for a specific application-stage combination.
- For multiple cells (all the applications in a stage)–If the environment in a stage is the same for all the applications, you can select all the cells in a column (stage) by clicking in the header cell with the stage name.

**Note:** After one or more cells is selected, the **Fill** button in the upper right corner is enabled.
16. Click the > button in the upper left corner of the dialog box.

The "Fill Environment Names" section opens on the left side of the dialog box.
17. Select an environment using one of these options:

- **Select Environment**—Click the down arrow to select an environment or environment template.

  Clicking **Select Environment** opens the list of available environments in the **Environments** tab. These are static environments that are authored before deploying the application in the stage.

  Clicking on the **Templates** tab opens a list of environment templates. These are dynamic environments with provisioned cloud resources that can be spun up during the application deployment. For more information about dynamic environments, see **Modeling Dynamic Environments** on page 203.

- **Name Pattern**—Click ? for tips on how to specify environment names. The tips describe how to specify environment names using static text or a fill pattern.

  ![Tips for specifying Environment Names](image)

  - **Static Text**: MyCompany-QA
  - **Using fill Pattern**: MyCompany-<Application> or MyCompany-<Stage> MyCompany-<Application>-<Stage>

- **N/A**—Select this to not run the application in the stage. You should set environment mapping to N/A for stages where you do not want an active deployment even though the deployer is attached to a stage.

In this example, the "hc-store dev" environment is selected from the Environments list.

![Fill Environment Names](image)

It shows the list of available environments. The default is to show the environments for all projects.
If you want to see only the environments for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more environments by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environments in the selected projects.

18. Click **OK** to close the "Fill Environment Names" section.
19. Click **OK** to save the settings.
20. Click **Configurations** to enter the inputs (parameters) for the applications in a stage.

If any of the required parameters have not been entered on one of the cells for an application in a stage,

you will see this: 

You can enter the value for it now or at runtime.

21. Click **OK**.

The next step is to run the Release. Go to **Running and Completing Releases** on page 393 to learn more about running and completing the Release.

**Example: Continuous Delivery Style Releases for One Application**

This example shows that when you define a Release, you do not have to enter all the details. However, any configuration issues have to be resolved before the Release run.

After a Release is added, the Release definition opens:

Click in the **Pipeline** field. A dialog box opens where you can select a pipeline:
**Note:** When you click the button (number 1 above), a description of the deployPipeline appears. The icon on the right (number 2 above) means that two required parameters are attached to the pipeline.

It shows the list of available pipelines. The default is to show the pipelines for all projects.

If you want to see only the pipelines for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more pipelines by entering the search criteria in the Search field next to the **All projects** field. If there are no matches, a message appears stating that there are no pipelines in the selected projects.

Select the **deployPipeline** application, and click **Next**.

If the pipeline does not have a Deployer task, a message appears reminding you that you need to define a Deployer task to run the Release. Close the message to continue, and click **Next**.

If the pipeline has a Deployer task, the message does not appear so you need to only click **Next**.

In the example, the pipeline has four required parameters. Some of them have default values that you can keep or change. Others do not, and you have to enter a value for them.
After you enter the values, click OK.

Now click in the Applications field. The dialog box to select one or more applications opens:

It shows the list of available applications. The default is to show the applications for all projects.

If you want to see only the applications for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more applications by entering the search criteria in the Search field next to the All projects field. If there are no matches, a message appears stating that there are no applications in the selected projects.

Select one or more applications, click the button to add them to the pipeline, click OK, and click <:
Now click in the **Environments** field. The dialog box to select an environment where the applications in each stage will be deployed opens:

It shows the list of available environments. The default is to show the environments for all projects.

If you want to see only the environments for a specific project, click the down arrow in the **All projects** field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

You can also search for one or more environments by entering the search criteria in the **Search** field next to the **All projects** field. If there are no matches, a message appears stating that there are no environments in the selected projects.

**About the filters in the "Environment selection" dialog box:**
When you mouse over the filter icons, the tool tip text appears, from left to right:

- View only cells with missing environments.
- View only cells with missing tier maps.
- View only cells marked “N/A”.
- View only empty cells.

For detailed instructions about how to select the environments in which the applications in each stage will be deployed, go here.

In this example, the environments are selected as follows:

- **ShoppingCart application in the QA stage:**

  In the ShoppingCart row, select the cell in the QA column and double-click in it. Notice that the **Fill** button is now enabled.

  A panel opens to the left where you can select the environment where the ShoppingCart application will be deployed.

  Select the environment to which the ShoppingCart application is deployed: **QA**.

  Click **OK** to save your selection.
• jpetstore2 application in the QA stage:

In the jpetstore2 row, select the cell in the QA column and click in it. Notice that the Fill button is now enabled.

A panel opens to the left where you can select the environment where the jpetstore2 application will be deployed.

Select the environment to which the jpetstore2 application is deployed: **jpetstore-qe**.

Click **OK**.

• All the applications in the PROD stage:

Click in the header cell for the PROD stage.

A panel opens to the left where you can select the environment where the applications will be deployed.

Select the environment to which the applications will be deployed: **PROD**.

Click **OK**.

Now click in the **Configurations** field. The dialog box to enter the required parameters for the pipeline to run opens:

If any of the required parameters have not been entered in a cell (an application to be deployed in a stage) with a cross in it, you can click in the cell to enter the inputs (parameters) for the application in a specific stage. You can enter the value for it now or at runtime. Then click **OK** to save your entries.

The Release definition now looks like this:
The next step is to run the Release. Go to Running and Completing Releases on page 393 to learn more about running and completing the Release.

**Release Dashboard**

The Release Dashboard, also referred to as the Release List, provides a way for the release team, task assignees, and approvers to quickly see the status of all the planned, active, or completed releases at any time. They can quickly see the current status, specific tasks and who is assigned to them, and the start and end dates for the stages in one place on one platform.

**Accessing the Release Dashboard**

To open the Release Dashboard from the Home page, do one of the following actions:

- Click Releases.

  - Click the Main Menu button ( ) and select Releases.

**Release Dashboard**

The Release Dashboard shows all the Releases that you have permission to view:

By default, the releases for all projects are displayed.
If you want to see only the objects for a specific project, click the down arrow in the All projects field to select one or more projects one of these ways:

- Click on the name of one or more projects.
- Enter the search criteria in the Search field. The projects that match the criteria appear in the list.

If there are no matches, a message appears stating that there are no resource templates in the selected projects.

The Release Dashboard has this information:

<table>
<thead>
<tr>
<th>Each row in the Release Dashboard contains this information:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release name</td>
</tr>
<tr>
<td>Q1 2018 Trading System</td>
</tr>
<tr>
<td>Release status</td>
</tr>
<tr>
<td>Release in planning</td>
</tr>
<tr>
<td>Release in progress</td>
</tr>
<tr>
<td>Release completed</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>Release in planning</td>
</tr>
</tbody>
</table>
### Start and target (end) dates for the Release

Example:

| Start: 10/30/15 | Target: 01/18/16 |

The default time frame between the start and target (end) dates is two weeks.

The color of the dates indicates the Release status:

- **Green**: The Release has not started yet, and the start and end dates are within the planned time frame.
- **Medium blue**: The Release is in progress, and the dates are the actual start and end dates.
- **Dark blue**: The Release is completed, and the dates are the actual start and end dates.
- **Red**: The date is past the planned end date.

### Project to which the pipeline belongs, name of the pipeline underlying the software release, and the number of stages in this pipeline

Example:

<table>
<thead>
<tr>
<th>Utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly Online Banking Release Pipeline</td>
</tr>
<tr>
<td>3 Stages</td>
</tr>
</tbody>
</table>

### Number of applications in the pipeline and any notifications for actions to be taken before the pipeline progresses

Example:

| 2 Applications |
| Approval waiting for quincy |

This pipeline requires human intervention to progress. The user named quincy needs to approve something at an entry or exit gate of a stage before the pipeline progresses.
Visual indicator showing how far the Release has progressed with the percentage completed, the current stage, and how long the Release has been running.

The visual indicator is split into sections equal to the number of stages in the pipeline. If pipeline has three stages, it is split into three segments.

This example shows that the Release is running without errors, is at the INT stage, and has been running for over 11 days. The duration is the total time that the Release has been running before the Release is ended.

If the Release is still in the planning phase, the percentage completed is 0%, and the segments are all gray.

If the pipeline is running with errors, the part of the segment representing the current completed stage is red.

If the pipeline run is completed, the visual indicator is blue and the percentage completed is 100%.

<table>
<thead>
<tr>
<th>Buttons and Icons in the Release Dashboard</th>
</tr>
</thead>
</table>

![Visual Indicator Example](image)
<table>
<thead>
<tr>
<th>Table Entry</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entering part or all of a pipeline name in the <strong>Find</strong> field on the top of the dashboard starts the search for Releases matching the search criteria.</td>
<td><img src="image" alt="Find..." /></td>
</tr>
<tr>
<td>Selecting <strong>All</strong> or <strong>None</strong> and then clicking the <strong>Delete</strong> button removes the selected pipelines from the list.</td>
<td>![Select][All]<a href="image">Delete</a></td>
</tr>
<tr>
<td>Clicking the <strong>Add+</strong> button adds a Release.</td>
<td><img src="image" alt="Add+" /></td>
</tr>
<tr>
<td>Clicking this button opens to Path-to-Production view, which displays the applications being deployed in the Release and the environments where they are deployed. The details in this view include the application versions and the environments that are not in compliance with the bill of materials throughout the Release. Go to <strong>Path-to-Production View</strong> on page 389 for more information.</td>
<td><img src="image" alt="Path-to-Production View" /></td>
</tr>
</tbody>
</table>
Clicking this button opens the Release Definition dialog box. Go to Release Definition on page 367.

Clicking this button starts a Release run.
You can optionally select a previous release run to use the parameters from that run. You can modify one or more of these parameters as described in the dialog box where the runtime parameters and settings are set.

Clicking this button allows you to end, re-run, or abort the Release pipeline.

**Note:** To go to the Pipeline Run page, click the button in the upper left corner of the Release Dashboard, and select Pipelines > Pipeline Runs. For more information about the Pipelines Runs page, go to here.

For more information about running and ending (completing) the Release, go to Running and Completing Releases on page 393.

Select one of these actions:

- **End Release**—Clicking this ends the Release. You cannot end the pipeline that is currently running. If you want to end it, you must wait for this run to complete or abort it in the Pipeline Run page. When the pipeline is aborted, tasks that are currently running will finish, and no new tasks will be started.
- **Run Pipeline**—Clicking this starts a new pipeline run.
- **Abort All Runs**—Clicking this aborts all pipeline runs.
- **Schedules**—Clicking this lets you create a release schedule.

**Path-to-Production View**

The Path-to-Production view shows the applications deployed in the Release, which versions are deployed, and the environments to which they are deployed. The details in this view include the application versions, snapshots, and the environments that are not in compliance with the bill of materials throughout the Release.

To go to the Path-to-Production view:
1. Go to the Release Dashboard.
2. Find a Release that is in progress or completed.
   
   ![Screen Shot](image)
   
   The button should be enabled.  
   
   **Example:**
   
   Select one of these Releases:

   ![Release Example](image)

3. Click the button to open to Path-to-Production view.
   
   This is a Path-to-Production view showing the bill of materials.

   ![Path-to-Production View](image)

   This information is in the bill of materials:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Release name and pipeline name</td>
<td>Example:</td>
</tr>
</tbody>
</table>

   ![Example](image)
<table>
<thead>
<tr>
<th></th>
<th>Stage</th>
<th>Each column shows the details for each stage in all the applications. Stage names are defined from the associated Pipeline. The stages in this example are UAT, STG, and PROD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Summary</td>
<td>The bill of materials has three applications. In this example, the STG and PROD stages each have a compliance issue indicated by [ ] .</td>
</tr>
</tbody>
</table>
| 4 | Application | Each row shows the details for each application across all the environments. The application names are defined from the associated pipeline. The applications in this example are:  
  - OB - Account Statements  
  - OB - Credit Card Statements  
  - OB - Fund Transfer |
| 5 | UAT stage | In this example, the UAT stage has no compliance issues. The versions of the applications deployed in the Release match what is in the bill of materials. |
| 6 | STG and PROD stages | In this example, the STG and PROD stages have compliance issues. The "OB - Credit Card Accounts" application version 2.0 is supposed to be deployed in the STG and PROD stages. However, version 1 of the application is deployed instead. |

To get more details about compliance issues:
• Mousing over shows a message explaining the noncompliance. Use this information to troubleshoot and resolve the noncompliance.

• Clicking shows the environment to which the application is deployed, the deployment date, and information about the deployed components and artifacts.

You can take these actions in the bill of materials:

• Clicking the button shows less detail.

• Clicking the button shows all the details.

• Clicking the button starts opens to Search field, where you can enter the part of an application name to find specific applications, which is especially helpful when you have a long list.

Release Summary

The Release summary feature allows Release-specific information from pipeline stage tasks to be displayed in the Release Dashboard. You can add Release summary information by creating properties under the ec_releaseSummary property sheet that exists on the run time associated with the Release.

These examples show how to do this from ectool:

ectool setProperty /myReleaseRuntime/ec_releaseSummary/summary1 --value "<property value in plain text>"

or


For a pipeline that is run from a release, after the task in a pipeline stage is completed, you can view the summary property in the Release Dashboard:
Running and Completing Releases

After a Release is defined, you can run it multiple times on the journey to production. At the end of the software release life cycle, when the Release process has been successfully completed and the software is ready for production, you can end the Release. Once the Release has ended, it cannot be run again.

Running the Release

This example shows how to run a Release called Q1_TimeBaseRelease.

You can start the Release run when the Release status is "Release in planning" and the Run button ( ) is enabled.

The Release status changes to "Release in progress" and the Run button ( ) has been replaced by the button. Clicking on it shows a pop-up window with more actions. The Start and Target dates are in blue because the Release is in progress.

When is displayed, human intervention is required for the pipeline to progress to the first stage.

Clicking on causes the Pipeline Run view for the deployPipeline to be displayed.
The pipeline can progress after the user named john approves the entry to the QA stage of the pipeline.

As the pipeline progresses, you can click in the QA stage to view the pipeline stage summary:

The pipeline continues to progress to the PROD stage after the required approvers respond at the exit gate. Progress continues until this Release run is completed.

After the Release is completed, you can start a new Release run by clicking the button and selecting Re-run Pipeline. You can re-run the Release as many as times as you want during the software release life cycle.

**Aborting a Release Run**

There are two ways to abort a Release run.

- During the first Release run, you can abort it from the Release Dashboard.
Clicking the *...* button and selecting **Abort Pipeline** will abort the pipeline. The tasks that are currently running will finish, and no new tasks will be started. This message appears:

![Abort Pipeline Confirmation Message]

This is the Release status after the Release run is aborted.

![Release Status After Aborted]
• During subsequent Release runs, you can abort the current Release run from the Pipeline Run view.

Clicking the Abort ( ) button will abort the pipeline. The tasks that are currently running will finish, and no new tasks will be started. This message appears:

After you click OK, the Pipeline Run view now displays this status:

Completing the Release

When you complete the Release, no other actions can take place on it, and this action cannot be undone (reversed). The Release cannot be run again.

You cannot end the pipeline that is currently running. If you want to end it, you must wait for this run to complete or abort it in the Pipeline Run view. For more information, go to Aborting a Release Run on page 394.

If the Release run is complete, you can complete the Release from the Release Dashboard.
Clicking the button and selecting **End Release** ends the Release. This message appears:

![End this Release?](image)

After you click **OK**, the Pipeline Run view now displays this status:

![Release completed](image)

The Release status is now:

- The icon next to "Release completed" indicates that the Release has been completed (ended).
- The "percentage complete" icon on the right is split into two sections because the pipeline has two stages. It shows that the Release run is 100% complete.
- The Target date has been replaced by the Ended date.
- The Start and Ended dates are in dark blue because the Release is completed.
- The Duration is the total time for the Release.
Using the ElectricFlow DSL

The ElectricFlow domain-specific language (DSL) is an intuitive, easy-to-use computer language that allows you to model continuous delivery (CD) and Application Release Automation (ARA) solutions. It has these capabilities:

- Easy to understand
- Self documenting
- Process-as-code: You can define your processes as high-level code that can be versioned, tested, and reused.
- User defined versions for any object
- Modeling of applications, pipelines, and releases using simple, logical constructs
- Based on the Groovy language
- Supports various means of code reuse
- Access to all the ElectricFlow API commands

This is a snippet of a DSL script:

```
pipeline "Product ABC Pipeline", {
    description = "pipeline from dev to prod"
    stage "dev", {
        description = "dev stage"
        task "run build", {
            ...
        }
    }
    stage "test", {
        description = "test stage"
        task "manual regression", {
            ...
        }
        task "QE automation", {
            ...
        }
    }
}
```

Why Use DSL?

ElectricFlow DSL is the easiest of the ElectricFlow programming constructs to use.

For example, this is a comparison of DSL (the easiest to use) and ec-perl (the most difficult to use):

<table>
<thead>
<tr>
<th></th>
<th>ec-perl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declarative (what)</td>
<td>Script-based, imperative (how)</td>
</tr>
<tr>
<td>Concise</td>
<td>Relatively verbose</td>
</tr>
</tbody>
</table>
Using the ElectricFlow DSL

<table>
<thead>
<tr>
<th>DSL</th>
<th>ec-perl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not need to understand Groovy to read DSL</td>
<td>Need to understand Perl</td>
</tr>
<tr>
<td>The entire DSL script is sent only once to the server for evaluation</td>
<td>Client-server chattiness: Each API invocation is separate call to the server</td>
</tr>
</tbody>
</table>

This is the DSL version of the helloProcedure in JSON:

```json
project "Hello Project", {
  procedure "Hello Procedure", {
    step "Hello World",
    command: "echo 'Hello World from EF DSL!'"
  }
}
```

ectool --format json evalDsl -dsFile helloProcedure.groovy

This is the ec-perl version of the helloProcedure:

```perl
use strict;
use ElectricCommander;
$| = 1;
my Sec = new ElectricCommander({format=>'json'});
Sec->createProject("Hello Project");
Sec->createProcedure("Hello Project",
  "Hello Procedure");
Sec->createStep("Hello Project",
  "Hello Procedure",
  "echo 'Hello World from ec-perl'";

ec-perl helloProcedure.pl
```
You create models or scripts to represent the ElectricFlow objects using the DSL methods and let the ElectricFlow DSL engine take care of invoking the correct API to create or update the object if it already exists. The DSL is based on Groovy scripting language; however, you do not need to know Groovy in detail to use it.

The benefits of using DSL scripts are:

- You can create one master model or script and run it one or more times for different scenarios to build, test, and deploy your software or application by passing different parameter values for evaluating the script.
- You can automate software delivery processes to produce repeatable, scalable, and efficient results.
- You can quickly and easily create and deploy applications using DSL scripts. Using these scripts enables a higher-order command-line interface (CLI) with richer syntax than the CLI on your system.
- Users with little to no programming experience levels can create and run DSL to perform specific operations. They do not need to know how to use the ElectricFlow API or UI to create and deploy an application.
- Using DSL scripts make Continuous Delivery and Continuous Integration possible at scale.

**Using DSL for Object Versioning**

In addition to all of the previous benefits, DSL also provides the crucial functionality of object versioning. You can easily generate a DSL file for any ElectricFlow object either by using the API or UI for the Deploy and Release objects. See Generating DSL Scripts on page 409 for more information on how to generate DSL scripts.

These DSL files can then be used for further editing or stored in a version management system of your choice. DSL is a great way for creating and using user-defined versions of any ElectricFlow object.

**Running DSL**

You can run DSL one of these ways:

- From the command-line interface
- Using REST
- From a step command
- Using the DSL IDE. Go to DSL IDE on page 409 for the details.

**From the Command-Line Interface**

Use the `evalDsl` command to evaluate and run a DSL script. See the `evalDsl` command in the "API Commands - Miscellaneous Management" section of the ElectricFlow API Guide for a list of the supported arguments.

These `ectool` examples show how to evaluate a DSL script.

- When specifying the DSL text, enter `ectool evalDsl <dsl>`.
  For example:

  ```
  ectool evalDsl "project 'My WAR file' "
  ```
- When specifying the path to the DSL script on the client, enter `evalDsl --dslFile <dslFile>`. For example:

  ```text
  ectool evalDsl --dslFile c:/dslScripts/myWarFile.dsl
  ```

**Using REST**

Go to http://<ElectricFlow_server>:8000/rest/v1.0/server/dsl, where `<ElectricFlow_server>` is the hostname (the fully qualified domain name [FQDN]) or IP address of the ElectricFlow server.

1. Select the dsl method.

2. For the Request, select or enter the following information for the Request and then click Try it out!

   - For **Response Content Type**, select application/json.
   - For **Project**, enter Default.
   - For **Application**, enter TestApp.
   - For **artifactLocation**, enter my artifact location.

   The response appears in the **Response Body** field and includes the project ID, project name, and workspace name.

   ```json
   
   ```

**From a Step Command**

You can enter the DSL script as a step command in a procedure.
You can use `ectool` to evaluate and run this DSL script by entering `ectool evalDsl --dslFile {0}`.

**Modeling with DSL**

The DSL provides an alternative to the UI for authoring and managing ElectricFlow objects. It allows you to perform all the same operations as the RESTful APIs or Perl APIs but much easier and simpler.

- Create and call procedures
- Model and deploy applications
- Create and manage resources
- Create environment models and add resources to them
- Model and run pipelines
- Model and run releases
- Create and manage artifacts
- Create and manage object properties

For the list of supported DSL methods, go to the “DSL Methods” section in the ElectricFlow API Guide.

For more information about the ElectricFlow DSL, go to:

- ElectricFlow DSL: Process-As-Code for All Your Automation Needs
- Process as Code: An Introduction to the ElectricFlow Automation DSL

**Getting Started with DSL**

Creating and Running DSL Scripts on page 403

Common Use Cases on page 403

Generating a DSL Script for an Existing ElectricFlow Object on page 404

Passing Parameters or Arguments to Your DSL Script on page 405
Creating and Running DSL Scripts

Using ectool
To create and run a DSL script using ectool:

1. Use any text editor or Groovy IDE to create a script using ElectricFlow DSL methods, and save it.
2. Log into ectool.
3. You can use these arguments with evalDsl. Enter evalDsl to run the DSL script.
   - debug—ElectricFlow generates debug output as the DSL script is evaluated when the debug argument is set to 1 or true.
   - describe—ElectricFlow prints a description of the DSL text when the describe argument is set to 1 or true.
   - parameters—Parameters are passed to the script by ElectricFlow as JSON text.

Using ec-perl
To create and run a DSL script using ec-perl:

1. Use any text editor or Groovy IDE to create a script using ElectricFlow DSL methods, and save it.
2. Start ec-perl.
   - If you used ec-perl in for the previous step, skip this step.
3. Enter evalDsl to run the DSL script.
   - You can use these arguments to get more information about results as the script runs.
     - debug—ElectricFlow generates debug output as the DSL script is evaluated when the debug argument is set to 1 or true.
     - describe—ElectricFlow prints a description of the DSL text when the describe argument is set to 1 or true.
     - parameters—Parameters passed to the script by ElectricFlow as JSON text.

Common Use Cases

Getting Help on DSL Methods
You can get information on the supported DSL methods by using evalDsl for help while creating your DSL script.

These options are available to describe DSL methods:
• Obtaining the complete list of DSL methods for ElectricFlow objects.
  
  ectool evalDsl dsl --describe 1

• Obtaining DSL method details for a specific ElectricFlow object, such as an application.
  
  ectool evalDsl application --describe 1

• Obtaining details for a specific API, such as getProcedure.
  
  ectool evalDsl getProcedure --describe 1

Generating a DSL Script for an Existing ElectricFlow Object

To generate a DSL script for an existing ElectricFlow object, which was created through a Perl API, RESTful API, or the UI, enter

  ectool generateDsl <path>

where <path> is the path to the ElectricFlow object for which you want to generate the DSL script.

For example, if you have a resource named local in your ElectricFlow instance:

1. Run the following command to redirect the output to a file (for example, myScript.dsl):

  ectool generateDsl /resources/local> myScript.dsl

  This command generates output redirected to the specified file, which looks similar to the following:

    resource 'local', {
        description = 'Local resource created during installation.'
        artifactCacheDirectory = null
        hostName = '192.168.10.10'
        hostType = 'CONCURRENT'
        port = '7800'
        proxyCustomization = null
        proxyHostName = null
        proxyProtocol = null
        repositoryNames = null
        resourceDisabled = '0'
        shell = null
        trusted = '0'
        useSSL = '1'
        workspaceName = null
        zoneName = 'default'
    }
2. Use the script file created in the previous steps with the evalDsl command to create or update the resource in ElectricFlow.

You can also edit the file to add or update resource attributes before using the script with evalDsl.

```
ectool evalDsl --dslFile myScript.dsl
```

### Passing Parameters or Arguments to Your DSL Script

ElectricFlow DSL allows you can create a template script using script parameters instead of hard-coding all the values in the script. You can then invoke the same script with different parameter values each time to create different instances of ElectricFlow objects. For example, you have the following script to create a resource that uses SSL in the secure zone:

```plaintext
zone 'secure'
resource() {
    resourceName = args.resourceName
    hostName = args.resourceIP
    hostType = 'CONCURRENT'
    resourceDisabled = '0'
    trusted = '1'
    useSSL = '1'
    zoneName = 'secure'
}
```

The script has the values `args.resourceName` and `args.resourceIP` for the `resourceName` and `hostName` resource attributes, respectively. These argument or parameter values can be passed from the command line to the DSL script in JSON form using the following command:

For Linux:

```
ectool evalDsl --dslFile myScript.dsl --parameters '{"resourceName":"MyFirstResource", "resourceIP":"192.168.10.12"}'
```

For Windows:

```
ectool evalDsl --dslFile myScript.dsl --parameters "{"resourceName":"MyFirstResource", "resourceIP":"192.168.10.12"}"
```

Note the special handling required on Windows for passing command-line arguments that contain double-quotes and spaces. To allow spaces and other special characters in a command-line argument, Windows requires wrapping the value in quotes. In addition, if the value itself contains quotes, you need to escape those quotes using a backslash '\'. An alternate method for passing parameter values for DSL is described in Passing Parameters or Arguments to Your DSL Script using a File on page 405.

### Passing Parameters or Arguments to Your DSL Script using a File

Parameters to a DSL script can be passed using a file that contains the parameters in JSON format as follows:

```
ectool evalDsl --dslFile myScript.dsl --parametersFile myParams.json
```

Where the file `myParams.json` may contain:
Go to Passing Parameters or Arguments to Your DSL Script on page 405 for details about using parameters in a DSL script.

Evaluating Your DSL Script in a Specific Application Context

ElectricFlow DSL supports a simple and intuitive nested structure to represent the logical structure of ElectricFlow objects. This allows the DSL methods to be evaluated in a specific context, such as with respect to an ElectricFlow project, application, or pipeline.

For example, the following is a very simple script that can create an application with an application tier in a project.

```
// ElectricFlow DSL engine will create project ‘Default’ unless it already exists
project ('Default') {
    // 'Deploy world' application will be created within 'Default' project unless it already exists
    application ('Deploy world') {
        // 'Web Tier' application tier will be created within 'Deploy world' application unless it already exists
        applicationTier ('Web Tier')
    }
}
```

Using ElectricFlow APIs in DSL

All ElectricFlow APIs available through ec-perl are available for use in your DSL script with the exception of publishArtifactVersion and retrieveArtifactVersions.

The syntax for invoking an ElectricFlow API in DSL is as follows:

```
<methodName> (argumentName1: value1, argumentName2: value2, ...)
```

For example, the getProcedure API can be invoked as:

```
def proc = getProcedure (procedureName: 'RunInstances', projectName: 'DeployUtilities')
```

Adding Support for Augmenting the Groovy Runtime classpath for ectool evalDsl

Using External .jar Files With DSL

ElectricFlow DSL is based on Groovy so that you can take advantage of all the Groovy and Java capabilities. You can use any Groovy or Java libraries in your DSL script. The libraries can be made available to the ElectricFlow DSL runtime engine when the DSL script is executed using the serverLibraryPath parameter.
This example from *HttpBuilder - Easy HTTP client for Groovy’s wiki* shows how to use the HTTPBuilder classes in a DSL script.

1. Create a file named `httputil.groovy` with the following content. The script uses the `groovyx.net.http.HTTPBuilder` class to make an HTTP GET request.

   ```groovy
   import groovyx.net.http.HTTPBuilder
   import static groovyx.net.http.Method.GET
   import static groovyx.net.http.ContentType.JSON

   def result = [:]
   def http = new HTTPBuilder( 'http://ajax.googleapis.com' )
   http.request( GET, JSON ) {
     uri.path = '/ajax/services/search/web'
     uri.query = [ v:'1.0', q: 'Calvin and Hobbes' ]

     response.success = { resp, json ->
       assert json.size() == 3
       json.responseData.results.each {
         result.put(it.titleNoFormatting, it.visibleUrl)
       }
     }
   }
   result
   ```

2. Create a directory, `/opt/dslSamples/lib`, that should be accessible from the ElectricFlow server with the following `.jar` files:

   ```
   http-builder-0.6
   json-lib-2.3-jdk15.jar
   xml-resolver-1.2.jar
   ```

3. Evaluate script using the following command:

   ```
   ectool evalDsl --dslFile httputil.groovy --serverLibraryPath /opt/dslSamples/lib
   ```

   When the DSL is evaluated on the ElectricFlow server, any `.jar` files contained in the directory specified for `serverLibraryPath` will be available to the ElectricFlow DSL runtime engine.

   Any Groovy files and Java class files contained in the directory specified for `serverLibraryPath` will also be available to the script evaluated by `evalDsl`. For example, if the directory contains a Groovy class
my.sample.dsl.DslUtil in the directory structure my/sample/dsl/DslUtil.groovy, the script can use the Groovy class by importing the class in the script like any other class.

**Debugging Your DSL Script**

You can use debug logging as well as the `println` method for debugging DSL scripts.

**Using Debug Logging**

You can use the `debug` argument to return debug messages in the `evalDsl` response for your script while it is evaluated by the ElectricFlow DSL engine. These messages are useful for debugging DSL scripts.

For example:

```groovy
ectool evalDsl --dslFile myScript.dsl --debug 1
```

or

```groovy
ectool evalDsl "project 'My WAR file'" --debug 1
```

**Using the println Method**

You can use the standard Groovy `println` method in your DSL script to print messages to the client console while it is evaluated by the ElectricFlow DSL engine. The line numbers for lines that produced `println` output are included.

For example, entering `ectool evalDsl --dslFile myfile.dsl`, where `myfile.dsl` contains:

```groovy
def result
    for (int i =0; i< 10; i++) {
        println 'Creating project: ' + 'ABTest-' + i
        result = project 'ABTest-' + i, resourceName: 'res1'
    }
result
```

returns the following output:

```xml
<response requestId="1" nodeId="10.0.1.15">
    <value>
        Result: project[name=ABTest-9,id=7777e4ff-7941-11e6-94c1-34e6d71279c8]
        Console output:
        Line 0003: [OUT] Creating project: ABTest-0
        Line 0003: [OUT] Creating project: ABTest-1
        Line 0003: [OUT] Creating project: ABTest-2
        Line 0003: [OUT] Creating project: ABTest-3
        Line 0003: [OUT] Creating project: ABTest-4
        Line 0003: [OUT] Creating project: ABTest-5
        Line 0003: [OUT] Creating project: ABTest-6
        Line 0003: [OUT] Creating project: ABTest-7
        Line 0003: [OUT] Creating project: ABTest-8
        Line 0003: [OUT] Creating project: ABTest-9
    </value>
</response>
```

If you also use the `debug` argument, the `println` output is interleaved with the debug logging to the console. The line numbers for lines that produced `println` output and debug logging are included. The `println` output is similarly interleaved with debug logging for exceptions where the debug logs are returned in the `evalDsl` response.
For example, entering `ectool evalDsl --dslFile myfile_that_throws_exception.dsl --debug 1`, where `myfile_that_throws_exception.dsl` contains:

```java
project 'printingInInvalidDsl'
println("Causing NPE now..")
def a
  a.name //will cause NPE
println("Should not print")
```

returns the following output:

```text
ectool error [InvalidScript]: Unknown exception during DSL eval at line 4: Cannot get property 'name' on null object
Line 0001: DSL method 'project'
Line 0001: Checking if project exists with args {projectName=printingInInvalidDsl}
Line 0001: project exists: false
Line 0001: Invoking 'createProject' with args {projectName=printingInInvalidDsl}
Line 0001: Done invoking 'createProject'
Line 0002: [OUT] Causing NPE now..
Details:
Cannot get property 'name' on null object
```

### Generating DSL Scripts

There are two ways to generate DSL scripts:

- Through `ectool`
- Through the ElectricFlow UI

#### Through `ectool`

Use the `ectool generateDsl <path> [optionals]` API command to generate an XML file representing the contents of an ElectricFlow object, such as a project, procedure, application, environment, master component, environment or resource template, pipeline, or release. Go to the `generateDsl` command in the ElectricFlow API Guide for the full syntax and for `ectool` examples.

#### Through the ElectricFlow UI

To quickly and easily generate and export a DSL script from the ElectricFlow UI, click the button in the following UIs and select the **DSL export** option:

- Visual editors for Applications, Environments, Master Components, Environment and Resource Templates, and Pipelines
- Release Definition

For an example showing how to export DSL scripts from the UI, go to **DSL IDE** on page 409.

### DSL IDE

The modeling process is simplified by using the DSL IDE because it allows you to run DSL code from the platform UI rather than having to go to an external IDE or command-line interface to run the `evalDsl` API call.
The DSL IDE is an ElectricFlow plugin that can be invoked from the ElectricFlow platform UI.

The following example shows how you can generate and export a DSL script for an existing object in the UI (an application), modify it, and run it through the DSL IDE to apply your changes. For instructions to use the DSL IDE, go to the EC-DSDLIDE plugin Help file.

1. Navigate to an object in the UI.

   **Example:**

   Go to an application called "HeatClinic QA" and view it in the Applications Visual Editor.

2. Click the button for that object and select the **DSL export** option to generate a DSL script and export it.

   **Example:**

   Click the button in the upper right corner of the Applications Visual Editor.
3. Click **DSL IDE** in the platform UI to invoke the DSL IDE in ElectricFlow.

The DSL IDE opens.

**Example:**

![ElectricFlow DSL IDE](image-url)
4. Copy the content from the DSL script and paste it into DSL IDE editor window.

**Example:**

This is a snippet of the DSL script that was exported:

```java
application 'HeatClinic QA ', {
    description = 'QA test version of the HeatClinic application'
    projectName = 'Default'
}

applicationTier 'App Server', {
    applicationName = 'HeatClinic QA'
    projectName = 'Default'
}

component 'Config', pluginName: 'EC-FileSysRepo-0.0.4.81789', {
    applicationName = 'HeatClinic QA'
    pluginKey = 'EC-FileSysRepo'
    projectName = 'Default'
    reference = '0'
    sourceComponentName = null
    sourceProjectName = null
}

process 'Start server', {
    applicationName = null
    processType = 'DEPLOY'
    projectName = 'Default'
    timeLimitUnits = null
    workspaceName = null
}

processStep 'Retrieve', {
    applicationTierName = null
    dependencyJoinType = null
    errorHandling = 'failProcedure'
    instruction = null
    notificationTemplate = null
    processStepType = 'component'
}
```

Copy and paste the content into the DSL IDE:
5. Modify the object.

**Example:**

Change the name of the application tier from "DB QA lab" to "DB QA":

```applicationTier 'DB QA lab', {
  description = '';  
  applicationName = 'HeatClinic QA'
  projectName = 'Default'
```

Go to the "Cleanup DB QA backup" component in this application tier, and change the component name from "Cleanup DB QA backup" to "Cleanup DB QA":

```component 'Cleanup DB QA backup', pluginName: 'EC-FileSysRepo-0.0.5.103138', {
  applicationName = 'HeatClinic QA'
  pluginKey = 'EC-FileSysRepo'
  projectName = 'Default'
```
6. Click **Submit DSL**.

The IDE processes the script line by line.

**Example:**

```
Line 0002: DSL method 'application'
Line 0003: Setting argument 'description' to 'QA test version of the HeartClinic application'
Line 0004: Setting argument 'projectName' to 'Default'
Line 0006: DSL method 'applicationTier'
Line 0006: Handling 'application' before processing 'applicationTier'
Line 0006: Checking if application exists with args {'applicationName'=HeartClinic QA, description=''}
Line 0006: application exists: true
Line 0006: Invoking 'modifyApplication' with args {'applicationName'=HeartClinic QA, description=''}
Line 0006: Done invoking 'modifyApplication'
Line 0007: Setting argument 'applicationName' to 'HeartClinic QA'
Line 0008: Setting argument 'projectName' to 'Default'
Line 0010: DSL method 'component'
```

7. Go to the UI page in the first step to view the changes you made.

**Example:**

![UI page example](image-url)
Troubleshooting and FAQs

Troubleshooting

<table>
<thead>
<tr>
<th>Issue</th>
<th>What to Do</th>
<th>Links to Related Topics</th>
</tr>
</thead>
</table>
| Get help on the DSL methods | To get the complete list of supported DSL methods, enter the following command:  
ectool evalDsl --describe 1  
To get help on a particular DSL method, enter the following command:  
ectool evalDsl <dsl_method_name> --describe 1  
Example:  
ectool evalDsl procedure --describe 1 | Getting Started with DSL on page 402 |
| The DSL script completes successfully using the evalDsl command; however, the ElectricFlow objects are not created or updated as expected. | Use the debug option to trace and debug the script processing using the following command:  
ectool evalDsl <dsl> --debug 1  
The debug option will allow evalDsl to generate debug output that you can use to follow the DSL script processing by evalDsl and identify any possible issue with the DSL script. | Creating and Running DSL Scripts on page 403 |

FAQs

I am comfortable with Perl and am already using the ElectricFlow Perl API for my scripting purposes. Do I need to switch to ElectricFlow DSL?

Answer: ElectricFlow DSL being a dynamic scripting language provides a cleaner and much easier syntax for non-technical users to understand. However, ElectricFlow Perl API and the RESTful API are both supported as well, and you can continue to use them both if they suit your scripting needs.

ElectricFlow DSL is based on Groovy. So, are all Groovy constructs available for use in a DSL script?

Answer: Yes, most Groovy constructs such as closures, named arguments, and so on can be used in your DSL script.
Is there a way to create a DSL script for the ElectricFlow objects that I have created through the UI or using the ElectricFlow Perl API?

Answer: Yes, you can use the `generateDsl` command to create a DSL script for any ElectricFlow object.

Command: `ectool generateDsl [path]`

Example: `ectool generateDsl /projects/Default/applications/MyApp`

**How to create or update access control for an object**

You should use one of the following patterns for defining access control for objects in your DSL script. These patterns allow the DSL runtime engine to deterministically find the correct ElectricFlow object for creating or updating access control entries (ACEs).

- Access control entries can be nested inside the DSL method of the object for which the access control is being defined. For example, the following script provides the user named "joe" full access to project called Foo.

```plaintext
project 'Foo', { 
  aclEntry principalName: 'joe',
  principalType: 'user',
  readPrivilege: 'allow',
  modifyPrivilege: 'allow',
  changePermissionsPrivilege: 'allow'
}
```
• Use the `objectType` argument to declare the type of object for which the access control is being defined if the access control method is not enclosed within the DSL method for the object. This can be used to define ACEs for objects such as server and other system objects because they do not have a DSL method similar to other regular objects.

```java
// Removing any previously set ACL for 'Everyone'
deleteAclEntry {
   principalType: 'group',
   principalName: 'Everyone',
   objectType : 'server',
   systemObjectName : 'server'
}

aclEntry principalName: 'joe',
   principalType: 'user',
   objectType : 'server',
   systemObjectName : 'server',
   readPrivilege: 'allow',
   modifyPrivilege: 'allow',
   changePermissionsPrivilege: 'allow'

or

aclEntry principalName: 'joe',
   principalType: 'user'
   objectType : 'systemObject',
   systemObjectName : 'resources',
   readPrivilege: 'allow',
   modifyPrivilege: 'allow',
   changePermissionsPrivilege: 'allow'
```
Security

ElectricFlow provides security by assigning roles and privileges to specific users and groups on:

- System objects including applications, environments, projects, jobs, and schedules.
- Actions performed on deployment models.

ElectricFlow uses access control, project-level security, and credentials and impersonation to enforce roles and privileges when executing deployment steps.

For an example of how to define roles and privileges when a specific user is allowed to deploy an application only to a specific environment, go to Use Case: Attaching Credentials in Deployment Automation on page 428.

Access Control

ElectricFlow uses access control to provide security for all system objects. This mechanism controls how users and groups use the system. Users must log in to view information or to perform operations (actions). After users log in, their system access is limited based on:

- The user name
- The groups to which the user belongs
- The permissions specified for various ElectricFlow objects.

Go to Access Control for more information about how ElectricFlow enforces access control and for security examples using access control.

For instructions on how to set up access control, go to these topics:

- Access Control on page 607 GUI page
- Access Control - defining entries on page 609
- Privileges - create new or edit existing privileges on page 610

Project-Level Security

Multiple Project support is available on applications, pipelines, Releases, environments, Master Components, resources, and environment templates as well as platform objects (for example, artifacts, procedures, jobs, schedules, and workflows) These objects as well as the objects belonging to them can be in any project within ElectricFlow.

This significantly improves object management at scale by allowing:

- ACL inheritance—All objects in a project inherit the access control settings from the project, providing better security for all the objects. They can be managed in their own projects and will inherit the ACLs setup at the project level. This significantly simplifies permissions management.
• Logical grouping—This allows users to better manage Deploy and Release objects under various projects that are logically mapped by users, roles, geography, department, and so on, resulting in easier maintenance.

  For more information about specific objects, go to the appropriate sections in the ElectricFlow User Guide.

  For an example showing how to select a project for an application in the GUI, go to Example: Modeling and Deploying Applications on page 133. You can also use API commands to do this:

  • Use the createApplication API command to create a new application for a specific project.
  • Use the createProcess command to create an application or component process for a specific project.

  See the ElectricFlow API guide on the ElectricFlow documentation page for more information about using these API commands.

  Also go to Example: Modeling and Deploying Applications on page 133 to see how to author and deploy an application in the GUI.

  For an example showing how to select a project for a Release in the GUI, go to Release Definition on page 367. You can also use the createRelease API command to define a Release for a specific project.

### Credentials and User Impersonation

- **What is a Credential?** on page 419
- **Defining a Credential** on page 420
- **Why Use Credentials?** on page 420
- **Credential Access Control** on page 420
- **Using Credentials for Impersonation at the Platform Level** on page 421
- **Accessing Credentials From a Step at the Platform Level** on page 423
- **Credential References** on page 424
- **Best Practices for Retrieving Credentials** on page 425

### What is a Credential?

In ElectricFlow, a "credential" is an object that stores a user name and password for later use. Two credential types are available, *stored* or *dynamic*:

- **stored** credentials – These credentials are given a name and stored in encrypted form in the database. Each Project has a list of stored credentials it owns. These credentials are managed from the Project Details page.

- **dynamic** credentials – These credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.
Defining a Credential

After a credential is created, no one can view the password for the credential's account. This means one person can define a credential and enter the password, and other people can use the credential (and its account) without needing to know the password.

To create a new credential in the automation platform UI:

1. Click the Projects tab.
2. Select a project (first column) to see the Project Details page.
3. Select the Credentials tab and then click Create Credential.
   
   Click the Help link on the New Credential page if you need more information about what to enter in the fields.

Why Use Credentials?

Use ElectricFlow credentials for:

- User impersonation
- Saving passwords for use inside steps

When a step needs to run as a particular user, ElectricFlow can retrieve the user name and password from a stored credential. The credential is passed to the agent over an encrypted channel so the agent can authenticate itself to the operating system and set up a security context where the step runs with the user permissions in the credential.

In some cases, a step needs to enter credentials directly to an application.

- The credential may be a fixed application credential that needs to be presented every time the step runs. In this case, a stored credential provides a place to put this information without needing to embed the password in a script.
- Other times, the password is not known in advance. In this case, a dynamic credential created when a job is launched can prompt a user for information and then pass the credential to the step in a secure manner.

Credential Access Control

Because ElectricFlow stores passwords in a recoverable manner, it is important that credentials are accessible only under carefully controlled circumstances. To protect credentials, ElectricFlow uses two mechanisms: access control lists (ACL) and attached credentials.

To use a credential for any purpose, a user who attempts to reference the credential must have execute permission on the credential object—this allows you to explicitly control which users are allowed to use a credential anywhere in the system.

In addition to the user-based access control check, ElectricFlow requires a credential be explicitly attached to the object that is going to use it. After an object has a credential attached, object modifications are restricted to users who have both execute permission on the credential and modify permission on that object. This safeguard helps prevent credentials from accidentally being used by unauthorized users.

Attach a credential to an object in the automation platform UI one of these ways:
- Set the impersonation credential for a step, procedure, project, or schedule.

  You can also set the impersonation credential for an application process, component process, or a process step.

  Impersonation credentials are inherited, so attaching a credential to a container object like a procedure or a project implicitly attaches it to every object inside the container, such as all steps in a procedure.

- Explicitly attach the credential to a step or schedule using the UI or the attachCredential API.

  To access credentials from a step, the credential must be attached directly to the step, or the credential must be passed as a parameter to the containing procedure and have the parameter attached instead.

### Using Credentials for Impersonation at the Platform Level

This information addresses the question, "When a job step is running on a resource, under which account is it running and how can I control that?" By default, a job step runs under the account used by the ElectricFlow agent that runs the step, which was chosen when the agent was installed. This approach works well in environments where it makes sense to run all jobs under a single user such as a "build" user. You install all agents to run as the desired user, and you do not have to worry about anything else—every step of every job runs as that user.

However, in other environments you may prefer to run different jobs, or even different job steps, under different accounts.

For example:

- If independent groups are sharing an ElectricFlow system, you may want each group to use a different account for its jobs.
- You may need to run jobs as particular users to access ClearCase views for those users.
- There may be certain steps that require special privileges.

  For example, as part of your builds you may need to run a step that generates a certificate using privileged corporate information; that step must run under a special high-privileged account, but you want the remainder of the steps in the build to use a less-privileged account.

ElectricFlow allows you to select accounts on a per-job or per-job-step basis. This mechanism is called *impersonation*, where the ElectricFlow agent impersonates a particular user for the duration of a job step, and this *impersonation* is implemented using credentials. The use of credentials creates special security challenges.

**Note:** It is important to ensure privileged accounts can be used only for the purposes you intend and cannot be "hijacked" for other purposes. The ElectricFlow access control mechanism contains special facilities to ensure proper credential use.

### Setting the Impersonation Credential in the Automation Platform

#### Attaching Impersonation Credentials to Steps, Procedures, and Projects

You can attach impersonation credentials to procedure steps, procedures, and projects before executing a job step.

ElectricFlow searches for a credential in the following order and uses the first credential it finds:
1. Procedure step
2. Procedure to which the step belongs
3. Project to which the project belongs

If the step is in a nested procedure, and no credential is found on the step, its procedure, or its project, ElectricFlow checks the calling step (and its procedure and project), its caller, and so on until it has worked up through the topmost procedure in the job. If no credential is found, the job step runs under the ElectricFlow agent account on its resource.

This approach makes it easy to manage your account usage. For example, if you want all jobs in one project to use a particular account, define a credential in that project for the account, and then attach the credential to the project. If you want all jobs in a project to use a particular account, except for one step that should use a different account, create two credentials in the project. Attach the first credential to the project and attach the second credential to the particular step.

**Attaching Impersonation Credentials to Schedules**

You can also attach a credential to a schedule. The credential in the schedule is used for steps where no other credential is available.

The schedule's credential receives the lowest priority.

**Attaching Impersonation Credentials to Jobs**

You can specify a credential when you launch a job manually one of these ways:

- Provide the name of an existing credential
- Enter an account and password.

If you choose the second approach, the account and password are stored only in ElectricFlow for the duration of the job.

For either way, the credential you specified when you launched the job is used as a last resort for steps only with no other credential.

**Attaching a New Impersonation Credential**

To attach a new impersonation credential for a procedure, step, or schedule:

1. Click the Projects tab.
2. Select a project.
3. Go to the Project Details page for the project you selected.
4. Do one of the following:
   a. For a **procedure**:
      i. Click **Create Procedure** to go to the New Procedure page.
      ii. On this page, select the Impersonation Credential drop-down box to select a credential to use for impersonation.
   b. For a **step**:
      i. Select a procedure to go to the Procedure Details page.
      ii. Select a step name to go to the Edit Step page.
      iii. On the Edit Step page, scroll down to the Impersonation section.
   c. For a **schedule**:
      i. Select the Schedules subtab.
      ii. Select a schedule to go to the Edit Schedule page.
      iii. Scroll down to Impersonation Credential section.

For more information in the platform GUI, each of these web pages contains a **Help** link in the upper-right corner.

### Accessing Credentials From a Step at the Platform Level

The ElectricFlow server supports an operation called **getFullCredential** that can return a password when called from inside a step. The ectool interface for this operation is:

```
getFullCredential <credential name>

   [--value <password|user>]
```

Without the **--value** option, the response is the same as that returned by **getCredential**, with the addition of a "password" element.

With **--value**, the simple text password or user name value is returned on *stdout* so it can be used directly without XML parsing.

The **getFullCredential** API is allowed only inside a running step, and is allowed to use credentials that were explicitly attached to the step only.

### Attaching a Credential to a Procedure Step, Procedure, or Schedule

A credential must be explicitly attached to the object using it so the server can perform an access control (ACL) check at definition time and limit the visibility of the password. To support accessing credentials other than the one being used for impersonation, steps, procedures, and schedules contain a list of credential names.

In the platform GUI, to attach a credential (other than an impersonation credential) to a step, procedure, or schedule:

1. Go to an "Edit" page.
   
   For example, to create a credential for a step, a step must already exist.

2. Select a step that needs a credential. The Edit Step page opens.

3. Scroll to the lower section of the page and click **Attach Credential**.
If you are an ectool command-line user, use the attachCredential API command. For more information on the command-line interface, go to the ectool Help topics within the online Help system.

**Passing Credentials as Parameters**

Sometimes you may not know which credential you need to use when you define a procedure step. In this situation, you can leave the credential choice up to the caller of the procedure.

The following example describes the procedure for passing credentials as parameters:

1. Create a project named InnerProj.
2. Within that project create a procedure named InnerProc with a parameter 'cred' of the type credential.
3. Within that procedure create a step named InnerStep with:
   - Command: ectool getFullCredential cred
   - Attached Parameter Credential: cred
4. Create a project named OuterProj with two credentials: cred1 and cred2.
5. Within that project create a procedure named OuterProc with two parameters, cred1 and cred2, of the type credential.
6. Within that procedure create two subprocedure steps that both call InnerStep from the InnerProj project:
   - OuterStep1 with Attached Parameter Credential cred1, and cred1 in the Parameters section
   - OuterStep2 with Attached Parameter Credential cred2, and cred2 in the Parameters section

If you are an ectool command-line user, you can use the createFormalParameter and attachParameter API commands. For more information on the command-line interface, go to the ectool Help topics within the online Help system.

**Credential References**

For schedules, the value for any actual parameter passed to a credential-type formal parameter is interpreted as a reference to a previously attached credential on the schedule.

For procedure steps, the value for any actual parameter passed to a credential type formal parameter is interpreted as a reference to a previously attached credential or credential parameter on the calling step.

When a job step is created, all credential references are resolved and the content is copied into transient credentials on the job step. Credential parameter references are resolved by looking for a credential in the calling job step’s transient credential map—looking for a credential with the name specified as the actual parameter value.

Credential references in the API can be specified as a relative or an absolute credential path.

- A relative path is similar to "rootCred" and is interpreted as referring to a credential in the current project.
- An absolute path includes a project name like "/projects/MyProject/credentials/rootCred" and can refer to a credential in any project.

Anywhere a credential reference is accepted (for example, setting an impersonation credential or attaching a credential to a step), either form can be used.
Best Practices for Retrieving Credentials

The ElectricFlow impersonation mechanism provides powerful mechanisms for using different accounts in job steps, and it can be used to handle a variety of challenges. However, if misused, impersonation can open up dangerous security loopholes. This section discusses these risks and how to avoid them.

Use of credentials and impersonation tend to fall into two classes.

First Class

In the first class, your goal is to open up access to accounts, you want to make some accounts generally available, and you trust large groups of users (such as everyone who can access a particular project) to use the accounts appropriately. This usage type is simplest and relatively safe.

1. Define an ElectricFlow group containing all trusted users.
2. Set permissions on the Project so only trusted users can access the project.
3. Define credentials for accounts in the Project and grant execute permission to everyone in the group.

After completing this task, everyone in the group can use the accounts for arbitrary purposes. No one outside the group will be able to access the project or the credentials.

Second Class

In the second class, you want to provide tightly-controlled access to a highly privileged function such as generating a certificate or accessing sensitive information. This kind of usage requires careful thought to avoid allowing unintended access to the credential. The best way to implement a solution for this scenario is to restrict access to the credential and use it on individual steps only after careful analysis of issues such as the following:

Does the step's command use properties?

If so, someone could potentially change the property value to change the step behavior.

For example, suppose the step's command is defined like this:

echo $[/myProject/x]

Anyone with write access to property x can hijack the step by placing the value "nothing; myCommand" in the property.

After property substitution, the final command will be:

echo nothing; myCommand

that will cause "myCommand" to execute in the step.

Either restrict access to the property sheet or avoid substitutions.

Does the step execute code or commands that can be modified?

In most jobs that execute build and test sequences, the job extracts various files from a source code control system and some of those files contain code executed during the build. In this case, anyone with access to the source code control system can affect the executed code.
For example, suppose a step runs a Make or Ant command using a configuration file extracted from the source code control system. Anyone with access to the source code control system can modify the configuration file to introduce new commands executed during the Make or Ant step. In this situation, it is virtually impossible to control what happens during the step, so you should never attach a credential for a privileged account to such a step.

The higher you attach a credential, the greater the risk of uncontrolled access to the credential's account.

For example, if you attach a credential to a project, there is a good chance anyone with write access to the project, or even the ability to execute the project's procedures, can hijack the credential using one of the loopholes described above. If you attach a credential to a step that invokes a subprocedure, you effectively give anyone with write access to the subprocedure complete access to the credential's account. If you care about access to an account, you should use its credential in the narrowest possible fashion, such as attaching it to a single job step.

Avoid passing passwords on the command line

When using credentials, avoid passing the password on the command line because [on most platforms] those passwords will be visible to all users logged into the system. The secure way to pass a credential to an application is to use a secured file in the file system or to pipe the value into the application via stdin.

Credentials and Impersonation in Application and Component Processes

You apply credentials and impersonation to control who can deploy applications and where the applications are deployed.

- You can attach one or more credentials to component or application process steps.
- You can attach only one impersonation credential to an application process, component process, or a process step.
- When you attach an impersonation credential in ElectricFlow, it specifies the user who can deploy the application and the environment in which the application is deployed.
- When you attach an impersonation credential to a platform-level object (such as a procedure), it specifies the account (user) that can run the job or job step. If you want to specify another condition, you have to attach another credential to the object.

**IMPORTANT:**

When you impersonate a credential, make sure that the impersonated user has the absolute path to the bin directories in the $PATH environment.

If you define a process step with a command, you must enter the absolute path in the Post Processor and Shell fields in the "Define Step" dialog box.

1. Click in the Add Credentials field.

**Example:**
The Component Process Step / Add dialog box opens.

2. To impersonate one credential:

   **Example:**

   **a.** Select **Impersonate** in the **Type** field.
   
   **b.** Click the **Select Project** field to select a project. You can select a credential from a project that is different than the one containing the application.
   
   **c.** Click the **Select Credential** field to open a drop-down list of credentials for the process step.
   
   **d.** Select a credential.
   
   **e.** Click **OK**.
   
   The **Credentials** dialog box now shows the one credential for impersonation.
3. To attach one or more credential parameters to the process step:

Example:

![Credential dialog box](image)

- a. Select **Attach Parameter** in the **Type** field.
- b. Click the **Select Credential Parameter** field to open a drop-down list of credentials for the process step.
- c. Select a credential.
- d. Click **OK**.

The **Credentials** dialog box now shows the attached credentials.

4. To attach one or more credentials to the process step:

Example:

![Credential dialog box](image)

- a. Select **Attach** in the **Type** field.
- b. Click the **Select Project** field to select a project. You can select a credential from a project that is different than the one containing the application.
- c. Click the **Select Credential** field to open a drop-down list of credentials for the process step.
- d. Select a credential.
- e. Click **OK**.

The **Credentials** dialog box now shows the attached credentials.

**Use Case: Attaching Credentials in Deployment Automation**

When modeling an application, you can attach credentials these ways:
• For credentials, attach one or more credentials to component or application process steps.

• For credentials for impersonation, attach only one impersonation credential to these objects:
  • Component process
  • Component process step
  • Application process
  • Application process step

When you deploy the application, ElectricFlow applies the credentials based on the user permissions and deploys the application in one or more environments.

Example

This example describes how to define roles and privileges when an application is deployed to more than one environment and specific users are limited to specific environments.

You can attach impersonation credentials to an application in the GUI. The application has these credentials:
  • Development (dev)
  • Quality Engineering (qe)
  • Production (prod)

Users have these privileges:
  • User A is allowed to deploy the application to build a MySQL database in any environment and has admin privileges.
  • User B is allowed to only deploy the application in the quality (qa) environments and is not trusted in the development (dev) and production (prod) environments.

The following user permissions determine what users are allowed to do in ElectricFlow. You can configure these credentials only from the GUI.

• You configure User A’s profile in the automation platform and give User A higher-order privileges than other users. User A has the following credentials, including a credential for impersonation:

  For each environment in ElectricFlow, set a property using a reference such as ${myEnvironment/dbConfigName} and define a unique value, which can be passed as a credential to a process or process step.

  • In the development (dev) environment, set `dbConfigName = dbUser_dev`.
  • In the quality engineering (qe) environment, set `dbConfigName = dbUser_qa`.
  • In the production (prod) environment, set `dbConfigName = dbUser_prod`.

• When you configure User B’s profile in the automation platform, User B is only given the credentials to deploy in the quality (qa) environment. You do not need to set properties to be passed as credentials when the application is deployed.

Attaching the same credentials from the automation platform is more complicated. Instead of setting only one credential for User A and one for User B, you need to create three unique credentials for the environments in
addition to credentials for the various user and environment combinations, such as User A and the development environment.

**Credentials in Pipelines**

Credentials are passed to pipelines through applications in pipeline stages. If an application has required inputs (parameters) and any of the inputs is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (Parameter Credential) or a credential binding to a pipeline task (Credential binding), or select a user-defined credential that is attached to the project associated with the pipeline.

A credential must be explicitly attached to the object using it so the server can perform an access control list (ACL) check at the definition time and limit the visibility of the password. To support accessing credentials at the pipeline task level, these tasks need to have the appropriate credentials attached. This is done implicitly by the UI when you are binding credentials to the pipeline tasks. If you are using ectool, use the attachCredential API command to perform the same operation.

**Credentials in Releases**

In the Release definition, credentials appear in these objects:

- **Pipelines**: How the credential is applied to the Release depends on the selected pipeline.
  
  If the pipeline has required inputs (parameters) and any of the inputs is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (Parameter Credential) or a credential binding to a pipeline task (Credential binding), or select a user-defined credential that is attached to the project associated with the pipeline.

- **Applications**: How the credential is applied to the Release depends on the applications in the selected pipeline.
  
  If any input to an application is a credential parameter, you can enter the path to the credential, browse to it, select a credential parameter (Parameter Credential) or a credential binding to a pipeline task (Credential binding), or select a user-defined credential that is attached to the project associated with the pipeline.

See the steps to select a pipeline and to select credential inputs for an application in the pipeline in the Release Definition on page 367 for examples of these operations.
What is a Credential?

In ElectricFlow, a "credential" is an object that stores a user name and password for later use. Two credential types are available, stored or dynamic:

- **stored** credentials – These credentials are given a name and stored in encrypted form in the database. Each Project has a list of stored credentials it owns. These credentials are managed from the Project Details page.
- **dynamic** credentials – These credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.

Defining a Credential

After a credential is created, no one can view the password for the credential’s account. This means one person can define a credential and enter the password, and other people can use the credential (and its account) without needing to know the password.

To create a new credential in the automation platform UI:

1. Click the Projects tab.
2. Select a project (first column) to see the Project Details page.
3. Select the Credentials tab and then click **Create Credential**.
   
   Click the **Help** link on the New Credential page if you need more information about what to enter in the fields.

Why Use Credentials?

Use ElectricFlow credentials for:

- User impersonation
- Saving passwords for use inside steps
Using ElectricFlow

When a step needs to run as a particular user, ElectricFlow can retrieve the user name and password from a stored credential. The credential is passed to the agent over an encrypted channel so the agent can authenticate itself to the operating system and set up a security context where the step runs with the user permissions in the credential.

In some cases, a step needs to enter credentials directly to an application.

- The credential may be a fixed application credential that needs to be presented every time the step runs. In this case, a stored credential provides a place to put this information without needing to embed the password in a script.
- Other times, the password is not known in advance. In this case, a dynamic credential created when a job is launched can prompt a user for information and then pass the credential to the step in a secure manner.

**Credential Access Control**

Because ElectricFlow stores passwords in a recoverable manner, it is important that credentials are accessible only under carefully controlled circumstances. To protect credentials, ElectricFlow uses two mechanisms: access control lists (ACL) and *attached* credentials.

To use a credential for any purpose, a user who attempts to reference the credential must have execute permission on the credential object—this allows you to explicitly control which users are allowed to use a credential anywhere in the system.

In addition to the user-based access control check, ElectricFlow requires a credential be explicitly *attached* to the object that is going to use it. After an object has a credential attached, object modifications are restricted to users who have both execute permission on the credential and modify permission on that object. This safeguard helps prevent credentials from accidentally being used by unauthorized users.

Attach a credential to an object in the automation platform UI one of these ways:

- Set the impersonation credential for a step, procedure, project, or schedule.
  You can also set the impersonation credential for an application process, component process, or a process step.
  Impersonation credentials are inherited, so attaching a credential to a container object like a procedure or a project implicitly attaches it to every object inside the container, such as all steps in a procedure.
- Explicitly attach the credential to a step or schedule using the UI or the attachCredential API.
  To access credentials from a step, the credential must be attached directly to the step, or the credential must be passed as a parameter to the containing procedure and have the parameter attached instead.

**Using Credentials for Impersonation at the Platform Level**

This information addresses the question, "When a job step is running on a resource, under which account is it running and how can I control that?" By default, a job step runs under the account used by the ElectricFlow agent that runs the step, which was chosen when the agent was installed. This approach works well in environments where it makes sense to run all jobs under a single user such as a "build" user. You install all agents to run as the desired user, and you do not have to worry about anything else—every step of every job runs as that user.
However, in other environments you may prefer to run different jobs, or even different job steps, under different accounts.

For example:

- If independent groups are sharing an ElectricFlow system, you may want each group to use a different account for its jobs.
- You may need to run jobs as particular users to access ClearCase views for those users.
- There may be certain steps that require special privileges.

For example, as part of your builds you may need to run a step that generates a certificate using privileged corporate information; that step must run under a special high-privileged account, but you want the remainder of the steps in the build to use a less-privileged account.

ElectricFlow allows you to select accounts on a per-job or per-job-step basis. This mechanism is called impersonation, where the ElectricFlow agent impersonates a particular user for the duration of a job step, and this impersonation is implemented using credentials. The use of credentials creates special security challenges.

**Note:** It is important to ensure privileged accounts can be used only for the purposes you intend and cannot be "hijacked" for other purposes. The ElectricFlow access control mechanism contains special facilities to ensure proper credential use.

### Setting the Impersonation Credential in the Automation Platform

**Attaching Impersonation Credentials to Steps, Procedures, and Projects**

You can attach impersonation credentials to procedure steps, procedures, and projects before executing a job step.

ElectricFlow searches for a credential in the following order and uses the first credential it finds:

1. Procedure step
2. Procedure to which the step belongs
3. Project to which the project belongs

If the step is in a nested procedure, and no credential is found on the step, its procedure, or its project, ElectricFlow checks the calling step (and its procedure and project), its caller, and so on until it has worked up through the topmost procedure in the job. If no credential is found, the job step runs under the ElectricFlow agent account on its resource.

This approach makes it easy to manage your account usage. For example, if you want all jobs in one project to use a particular account, define a credential in that project for the account, and then attach the credential to the project. If you want all jobs in a project to use a particular account, except for one step that should use a different account, create two credentials in the project. Attach the first credential to the project and attach the second credential to the particular step.

**Attaching Impersonation Credentials to Schedules**

You can also attach a credential to a schedule. The credential in the schedule is used for steps where no other credential is available.

The schedule's credential receives the lowest priority.
**Attaching Impersonation Credentials to Jobs**

You can specify a credential when you launch a job manually one of these ways:

- Provide the name of an existing credential
- Enter an account and password.

If you choose the second approach, the account and password are stored only in ElectricFlow for the duration of the job.

For either way, the credential you specified when you launched the job is used as a last resort for steps only with no other credential.

**Attaching a New Impersonation Credential**

To attach a new impersonation credential for a procedure, step, or schedule:

1. Click the Projects tab.
2. Select a project.
3. Go to the Project Details page for the project you selected.
4. Do one of the following:
   a. For a **procedure**:
      i. Click **Create Procedure** to go to the New Procedure page.
      ii. On this page, select the Impersonation Credential drop-down box to select a credential to use for impersonation.
   b. For a **step**:
      i. Select a procedure to go to the Procedure Details page.
      ii. Select a step name to go to the Edit Step page.
      iii. On the Edit Step page, scroll down to the Impersonation section.
   c. For a **schedule**:
      i. Select the Schedules subtab.
      ii. Select a schedule to go to the Edit Schedule page.
      iii. Scroll down to Impersonation Credential section.

For more information in the platform GUI, each of these web pages contains a Help link in the upper-right corner.

**Accessing Credentials From a Step at the Platform Level**

The ElectricFlow server supports an operation called `getFullCredential` that can return a password when called from inside a step. The `ectool` interface for this operation is:

```
getFullCredential <credential name>

[--value <password|user>]
```

Without the `--value` option, the response is the same as that returned by `getCredential`, with the addition of a "password" element.
With --value, the simple text password or user name value is returned on stdout so it can be used directly without XML parsing.

The getFullCredential API is allowed only inside a running step, and is allowed to use credentials that were explicitly attached to the step only.

**Attaching a Credential to a Procedure Step, Procedure, or Schedule**

A credential must be explicitly attached to the object using it so the server can perform an access control (ACL) check at definition time and limit the visibility of the password. To support accessing credentials other than the one being used for impersonation, steps, procedures, and schedules contain a list of credential names.

In the platform GUI, to attach a credential (other than an impersonation credential) to a step, procedure, or schedule:

1. Go to an "Edit" page.
   - For example, to create a credential for a step, a step must already exist.
2. Select a step that needs a credential. The Edit Step page opens.
3. Scroll to the lower section of the page and click **Attach Credential**.

If you are an ectool command-line user, use the attachCredential API command. For more information on the command-line interface, go to the ectool Help topics within the online Help system.

**Passing Credentials as Parameters**

Sometimes you may not know which credential you need to use when you define a procedure step. In this situation, you can leave the credential choice up to the caller of the procedure.

The following example describes the procedure for passing credentials as parameters:

1. Create a project named InnerProj.
2. Within that project create a procedure named InnerProc with a parameter 'cred' of the type credential.
3. Within that procedure create a step named InnerStep with:
   - Command: ectool getFullCredential cred
   - Attached Parameter Credential: cred

4. Create a project named OuterProj with two credentials: cred1 and cred2.
5. Within that project create a procedure named OuterProc with two parameters, cred1 and cred2, of the type credential.
6. Within that procedure create two subprocedure steps that both call InnerStep from the InnerProj project:
   - OuterStep1 with Attached Parameter Credential cred1, and cred1 in the Parameters section
   - OuterStep2 with Attached Parameter Credential cred2, and cred2 in the Parameters section

If you are an ectool command-line user, you can use the createFormalParameter and attachParameter API commands. For more information on the command-line interface, go to the ectool Help topics within the online Help system.
Credential References

For schedules, the value for any actual parameter passed to a credential-type formal parameter is interpreted as a reference to a previously attached credential on the schedule.

For procedure steps, the value for any actual parameter passed to a credential type formal parameter is interpreted as a reference to a previously attached credential or credential parameter on the calling step.

When a job step is created, all credential references are resolved and the content is copied into transient credentials on the job step. Credential parameter references are resolved by looking for a credential in the calling job step's transient credential map—looking for a credential with the name specified as the actual parameter value.

Credential references in the API can be specified as a relative or an absolute credential path.

- A relative path is similar to "rootCred" and is interpreted as referring to a credential in the current project.
- An absolute path includes a project name like "/projects/MyProject/credentials/rootCred" and can refer to a credential in any project.

Anywhere a credential reference is accepted (for example, setting an impersonation credential or attaching a credential to a step), either form can be used.

Best Practices for Retrieving Credentials

The ElectricFlow impersonation mechanism provides powerful mechanisms for using different accounts in job steps, and it can be used to handle a variety of challenges. However, if misused, impersonation can open up dangerous security loopholes. This section discusses these risks and how to avoid them.

Use of credentials and impersonation tend to fall into two classes.

First Class

In the first class, your goal is to open up access to accounts, you want to make some accounts generally available, and you trust large groups of users (such as everyone who can access a particular project) to use the accounts appropriately. This usage type is simplest and relatively safe.

1. Define an ElectricFlow group containing all trusted users.
2. Set permissions on the Project so only trusted users can access the project.
3. Define credentials for accounts in the Project and grant execute permission to everyone in the group.

After completing this task, everyone in the group can use the accounts for arbitrary purposes. No one outside the group will be able to access the project or the credentials.

Second Class

In the second class, you want to provide tightly-controlled access to a highly privileged function such as generating a certificate or accessing sensitive information. This kind of usage requires careful thought to avoid allowing unintended access to the credential. The best way to implement a solution for this scenario is to restrict access to the credential and use it on individual steps only after careful analysis of issues such as the following:
Does the step's command use properties?

If so, someone could potentially change the property value to change the step behavior. For example, suppose the step's command is defined like this:

```bash
echo ${/myProject/x}
```

Anyone with write access to property x can hijack the step by placing the value "nothing; myCommand" in the property. After property substitution, the final command will be:

```bash
echo nothing; myCommand
```

that will cause "myCommand" to execute in the step.

Either restrict access to the property sheet or avoid substitutions.

Does the step execute code or commands that can be modified?

In most jobs that execute build and test sequences, the job extracts various files from a source code control system and some of those files contain code executed during the build. In this case, anyone with access to the source code control system can affect the executed code.

For example, suppose a step runs a Make or Ant command using a configuration file extracted from the source code control system. Anyone with access to the source code control system can modify the configuration file to introduce new commands executed during the Make or Ant step. In this situation, it is virtually impossible to control what happens during the step, so you should never attach a credential for a privileged account to such a step.

The higher you attach a credential, the greater the risk of uncontrolled access to the credential's account.

For example, if you attach a credential to a project, there is a good chance anyone with write access to the project, or even the ability to execute the project's procedures, can hijack the credential using one of the loopholes described above. If you attach a credential to a step that invokes a subprocedure, you effectively give anyone with write access to the subprocedure complete access to the credential's account. If you care about access to an account, you should use its credential in the narrowest possible fashion, such as attaching it to a single job step.

Avoid passing passwords on the command line

When using credentials, avoid passing the password on the command line because [on most platforms] those passwords will be visible to all users logged into the system. The secure way to pass a credential to an application is to use a secured file in the file system or to pipe the value into the application via stdin.

Performance Consequences of Change Tracking

Change Tracking affects how ElectricFlow runs. The impact can be from low (minimal changes to the times to update the database) to high (significantly longer times to update the database).

ElectricFlow needs to store additional information in the database about the tracked objects in the Change History. In addition to storing normal information about ElectricFlow operations, ElectricFlow stores a separate archival copy of every state of every tracked object as well as the indexing information used to retrieve the
Change History of tracked objects and the objects they own. This increase in database usage has performance consequences.

For most of ElectricFlow operations, the performance consequences of Change Tracking are insignificant, typically a few percent slower in one of these situations:

- None of the affected objects are tracked (job records and similar runtime-only objects are not tracked).
- Only a small number of tracked objects are changed by operations.

However, for operations that affect a very large number of tracked objects in a single operation (such as importing, cloning, or deleting a large project for which change tracking is enabled), the performance consequences will be significant. The performance consequences are similar when enabling or disabling Change Tracking for a large project, because both operations require the server to write to the database the records for every tracked object owned by the project.

For these Change Tracking-intensive operations, the system performance will typically be significantly slower because several times as much data is being read and written between the ElectricFlow server and the database. In our testing, we have seen a wide range of degrees of performance decrease from 1.25x to 10x slower when Change Tracking is enabled on a large project, compared to a project on which Change Tracking is disabled. The decrease in performance is typically from 2x to 6x.

**Use Case 1: Importing and Cloning Large Projects with Change Tracking Enabled**

ElectricFlow does the following to increase the performance of Change Tracking-intensive operations in a large project with this configuration:

- The project contains over 20,000 audited objects.
- Change Tracking is enabled.

To increase the performance when a large project is imported or cloned, ElectricFlow automatically decreases the amount of Change History indexing information that it saves, reducing the level of detail for these operations in the Change History. While this can improve the system performance, it can also make it harder when you want to revert an object to a specific state or to find information in the Change History while troubleshooting or debugging an issue. If you want suppress this behavior, use `--reducedDetailChangeHistory false` in the import or clone API command.

By default, the objects listed in the table below and the tracked objects that they own are always tracked when Change Tracking is enabled (except when Change Tracking is globally disabled).

During an upgrade from ElectricFlow 5.0.x to ElectricFlow 6.0, when the ElectricFlow server starts, the server writes to the database a record for every tracked object and the objects that it owns. The objects listed in the table get new audit records. If any of the objects owns many tracked objects (such as properties), the startup process will be slow.
Use Case 2: Change Tracking of Non-Project- Owned Objects

In this context, non-project-owned objects include all objects not contained within a project. Such objects include resources, artifacts, users, groups, zones, and other objects as well as the property sheets, properties, access control lists (ACLS), and ACL entries (ACEs) for them. In releases earlier than ElectricFlow 6.2, Change Tracking was enabled by default for non-project-owned objects, and there was no way to disable Change Tracking for them. When users upgraded from earlier versions of ElectricFlow to ElectricFlow 6.0.x, the upgrade process initialized and created Change Tracking-related data for them in the database. The performance impact was usually low, except when there was a very large number (in the several hundred thousands) of non-project-owned objects, such as many properties under the /server directory; in this situation, the performance of the first startup was significantly slower. The best solution to this situation is to relocate most of the projects under a project and disable Change Tracking for that project, which may not be a practical short-term solution.

<table>
<thead>
<tr>
<th>Objects (Entities)</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>server</td>
<td>/server</td>
</tr>
<tr>
<td>system objects</td>
<td>/systemObjects/*</td>
</tr>
<tr>
<td>users</td>
<td>/users/*</td>
</tr>
<tr>
<td>groups</td>
<td>/group/*</td>
</tr>
<tr>
<td>plugin</td>
<td>/plugins/*</td>
</tr>
<tr>
<td>email configuration</td>
<td>/emailConfigs/*</td>
</tr>
<tr>
<td>workspaces</td>
<td>/workspaces/*</td>
</tr>
<tr>
<td>zones</td>
<td>/zones/*</td>
</tr>
<tr>
<td>gateways</td>
<td>/gateways/*</td>
</tr>
<tr>
<td>agents</td>
<td>/agents/*</td>
</tr>
<tr>
<td>resources</td>
<td>/resources/*</td>
</tr>
<tr>
<td>resource pools</td>
<td>/resourcesPools/*</td>
</tr>
<tr>
<td>repositories</td>
<td>/repositories/*</td>
</tr>
<tr>
<td>directories</td>
<td>/directories/*</td>
</tr>
</tbody>
</table>
Starting in ElectricFlow 6.2, Change Tracking can be disabled for all non-project-owned objects. (Change Tracking for these objects is enabled by default.) Using this feature is not recommended as a long-term solution; instead we recommend moving most of the objects under a project that has Change Tracking disabled. (Repeatedly disabling and enabling Change Tracking for non-project-owned project is expensive and time-consuming.)

In ElectricFlow 6.2, when there are many non-project-owned objects, the best way to disable Change Tracking for all non-project-owned objects is to change the `database.properties` configuration file to disable Change Tracking for these objects before starting the server running a pre-ElectricFlow 6.2 release. In the `database.properties` file, make sure that it has this line:

```
COMMANDER_DB_NON_PROJECT_AUDITING_ENABLED=false
```

Then install ElectricFlow 6.2 and start the server, running the system this way until most of the non-project-owned objects are relocated to a non-tracked project, and re-enable Change Tracking for non-project-owned objects, which requires restarting the server.

**Estimating Database Growth**

Here is one way to estimate the rate at which the database grows for Change Tracking:

Most of the information needed to estimate the database growth rate can also be parsed from an exported XML file of the project (such as a full import), except for the version count.

The likely rate of database growth is based on these factors:

- How many objects of different types will be tracked
- How big they are
- How often their state changes

The rate of database consumption is then the sum over all different types of tracked objects of the product of these three factors.

**Common Usage Patterns**

For most customer usage patterns, the most common objects (the ones that dominate on first factor) are ACLs and their ACEs, properties, or all of these objects. Typically:

- ACLs and ACEs: ACLs are consistently small, and usually have only a few ACEs.
- Properties: While most of them are small, some properties can be very large. The average property size is large.

For most users, a good quick estimate can be based on properties, especially properties that are large or are modified often.

**Estimating Process**

If you expect to enable Change Tracking for all projects, determine the values for these factors and calculate the database growth rate:

\[
\text{Database growth rate} = \text{Factor 1} \times \text{Factor 2} \times \text{Factor 3}
\]
• Factor 1: How many objects of different types will be tracked

The following procedure is only for properties:

1. Join the ec_property table in the database joined to the ec_property_sheet table by ec_property.parent_sheet_id = ec_property_sheet.id.
2. Search for properties where the ec_property_sheet.entity_type value is one of the entity types corresponding to a database table that has a matching ec_*_aud table.
3. Determine the number of tracked objects per property type.

For most usage patterns, the great majority of properties will belong to entity types like job and jobStep that are not change tracked and so have no corresponding ec_*_aud table.

If you are already using ElectricFlow 5.3 or later, these properties and properties belonging to projects for which Change Tracking is disabled are also recognizable by having ec_property_tracked set to false.

• Factor 2: How big they are (size)

The following procedure is only for properties.

For small properties:

1. Search for objects that are less than 450 bytes in the ec_property.string column.
2. Add an overhead value of half a kilobyte per property for the other columns.
3. Determine the average size of the tracked objects.

For larger properties:

1. Search for the length of the value in the ec_clob table linked to by the ec_property.clob column.
2. Add an overhead value of one kilobyte per property for the other columns.
3. Determine the average size of the tracked objects.

• Factor 3: How often new copies of the objects are generated

The following procedure is only for properties:

1. Use one of these methods:
   • Determine ratio of how long ago the ec_property.created and ec_property.modified datetimes are, which gives an estimate concentrating on only the most recent changes.
   
   and/or

   • Determine the value of the ec_property.version counter divided how long ago the ec_property.created datetime is, which gives a long-term average rate of changes to the property since it was created.

2. Determine the average update frequency.

For properties that are frequently updated always to be a numerical value, it is possible to suppress Change Tracking of numerical-value updates by using one of these commands:

ectool:ectool modifyProperty <projectName> -- path <propertyPath> -- counter true

or
ec-perl: $cmdr-> modifyProperty (<projectName>, {path => <propertyPath>, counter => true});

When the counter flag is set for a property, Change Tracking does not track changes to the property if the only change was a change in the property value from one numeric value to another. All other forms of changes to the properties that have this flag set are tracked normally.

CAUTION: Reverting an object that owns a counter property to a previous state will revert the value of the counter property to its value at the previous time that a change to this property was tracked—typically this is when its value is initialized. This may not be the desired behavior, so you may need to manually set a counter property if it is reverted.

Alternative Estimating Methods

Depending on your usage patterns, one of these methods may result in a more accurate estimate than the previous method of determining the average factor values and multiplying them

Split the set of properties of change tracked objects into different populations

For each object, perform the previous method of determining the average factor values and multiplying them per tracked object.

Add the values for each tracked objects together.

Example:

- If you have one set of properties (such as those in one project, or belonging to one user) containing very large properties that are never changed, and another set containing very small properties that change often, multiplying the average property size by the average rate of property update would result in an overestimate of the total database consumption.
- If you put the properties in separate projects and calculate the database growth rate for each project, the database growth rates are more accurate.

Other columns that may be of interest include ec_property.owner (who created the property) and ec_property.last_modified_by usernames (who last modified the property).

Best Practices for Change Tracking

Change Tracking allows you to troubleshoot and debug issues, find information about specific objects, and revert an object to a specific state. However, Change Tracking affects the system performance. In some situations, the performance consequences of Change Tracking can be significant.

This section describes how to improve the system performance.

When to Enable or Disable Change Tracking for a Project

In some situations, enabling or disabling Change Tracking on a project causes significant performance consequences. The ElectricFlow system performance becomes slower as the server writes to the database the records for all the tracked objects in the project.

To determine when to use Change Tracking on a project, do the following:
1. Export the project using this command:

   `ectool export <project_name> --relocateable 0 --withAcls 1 --withNotifiers 1`

2. Evaluate the results.
   a. The size of the results file gives you a good estimate of how big the project is:
      - If the file size is in the hundreds of MB, the project is large.
      - If the file size is in the tens of MB or less, the project is small.
   b. (Optional) Write a script to parse the results and determine these statistics:
      - Total number of objects that can be tracked in the project.
      Use this value to determine the project size (for example, small, medium, or large), which is used to determine how long it would take to enable, disable, copy, import, or delete a project on which Change Tracking is enabled.
      - The total size (in XML format) of the entities in the project that can be tracked by Change Tracking.
      This gives a rough estimate of how much the database usage will immediately grow when Change Tracking is enabled for the project.
      - The rate at which tracked entities are modified in the project.
      Look at the most recent last-modification dates of entities owned by the project for a pattern where certain entities are modified on a regular basis.
      If there are objects that appear to be being modified frequently, the script can also parse out their path and the user name they were last modified by.

Next Steps:

- If the project is small, and its contents are not frequently changed by an automated process, you can safely enable Change Tracking for it.
- If the project is large, and if you frequently export, import, or copy it, and if the performance of these operations is very important to you, enabling Change Tracking for it may be problematic (see Estimating Process on page 440 for a possible workaround).
- If significant parts of the contents of the project are frequently updated by an automated process, enabling Change Tracking for the project will consume significantly more database space, and tracking the changes performed by the automated process is unlikely to be of much value, so enabling Change Tracking for the project is inadvisable.

**Splitting Tracked Objects Into Separate Projects**

If you export the project, evaluate the results, and determine that enabling or disabling Change Tracking on the project will significantly affect the performance of the ElectricFlow system, one way to improve the system performance is to split the project into separate projects based on how the objects are modified.

For example, if you parse the results and find that there are two types of entities in your current project:
Objects that are manually modified over time by real users.

These objects represent real changes in project and are modified as procedures, jobs, and applications are run.

Objects that are frequently updated at regular intervals by an automated process using metaprogramming.

These objects are automatically generated and updated on a regular basis. The project file should have a large list of modifications to tracked objects.

Then you should split the objects into separate projects.

- Put the objects that are manually modified by real users in one project and enable Change Tracking on this project.
- Put the objects that are updated by an automated process in a different project and disable Change Tracking on it.

**Configuring Change Tracking**

Change Tracking must be enabled when ElectricFlow starts for your system to track changes and record the Change History.

By default, Change Tracking is enabled for projects created in ElectricFlow 5.3 or later. It is disabled for projects created in ElectricFlow versions before ElectricFlow 5.3, but can be enabled manually.

**Enabling Change Tracking Globally**

When installing ElectricFlow:

1. Add this line to the database.properties file:
   
   `COMMANDER_DB_AUDITING_ENABLED=true`

2. Restart the ElectricFlow server.

**Enabling Change Tracking on a Per-Project Basis**

IMPORTANT: Unless the allowEnablingDisablingChangeTrackingProjectLevel setting has been altered, only admin users are allowed to perform this task. The default setting is adminOnly. If the setting is changed to anyoneWithAccess, any user with access to the project can enable or disable Change Tracking for the project.

You can enable Change Tracking one of the following ways:

* **In the ElectricFlow Platform UI**

  Change Tracking is enabled when the **Enable Change Tracking** check box is selected.
To disable Change Tracking, click the **Enable Change Tracking** check box to clear it, and click **OK**.

**Using ectool**

- Enter `ectool modifyProject <projectName> --tracked true` to **enable** Change Tracking.
- Enter `ectool modifyProject <projectName> --tracked false` to **disable** Change Tracking.

**Using ec-perl:**

- Enter `$cmdr->modifyProject(<projectName>, {tracked => true})` to **enable** Change Tracking.
- Enter `$cmdr->modifyProject(<projectName>, {tracked => false})` to **disable** Change Tracking.

For properties that are frequently updated always to be a numerical value, it is possible to suppress Change Tracking of numerical-value updates by using one of these commands:

**ectool:**

```
ectool modifyProperty <projectName> -- path <propertyPath> -- counter true
```

or

**ec-perl:**

```
$cmdr-> modifyProperty (<projectName>, {path => <propertyPath>, counter => true});
```

When the **counter** flag is set for a property, Change Tracking does not track changes to the property if the only change was a change in the property value from one numeric value to another. All other forms of changes to the properties that have this flag set are tracked normally.

**CAUTION:** Reverting an object that owns a counter property to a previous state will revert the value of the counter property to its value at the previous time that a change to this property was tracked—typically this is
when its value is initialized. This may not be the desired behavior, so you may need to manually set a counter property if it is reverted.

**Upgrading to ElectricFlow 6.x**

Change Tracking is enabled when you upgrade to ElectricFlow 6.x. This can significantly increase the time it takes to complete the upgrade.

If you want to upgrade with Change Tracking disabled, add this line to the `database.properties` file before starting the upgrade:

```
COMMANDER_DB_AUDITING_ENABLED=false
```

**Customizing the Change History Page**

The performance of the Change Tracking feature is affected by number of records in the Change History as well as the number of entries being tracked. For example, a page showing 5000 entries may be slow to load and update and does not provide much useful information.

This ElectricFlow server uses the lowest of the following limits to determine the maximum amount of records to display in the Change History page:

- Maximum amount of records on the Change History page

  To change the maximum number of records in the Change History page:

  1. Set the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file to a new value.

     The default value is 1000.

  2. Restart the ElectricFlow server.

- Maximum number of records retrieved

  Set the `TrackingMaxRecords` server setting to a new value not exceeding the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file.

  To set `TrackingMaxRecords`, do one of the following:

  Change the value in the UI. See the Server Settings page in the automation platform UI.

  Use `ectool` to change the value. For example, enter the following command to limit the number of records retrieved to 100:

  ```
  ectool setProperty /server/settings/changeTrackingMaxRecords --value 100
  ```

**Searching the Change History**

Follow these steps to start a search in the Change History.

You can start a Change History search from most pages in the ElectricFlow UI.

1. Click the **Search** button or click **Change History**.

   **Example:**
The Change History - Search dialog box opens.

**Example:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Change History - Search</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td><strong>Time range</strong> field.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Click the down arrow to open the drop-down list of start times.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The end time is the current time.</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td><strong>Objects</strong> field.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Click the down arrow to open the drop-down list of objects to include in the search. You can select <strong>All</strong> or specific objects.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>By default, seven of the most commonly tracked objects are selected.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Search criteria.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After you type, the system starts searching for objects based on the time range and objects that you selected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The search results are in the Change History.</td>
</tr>
</tbody>
</table>
2. To select a time range for the search:
   a. Click the down arrow in the Time range field to open the drop-down list.
   b. Select a time range.
   c. If you want to use a time increment longer than three days, do the following:
      a. Click Select Date.
      The Date Picker opens.
      
      **Example:**

      ![Date Picker Example](image)

      b. Select a date.
      The Date Picker closes and the date that you selected appears in the Time Increment field.
      
      **Example:**

      ![Date Picker Example](image)

3. To select an objects for the search:
   a. Click the down arrow in the Object field to open the drop-down list.
   b. Select the objects for the search.

4. Enter the search criteria.
   As you type, the system starts to search for objects that match your search criteria.
   A list of objects matching your search criteria appears in the results section.
5. Select an object in the list.

Example:

![Image of a table showing change history for an object]

The change history for the object that you selected appears.

Example:

![Image of a change history table]

Viewing the Change History

You can open and view the change history from the following objects in ElectricFlow:

- Applications List
- Applications Visual Editor
- Application Process Designer
- Artifacts
- Component
- Component Process Designer
- Environments Designer
- Environment Tier
- Jobs
- Process Step (Application or Component)
- Projects
- Resources
- Workflows

**Viewing the Change History from the Applications List**

You may want to view the Change History for these objects in an application:

- An application process that did not run successfully

![Application Process Diagram]

- Component or component process in an application process that did not run successfully

![Component Process Diagram]

- Resource that was not deployed successfully

Starting from the Home page:

1. Go to the Applications List.
2. Choose an application.
3. Click the View button.

**Example:**

![Example Diagram]

A list of the application processes for the application appear.
4. To view the Change History of an application process:
   a. Choose a process.
   b. Click the **Change History** button.

   **Example:**

   ![Change History button]

   The Change History for the application process opens.

5. To view the change history for an object in the application process,
   a. Click the **View Details** button.

   A list of objects in the application process (components and component processes) appears, and the breadcrumb changes to *Applications/View Run*.

   b. Choose an object.
   c. Click the **Change History** button to see the change history for the object.

**Viewing the Change History From an Application or Environment**

You may want to view the Change History for these objects:

- Applications
- Application processes
- Component processes
- Environment
- Resources

**Application Visual Editor**

1. Go to the Applications List.
2. Select an application.

   The Applications Visual Editor opens.
3. Click the **Menu** button.

   **Example:**

   ![Menu button]
4. Select **Track Changes**.

The Change History for the object opens.

The default time increment is **Past 60 Minutes**.

**Example:**

![Change History](image)

1. Go to the Applications List.
2. Select an application.
   
   The Applications Visual Editor opens.
3. Select an application process.
   
   The Application Process Visual Editor opens.
4. To view the Change History for the application process:
   a. Click the Menu button.

   **Example:**

   ![Menu button]

   b. Select **Track Changes**.

   The Change History for the application process opens.

   The default time increment is **Past 60 Minutes**.

   **Example:**
5. To view the Change History for the application process step:
   a. Choose a step.
   b. Click the Edit button in the step to open the context menu.

   **Example:**

   ![Example Image]

   c. Select **Track Changes**.

   The Change History for the application process step opens.

   The default time increment is **Past 60 Minutes**.

   **Example:**

   ![Change History Image]

**Component Process Visual Editor**

1. Go to the Applications List.
2. Select an application.
   The Applications Visual Editor opens.
3. Choose a component.
4. Select a component process for the component.
   The Component Process Visual Editor opens.
5. To view the Change History for the component process:
   
   a. Click the **Menu** button.
      
      **Example:**

      [Menu button image]

   b. Select **Track Changes**.

      The Change History for the component process opens.

      The default time increment is **Past 60 Minutes**.

      **Example:**

      [Change History screenshot]

      | What                  | What   | Name         | By... | Change  | Path  |
      |-----------------------|--------|--------------|-------|---------|-------|
      | Dec 16, 2014 12:32 PM | process | setproperties | admin | created |       |
      | Dec 16, 2014 12:15 PM | property | repositoryname | admin | created |       |
      | Dec 16, 2014 12:32 PM | property | artifactstore | admin | created |       |
      | Dec 16, 2014 12:32 PM | property | property      | admin | created |       |
      | Dec 16, 2014 12:32 PM | property | property      | admin | created |       |
      | Dec 16, 2014 12:32 PM | property | property      | admin | created |       |
6. To view the Change History for the component process step:
   a. Choose a step.
   b. Click the Edit button in the step to open the context menu.

   **Example:**

   ![Example Image]

   c. Select **Track Changes**.

   The Change History for the component process step opens.

   **Example:**

   ![Change History Example]

**Environments Visual Editor**

1. Go to the Environments List.
2. Select an environment.
   The Environments Visual Editor opens.
3. Click the **Menu** button.

   **Example:**

   ![Menu Example]
4. Select **Track Changes**.

   The Change History for the object opens.

   **Example:**

   ![Change History](image)

   **Environment Tier**

   1. Go to the Environments Designer.
   2. Choose an environment tier.
   3. Click the **Menu** button.

   **Example:**

   ![Menu Button](image)

   4. Select **Track Changes**.

   The Change History for the object opens.

   The default time increment is **Past 60 Minutes**.

   **Example:**

   ![Change History for Database](image)

   **Viewing the Change History for Artifacts, Jobs, Projects, and Workflows**

   When troubleshooting why a job failed, you can view the Change History for artifacts, jobs, projects, and workflows in the automation platform.
Artifacts

Starting from the Home page:

1. Go to the Artifacts tab.
2. Choose an artifact.
3. Click the Track Changes button.

**Example:**

The Change History for the selected artifact opens.

The default time increment is Past 60 Minutes.

**Example:**
Jobs

Starting from the Home page:

1. To go to the Job Details page, do one of the following:
   - Use the Jobs tab.
   - Use the Jobs Quick View list.

2. If you use the Jobs tab, follow these steps:
   a. Click the Jobs tab.
      The Jobs page opens.

      **Example:**

      ![Jobs Table]

   b. Click a job name to select a job.
      The Job Details page opens.

      **Example:**

      ![Job Details]

3. If you use the Jobs Quick View list, click a job name to select a job.
   The Job Details page opens.

4. Choose a job or job step.

5. Click **Track Changes** for the job or job step.
   The Change History for the job or job step opens.
   The default time increment is **Past 60 Minutes**.
Projects
Starting from the Home page:
1. Go to the Projects tab.
2. Choose a project.
3. Click the Track Changes button.
   The Change History for the project opens.
   **Example:**

![Example screenshot of a Projects tab with a list of projects and their details.]

Workflows
Starting from the Home page:
1. Go to the Workflows tab.
2. Choose a workflow.
3. Click Track Changes.
   The Change History for the workflow opens.

Change History Page
**How to get here:** Click the Search button to open the "Change History - Search" form, and enter the search criteria.

The search results appear in the Change History page and include the following information:
How to get here:

From the Home page in the automation platform, use one of the following methods to open and view the change history for jobs, projects, workflows, and artifacts:

- Select a job that failed > Click the job name to go to the Job Details page > Click Track Changes in the upper right of the page.
- Click the Jobs tab > Select a job that failed to the Job Details page > Click Track Changes in the upper right of the page.

The search results appear in the Change History page for the job and include the following information:
### 1. Time range.

The end time is the current time. You can change the end time after you run the search and get the search results.

### 2. Name of the tracked object.

### 3. Path to the tracked object.

Example:

![Change History for JPetStore](image)

### 4. After making a change, you can revert or export the object. Click this to go to the undo or redo the last action on the page.

### 5. Click this to run a new change history search.
Time line.
The start time is based on the time range that you selected.
The end time is the current time.
You can manually change the start and end times after you run the search and get the search results.

Filters for the change history.
You can view all changes or view only selected changes.
The objects in the list are the objects in the change history search results.

Change history for the selected object.
- When—the date and time that the object changed.
- What—the type of object.
- Name—the name of the object.
- By—The "user" that changed the object, which can be a project or a user.
- Change—the type of change.
- Path—Click the View Path button to see the path to the object.

Click the View button to see more details about the object.

Time Line
The time line for the change history is at the top of the Change History page.
The time line is automatically separated into divisions based on the number of minutes, hours, or days between the end time and the start time.

Default Settings
These are the default settings for the time line:
- The start time is the selected time range in the upper left of the page.
- The end time is Most Recent when the latest change to the object occurred.
The default range is from the **Last Successful Run** to the **Most Recent**.

The entire time line is displayed, and all the changes are in the list below the time line.

The time line on this page has the default range.

**Note:** The **Last Successful Run** range is available only after the first time that you run an application.

When the range is changed to **Past 60 Minutes**, the time line changes:

- The start time is 60 minutes from **Now**.
- The end time is when the **Most Recent** change occurred (**Now**).
- The time line has four divisions.

If the increment is **Past 7 Days**, the time line has seven one-day divisions.

You can view the change history in different ways depending on the time range for the time line.

**Selecting the Time Range**

You can view the change history in different ways depending on the time range for the time line.

Click the down arrow next to the time range to select a different range for the change history.
You can see the change history since the last successful run. Notice that the information on the left side shows a summary of the changes, which is a subset of the results that you got.

Moving the Start and End Times

You can manually move the start and end times on the time line.

When you move the start time to 18:00 and the end time to 6:00, notice that the list of objects in the change history changes.
When you move the start time to 18:00 and the end time to 6:00, notice that the list of objects in the change history changes.

Specifying the Time Range

Example:

To manually set the times and dates for the start and end times:

1. Select Between.

   A drop down dialog box opens.

   Example:
2. Select the time and date for the start of the time line.

The default settings are 3:30 pm and eight days before the current date.

**Example:**
3. Click **OK**.

   A drop down dialog box opens at the other end of the time line.

   **Example:**

   ![Example dialog box](image)

4. Select the time and date for the end of the time line.

   The defaults are 3:30 pm and the current date.

   **Example:**

   ![Example dialog box](image)
5. Click **OK**.

The timeline changes to show only the changes from the start and end times and dates that you selected.

**Example:**

![Change History for JPetStore](image)

**Number of Changes**

The time range at the top of the change history shows the number of changes.

- There have been 233 changes in the last 24 hours.
- There have been 213 changes in the last 12 hours.
- There have been 20 changes in the last 6 hours.

![Change History for JPetStore](image)

When you change the time range, the number of changes also changes. In the last 60 minutes, there have been only two changes.

![Change History for JPetStore](image)
Paths to Objects

Click the View Path button next to the "Change History for JPetStore" title to see the path to the application.

Click the View Path button to see the change in the path to the object before and after the change.

Detailed Object Changes

Click the View button to see the change in the property called jobcounter.

Filters

You can use filters to view changes to specific objects, the types of changes, and the users how made those changes.

Instead of selecting View All Changes, you can select specific objects, such as only properties, processes, property sheets, process steps, and process dependencies that have been modified by the Project:Default and Admin users.
When the list of filter criteria is long, not all of the criteria may appear in the filter list. To see all of the criteria, use the up or down arrows to see all the options.

This list does not show all of the users. Use the up and down arrows to see all four of the users.

Click the down arrow to see the other users.
Modifying What You See the Change History

You can modify the information that appears in the Change History with these settings:

- **Time line**—Go to Change History Time Line on page 866.
- **Filters**—Go to Change History Filters on page 872.

### Change History Time Line

The time line is at the top of the Change History page.

This example shows the Change History for a property called `propertyviewer-1.0.1`.

1. **Time increment.**
   
   The default is Last Changes.
   
   Click the down arrow to select another time increment.
The system automatically calculates the minutes, hours, and days since the last successful run. In the example, the last successful run occurred 24 hours ago. The time line is divided into four 6 hour subdivisions.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>The number of changes that occurred between 6 hours ago and now is 4. When you click the change number, the Change History is updated and shows only those changes.</td>
</tr>
<tr>
<td>3</td>
<td>Total number of changes in the selected time increment.</td>
</tr>
<tr>
<td>4</td>
<td>Drag the start and end time markers to view specific changes.</td>
</tr>
</tbody>
</table>

**Default Settings**

The default time increment is **Last Change**.

The entire time line is displayed, and all the changes are in the list below the time line.

**Number of Changes**

The time line shows the number of changes throughout the time increment. In the following example:

- There have been 233 changes in the last 24 hours.
- There have been 213 changes in the last 12 hours.
- There have been 20 changes in the last 6 hours.

When you change the time increment, there have been two changes in the previous 60 minutes.
Time Increment

The system automatically determines how the time line is divided for the selected time increment. When the range is changed to **Past 60 Minutes**, the time line changes:

- The start time is 60 minutes from **Now**.
- The end time is when the **Most Recent** change occurred (**Now**).
- The time line has four divisions.

If the increment is **Past 7 Days**, the time line has seven one-day divisions.

**Moving the Start and End Times Manually**

You can manually move the start and end times on the time line.

When you move the start time to 18:00 and the end time to 6:00, the list of objects in the change history changes.
Setting Custom Time Increments

Example:

1. Select **Between**.

A drop down dialog box opens.

   **Example:**
2. Select the time and date for the start of the time line.

The default settings are **3:30 PM** and eight days before the current date.

**Example:**
3. Click **OK**.

A drop down dialog box opens at the other end of the time line.

**Example:**

![Example Image 1]

4. Select the time and date for the end of the time line.

The defaults are **3:30 PM** and the current date.

**Example:**

![Example Image 2]
5. Click OK.

The time line changes to show only the changes from the start and end times and dates that you selected.

**Example:**

![Change History for JPetStore](image)

**Change History Filters**

The Change History has records only for an object and its tracked entities, not all entities belonging to the object. You can use filters to view changes to specific objects, the types of changes, and the users how made those changes if they are tracked.

In this example, instead of selecting **View All Changes**, you can select specific objects, such as only properties, processes, property sheets, process steps, and process dependencies that have been modified by the Project:Default and Admin users.
When the list of filter criteria is long, not all of the criteria may appear in the filter list. To see all of the criteria, use the up or down arrows to see all the options.

This list does not show all of the users. Use the up and down arrows to see all four of the users.

Click the down arrow to see the other users.
Reverting Changes to a Tracked Object and Its Tracked Contents

The Change History displays a list of changes in reverse chronological order (from latest to oldest) for tracked entities in objects such as applications, procedures, workflows, workspaces, resources, and project-owned components such as library components. Each row in the Change History or a tracked object is a record of a change made either to the tracked object or to a tracked object owned by the object (directly or indirectly). For example, the Change History of a project would show both changes to the project itself and changes to any tracked object in the project, such as its procedures, the steps for each procedure, or properties belonging to the procedure steps.

Some types of objects (mostly run-time objects such as jobs, because tracking those would be resource-intensive and seldom useful) are not tracked by the Change Tracking feature. For a few types of tracked objects, some of their attributes are not tracked (for example, agents are tracked, but certain attributes of agents that vary frequently in real-time, such as their current status, are not). Changes to untracked objects, or to untracked attributes of tracked objects, are not shown in the Change History and cannot be reverted. In general, objects that are normally created or changed manually are tracked, and objects that are normally created or modified during automated processing are not. However, depending on your specific usage patterns, this behavior may not be recorded in the Change History, such as when you frequently run jobs that use ectool or API commands to automate the creation of new procedures or steps.

**Note:** You must have the Read, Modify, and Execute permissions to revert changes in the UI or to access the revert API function.

Follow these steps to select a tracked object and its tracked entities that you want to revert:

1. Go to the Change History for the object that you want to revert using one of these methods:

   - Click the Track Changes button ( ) for the object.

   - From the ElectricFlow Home page, click the Search button ( ) to go to the "Change History - Search" page and search for the object.

2. Locate the time period in which you are interested.

   A list of changes for the tracked object appears.
3. If you decide to revert the changes for an object owned by the tracked object or for an object that owns the tracked object, use one of the methods to view the list of changes for this object:

- Close the current Change History and navigate to the Change History for the object.

- Click the **View Path** button ( ) on the top of the current Change History, copy the path, go to the "Change History - Search" page, and search for a suitable addition to or truncation of that path.

4. Select a row (record) in the Change History corresponding to the earliest of the changes that you want to undo.

You will be reverting the object and all its tracked contents to their state directly before the selected change was made.

a. If the **Revert** button ( ) becomes enabled, ElectricFlow is capable of reverting the selected changes to the object.

   Go to Step 5.

b. If the **Revert** button is still disabled, ElectricFlow is not currently capable of reverting changes to the selected object. This could be due to tracking of this object being disabled and re-enabled, or the Change History feature being disabled and re-enabled. Also, not all types of tracked objects can currently be reverted (and due to mutual consistency requirements in the database format, certain types of objects cannot be reverted).

   If you are unable to revert the selected object, you may still be able to achieve what you need to do one of these ways:

   - Revert the parent object that owns the object you want to revert.

   - Separately revert the individual objects owned by the selected object or even nested partial-reversions-of-reversions, possibly combined with manually reversion (undoing) certain changes.

   Go to Step 3 to search for an owned or owning tracked object.
5. Before clicking the **Revert** button, make certain that you know all the changes that will be reverted, and have confirmed that this is what you want to do. (While it is possible to re-revert the changes caused by a mistaken reversion operation, doing so leaves a lot of activity in the Change History.)

**IMPORTANT:** All of the changes for tracked entities will be reverted, even the ones that you do not see in the Change History because of the timeline and filter settings.

a. You may need to modify the timeline and filter settings to display all records in the Change History before you verify that all of the records are changes you want to revert.

b. Make sure that the end of the timeline is set to **Now** and that the filters are set to **View All Changes**.

c. Look through the entire list of changes from the most recent to the one you have selected, expanding them to see the details if needed, and confirm that you really want to revert all of them.

**IMPORTANT: Tip on how to further refine what changes will be reverted**

If you want to revert some of the changes shown but not others, you may be able to achieve what you want to do with some combination of the following methods:
- Reverting just certain objects owned by the object that you want to revert.
- Using nested or overlapping sets of reverts of owned objects.
- Undoing individual changes manually using the ElectricFlow UI.
- Using nested partial-reverts-of-reverts.

If you fully understand the XML format used for ElectricFlow exports, you can use the export API call to export the past and current states of a part of the object hierarchy, diff and merge them using a suitable tool for diffing and merging XML files, and then re-import the results. Caution is strongly suggested if you are using this approach to revert objects for which ElectricFlow does not currently support reversion, because:
- There are some places in the ElectricFlow XML data hierarchy where peer objects refer to each other in ways that need to be kept consistent (such as by index of current position in a list).
- For some types of objects, re-importing them can change their IDs and break references-by-id.

6. Click the **Revert** button. Depending on the size of the object and every tracked object it owns, this operation could take some time (as long as exporting a past state of them and then re-importing it).

If this operation is successful, the object and its tracked entities are reverted back to the state at the date and time of the record selected in Step 3. A message appears that the Revert operation was successful.

If this operation is not successful, the object and its tracked entities are not reverted, and a message appears about the failed operation.
Notifications

ElectricFlow supports email notifications, also referred to as email notifiers, for these ElectricFlow objects:

- Application processes
- Application process steps (type: process)
- Jobs and job steps
- Workflow states
- Procedure results
- Procedure step results
- State definition results

Application Processes and Process Steps

ElectricFlow sends email notifications to users and groups at the application-process and application-process-step (type: process) levels. The notifications are triggered based on how the job finishes (the onCompletion event) and on the job outcome (success or failure).

When configuring email notifications:

- You specify users, groups, or email addresses as recipients of the notifications.
- You can also target notifications at specific environments.
- You can enable or disable notifications at the application-process and application-process-step levels.

Note: The user and group settings are defined and managed at the platform level. See the "Users and Groups" section for more information.

Go to Configuring Email Notifications in Application Processes about how to set up email notifications. When notifications are enabled and a default template is used, you do not have to perform additional steps to set up an email notification.

ElectricFlow provides default templates for success and failure outcomes. All the templates have a name, subject, body, and type content that are stored as properties in ElectricFlow.

You can edit existing templates or create new email templates in ElectricFlow. Go to Selecting and Editing Email Messages for Application Processes about how to edit HTML default notifications and to create new email templates.

ElectricFlow also sends notifications for assignees and approvers of manual process steps. Go to Manual Tasks and Steps on page 116 for more information.

Jobs, Workflow States, and Procedures

For jobs and job steps, two types of email notifiers:

- On Start Notifier – Sends an email when a job or job step starts.
- On Completion Notifier – Sends an email when a job or job step completes.
For workflow states, three types of email notifiers:

- On Enter Notifier – Sends an email when the state becomes the workflow’s active state.
- On Start Notifier – Sends an email after the state’s subjobj or subworkflow starts. If no subjobj or subworkflow is defined for that state, the notifiers will not be sent.
- On Completion Notifier – Sends an email after the state’s subjobj or subworkflow completes. If no subjobj or subworkflow is defined for that state, the notifiers will not be sent.

Using email notifiers:

- Attaching an email notifier to a procedure results in a corresponding email notifier associated with the job that is created when the procedure is executed.
- Attaching an email notifier to a procedure step results in a corresponding email notifier associated with the job step created when the procedure referencing the procedure step is executed.
- Attaching an email notifier to a state definition results in a corresponding email notifier associated with the state that is created when the workflow is executed.

You must create an email configuration before you create and configure email notifiers at the platform level. Then you can send them to individuals and groups.

To create and edit email configurations, go to Email Configurations on page 622, and Email Configuration - create new or edit existing email configuration on page 622.

To create or edit email notifiers, go to Email Notifier - create new or edit existing email notifier on page 623. See the topics starting with "Email Notifier Template" for examples of HTML templates that you can use as-is or copy and rename to create a new template.

**Pipelines**

Notifications for pipelines are automatically sent in the following scenarios. You do not have to perform any additional steps to send email notifications.

- For a manual task in a stage, the appropriate notifications are sent to the user or group who performs that task and to the user or group who responds when the task is completed.
- When entry and exit gates have specified approvers, ElectricFlow sends approval notifications to them.
  - You can set the approvals such that approval from only one of the approvers is sufficient for the pipeline to progress. In this case, you can have one approval rule and have all the approvers assigned to that rule.
  - Instead, if you want all the key individuals to approve sequentially, you can specify multiple approval rules, each for a specific user.
  - In addition to specific users, approval rules support groups. Approval or rejection from any user in the group will allow the pipeline to progress or stop.

After approvers log into ElectricFlow, they can approve or reject the approval rules. The pipeline’s progress will continue if the approval rules are approved. The pipeline will end with the appropriate error if the rules are rejected.

Go to Pipeline Concepts on page 284 for more information about notifications in pipelines.
Configuring Email Notifications in Application Processes

Review these guidelines before configuring email notifications:

- You can configure notifications for application processes and application process steps (type: process).
  
  When you open the Applications notifications dialog box and expand the application process details, only the application process steps (type: process) appear in the list.
- New email notifications are disabled in the application, its application processes, and the process steps before you configure them.

- You configure notifications in the "Application notifications / edit" dialog box.

  IMPORTANT: The first time that you set notifications in this dialog box, the Notifications toggle changes to On. After you enter notification settings and click OK, email notifications are enabled at that level.

By default, the application expects that the user creates an email configuration called "default." The email configuration defaults to the server property /server/ec_deploy/ec_defaultEmailConfiguration, which is set to "default."

If you want to use a different name for the email configuration, change the value of /server/ec_deploy/ec_defaultEmailConfiguration to the new email configuration name.

Starting from the Home page, to set email notifications:

1. Go to the Applications List.
2. Select an application.
   
   The Applications Visual Editor opens.
3. Click the Menu button.

   Example:

   ![Menu button](image)

   The Applications menu opens.
4. Click **Notifications** to add a new application.

**Example:**

![Notifications button]

The **Application notifications** dialog box opens.

**Example:**

![Application notifications dialog box]

<table>
<thead>
<tr>
<th>For MyNewApp</th>
<th>Status</th>
<th>Recipient</th>
</tr>
</thead>
<tbody>
<tr>
<td>MyNewApp</td>
<td>Off</td>
<td>Some</td>
</tr>
<tr>
<td>New installation</td>
<td>Off</td>
<td>Some</td>
</tr>
<tr>
<td>existing installation</td>
<td>Off</td>
<td>None</td>
</tr>
</tbody>
</table>
5. Configure email notifications as follows:

You can configure one or more notifications in an application process or an application process step (type: process).

**Configuring recipients**

In the **Who** field, add users, groups, and/or email addresses.

When you start typing a user name, group name, or email address, a list of names or email addresses appear that match what you are typing.

**Note:** The user and group settings are defined and managed at the platform level. See the "Users and Groups" section for more information.

**Example:**

![Application notifications / edit](image)

If one of the suggestions matches the name or email address, select it or continue typing. You can add more than one name or email address.

**Example:**
**Configuring the event that triggers the notification**

In the **When** field, select the event that triggers a notification to be sent to the recipients in the **Who** field. The default is **Both Failed and Successful**. Clicking in the **When** field shows a list of event triggers.

**Example:**

**Configuring the environments where the notification applies**

In the **Where** field, you select the environments to which the notifications apply. Clicking in the **Where** field shows the list of available environments to which the application is mapped in the tier map.

**Example:**
6. Select and edit the email notification message.
7. Add another notification for an application process or application process step.

Click the Add Notifications button to add a new notification.

Example:

After you have added your email notifications, click OK to save the settings and return to the Application notifications / edit dialog box.

Example:
8. (Optional) Enable email notifications for the application processes or application process steps that are not already enabled.

To enable email notifications at the application level:

- Click the Notifications toggle and change it to On.

The status of the application changes to On.

**Example:**

![Application notifications dialog box]

- Click the **Edit** button to open the **Application notifications / edit** dialog box.

The **Application notifications / edit** dialog box appears. The Notification toggle changes to On.

**Example:**

![Application notifications / edit dialog box]

To enable notifications at the application process and process step levels, go to the **Application notifications / edit** dialog box for the specific process or process step.

The dialog box opens, and the Notifications toggle is now On.

**Example:**
When you enter notification settings in the dialog box and click OK, the settings are saved. The Application notifications dialog box appears and now shows that the application process status is On.

**Example:**

**Selecting and Editing Email Messages for Application Processes**

You can edit the email messages sent as notifications for application processes and application process steps (type: process).

Starting in the Application notifications / edit dialog box:

1. Click the Template button.

   A drop-down box opens.
Example:

2. Click the down arrow to open the list of email message templates that can be applied to the application.
3. Select a template.

**Example:**

If the template is the current template applied to notification, the name of the template appears in the dialog box.

**Example:**

If the template is not the current template, the **Apply** and **Edit** buttons appear in the dialog box.

**Example:**
4. If you want to use the template that you selected instead of the current one and do not want to change selected one, skip the remaining steps in this task.

5. If you want to apply a different template or edit the template that you selected, do the remaining steps in this task.
   - If you click **Apply** to use the template as-is, skip the remaining steps.
   - If you click **Edit** to modify the template, go to the next step.

The Email Message Preview dialog box appears.

**Example:**
6. To edit the template:
   a. Change the name of the template in the **Name** field.
   b. Change the subject of the email in the **Email subject line**.
   c. To modify the body of the email message, click **Edit HTML** and edit the HTML code.

   **Example:**

   ![Email Message Preview](image)

7. Click **Preview**.

8. To save your changes:
   - Click **Save Changes** to save the changes in the existing template
   - Click **Save as New** to save the template as a new template.

The **Application notifications / edit** dialog box re-appears.
9. Click the down arrow to open the list of email message templates that can be applied to the application. The new email message template is in the list.

**Example:**

![Image of application notifications/edit interface]

10. Click **OK** to save the settings.
Automation Platform

ElectricFlow is built on a powerful proven automation platform that natively integrates domain-specific capabilities for Enterprise-level continuous delivery. The automation platform gives distributed DevOps teams shared control and visibility into infrastructure, tool chains, and processes. It accelerates and automates the software delivery process and enables agility, availability, predictability, and security across many build-test, deployment, and release pipelines.

This section describes how to create, configure, and manage objects in the automation platform that make the automation of build-test processes, application deployments, and pipelines possible in ElectricFlow. Examples include:

- For build-test automation: Configuring resources and creating procedures to build and test your software.
- For deployment automation: Creating components based on artifacts, defining process steps with plugins, and assigning resources to environments.
- For pipelines: Defining tasks based on procedures, workflows, or plugins.
- For release management: Defining releases based on pipelines.

You use only the automation platform UI to configure ElectricFlow to perform these tasks. The objects and operations for build-test automation are the same as those for the automation platform.

You can also use Perl API commands through ec-perl and ectool, RESTful API commands, and DSL scripts. For information about using API commands and DSL scripts, see the ElectricFlow API Guide.

Build-Test Automation

Before you use ElectricFlow for build-test automation, deployment automation, pipelines, or release management, you must create, configure, and manage these objects in the automation platform:

For build-test automation, you must create, configure, and manage these objects in the automation platform:

- Projects

  A project is an object used in ElectricFlow to organize information. A project is a container object for procedures, steps, schedules, workflows, and properties. If you use ElectricFlow for different purposes, you can use a separate project for each purpose so different projects do not interfere with each other. When you work in one project, you do not normally see information in other projects. At the same time, a project can use information defined in other projects, which allows you to create shared library projects.

- Resources

  A resource is defined as an agent machine where steps can execute. A resource has a logical name and a host name. In some situations, it is convenient to have multiple logical resources associated with the same host. A resource can also be associated with one or more pools. Each resource has a step limit that determines the maximum number of steps that can execute simultaneously on the resource. Resources can be grouped into resource pools. Multiple resources can be defined on the same machine.
• Procedures

Procedures and steps define tasks that you want ElectricFlow to execute. A procedure consists of one or more steps. A step includes a command or script executed on a single resource and is the smallest unit of work that ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a resource pool of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit, and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

You can define parameters for procedures. Parameter values are assigned when procedures are scheduled. Parameters can be required, optional, or have default values. Parameters are used for a variety of purposes such as specifying the branch to build or the set of platforms on which to run tests. Parameter values can be used in step commands and many other places.

Procedures can be nested. A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure, also referred to as a subprocedure.

• Schedules

A schedule is used to execute procedures and determine when specific procedures run. A schedule can trigger at defined times, for example, every 2 hours from 10:00 pm to 6:00 am on Mondays, Wednesdays, and Fridays, or when modifications are checked into a particular branch of your source code control system. It is also possible to create a schedule that runs immediately and disappears after the job runs. When you create a schedule, you must provide the parameters required by the procedure that you want to invoke.

The Continuous Integration Dashboard works with your source code management (SCM) system and provides visibility into running builds, the ability to add a project to continuous integration quickly, and easily accessible configuration pages to setup or modify a continuous integration schedule.

• Workflows

Managing a build-test-deploy product life cycle spanning multiple procedures and projects requires a significant amount of "meta-programming" and a heavy use of properties, and the workflow feature simplifies this process. Using the workflow object, you can create build-test-deploy life cycles by defining a set of states and transitions. Any ElectricFlow project can contain a workflow.

• When a procedure is executed or run, a job is created. A job is an object that is created each time a procedure begins to execute or run. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

After setting resources, procedures, and schedules, ElectricFlow automatically runs the procedures that you created using these objects and facilities:

• Zones and Gateways—A zone (or top-level network) that you create is a way to partition a collection of agents to secure them from use by other groups. A gateway is a secured connection between two zones when you want to share or transfer information between the zones. For example, you might want a developers zone and a test zone. The ElectricFlow server is a member of the default zone, created during ElectricFlow installation.
• **Continuous Integration Builds** and other schedules—Run jobs according to schedules that you define. Scheduled jobs can run at specific times or when source code changes are checked in to your source control system. ElectricFlow integrates with major source control systems. The Continuous Integration Dashboard allows you to add more projects easily and create build configurations quickly so you can visually see running builds, build status, and so on.

• **Artifact Management** functionality—Using artifacts can improve performance across builds, provide better reusability of components, and improve cross-team collaboration with greater tractability. For example, instead of developers repeatedly downloading third-party packages from external sources, these components can be published and versioned as an artifact. Developers then simply retrieves a specific artifact version from a local repository, guaranteeing a consistent package from build to build.

• **Preflight build functionality**—Used by developers to build and test code changes in isolation on their local machines before those changes are committed to a production build.

• **Plugin** capability—ElectricFlow is built with an extensible UI, enabling easy development of plugins that include integrations with other tools, custom dashboards, and unique user experiences based on roles. "Bundled" plugins, installed during ElectricFlow installation, provide easy integration with your SCM systems, defect tracking applications, and so on. For a complete list of bundled plugins, see **Plugins That are Bundled with ElectricFlow** on page 1138.

• **Workflow** functionality—Use a workflow to design and manage processes at a higher level than individual jobs. You can use workflows to combine procedures into processes to create build-test-deploy life cycles (for example). A workflow contains states and transitions that you define to provide complete control over your workflow process. The ElectricFlow Workflow feature allows you to define an unlimited range of large or small life cycle combinations to meet your needs.

• **Resource** management—If a resource is overcommitted, ElectricFlow delays some jobs until others are finished with the resource. You can define pools of equivalent resources, and ElectricFlow spreads usage across the pool.

• Recording a variety of information about each job, such as the running time and the success or failure of each step. A set of reports is available to provide even more information.

• **Powerful and flexible reporting** facilities—Various statistics such as number of compiles or test errors are collected after each step and recorded in the ElectricFlow database. A variety of reports can be generated from this information.

• Allowing you to observe jobs as they run and to cancel jobs.

• **Credentials**—Use a credential, consisting of an user name and password, can be attached directly to a step or schedule at the platform level. You can also attach impersonation credentials to procedure steps, procedures, and projects before executing the job step. It allows ElectricFlow to use a specific account with special privileges on a per-job or per-step basis.

• **Workspace** for each job, which is a disk area a job uses for storage—ElectricFlow also provides a facility for reclaiming space occupied by workspaces.

• **Powerful data model based on properties**—Properties are used to store job input data such as the source code branch to use for the build, to collect data during a job (such as number of errors or warnings), and to annotate the job after it completes (for example, a build has passed QA).

• **Access control** for users logged into the system—ElectricFlow uses this information to control their activities and integrates with Active Directory and LDAP repositories.

• **Search, sort, and filter** functions to minimize viewing or "wading" through information that is of no interest to you, allowing you to access to the information you need quickly.
• *Email notifications* to get important information or data to individuals or groups immediately and on a regular basis for a particular job or a specific job aspect.

• All ElectricFlow operations and features are available from a command-line application tool (Perl API), *ectool*, the RESTful API, DSL methods, and a user interface (UI).

For more information, go to *ElectricFlow Platform Objects and Functionality* on page 817.

## Getting Started

### Overview

*Automation Platform Terminology*

*Getting Started Scenarios Help Topic Series*

*Navigating the ElectricFlow User Interface*

### Overview

ElectricFlow is an application for automating and managing your development life cycle, the software build, test, and deployment process. It helps development teams make these tasks repeatable, visible, and efficient.

ElectricFlow creates an environment where IT and Development organizations can work together to connect physical and virtual environments, processes, and tools already in use to create a private development cloud, also known as a *smart development cloud*. ElectricFlow is a scalable solution, solving some of the biggest challenges of managing "back-end" software development tasks.

### Automation Platform Terminology

To get an overview of how the automation platform works and understand the ElectricFlow concepts and processes, review the following basic terms:

• Project
• Procedure
• Step
• Plugins
• Parameter
• Schedule
• Continuous Integration
• Resource
• Job
• Reports
• Workspace
• Zones
• Gateways

See the *glossary* for a list of ElectricFlow terminology.
Getting Started Scenarios Help Topic Series

The series of scenario Help topics are designed to help you learn to use the ElectricFlow automation platform quickly. Follow the step-by-step scenario format to learn the automation platform basics:

- Creating a simple procedure—Scenario 1
- Creating a procedure that uses a Source Code Management (SCM) system—Scenario 2
- Setting up email notifications, reporting, and scheduling—Scenario 3
- Creating a multi-agent build procedure—Scenario 4

Each scenario builds on what you learned in the previous scenario, and each scenario ends with one or more scenario extensions to introduce you to other related ElectricFlow functionality.

Navigating the Automation Platform User Interface

To quickly link to task pages, view running or completed jobs, configure resources and so on, the automation platform web interface displays tabs across the top of the page. These tabs remain available at the top of all ElectricFlow automation-platform web pages.

When you select some of the main tabs, subtabs are provided. For example (see the next screen example), when the Home tab is selected, notice that the Overview tab is in bold font, which means you are looking at the Overview page. This page can be customized to show the information that you want to see quickly. You can use this page for shortcuts, quick links to jobs, "thumbnail" report views, and so on.

Selecting the Continuous Integration subtab takes you to the Continuous Integration Dashboard, which is place to configure your projects for continuous integration builds.

In addition to the main set of tabs, the top bar includes:

- **Logged in as** clearly shows the name of the logged-in user.
- **Logout**—Use this link to log out between ElectricFlow sessions if necessary.
- **Help**—This link provides a Help topic for the current page you are viewing, but if you select the down-arrow adjacent to the Help link, you have access to the following:
  - **Tutorials**—Use this link to display the Table of Contents for all currently available tutorial examples you may find useful as you become familiar with ElectricFlow.
  - **Documentation**—Use this link to access the entire ElectricFlow online Help system, which is fully searchable in the event you do not quickly see what you are looking for in the left-pane Table of Contents.

The Help Table of Contents contains feature overview/concept user-guide style Help topics, which are not linked to a particular web page. These topics are listed in the Table of Contents above the "Web Interface Help" section. The Web Interface Help section contains all of the page-specific Help topics.

**Note:** To print a Help topic—Right-click your mouse in the Help topic pane or go to your browser File menu.
○ **Visit the Community Site**—This link takes you to the Electric Cloud Knowledge Base, all product documentation, and so on.

○ **Contact Support**—Use this link to access the Electric Cloud Technical support phone number and email address. At a later time, you may choose to reconfigure this link to redirect it to your internal support time. See the "Reconfigure Contact Support" section in the "Customizing the ElectricFlow UI" Help topic.

○ **About**—Use this link to display the current version of ElectricFlow you are using.

### Home Tab

You can customize the Home page to see the information you need at-a-glance or add Shortcuts to quickly return to the ElectricFlow pages you visit frequently. The Home page provides four categories:

- **Job Configurations**
  ElectricFlow procedures can contain complex sets of parameters, making it difficult to remember the correct parameters for a particular situation and tedious to re-enter those parameters every time the procedure is invoked. Job Configurations provide a one-click solution to this problem.

- **Shortcuts**
  Use shortcuts to save frequently visited ElectricFlow web pages, so those pages are immediately accessible. You can also create a shortcut to any page on the web.

- **Jobs Quick View**
  The Jobs Quick View allows you to define job categories that are interesting to you. You may be interested in a few jobs on this server. For example, you want only information about jobs that you launch manually and official builds for the products you work on. You do not want information about production builds for other products or personal jobs for other users.

- **Reports**
  You can configure reports you would like to see on a regular basis and display a thumbnail"report graphic in this section.

In the following Home page example, there are additional links. This page allows you to create, edit, and delete objects you see so that you can easily keep the page updated and current.

For more information about Home page functionality, see the Home Page Help topic.
Continuous Integration Subtab

The Continuous Integration Manager (CI Manager) provides a front-end user interface (the Continuous Integration Dashboard) for creating, managing, and monitoring continuous integration builds.

The Continuous Integration Dashboard provides:

- Visually seeing your running builds, build progress, build status, and accumulated build status.
- Easily accessed "Actions" to configure a continuous integration build.
- Quick configuration of your preferred SCM system.
- A project that contains any number of continuous integration builds, depending on the work you have already setup for your procedures and steps to perform.

The following is an example of the dashboard. Your initial view will be blank until you add configurations (using your preferred SCM) to run your build procedures continuously. When this tab is opened to view the dashboard, click the Help link in the upper-right corner of the page for instructions to begin using the dashboard.
Projects, Jobs, and Workflow Tabs

Selecting the Projects, Jobs, or Workflows tab displays a table listing all previously configured projects, all completed jobs, or all previously configured workflows, respectively. Each table contains links in the table and links in the section above the table.

For example, selecting the Projects tab displays a table (see the next screen example), which has the projects you created and ElectricFlow default projects, which were added during ElectricFlow installation.

- Links at the top of the table include:
  - A "star" icon—Click this icon to add this page to your Home page.
  - A drop-down menu to choose which projects you want to see.
  - Create Project link to go to the New Project page to define and add a new project.
  - New Search link to find a project whose name you may not remember or projects of the same type.

- Links within the table include:
  - Click on a Project name (first column) to go to the Projects Details page for that project.
  - Actions column—This column usually contains links to Track Changes, Edit, Copy, or Delete the object, which is a project in this example.

Each table, Projects, Jobs, or Workflows, has similar links to help you get more information, modify existing information, or create a new object. For more information on any of these ElectricFlow pages, see these Help topics: Projects, Jobs, or Workflows.
Cloud Tab

This tab opens to the Resources page and provides several other subtabs—Pools, Workspaces, Zones, Gateways, and the Cloud Manager plugin if it is installed.

Resources Page

The following example displays all resources that you configured ElectricFlow to use.

- In the information immediately after the Resources title at the top of the table, you can see how many licensed resources are in use.
- Use the row of buttons at the top of the page to perform resource management tasks.
- A resource name, in the Name column in the table, is a link to open the Resource Details panel for more information about the resource, and to access the Edit Resource panel to change or add access control privileges.

See the Resources Help topic for more information.

Pools Subtab

Click this subtab to display a list of all resource pools available to ElectricFlow. You may find it useful to group resources, creating one or more resource pools. For example, you can have resource pools for specific purposes, development teams, or other groups in your organization.

Similar to the Resources page, this page provides:

- A link to create a new resource pool.
- A Search link to find an existing resource pool.
- Summary information for each resource pool in the list.
- Clicking the resource Pool Name takes you to the Resource Pool Details page for more information about that pool.
- And the Action column contains Copy and Delete links.

For more information about pools, see the Resource Pools or Resource Pool - create new or edit existing pool Help topics.
Workspaces Subtab

Similar to the Resources and Pools pages, the Workspaces page displays a table all available workspaces and summary information for each workspace.

Available links are:

- **Create Workspace** for adding another workspace.
- **New Search** to find an existing workspace.
- Clicking the Workspace Name takes you to the Edit Workspace page to make modifications.
- And the Action column contains Copy and Delete links.

For more information, see the Workspaces and Disk Space Management, Workspaces, or Workspaces - create new or edit existing workspace Help topics.

Zones and Gateways Subtabs

Similar to the other subtabs under the Cloud tab, the Zones and Gateways subtabs each have a table, listing all available zone or gateways, respectively.

- Selecting an object in the Name column takes you to the "Detail" page for more information.
- These pages are your management centers for zones or gateways, respectively.

For more information, see the Zones and Gateways Help topics.

Artifacts Tabs

This page displays all artifacts available on this ElectricFlow server. Clicking on an artifact Name (first column) takes you to the Artifact Details page. For more information, see the Artifact Management Help topic.

Artifact Versions Subtab

The Artifact Versions page displays all artifact versions available on the ElectricFlow server. Links in the table are the similar to other ElectricFlow pages. For more information, see the Artifact Versions Help topic.
Repositories Subtab

The Repositories page displays all artifact repositories available to the ElectricFlow server. For more information about repositories, see the Artifact Management and Repositories Help topics.

Search Tab

While many ElectricFlow web pages have a Search link, some do not. The Search page is always available. You can search any ElectricFlow supported object type on this page. For more information, see the Searching and Filtering Help topic.

Administration Tab

The next screen example shows all the current subtabs available when you select the Administration tab. Less-frequently used tasks are grouped for you as subtabs under the Administration tab. For example, after users and groups are set up, you do not need these pages unless a user or group configuration changes.

Administration subtab descriptions:

- Event Log–This page displays a log of events generated anywhere in the system, including jobs and workflows.
- Groups–Use this page to view a filtered list of ElectricFlow local users or groups.
- Users–Use this page to view a filtered list of ElectricFlow local users or groups.
- Licenses–This page displays all license information known to the ElectricFlow server. Typically, a single license is displayed, which describes the usage to which you are entitled. The license on the server may be based on concurrent resources, concurrent users, concurrent steps, registered hosts, or any combination of these licenses.
- Directory Providers–ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. Local users and groups are defined in ElectricFlow.
- Email Configurations–This page displays all previously configured email configurations. You must create an email configuration so ElectricFlow can communicate with your mail server to send email notifications
- Database Configuration–If you do not use the ElectricFlow-supplied default database, use this page to configure another database to communicate with ElectricFlow. See the ElectricFlow Installation Guide for a list of approved databases for use with ElectricFlow.
• Plugins—This subtab displays the Plugin Manager page. A plugin is a collection of one or more features that can be added to ElectricFlow. Numerous plugins are bundled and installed with ElectricFlow, integrating third-party products seamlessly with ElectricFlow. For example, Source Code Management plugins are installed and so that you can configure your preferred SCM to communicate with ElectricFlow. For a complete list of bundled plugins, see Plugins That are Bundled with ElectricFlow on page 1138.

• Server—This page displays overall information about the ElectricFlow server. Use the Settings or Access Control links to make changes.

• Source Control—This page displays all SCM (source code management) configurations you have created to communicate with ElectricFlow.

• Defect Tracking—This page displays previously configured Defect Tracking systems known to the ElectricFlow server. Use plugins to integrate ElectricFlow with numerous defect tracking systems.

Go to Scenario 1.

Getting Started - Scenario 1 - Creating a Simple Procedure

To begin, select the Projects tab, then the Create Project link at the top of the table. You need to create a project to contain the procedures you create.

On the New Project page, enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Type a unique project name. You may want your project names to reflect the work groups or teams that will be using them. For example, you might set project names based on the products they support. For our scenario examples, we will use &quot;FirstNewProject&quot; for our project name.</td>
</tr>
<tr>
<td>Description</td>
<td>Enter a text description for your reference if you choose. ElectricFlow does not use or interpret this information.</td>
</tr>
<tr>
<td>Default Resource</td>
<td>(optional) For the purpose of &quot;getting started&quot;, leave this field blank to use the Default resource already created during the ElectricFlow installation.</td>
</tr>
<tr>
<td>Default Workspace</td>
<td>(optional) For the purpose of &quot;getting started&quot;, leave this field blank to use the Default workspace already created during the ElectricFlow installation.</td>
</tr>
</tbody>
</table>

Click OK to save the information you entered.

After clicking OK, you see the Project Details page and the name of the new project adjacent to the page title.

• For our scenarios, the project name is FirstNewProject.

• Your new project name will appear on the Projects page also.
**Scenario requirement:** No additional requirements for this scenario. This scenario uses the *local* agent (resource) that was included on your local machine when ElectricFlow was installed.

**Overview**

This scenario establishes that ElectricFlow and its components were installed successfully and guides you through creating a simple procedure with a parameter that will echo Hello World. After you create this procedure, you will run the procedure and review the results.

At the end of this scenario, you will be familiar with the following ElectricFlow concepts and features:

- Projects
- Procedures
- Steps
- Parameters
- Jobs
- Navigating the Job Details web page

**Begin Scenario 1**

**Step 1. Select the Projects tab**

On the Projects page, you can see the default projects installed during the ElectricFlow installation and the new project you just created.

Select your new project name to go to its Project Details page, then click the **Create Procedure** link.

**Step 2. Create a procedure**

On the New Procedure page, you need to be concerned with the section of the page illustrated below only.
Enter the following information:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>For this scenario, Hello World is the procedure name. At a later time when you are creating your own procedures, you can choose any unique name that is most meaningful for procedures in your project.</td>
</tr>
<tr>
<td>Description</td>
<td>(optional) Enter a text description for your procedure if you choose to do so.</td>
</tr>
<tr>
<td>Default Resource</td>
<td>Use the Browse link and choose local. Using local accesses the agent installed during the ElectricFlow installation. At a later time after you have configured other resources, your Browse list could contain many choices.</td>
</tr>
</tbody>
</table>

Your New Procedure page will look similar to the following:

Before leaving this page, notice the "breadcrumb" in the top-left corner. Most ElectricFlow web pages contain a breadcrumb for easy return to the previous page.

Click OK to continue.

After clicking OK, ElectricFlow takes you to the Procedure Details page—this is the page you use to add important information to your procedure. When your procedure contains steps, parameters, or email notifiers, and so on, those objects will be displayed here for your reference.

**Step 3. Create a parameter**

An ElectricFlow procedure can define one or more parameters. These parameters are similar to the parameters of a subroutine in a programming language. Parameters allow you to define a "reusable" procedure by using symbolic variable names in place of a single, fixed value. When you run the procedure, you can type in a value to use for that particular job. You can refer to the parameter in a step for a procedure, using the standard
ElectricFlow "property reference syntax" - $[...]$. For example, see Step 4, specifically the text in the Command(s) text box.

On the Procedure Details page, click the Create Parameter link to go to the New Parameter page.

Enter the following information:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter the parameter name message for this scenario.</td>
</tr>
<tr>
<td>Type</td>
<td>Use the default Text entry for the parameter type.</td>
</tr>
<tr>
<td>Default Value</td>
<td>Type-in Hello World for the default parameter value.</td>
</tr>
</tbody>
</table>

Your New Parameter entries will look like the following:

Click OK after filling in the fields and ElectricFlow returns you to the Procedure Details page.

On the Procedure Details page:

Notice the Parameters table is populated with your parameter entry.
Also notice the name of the procedure we created (Hello World) is shown adjacent to the page title for your reference.

### Step 4. Create a step

Now we can create a step on this procedure. On the Procedure Details page, to create a New Step for our current purpose, click the Command link to go to the New Step page.

**On the New Step page:**

The following screen displays the portion of the New Step page you need for this scenario.

Notice this version of the New Step page contains a Command text box to enter the information you need.

At a later time, when you choose to create a different step type, the New Step page will be populated with the appropriate fields required for that step type.

Enter the following information:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step Name</td>
<td>Use Print message for the step name. For work outside this scenario, you can enter any unique name of your choice for the step name.</td>
</tr>
<tr>
<td>Description</td>
<td>(optional) Add a text description about this step if you need one.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Command(s) box</td>
<td>Type <code>echo $[message]</code></td>
</tr>
<tr>
<td></td>
<td>In this command, <code>message</code> refers to the parameter we created.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> The ElectricFlow Server does not actually interpret (or even understand) the contents of this field. ElectricFlow simply expands all property references and then passes the resulting text block to the ElectricFlow Agent. The Agent copies the text block to a temporary file and then invokes the Agent's native shell command, passing the name of the temporary file as a parameter to the shell command. The overall result is the same as if you had created this block of text as a BAT file (on Windows) or a shell script (on Linux). The operating system of the Agent machine takes over from that point to actually run your commands.</td>
</tr>
<tr>
<td>Resource(s)</td>
<td>For this scenario, leave this field blank to use the default resource you set on the procedure. If multiple resources are configured, you have the option to change the resource for each step if you prefer.</td>
</tr>
</tbody>
</table>

Your New Step page will look like the following example:

![New Step example](image)

Click **OK** to create the step and ElectricFlow returns you to the Procedure Details page to see its entry as displayed in the next screen example.
Step 5. Run the procedure

Notice the Run-arrow icon among the links at the top of the tables. If you click the Run link, the procedure will run as-is immediately.

For this scenario, hover your mouse over the adjacent down-arrow and select the Run... option.

Selecting this option provides the Run Procedure page where you can add or modify the parameter values as necessary.

The Run Procedure page has the information we want for this scenario, so click the Run button.

When a procedure runs, it creates a "job".

After clicking Run, ElectricFlow takes you to the Job Details page to see the status of the "job" and watch its running progress.

This web page supplies a wealth of other information.
The Job Details page contains two sections. The section at the top of the page is the job's summary, displaying the job's status and other general information:

- The "green check" icon is displayed to show the job completed successfully.
- The "Completed with Success" section displays the result of the procedure that ran.
- The General Information section displays the project and procedure names and who launched the job.

The section below the summary area displays detailed job information, including tabs to expand information and links to access various other ElectricFlow web pages.

- Notice the "Success" entry in the Status column—this is your step result.
- In the Log column, click the icon in the Print message row to see the outcome/result of your Hello World Print message step. Your file will look similar to the following:

```
Job: job_6_20150711160208
Workspace File / Print message.db7dd766-2820-11e5-8679-0050568f747c.log
Hello World
```

- Select the Parameters tab to see the parameter you created and its value.

For complete information about the Job Details page functions and available information, click the Help link in the top-right corner of this ElectricFlow web page.

**Scenario Extension - Adding Another Step**

Each procedure you create can contain as many steps as you need. We created only one step in this scenario. This example shows how to modify a procedure by adding additional steps. You can always add more steps or edit an existing step before you run a procedure again.

To add a step to an existing procedure:
1. On the Job Details page, select your procedure name (at the top of the page) to go to the Procedure Details page.
2. On the Procedure Details page, click the Command New Step link again.
3. On the New Step page, enter information in the fields as follows:
   - Name=Print Step Info
   - Command(s)=Enter the following text:
     ```
     print "This step was launched by ${launchedByUser} on the resource
     ${/myResource/resourceName}.
     
     Shell=ec-perl
     
     Click OK to save the step and return to the Procedure Details page.
     
     Note: You can move this new step to the top of the procedure by hovering your mouse over the icon next to the step name, then drag-and-drop the step to the top of the list. This is a useful function particularly if you find you have created steps in a different order in which you need them.
     
     Click Run (from the Procedure Details page).
     
     Finding an ElectricFlow Automation Platform Web Page
     
     If you "lose" the Job Details page or any other ElectricFlow web page, several navigation methods are available:
     
     - Use your browser’s Back button if you were recently on a page you want to revisit.
     - Use ElectricFlow "breadcrumbs." On some pages you see breadcrumbs on the left-side of the page that note your current position/level within the project.
     - Use the tabs at the top of the page to drill-down to the page you need.
     
     For example:
     
     - **To find the Job Details page:**
       Select the Jobs tab and notice that your procedure name is now listed in the Job column, accompanied by a date, job number, and other related job information on the same row. When you run a procedure, it becomes a job. Select the job you want to see and you will go to the Job Details page for that job.
     
     - **To find the Procedure Details page:**
       Select the Projects tab, then select your project to go to the Project Details page to see a list of procedures in that project. Click on a procedure to go to the Procedure Details page for that procedure.
     
     Note: A "project" is a container for all related procedures you create. You can create as many projects as you need, using the Create Projects link on the Projects page.

     As you use ElectricFlow, you will quickly learn other navigation paths for your particular interests. In addition, most ElectricFlow web pages contain a "star" icon in the upper-right corner. Click this icon to add that page to your Home page for quick "one-click" access in the future.
Summary

This simple Hello World procedure demonstrated how to quickly create a procedure and how any command can be wrapped and parameterized using an ElectricFlow procedure. If you have an existing script you want to automate, you can call that script within a step command block. This scenario also introduced you to running a job, entering parameters for the job, and viewing results for the job you ran.

Go to Scenario 2

Getting Started - Scenario 2 - Creating a Procedure That Uses an SCM

Scenario requirements: Before you begin this scenario, ElectricFlow needs to be able to access your Source Control Management (SCM) system.

To set up a Source Control system (SCM) to use with ElectricFlow, you need:

- a running SCM system
- an active source depot in your SCM system
- an ElectricFlow agent that can communicate with your SCM server

**Note:** If the machine where you installed ElectricFlow can communicate with your Source Control (SCM) server, this requirement is met. **If not,** return to the installation executable file and run the ElectricFlow Agent install program on a machine that has access to your SCM system.

To install ElectricFlow agent software on another machine, copy the installation executable file to that machine, then double-click on the file to run the installation program. Select Express Agent when the install window opens.

When installation is complete, configure this new agent as an ElectricFlow Resource. See the beginning of Scenario 4 for more information.

- Configure ElectricFlow to communicate with your SCM system.
- Select the Administration tab, then the Source Control subtab.
- The Source Control Configurations page displays a table listing Source Control configurations after you create them. Click the Create Configuration link and the following web page is displayed.

![New Source Control Configuration](image)

- On the New Source Control Configuration web page, use the drop-down menu to choose your SCM type.
  - For our example, we chose Perforce.
Depending on which SCM you choose, the page expands to display appropriate fields for entering values to configure your SCM.

See the next screen example.

Enter information in the fields as follows:

- **Configuration Name** - For our example, we use the name, "p4". You can choose any name for your SCM Configuration.
  
  **Note:** You will need this name later, so remember the name you choose for your SCM configuration. A configuration name is important because you may want to create more than one source control configuration.

- **P4PORT** - For our example, we use p4:3710 to designate the P4PORT. Your specification will be different.

  **Important:** Other fields remain blank to use the defaults, but you may need to specify some or all information in the remaining fields depending on how your internal systems and access are set up for access to your SCM system.

Click **OK** after filling-in the fields.

For additional help with this ElectricFlow web page, click the **Help** link in the top-right corner of the web page.
Overview

This scenario guides you through creating a common build process integrated with your SCM system and build utility. And you will learn how to navigate and modify the procedure definition using the ElectricFlow Procedure Details web page.

At the end of this scenario, you will be familiar with the following ElectricFlow concepts and features:

- Source control configuration
- Creating more complex steps
- Creating a build process
- Navigating the Procedure Details web page

Begin Scenario 2

**Step 1. Select the Projects tab**

On the Projects page, select the project name you created in Scenario 1 (in the first column) to go to the Project Details page, then select the Create Procedure link to begin.

**Step 2. Create a procedure**

On the New Procedure page, enter a Procedure Name - it is required.

You can use any unique name you choose—do not use the same procedure name you chose for Scenario 1. Procedure names within the same project must be unique.

- Name - For this scenario, we use Basic Build for the procedure name.
- Default Resource - Use local for the resource name.

Click OK to go to the Procedure Details page.
Step 3. Create a parameter

On the Procedure Details page (illustrated above), click the Create Parameter link to go to the New Parameter page.

![New Parameter dialog](image)

- **Name** - For our example, the parameter name is `target`. You can choose any unique name of your choice for your parameter name—parameter names must be unique within a procedure.
- **Default Value** - We chose `jar` for this value.

Click **OK** to continue and to return to the Procedure Details page to see the parameter you just created.

Step 4. Create a step to “checkout” source files from your SCM system

From the same Procedure Details page, click the Plugin link to create a New Step.

- In the Choose Step dialog, select Source Code Management from the left pane.
- Next, select ECSCM-Perforce from the list, then select "Perforce - Checkout" from the right pane.
- **Click Close** to go to the New Step page, which will be populated with the fields you need to enter for the Perforce SCM.
  - Both the Subprocedure and the Parameters sections are populated with fields to enter information so ElectricFlow can communicate with your Perforce SCM system, using the ElectricFlow Perforce plugin.

**Note:** Depending on the SCM you chose to work with, including Perforce, the New Step screen you see may be different than the following example. If you need additional help configuring your SCM, see the corresponding SCM plugin on the Plugin Manager page. Each plugin has its own Help topic.
Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique name for your subprocedure step. For this scenario, the step name we supplied is checkout.</td>
</tr>
<tr>
<td>Description</td>
<td>(Optional) Enter a text description for this step.</td>
</tr>
</tbody>
</table>

**In the Subprocedure section:**
This section displays the subprocedure name or a plugin name because the plugin is being called as subprocedure.

**Note:** The plugin name defined: "EC" is for Electric Cloud, "SCM" identifies the plugin as belonging to the Source Control Management category, and "Perforce" identifies the name of the source control system.

Our example illustrates the fields for the Perforce SCM plugin. Your fields will be different if you are using a different SCM. These parameter fields request some of the same values you already specified when you created the Source Control Configuration.

<p>| ECSCM-Perforce | Clicking this link takes you to the Project Details page for the plugin. Generally, and for this scenario, you do not need to access this page to make changes—it is for your reference only. |</p>
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CheckoutCode</td>
<td>Clicking this link takes you to the Procedure Details page for this procedure. Generally, and for this scenario, you do not need to access this page to make changes—it is for your reference only.</td>
</tr>
<tr>
<td>Change</td>
<td>Clicking this link displays a dialog that allows you to change the project, plugin, or subprocedure. If you make a change in the Change Subprocedure dialog, the Subprocedure and Parameters sections on the New Step page will update automatically with corresponding fields for your new choice. <strong>Note:</strong> All SCM plugins that can checkout code contain the checkoutCode procedure.</td>
</tr>
<tr>
<td>Resource</td>
<td>The local resource was specified earlier. If this field remains blank, the local resource is used.</td>
</tr>
</tbody>
</table>

**Note:** The following two parameter fields are common among all SCM plugins:

<table>
<thead>
<tr>
<th>Configuration</th>
<th>The name of your Source Control Configuration.</th>
</tr>
</thead>
<tbody>
<tr>
<td>dest</td>
<td>The destination where you want to put your checked-out code—it is the directory within your job workspace. Each job adds a new directory to the workspace. At this point, you have not defined multiple workspaces, so the ElectricFlow default workspace is used.</td>
</tr>
</tbody>
</table>

For more information about workspaces, see the "Workspaces and Disk Space Management" Help topic.

Click **OK** after entering values and to continue to the Procedure Details page, which should now look similar to the following example:

![Procedure Details page](image)

The Procedure Details page now displays the name of our new procedure, Basic Build, and its new checkout step using the Perforce SCM, and the **target** parameter with the **jar** value.
**Step 5. Create a step to run the build**

This step can be another subprocedure step, a command step, or a custom step. Any procedure can contain multiple types of steps, any of which may be either simple or complex.

Steps can contain or use:

- parameters and/or properties
- many of your existing scripts, including shell scripts

For this step example (to run the build), we will create an Ant step. To invoke Ant, you could write a script that calls Ant directly, or you could call the ElectricFlow Ant plugin to invoke the runAnt procedure. For this example, we will use the ElectricFlow Ant plugin.

- From the Procedure Details page, click the **Plugin** link to see the Choose Step dialog and select the Build category.
- Select the EC-Ant plugin to see and select the "Ant - Run Ant" step.
- When the New Step page is displayed, notice the Subprocedure section is populated with the chosen EC-Ant plugin, and the Parameters section provides the appropriate fields for this Ant step.
Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>For this example, we specified AntBuild for the step name. You can use any unique name you choose for this step.</td>
</tr>
</tbody>
</table>

**Subprocedure section:**

Note the EC-Ant plugin project name and the runAnt procedure name.

| Resource       | Leave this field blank to continue using the local resource.                |

**Parameters section:**

<table>
<thead>
<tr>
<th>Build File</th>
<th>Use build.xml.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>For this example, we used $[target]</td>
</tr>
<tr>
<td>Working Directory</td>
<td>For this example, we used project.</td>
</tr>
</tbody>
</table>
For this scenario, we leave the remaining fields blank, but you may need to enter additional information depending on your Ant invocation.

Click OK to continue and return to the Procedure Details page.

The following screen example illustrates the two steps we created for this scenario.

![Procedure Details](image)

**Step 6. Running the procedure**

On the Procedure Details page, hover your mouse over the small down-arrow on the right-side of the Run link, choosing Run...

- **Run Immediately** - This option runs the procedure immediately as set.
- **Run...** - This option displays the Run Procedure web page where you may alter any existing parameters for this procedure, or set an existing credential.

**Note:** This scenario does not introduce you to the Advanced section of the Run Procedure page. For more information on these topics, click the Help link in the top-right corner of the Run Procedure page.

![Run Procedure](image)

Click Run to run the procedure and continue to the Job Details page to see the status of your running job.

**Step 7. On the Job Details page**

The Job Details page now displays the status and results of running the Basic Build procedure.
Your Job Details page will look somewhat different if you supplied other values in this scenario.

More about the Job Details page

- The General Information section at the top of the table provides links back to the **Project > Procedure** that was launched to create this job.
- Click on a Step Name to go to the Job Step Details page.
- Click the Parameters tab to see parameters in this job.
- If there are errors, the Diagnostics tab has specific information.

More about the Procedure Details page

To go to the Procedure Details page at any time:

- Select the Projects tab.
- Select the Project name (that contains the procedures you want to see) to go to the Project Details page.
- Select a Procedure name to go to the Procedure Details page.

You may want to review to the Procedure Details page frequently because it displays the steps that make up your procedure, the parameters contained in the procedure, email notifiers, and so on. Full edit capabilities are available by selecting any object (step, parameter, and so on).

Also, you can run this procedure again “on demand” by clicking the **Run** link at the top of the page.

For more information about the Procedure Details page functions, click the **Help** link in the top-right corner of the Procedure Details page.
Scenario extension - Add a step to show workspace contents

If you are curious about what your current default workspace contains at this point, you can create a step to see the workspace.

- Select the Projects tab, select FirstNewProject (or your project name if you used something different), select the Basic Build procedure name.
- Click the **Command** link to create a New Step—a new *command* step.
- The New Step page is displayed with a Command text box.
  - For **Name**, use `seeWorkspace`.
  - In the **Command(s)** text box:
    - for Windows - type `dir /s`
    - for Linux - type `ls -r`
- Click **OK** to create the step and go to the Procedure Details page.
- Click **Run** to create the job and to go to the Job Details page.

When the job is completed, click the log icon in the Log column to see the contents of the current workspace for this procedure. Your Workspace File will be similar to the following example:
Summary

This scenario demonstrated how easily ElectricFlow can integrate with your SCM system and build utilities.

Go to Scenario 3

Getting Started - Scenario 3 - Notification, Scheduling, and Reporting

Scenario requirements: For this scenario, you need to set up an Email Configuration to use the email notification feature.

To set up an Email Configuration:

- Select the Administration tab, then select the Email Configurations subtab.

  You will see a blank Email Configurations page. As you create one or more email configurations, they
will be listed in table format on this page.

- Click the **Add Configuration** link.

On the New Email Configuration page, enter information in the fields to define your mail system.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique name for your email configuration.</td>
</tr>
<tr>
<td>Description</td>
<td>(Optional) Enter a text description for your reference.</td>
</tr>
<tr>
<td>Mail Protocol</td>
<td>Use the drop-down arrow to make a selection.</td>
</tr>
<tr>
<td>Mail Host</td>
<td>Enter the name of your mail host.</td>
</tr>
</tbody>
</table>

Enter information in the remaining fields according to the specifications you need.

Your New Email Configuration page should look similar to the following example:

Click **Save** after filling-in the fields or click the **Test** button first if you want to make sure your email configuration works.

Enter an email address in the pop-up box and click **Send**.

**Note:** For additional help with this ElectricFlow page, click the **Help** link in the top-right corner of the page.
Overview

This scenario guides you through creating an email notification, invoking your build process with a timed (standard) schedule, invoking your build process using a continuous build integration trigger, and introduces ElectricFlow reporting features.

At the end of this scenario, you will be familiar with the following ElectricFlow concepts and features:

- Creating an email configuration
- Creating an email notifier
- Creating schedules
- Creating reports

Begin Scenario 3

**Step 1. Creating an email notifier**

On the Procedure Details page for the Basic Build procedure, click the Create On Completion Email Notifier link to begin. This link takes you to the New On Completion Email Notifier page.

Two email notifier types for jobs or job steps:

- On Start Notifier—Sends an email when a job or job step starts.
- On Completion Notifier—Sends an email when a job or job step completes.

The fields for each of these notifiers are similar, but we chose the On Completion notifier because you may find you use this one more frequently.

**On the New On Completion Email Notifier page:**

Enter information in the fields as follows:
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>For this example, we use <code>BuildTeam</code>. This name can be an arbitrary text string.</td>
</tr>
<tr>
<td>Description</td>
<td>(Optional) Enter a text description for your reference. ElectricFlow does not use or interpret this information.</td>
</tr>
<tr>
<td>Condition</td>
<td>Use the pull-down menu to select the type of condition you need for this email notifier. Edit the auto-supplied condition in the text box or add a completely new script for your purpose. The condition specifies whether the notifier should send a message depending on the result of a property expansion. If the result is empty, non-zero, or &quot;true&quot;, the message is sent. If the result is &quot;0&quot; or &quot;false&quot;, the message is not sent.</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>For this example, choose the &quot;Job summary HTML&quot; notification template, or you can use the drop-down menu to select from a list of global, ready-to-use formatting templates. Depending on the type of email notifier you are creating, the available template choices in the drop-down menu will be different.</td>
</tr>
<tr>
<td></td>
<td>To customize your template, edit the auto-supplied text in the Formatting Template text box, or you can add a completely new template for your purpose. <strong>Note:</strong> Any edits made in this text box will not be saved to the global template, and the template will appear as a Custom template when you return to this notifier definition. Additionally, make sure the content is formatted correctly, i.e., no illegal characters or spacing.</td>
</tr>
<tr>
<td>Email Configuration</td>
<td>Use <code>TestEmailConfig</code>, the email configuration we created.</td>
</tr>
<tr>
<td>Destinations</td>
<td>This is a space-separated list of valid email addresses, email aliases, or ElectricFlow user names, or a property reference that expands into such a list.</td>
</tr>
</tbody>
</table>

After filling in the fields, your page may look similar to the following example:
Click **OK** to create your email notifier and to return to the Procedure Details page, where you can now see the Email Notifier you created.

**Note:** For more information, see the Email Notifiers Help topic.

### Step 2. Creating a standard schedule

To create a standard "timed" schedule:

- Select the Projects tab.
- Select your project name to go to the Project Details page.
- Select the Schedules subtab, then select the down-arrow to the right of the "Schedule" link, and choose "Standard Schedule" to go to the New Schedule page.

**On the New Schedule page:**

The following is an example of the New Schedule page.

- Notice the "breadcrumb" above the New Schedule page title—this entry displays the name of the project that will contain this schedule.
After entering a name (unique within your project) for your schedule (we chose "Sentry-MainBuild"), choose the procedure your schedule will run.

- Click the Change link adjacent to the Procedure field.
- In the pop-up menu, leave the Current project selected.
- Place your cursor in the Procedure field to see a list of procedures in your project.
- Select the procedure you want this schedule to run. We chose "Basic Build".

Enter information in the remaining fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>(optional) A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt;</code> . . . <code>&lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code>, <code>&lt;b&gt;</code>, <code>&lt;br&gt;</code>, <code>&lt;div&gt;</code>, <code>&lt;dl&gt;</code>, <code>&lt;font&gt;</code>, <code>&lt;i&gt;</code>, <code>&lt;li&gt;</code>, <code>&lt;ol&gt;</code>, <code>&lt;p&gt;</code>, <code>&lt;pre&gt;</code>, <code>&lt;span&gt;</code>, <code>&lt;style&gt;</code>, <code>&lt;table&gt;</code>, <code>&lt;tag&gt;</code>, <code>&lt;th&gt;</code>, <code>&lt;tr&gt;</code>, <code>&lt;ul&gt;</code></td>
</tr>
</tbody>
</table>
### Field Name | Description
--- | ---
**Parameters** section | If the procedure has parameters, enter their values in this section. The procedure cannot execute unless all required parameters are provided.

**Frequency** section | "Run at" is a summary section: As you make selections for the following Days and Repetition sections, a summary of what you selected appears here.

#### Days
- Select weekdays, month days, or create a custom frequency when you want the schedule to run.
- **Note:** The "day" applies to the start time if the time range spans two days, that is, if the time range crosses the midnight boundary.

#### Repetition
- If Run Once - the schedule will run once per selected day, at the time you specify.
- If Run Every - the procedure will execute repeatedly during the specified time range. For example, if you select a time range from 11:00-14:00 and an interval of 40 minutes, the procedure will execute 5 times on each of the selected days: at 11:00 am, 11:40 am, 12:20 pm, 1:00 pm, and 1:40 pm.
- If Run Continuously - as soon as one job ends, the scheduler will trigger immediately to run the job again.

**Advanced** section | If this box is "checked," the schedule will run. You can disable this schedule whenever necessary.

**Note:** For this scenario, you do not need to enter information for any remaining fields. Later, when creating an actual timed schedule for one of your procedures, refer to the Help topic for this page for more information.

Click **OK** to save your information and create this schedule.

At any time, you can return to the Project Details page for this project, select the Schedules subtab, and then select the Schedule Name from the table to go to the Edit Schedule page to modify this schedule.

**Step 2a. Creating a continuous integration build trigger**

At a later time when you have procedures and steps created to do the work you need, you may prefer implementing continuous integration build configurations for your software builds. Unlike a standard schedule
that runs on days and times you specify, a continuous integration build can be triggered to run each time code is checked into your source code management (SCM) system.

Adding a project to the Continuous Integration Dashboard is quick and easy. Each project can have one or more CI configurations, depending on the number of source branches you want to monitor. After the simple configuration process, you can visually see status and other information about your continuous integration jobs as builds are triggered to run.

To find the Continuous Integration Dashboard, select the Home tab, then select the Continuous Integration subtab. The dashboard will be empty until you start adding projects. For help using the Continuous Integration Manager and Dashboard, click the Help link in the upper-right corner of the dashboard web page.

### Step 3. Creating a report

ElectricFlow provides multiple reports and custom report capabilities to help you manage your build environment.

Summary of available report types:

- Real-time reports - filtered view of your ElectricFlow data in real-time
- Build reports - summary reports produced at the end of a build and attached to the job
- Batch reports - summaries of your build environment with trends over time, two types:
  - Default Batch reports - automatically installed during ElectricFlow installation and scheduled to run daily (Cross Project Summary, Variant Trend, Daily Summary, Resource Summary, Resource Detail)
  - Optional Batch reports - you can configure and schedule these reports to fit your requirements (Category, Procedure Usage, Count Over Time, or Multiple Series reports)
- Custom reports - your choice to create and add at any time

**Note:** Batch and Custom reports must be run on the ElectricFlow server agent (local agent) only. These reports use the BIRT report engine, which is installed only on the ElectricFlow server.

### Defining a “saved” search

Before you create a report, you need to define a "search" to focus the report on the information you want to see.

- Select the Search tab to go to the **Searching and Filtering page**.

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object Type</td>
<td>Use the drop-down menu to select the object you wish to search.</td>
</tr>
</tbody>
</table>
Click **Add Criteria** one or more times to further define the sort criteria for your search.

- Use the drop-down arrow to select a criteria argument. These arguments are properties. For a description of any of these properties, see the **Properties** Help topic.
- Use the drop-down arrow to select an operator for the search.
- To narrow your search, enter an actual object name. For example, if you selected Project Name to begin your search, you might want to enter the actual project name in this field or the first few letters if you have multiple projects named in a similar pattern.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
<td>Use the drop-down arrow to select a criteria argument. These arguments are properties. For a description of any of these properties, see the <strong>Properties</strong> Help topic. Use the drop-down arrow to select an operator for the search. To narrow your search, enter an actual object name. For example, if you selected Project Name to begin your search, you might want to enter the actual project name in this field or the first few letters if you have multiple projects named in a similar pattern.</td>
</tr>
</tbody>
</table>

| Custom Criteria | Not needed for this scenario. |

Your Searching and Filtering page will look similar to the following example:

![Image of Searching and Filtering page]

Click **OK** after filling-in the fields and to go to the Search Results page.

![Image of Search Results page]

Click **Save Report Filter** to see the Save Filter dialog box.

![Image of Save Report Filter dialog box]
In this dialog box, use the drop-down arrow to select the project name for your report, then enter a name of your choice for the filter. We used BasicBuildFilter for the filter name to tie the filter name to the Basic Build procedure for which we are creating a filter.

Click OK to return to the Job Search Results page—now we are ready to define the report we want to see.

**Define the report**

For this scenario, we will create an Optional Batch report. Select the Projects tab, select your project name to go to the Project Details page, then select the Reports subtab.

Click Create Report.

**On the Optional Batch Reports page:**

For this scenario, select the Multiple Series report tab.

Enter information in the fields or select the appropriate values as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Title</td>
<td>This is your report title. Type over the default report name, choosing any unique name for your report. We supplied Basic Build Report for our report name.</td>
</tr>
<tr>
<td>Saved Filter</td>
<td>Project - Click your mouse inside this field to see a list of projects from which to make a selection. We select our FirstNewProject project name. Filter - Use the BasicBuildFilter we created earlier.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Time Period</td>
<td>Use the drop-down menu to select the time period.</td>
</tr>
<tr>
<td>Create thumbnail?</td>
<td>Check this box so you can view this report on your Home page.</td>
</tr>
<tr>
<td></td>
<td>(We will create a “thumbnail” report view on your Home page at the end of</td>
</tr>
<tr>
<td></td>
<td>this scenario.)</td>
</tr>
<tr>
<td>Object Type</td>
<td>Use the drop-down menu to select Job for this example.</td>
</tr>
</tbody>
</table>

**Table column choices**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart Type</td>
<td>Use the drop-down menu to choose the chart type.</td>
</tr>
<tr>
<td>Function</td>
<td>Use the drop-down menu to choose the function you need.</td>
</tr>
<tr>
<td>Property Name</td>
<td>Use the default property value or delete the text and click your mouse in</td>
</tr>
<tr>
<td></td>
<td>the blank field to see a list of possible properties. We chose &quot;outcome&quot; for</td>
</tr>
<tr>
<td></td>
<td>this example.</td>
</tr>
<tr>
<td>Display Name</td>
<td>You can choose a different unique Display Name if you prefer to do so.</td>
</tr>
<tr>
<td>Stacked</td>
<td>Select this check box to see your report results &quot;stacked&quot; versus overlaid.</td>
</tr>
<tr>
<td>The &quot;X&quot; icon</td>
<td>Click this icon to delete any row you no longer need.</td>
</tr>
<tr>
<td>Add Series button</td>
<td>Select this button if you would like to create additional table entries for</td>
</tr>
<tr>
<td></td>
<td>additional report information.</td>
</tr>
<tr>
<td>Chart Options</td>
<td>Use the down-arrow to adjust the Time Grouping and see the defaults for the</td>
</tr>
<tr>
<td></td>
<td>X and Y axis.</td>
</tr>
</tbody>
</table>

Your Multiple Series report page will be similar to the following example:
- Run Report button - (information only for this scenario) this button takes you to the Job Details page to run the report immediately—one time only.

- Click the Create Schedule button - this button displays a box with a default schedule name you can change.

- Enter a name for the schedule—again, we tied the schedule name to the procedure name for which we want the report.

- Click OK to go to the Project Details page.

Now you can see the report you just created listed in the Schedules table.
Click the **Run** link in the Actions column to run this report and then go to the Job Details page.

**On the Job Details page**, you will see your report running.

When the report is generated, you will see a Links section in the summary section at the top of the Job Details page.

This section contains a link to the report you generated.

Click this link to see your report.

For more information about the Job Details page, click [here](#).

For more information about ElectricFlow reports, see the [Reports, Creating Custom Reports](#), and other report Help topics.

**Scenario extension - Add a thumbnail report to your Home page**

When we created a report, we "checked" the Create thumbnail? checkbox, so we are ready to activate the thumbnail report view on the Home page.

**Note:** Viewing an interesting report assumes there is ample data to report. While you can see a report after running one job, it is not very interesting unless you can see trends or comparisons after running numerous jobs.

To see a thumbnail report on the Home page:

- Select the Home tab.
- Click the **Add Report** link and a New Report page is displayed.
On the New Reports page:

- **Project** - Use the down-arrow to select the project containing the report you want to view—FirstNewProject.
- **Report** - This is the report name you entered in the Report Title field when you configured this report—Basic Build Report.
- **Title** - This is the report title you want to see on your Home page to identify this report. We used the same Basic Build Report name.

Click **OK** to generate the thumbnail report view and to go to the Home page.

The following screen example illustrates how your Home page may look with the thumbnail report.

For more information about how to use the Home page, see *The Home Page* Help topic.
Summary

This scenario demonstrated how to create an Email Configuration so you could use an email notifier, how to create a continuous integration schedule, and how to set up a basic report with a "thumbnail" report view on your Home page.

Go to Scenario 4

Getting Started - Scenario 4 - Multi-agent Build and Test

**Scenario requirements:** For this scenario, you can use the configurations you created for Scenario 2 and 3. However, before you begin this scenario, you need to configure an additional agent machine. If you have a firewall running on the ElectricFlow server machine, disable it now or allow access to ports 8000, 8443, 61613, 80, and 443.

**Installing ElectricFlow Agent software:**

Install ElectricFlow Agent software on the machine you intend to use as an agent to run builds. For the simple purpose of getting started, install this agent on a different machine with the same operating system as the ElectricFlow server.

- Copy the ElectricFlow installation executable file to the machine you intend to use as an ElectricFlow agent.
- Double-click the executable file to begin the installation program.
- When the installation program opens, select the Express Agent installation.

**Note:** During the agent installation, you will have the opportunity to create a resource and provide a resource name. Enter any name you choose for your new resource. For this scenario, we will name our new resource, Resource2.

- After agent installation, verify that your new resource information is included in the ElectricFlow resource table.
  - Select the Cloud tab to go to the Resources page.

**Note:** At a later time when you are more familiar with ElectricFlow, you can use the Resources page to install additional agents. See the Resources page Help topic, then specifically review the "Install or Upgrade Remotes Agents" section.
To configure a shared workspace:

For Linux

If your agents are installed on Linux, change the default workspace to point to a network location accessible to both machines:

- Select the Cloud tab, then select the Workspaces subtab, to see a list of workspaces.
- Select the workspace named “default” to edit the default workspace.
- Change the value of the UNIX Path to a network location accessible to the ElectricFlow server and agent machines.
- Make sure this location is readable and writable by the users chosen during the server and agent installations.

After fulfilling these scenario prerequisites, you are ready to proceed.

For Windows

If using a Windows environment, the shared workspace is created for you already.

Overview

This scenario guides you through creating a multi-agent build and test process integrated with your SCM system, build utility, and unit/system tests. You can invoke this build using a schedule, Continuous Integration (CI), or "on demand". At the end of this scenario you will be familiar with the following ElectricFlow concepts and features:

- Agent-only installation
- Copying a procedure to create a new procedure
- Running steps in parallel
- Pools
- Post processor
- Search

Begin Scenario 4

Step 1. Create a new procedure

This time, we are going to copy an existing procedure, rename it, and add another step.

- Select the Projects tab, then select the FirstNewProject project name.
- On the Project Details page, click the Copy link to copy the Basic Build procedure.
• When the Basic Build copy procedure is displayed, you can click its name to go to the Procedure Details page to verify it contains the same contents of the Basic Build procedure.

• Return to the Project Details page.

• Select the **Edit** link for the Basic Build copy procedure.

**On the Edit Procedure page:**

• **Name**—Enter a new procedure name, `MultiAgentBuild`.

• **Description**—Add a description noting this procedure was copied from the Basic Build procedure.

• **Default Resource**—Select your new resource, `Resource2`, for this procedure.

Click **OK** after entering your information and ElectricFlow will take you back to the Project Details page.

Your Project Details page should now look similar to the following example:
This page now displays the new MultiAgentBuild procedure with a description, and a new resource is designated for this procedure to use.

**Step 2. Create two new Ant steps**

- Beginning on the Project Details page, click the MultiAgentBuild procedure name to go to the Procedure Details page.
- Click the AntBuild step Copy link, twice.

Now you see two additional steps names: AntBuild copy and AntBuild copy 2.

- Click the AntBuild copy step name to go to the Edit Step page.
- Notice the AntBuild copy step name is adjacent to the page title because this is the step we are going to edit.

**Modifications for creating the new Ant steps:**

Because this is an "Edit" page, some of the fields already contain the information we originally supplied to create the first Ant step. The following list contains the fields we need to edit or add new information:

- Name—For this example, we chose unittest for the step name. Type over the existing text to edit the text.
- Resource—Enter the name, TestPool, because we will be creating a resource pool for testing. At this point, you need to enter a pool name only (no spaces in the name).
- Target—Edit this field to: unittest

In the Advanced section:

- Run in Parallel—Click the check box to select this option. You are designating that you want this step to run in parallel with one or more other steps.

Click OK to create the first of two new Ant steps and ElectricFlow returns you to the Procedure Details page.
From the Procedure Details page, click the AntBuild copy two step name to go to the Edit Step page again.

To create the next Ant step, make the same edits (above) as you did to create the unittest step, except:
• Name–Change the step name to systemtest.
• target–Change this field to: systemtest

Click OK to create the second of two new Ant steps and to return to the Procedure Details page. You now have three Ant steps, including two new Ant steps, unittest and systemtest, with TestPool as the designated resource.

Also notice, the Parallel column now contains "checkmarks" for the 2 steps we want to run in parallel.

**Step 3. Create a resource pool**

Select the Cloud tab to see the following Resources page with a table listing the currently available resources.

To put these two resources in a resource pool that we previously "named" when we created the new Ant steps, we need to edit each resource.

Click the local resource name to go to the Resource Details panel, then click the Edit link at the top of the panel.

**On the Edit Resource panel:**

The only change we need to make is to add the TestPool pool name to the Pool(s) field.
Click **OK** to save your change and return to the Resources page.

- **Notice** the Pool(s) column now has TestPool specified as a resource pool where the local resource is a member.

- Repeat this process to put Resource2 in the TestPool resource pool.

A resource can belong to one or more pools. If any resource belongs to multiple pools, all pools would be listed in this column. For more information about the Resources page, click **here** or click the **Help** link in the top-right corner of the web page.

The following screen example should be similar to your Resources page.
Step 4. Run the procedure

To run the new MultiAgentBuild procedure, select the Projects tab > FirstNewProject project name > MultiAgentBuild procedure.

On the Procedure Details page:

- Click the Run link at the top of the page.
- Click Run on the Run Procedure page.

Your Job Details page should be similar to the following example.

Note: The screen example above illustrates a job that is still running—notice the green circular-arrow icon at the top of the page. This icon changes to a "checkmark" if this job completes successfully.

Scenario extension - Using postp

ElectricFlow implements data collection with a postprocessor. The postprocessor is a command associated with a particular procedure step. If the postprocessor is specified for a step, it executes concurrently with the main step command. The postprocessor runs on the same machine as the main command and in the same working directory, and it retrieves the log file from the step as its standard input.
The standard ElectricFlow postprocessor is called `postp`. `postp` scans the step's log file looking for interesting output such as error messages and then sets properties on the job step to describe what it found. For example, `postp` might create a property named "errors" whose value is the number of error messages in the log file, or a property named "tests" that counts the number of tests the step executes. Also, `postp` can extract portions of the step log that contain useful diagnostic information and save this information for reporting.

When you create a step, you can specify `postp`. If you already have a step and want to add `postp` reporting, you just have to edit the step to include `postp`.

- From the previous Job Details page screen example, click the **Edit** link for the AntBuild step.
- On the Edit Step - AntBuild page, in the Parameters section, add `postp` to Postp Line field.

Click **OK** to save your edit and return to the Job Details page.

Run this job again to see the `postp` result—click the **Run/Run Again** link.
On the next screen example, notice the AntBuild step now shows "3 compiles" in the Status column. Using postp supplies additional information.

For more information about using postp, see the "Postprocessors" Help topic.

Summary

This scenario demonstrated how ElectricFlow can drive a complete build and test process—including building steps to run in parallel and creating a resource pool. This scenario also provided a brief look at how you can use ElectricFlow to execute rapid root cause analysis by reviewing postp diagnostics.

Automation Platform Setup

The topics in this section describe how to set up the automation platform UI.

After completing the tasks, you can create, configure and manage the objects needed to automate your build-test processes, application deployment, and pipelines.

Automation Platform Home Page

Job Configurations

Shortcuts
Overview

This page provides a convenient console for running jobs and viewing results.

- This web page is your ElectricFlow Dashboard for tracking project health.
- You can customize the page to display only the jobs that interest you and to provide one-click access to the jobs you run frequently. Each of the Home page sections can be customized.
- The Reports section allows you to see thumbnail report images that are updated each time the report is generated.
- This page provides shortcuts for quick access to pages you use most frequently in the automation platform or anywhere on the web.

**IMPORTANT:** If you are using or plan to use the EC-Homepage plugin to share your Home page sections, you will not see some links normally available to you. For example, if a particular Jobs Quick View category is shared, you cannot Delete or Modify that category. You can perform these functions only if the category belongs to you alone.

For information on sharing your Home page configuration, see the "Home page configurations" section in the "Customizing the ElectricFlow Platform UI" on page 554 Help topic.

Job Configurations

Procedures in ElectricFlow can contain complex sets of parameters—making it difficult to remember the correct parameters for a particular situation and tedious to re-enter those parameters every time the procedure is invoked. Job Configurations provide a one-click solution to this problem. When you create a job configuration, you enter all the information needed to run a procedure, including parameters and/or a credential. All job configurations are displayed here on the Home page. Invoke a particular configuration by clicking its name in the Job Configurations section.

Create Job Configurations three ways

- On the Home page, create a job configuration from "scratch" by clicking the **Create** link in the Job Configurations section.
  - In the Create Configuration pop-up menu, select the project and procedure you want to use for creating this configuration.
- From the Job Details page for a previously invoked job, click the **Save Configuration** link at the top of the page.
  
  Your saved job configuration is displayed on your Home page.
- From the Edit Schedule page, click the **Save Configuration** link at the top of the page.
  
  Your saved configuration is displayed on your Home page.
Shortcuts

Use shortcuts to save frequently visited ElectricFlow web pages, so those pages are immediately accessible. You can create a shortcut to any page on the web also.

Create Shortcuts two ways

- Mouse-over the "star" icon at the top of any automation platform page and click "Add current page" to add that page to the shortcut list. Mouse-over the star icon again and click "Remove current page" to remove the shortcut for that page. The star icon is yellow for pages saved as a shortcut and gray for those pages not saved as a shortcut.
- Click the Create link in the Shortcut section and provide a name and URL to create a shortcut.

To modify or update a shortcut, click the Edit link adjacent to the shortcut you want to change.

Shortcuts can be accessed conveniently from any automation platform web page. Mousing-over the star icon displays a list of shortcuts saved by the current user. Click on a shortcut name to view the page.

Note: The Shortcut section may contain static entries that cannot be deleted. And if you "share" your Home page, the Edit link will not be available for shared items.

Jobs Quick View

Perhaps only a few jobs on this server are of interest to you. For example, you may care about jobs you launch manually and official builds for the products you work on, but you may not care about production builds for other products or personal jobs for other users.

The Jobs Quick View allows you to define job categories that are interesting to you.

The Home page displays the most recent jobs in each category, and you can easily click-through to get more details about any of those jobs. For example, clicking on a job name takes you to that job’s Job Details page.

Create a job category

- Click the Add Category link in the Jobs Quick View section. After creating a category, results are displayed on the Home page. Clicking the Details link displays a summary to the right of the category. In addition to job status and other diagnostic information, the summary displays running steps and failed steps (containing errors and warnings).
- Click the Modify link to edit the Jobs Quick View category or the Delete link to remove that job from the Jobs Quick View category.
- Click on the Details link to see job summary information—the summary remains visible, regardless of mouse location, until you click somewhere else on the page.

Note: If you "share" your Home page, the Modify and Delete links will not be available for shared items.

Reports

You can configure reports you would like to see on a regular basis and display a "thumbnail" report graphic in this section.

- Click the Add Report link to go to the New Reports page. After filling-in the information on the New Reports page, you will see a thumbnail view of your report.
ElectricFlow

(after it runs) on your Home page.

Note: If the drop-down menu on this page is empty, click the Help link on the New Report page for more information.

- Click the Collapse/Expand (+/-) box to see the full thumbnail report or just the report title.
- Click the Rename link if you need to rename your report.
- Click the Remove link if you need to remove this report from your Home page.

Note: If you "share" your Home page, the Rename and Remove links will not be available for shared items.

Customizing the ElectricFlow Platform UI

You can customize the ElectricFlow platform UI to get a more intuitive, task-specific user interface.

- Customizing parameters
- Customizing tab layouts
- Home page configurations

Customizing parameters

Two types of objects contain formal parameters – procedures and state definitions. For these objects, you can customize the way their formal parameters are presented. You can reorder the parameters and set the labels, form element types, default values, tooltip Help text, and whether or not the parameter is required. When defined, this customization shows up whenever the parameters are displayed—running a procedure, creating a step to call a procedure, creating a transition definition to a specific target state, and so on.

How do you customize parameters?

Create a property named ec_parameterForm on the object containing formal parameters (the procedure or state definition). The value of this property is an XML-style specification of form elements that map to the parameters. This property must be in sync with the formal parameters, which means all formal parameters must have a corresponding XML element, with no "extra" XML elements.

Custom parameter form contents

The value of the property in XML: Under a top-level element called <editor>, you need an element called <formElement> for each parameter. Under a <formElement>, you can specify the following tags:

- property* - the name of the formal parameter
- type* - entry|textarea|select|radio|checkbox|project|savedSearch|credential
- label* - displayed next to the element
- value - the initial value of the element (does not apply to credentials, which must be specified at runtime)
- required - if true, the user must enter a value for the element
- documentation - text displayed in the tooltip when the form element is "moused" over
- numRows - valid for textarea elements; represents the height of the element
• option - a single option for select|radio elements; at least one is required
  ○ name* - the text displayed in the option
  ○ value - the value of the option

• checkedValue - valid for checkbox elements; the value of the element when it is checked

• uncheckedValue - valid for checkbox elements; the value of the element when it is unchecked

• initiallyChecked - valid for checkbox elements; whether or not the element is "checked" by default

Note: An asterisk (*) in the list above indicates a required tag.

Example

The following example is a parameter form that rearranges parameters and sets the labels, descriptions, default values, and form elements for each parameter.

```xml
<editor>
  <formElement>
    <label>One:</label>
    <property>one</property>
    <documentation>The first parameter.</documentation>
    <type>entry</type>
    <value>Test value</value>
  </formElement>
  <formElement>
    <label>Two:</label>
    <property>two</property>
    <documentation>The second parameter.</documentation>
    <type>textarea</type>
    <required>1</required>
  </formElement>
  <formElement>
    <label>Three:</label>
    <property>three</property>
    <documentation>The third parameter.</documentation>
    <type>select</type>
    <option>
      <name>ABC</name>
      <value>abc</value>
    </option>
    <option>
      <name>XYZ</name>
      <value>xyz</value>
    </option>
    <value>xyz</value>
  </formElement>
  <formElement>
    <label>Four:</label>
    <property>four</property>
    <documentation>The fourth parameter.</documentation>
    <type>radio</type>
    <option>
      <name>First Option</name>
      <value>123</value>
    </option>
  </formElement>
</editor>
```
Customizing the tab layout

Overview

A "view" defines the layout of tabs in the ElectricFlow web UI. One or more tab views may be defined at the server, group, and user level. The default view the user sees when they first log in can be set at the server, group, and user level. The default defined on the user takes precedence over its groups and the groups take precedence over the server. Electric Cloud provides a system default view that will always show up in the user's list. Views can inherit from each other and add/modify/remove/reposition tabs and subtabs as needed.

If you define a custom view, you have to manually add tabs such as Continuous Integration so that they will appear in your custom view.

View definition syntax

A view is an XML property. The following is a list of elements that can be defined in a view:
The following is a basic definition of a two-tab view where one of the tabs has three subtabs.

```xml
<view>
  <tab>
    <label>Home</label>
    <url>home.php</url>
    <accesskey>h</accesskey>
  </tab>
  <tab>
    <label>Administration</label>
    <url>workspaces.php</url>
    <accesskey>a</accesskey>
    <tab>
      <label>Workspaces</label>
      <url>workspaces.php</url>
    </tab>
    <tab>
      <label>Directory Providers</label>
      <url>directoryProviders.php</url>
    </tab>
    <tab>
      <label>Licenses</label>
      <url>licenses.php</url>
    </tab>
  </tab>
</view>
```
The following is a view that inherits from the above view and:

1. Changes the URL of the Home tab
2. Adds a new tab called Projects and places it at the beginning of the list
3. Changes the accesskey of the Administration tab
4. Moves the Workspaces subtab to the end of the list
5. Hides the Licenses subtab

```xml
<view version="1.0" encoding="utf-8">  
  <base>firstView</base>  
  <tab>  
    <label>Home</label>  
    <url>customizedHome.php</url>  
  </tab>  
  <tab>  
    <label>Projects</label>  
    <url>projects.php</url>  
    <accesskey>p</accesskey>  
    <position>1</position>  
  </tab>  
  <tab>  
    <label>Administration</label>  
    <accesskey>z</accesskey>  
  </tab>  
  <tab>  
    <label>Workspaces</label>  
    <position>3</position>  
  </tab>  
  <tab>  
    <label>Licenses</label>  
    <show>0</show>  
  </tab>  
</view>
```
Storing views

Tab views are stored in the server, group, and user property sheets. The view definitions are stored in a property sheet called ec_ui/availableViews. The name of the view is set to the property's description if defined, otherwise it is set to the property's name. The value of the view property is the XML definition document described above.

Default views

The property ec_ui/defaultView, if set, determines the default view for users inheriting from that object.

- If this property is set on the server, it is the default for all users.
- If this property is set on a group, all users belonging to that group will see that view, overriding the server's default if it is set also.
- Finally, a user can explicitly set their view by defining the property on their own property sheet. If the user belongs to multiple groups that define defaults, then ElectricFlow chooses the first group alphabetically.

The user can set their view by clicking on their name in the navigation bar, then clicking on the Edit Settings link. The list of views shown here comprise all views defined in the ec_ui/availableViews property sheets for the server, groups to which the user belongs, and the user itself.

If views have the same name at different levels, then the user overrides the group which overrides the server. If a user selects a view and chooses to Save, then the ec_ui/defaultView property on their sheet is set accordingly.

Two special values are always available in this list: "EC Default" and "Inherit". The former is the default tab layout defined in the ElectricFlow web UI. The latter means to use the first view in the list. By default, all users inherit their tab view.

For more information on user settings, see the Edit User Settings Help topic.

Developing and troubleshooting

If you create an invalid view definition on a group or server property sheet, you will break the UI for all users who inherit that view. The best practice for developing tab views is to use a "test user". Store the view definition in the ec_ui/availableViews property sheet for that user, and set the ec_ui/defaultView for that user to the name of the new view. When the view is working properly and ready for other users, you can migrate the new view to a group or to the server.

If you continue to have difficulty and tab definitions are not working correctly and can no longer get to the user settings page, revert to the ElectricFlow default by running the following command:

        ectool setProperty /users/$USERNAME/ec_ui/defaultView ec_default

When you log out and then log back in, you will have the default view again.

Note that changes to views are not visible until the next time a user logs in.
Home page configuration

The automation platform Home page is your configurable Dashboard. This page allows you to manage shared configurations and you can customize this page for your work preferences also. Refer to The Home page Help topic for details on creating Job Configurations, Shortcuts, Jobs Quick View, and Reports.

Shared Home page configurations can be set globally or for specific groups of users only. The general model for creating shared configurations is:

1. Set up your personal configuration the way you want it to appear to others.
   To get to the configuration page, select the Administration tab > Plugins > and click the Configure link for EC-Homepage.

2. Click Save to make the configuration available to a specific group or globally to everyone on the server.
   If you published the configuration to a specific group, no further action is needed. If you published the configuration globally, continue to the next step.

3. Copy and paste the Tab XML string into a specific user's or group's view.
   This adds the public configuration to that user's or group's own home page and no further action is required for the user or group. If this step is not completed, additional action is required as described in Installing the Home page on page 560.

You can alter an existing shared configuration by loading from a previously saved location, make changes, then save the changes back to the original or an alternate location.

User settings

Use the Backup Settings action to save and restore your personal Home page configuration.

Select Create to back up and temporarily set aside your personal settings while you create or update shared settings.
Select Restore to retrieve your personal settings after updating shared settings.

Location

Select Global to share the new Home page with everyone on the server, or select Group to share with specific users only.

Installing the Home page

If a globally available Tab XML string (from the Configure EC-Homepage page) has not been pasted to the user's or group's view, it must be added to an existing view definition to replace the standard Home page with the one provided by this plugin. To do this, click Load. This replaces the current home page with the one that's publicly available.

Reconfigure Contact Support link

In the event you want to redirect the Electric Cloud Support URL (available from the Help link on each ElectricFlow web page) to your own support center, you can create a file to add to the ElectricFlow installed directory at <ElectricFlow Install Dir>/apache/htdocs/commander. Create a file named config_user.php with the following contents:
<?php
    $config["contactSupportUrl"] = "your URL";
?>

Notes:
1. You must enter the value (URL) for your customer support site, replacing "your URL" in the example above. If no value is supplied, a blank window is displayed.
2. You must restart the Web Server for your change to take effect.

Configuring ElectricFlow

Use this page for quick access to configuring resources, workspaces, email configurations, your source control system, and defect tracking to communicate with ElectricFlow.

Note: If you are viewing this Help topic from the "Configuring ElectricFlow" web page, use these instructions:

Click the Add link for any object you want to configure and that objects configuration page is displayed.
- Each item you configure will be listed in this table for your easy reference.
- Configure objects listed in this table are linked to their respective "Edit..." page in the event you need to modify any values previously supplied. Select a configured object to edit its values.

The table below provides a brief description of ElectricFlow configuration tasks

Click on one of the "Setting Up..." links to see more information about that topic.

<table>
<thead>
<tr>
<th>Setting Up Resources</th>
<th>Before resources can be set up, you need to know which agent machines are available to allocate to jobs. The ElectricFlow Resource web page displays all resources currently available to the ElectricFlow server.</th>
</tr>
</thead>
</table>
| Setting Up Workspaces | ElectricFlow provides each job step with an area on the disk it can use for "working files" and results. This disk area is called a job workspace.  
A job step can create whatever files it needs within its workspace and ElectricFlow automatically places files, such as step logs, in the workspace. The location of the job step workspace is displayed on the Job Details web page. |
| Setting Up Email Configurations | If you do not create an Email Configuration, you will be unable to send email notifications to individuals or groups.  
If you have multiple users or groups in remote locations who use a different mail server, you will want to create additional email configurations to accommodate those locations if they need to receive notifications. |
### Setting Up a Source Control Configuration

ElectricFlow needs to communicate with your Source Control system (SCM) if you intend to use the CI Dashboard for continuous integration schedules to start a new build based on new/modified source control checkins, or if you plan to configure Preflight builds (to build and test code changes before those changes are "committed").

### Setting Up Directory Providers

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. Local users and groups can be defined within ElectricFlow.

### Setting Up Defect Tracking

ElectricFlow uses plugins to integrate with numerous defect tracking systems. If the plugin you need for your defect tracking system is not automatically installed with ElectricFlow, see the Plugin Catalog to find the integration you need.

ElectricFlow provides a number of bundled plugins for defect tracking. For a complete list, see [Plugins That are Bundled with ElectricFlow](#) on page 1138.

### Web Interface Online Help System

Use the automation platform online Help system for more information. Click the **Help** link in the top-right corner of any product web page to see a specific Help topic for that page.

When the Help system opens, we recommend reviewing the Help table of contents. All Help folders above the Web Interface Help folder are user-guide style Help topics that provide more detailed information on each of their topics. If you generally prefer to use a command line rather than the ElectricFlow web interface, you will find complete ectl tool (the ElectricFlow command-line tool) commands and arguments here too.

### Setting Up Resources

Select **Cloud > Resources** to view the Resources page.

Before resources can be configured, you need to know which agent machines are available to allocate to jobs. The Resources page displays all resources currently available to the ElectricFlow server. This page is your Resources management center where you can create, modify, or delete resources and see the resource status.

To view the Resource Pools page where you can manage the resource pools in ElectricFlow, go to **Cloud > Pools**.

To view the Zones page where you can manage the zones in ElectricFlow, go to **Cloud > Zones**.

### What is a Resource?

A *resource* is defined as an agent machine where steps can execute. In addition:
Each resource has a logical name.

Each resource refers to an agent machine by its host name.

Multiple resources can be defined on the same physical host.

Each resource can be assigned to one or more pools, or one zone.

Each resource has a step limit that determines the maximum number of steps that can execute simultaneously on the resource.

In Create/Edit Resource panels, you define the number of steps that can run on a resource. Remember that setting the Step Limit to "0" or leaving the field blank defaults to no step limit.

When ElectricFlow allocates resources for a job and steps are executed on the resource, it considers the step limit, not the CPU load from the steps. The step limit for a resource in your system depends on the agent machine performance. For example, using unlimited as the step limit for a heavy load can slow the agent and result in less consistent agent performance if this is not managed properly.

What is a Pool?

A pool is a group of interchangeable resources. For example, you might have a pool of Windows servers.

Naming a pool in a procedure step allows ElectricFlow to assign any resource from that pool to do the work for that step. By default, ElectricFlow will try to balance the requests against the set of resources in the pool, but you can also define your own rules for how resources will be selected.

To define a resource for a procedure step, you can do the following:

- Specify a resource or a pool name in a procedure step to execute that step on that resource/pool.
- Define custom properties for your resources or resource pools.
- Mark a resource as "exclusive" (the step acquires and retains its resource exclusively).

For example, if configuration information varies from resource to resource, you can use custom properties to hold this information and then reference it from procedure steps where it is needed. Suppose you have a pool of test machines where the test hardware is in a different location on each machine. You could define a property named "testLocation" on each resource, then pass this property to procedure steps using a reference such as $[/myResource/testLocation]. This approach allows you to define procedure steps to run on any resource and automatically handle configuration differences.

**Note:** When the ElectricFlow server and agents are installed on different hosts, make sure that the configuration for each agent specifies the Domain Name System (DNS) server.

**ElectricFlow Supports Two Resource Categories**

- Standard
- Proxy

**Standard Resources**

This resource category specifies a machine running an installed ElectricFlow agent on one of the supported agent platforms, as specified in the *ElectricFlow Installation Guide*, Chapter 2, "System Requirements and Supported Platforms."
Proxy Resources

This resource category requires SSH keys for authentication. You can create proxy resources (agents and targets) for ElectricFlow to use on numerous other remote platforms/hosts that exist in your environment. A proxy agent is an ElectricFlow agent, channeling to a proxy target.

- **Proxy agent** - This is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported platform. A proxy agent is an ElectricFlow agent, channeling to a proxy target.

- **Proxy target** - This is a machine on an unsupported platform that can run commands via an SSH server. Proxy targets have limitations, such as the inability to work with plugins or communicate with ssh commands.

For a step that will run on a proxy target, specify the **Working Directory** to be the directory to which the step's commandFile is uploaded from the proxy agent to the proxy target via SSH.

When a step is running on a proxy resource, the proxy agent performs the following tasks:

- Uploads the commandFile to the Working Directory on the proxy target via SSH.
  - Working Directory - the step runs in this directory on the proxy target, which defaults to the UNIX path to the workspace
- Creates a wrapper sh shell script to:
  - CD to the Working Directory
  - Set COMMANDER_environment variables that exist in the proxy agent's environment
  - Run the commandFile that was uploaded earlier
- Uploads the wrapper script to the Working Directory on the proxy target
- Runs the wrapper script on the proxy target
- Cleans up script files on the agent and proxy target

**Setting up SSH keys**

If you are not familiar with setting up SSH keys, go to the knowledge-based article called "Setting up SSH Keys in preparation to use a Proxy Agent" in the Electric Cloud Support Web Site:

2. In the ElectricFlow KB section, enter **KBEC-00049** in the Search field.
3. Click **Search**.
4. Click the link to the knowledge-based article called "KBEC-00049 - Setting up SSH Keys in preparation to use a Proxy Agent" to open it.

On UNIX, the ElectricFlow agent looks in the ~/.ssh directory for the private and public key files to set up the SSH connection to the proxy target. Therefore, we recommend generating your key files in that directory.

On Windows, the ElectricFlow agent does not presume a default location. Therefore, in the proxy resource definition you must specify the key file location. Enter the following line in the resource "Proxy Customizations" field:

```
setSSHKeyFiles('c:\ foo\priv.key');
```
To create a new resource

Click the Cloud tab in the ElectricFlow web interface to go to the Resources page.

At the top right-side of the table, click the down arrow next to the plus sign and select Create Resource or Create Proxy Resource link to see the New Resource or New Proxy Resource panel.

Setting Up Workspaces

ElectricFlow provides each job step with an area on the disk it can use for “working files” and results. This disk area is called a job workspace.

A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files in the workspace, such as step logs. Normally, a single workspace is shared by all steps in a job, but it is possible for different steps within a job to use different workspaces. The location of the job step workspace is displayed on the Job Details page for the job under "Details" for the step.

To create a new workspace

ElectricFlow can handle any number of workspaces.

- To define a workspace from the web interface, click the Cloud > Workspaces tabs.
- On the Workspaces page, click the Create Workspace link at the top right-side of the table and the New Workspace web page is displayed.

Click the Help link in the top-right corner of the web page for assistance with filling in the fields to create a workspace.

To see the Workspaces Help topic now, click Workspace - create new or edit existing workspace.

After you create a workspace specification, you will see it listed on the Workspaces page.

Setting Up Email Configurations

This topic describes how to set up an email configuration. It must be created and configured before you set up email notifications, also referred to as email notifiers at the platform level. Then you can send them to individuals or groups.

If you have multiple users or groups in remote locations who use a different mail server, you need to create additional email configurations to accommodate those locations if they receive ElectricFlow notifications.

Creating an Email Configuration

To create an email configuration in the platform GUI:

1. Click Administration > Email Configurations to go to the Email Configurations page.
2. Click Add Configuration to go to the New Email Configuration page.
3. Enter information in the fields on the page.

There are two ways to get help in entering information in the fields:

- Click Email Configuration - create new or edit existing email configuration to go to the Email Configuration help topic.
- If you are in the platform GUI, click the Help link in the upper-right corner of the page to see descriptions and other information.

After the email configuration is created, you will see it listed in the table on the Email Configurations page.

Setting Up a Source Control Configuration

You must configure your source control system to communicate with the ElectricFlow server if you plan to take advantage of the ElectricFlow Continuous Integration Dashboard and associated functionality and Preflight functionality—both of these features are designed to work with a number of source control (SCM) systems.

- Continuous Integration Dashboard - use this feature to create continuous integration schedules for your build environment. The Continuous Integration Manager is the front-end user interface for the ElectricSentry Continuous Integration engine.
- Preflight - use this feature to build and test developer code before it is committed to the code base for your product.

ElectricFlow installs (bundles) and supports numerous source control types. After creating a source control configuration, your entry will appear in the table on the Source Control Configurations web page—to see this web page, select the Administration > Source Control tabs.

Note: If the SCM you prefer is not listed here, see the Plugin Manager page (Administration > Plugins) for a list of all currently available SCM plugin integrations available for ElectricFlow. To configure a different SCM, see the Help topic associated with that plugin.

Select one of the following links to go to the source control configuration page to configure your SCM system:

- AccuRev
- ClearCase
- File
- Git
- Perforce
- Property
- Subversion

The Continuous Integration Dashboard has its own Help topic. For more information on ElectricSentry or Preflights builds, see their respective Help topics: ElectricSentry, Preflight Builds.
Setting Up Directory Providers

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. Local users and groups can be defined within ElectricFlow.

To specify a directory provider

ElectricFlow includes a web page to facilitate adding your existing LDAP or Active Directory users and groups to ElectricFlow.

- To access the Directory Providers web page, select the Administration > Directory Providers tabs.
- Click the Add Active Directory Provider or the Add LDAP Provider link to add a new provider.

Depending on which Add... Provider link you choose, you will see either the New Active Directory Provider or the New LDAP Provider web page. From either page, click the Help link in the upper-right corner of the page. The Help topic describes each field on either web page so you can easily enter information in the forms to have ElectricFlow use your existing user or group account information.

To see the Directory Provider Help topic now, click Directory Providers - create new or edit existing directory providers.

After adding a provider, you will see it listed in the table on the Directory Providers web page.

Enable/Disable Local ElectricFlow Users

Two server settings properties are supplied for local ElectricFlow users (both are "on" by default):

- enableAdminUser - if set to '0', attempts to log in as the 'admin' user are denied as if the user did not exist
- enableLocalUsers - if set to '0', attempts by a non-admin local user to log in are denied as if the user did not exist

These settings are stored in properties in the '/server/settings' property sheet and can be set from ectool by calling:

```ectool setProperty /server/settings/enableAdminUser 0```

Or, these settings can be set from the automation platform web interface:

- Select the Administration > Server tabs.
- At the top of the page, select the Settings link.

**Note:** Disabling these properties takes effect only for new sessions. Existing sessions continue to function "as-is" until the user logs out and attempts to log in again.

wrapper.conf Properties

If you need to edit the wrapper.conf file, see http://wrapper.tanukisoftware.com/doc/english/properties.html for complete information about property formats.
Using ElectricFlow in Your Environment

This topic addresses some common issues you may encounter as you start using ElectricFlow and offers some tips about managing your ElectricFlow projects.

What's in a step?
Where's the script for the step?
Environment variables
When do you use subprocedures?
How do you evolve procedures?
Porting existing scripts
ElectricFlow project version control

What's in a step?

One of the first questions you may ask when you start to implement your build and test processes on ElectricFlow is how to divide processes into individual steps: “Should I use only a few steps, each of which does a lot, or a large number of fine-grain steps?” Here are some factors to help you decide how many steps to use:

- **Reporting** - If you would like a separate report of success/failure for two activities, put those activities in separate steps. If you are happy to have a single report for both activities, a single step may make sense. For example, compilation and test phases should probably be in different steps because errors in the two phases will probably be handled differently. Unit tests for product components managed by different groups may make sense in separate steps; each group can watch for errors in its step.

- **Parallelism** - If you want to use ElectricFlow to run two activities in parallel, put them in separate steps. If these activities are in the same step, ElectricFlow cannot run them in parallel.

ElectricFlow parallelism works best at a coarse grain, such as running different sets of unit tests in parallel or compiling for different platforms. Electric Cloud does not recommend trying to do fine-grain parallelism with ElectricFlow, such as compiling every individual source file in a separate step—this is likely to be complicated and brittle, resulting in an enormous number of job steps, which will make it difficult to view results. If you would like to use fine-grain parallelism for compilation, we recommend using our ElectricAccelerator product. In this case, you would make your compilation steps large, with as much work in each makefile as possible because ElectricAccelerator automatically subdivides the work and runs as many sub-steps as possible in parallel. The more work in a makefile, the more efficient the process becomes.

- **Resources** - If two different activities need to run on different resources, they need to be in different steps. A single step runs entirely on a single resource.
• **Conditional steps** - If you want to skip portions of your process during some jobs, but execute them during others, it probably makes sense to put those activities in separate steps and use the ElectricFlow "Run condition" mechanism to decide whether they run during each particular job. However, if you are invoking programs like *make* that already allow you to choose which actions to perform, it may make more sense to have a single large step and handle conditional behavior with those programs, rather than with ElectricFlow. For example, when running *make*, you can specify the targets to be built.

• **Setup** - You might want to have a single step at the beginning of a procedure that processes the procedure's parameters and sets up the environment for the rest of the procedure. The setup step will create a snapshot of your source code or set up a ClearCase view also. After setup, the remaining steps should be easier to write because they just use information created during the setup step.

**Where's the script for a step?**

Typically, each step executes a script of some type, which is processed by a command language such as *cmd* on Windows, a *shell* on UNIX, or Perl.

**Two ways to handle script execution**

- The first approach - Enter the script directly into the command field for the step. You can specify the language interpreter as the shell for the step.
- The second approach - Store the script in a file that is part of the source code for your project, then specify a simple command for the step that invokes the command language to process the script file.

We recommend using the second approach in most cases. The main advantage of this approach is that it makes your ElectricFlow procedures more robust. For example, suppose the script needs to change as your product evolves. If you have kept the script outside ElectricFlow with the source code for the product, each product version can have its own copy of the script. When you extract the source code for the product at the beginning of a job, you also extract the scripts for its steps. You can change a step's script without worrying about its impact on other versions of the product.

However, if the script for a step is stored in the step, it is more difficult to evolve the script with new product versions. You probably still need to build older product versions, so you will worry whether the new script for the step will work with older product versions. If the script does not work, perhaps you can modify the step's script to test the version being built and take different actions for each version—this process becomes increasingly more complex as the number of versions increases. Or, you can make a separate copy of the build procedure for each product version (more on this below), but this process also gets complicated as you acquire more and more procedure versions. We find it is easier to store scripts for steps with the product code, so script changes are handled in the same way as changes to the product.

**Two cases where it makes sense to store the script for a step in the ElectricFlow step**

- The first case is for the first step of a job. At this point you have not extracted the source code for the product, so you do not yet have access to any scripts stored with the source code.
- The second case is for steps with one or two commands only, or steps already specified primarily by information stored with your source code. For example, if a step is running a *make* or *ant* command, step behavior is already specified almost entirely by a makefile or a *build.xml* file for Ant. In this case, the step's script invokes a single, relatively simple command; no need to store this in a file. If you subsequently find that the script for a step is changing frequently, consider moving it out of ElectricFlow and into a file stored with your source code.

The object is to make your ElectricFlow procedures as reusable as possible, so no change is needed with every small change to your product. Even better, organize your ElectricFlow procedures so a single procedure can be used for multiple products. To do this, store product-or version-specific information with the product, not with ElectricFlow.

**Environment variables**

Your build and test scripts probably depend on certain environment variables having certain values. In your existing system, you probably set those values at the beginning of your script. However, in ElectricFlow you need to set those values in each step that depends on them. The easiest way to set values is to create a short command file during the first step of the job and save it in the top-level directory of the job workspace. The command file should contain a sequence of commands to set all environment variables required by the job. Then, in each subsequent step, invoke that command file at the beginning of the step to set environment variables for that step. This approach simplifies management of your environment variables: if you need to change a variable, you change only the setup step at the beginning of the job, and the value is reflected in all of the following steps automatically.

**When do you use subprocedures?**

In ElectricFlow, the action for a step can invoke another procedure, passing parameters. This is a powerful tool for structuring your processes. Subprocedures tend to be used in two ways: for *encapsulating reusable processes* and for managing concurrency.

- **encapsulating reusable processes**, is the preferred use. If you need to perform certain activities repeatedly in different places, you can use a subprocedure for them. For example, when we build and test the ElectricFlow product, we do it on multiple platforms, but the mechanism is virtually the same on all platforms. We implement the basic build and test mechanism for one platform in a subprocedure named BuildAndTest. In our main procedure for production builds, we invoke BuildAndTest multiple times, once for each of the platforms. If the mechanism changes, we only need to change it once in BuildAndTest to fix all six platforms.

- **managing concurrency** - suppose you have three steps A1, A2, and A3, that must run sequentially, and two other steps B1 and B2 that must also run sequentially, but the two groups can run in parallel. The way to implement this is to put A1, A2, and A3 in one subprocedure named "A", and B1 and B2 in another subprocedure named "B". Now you can create a top-level procedure with two steps: one invoking A and the other invoking B, and mark those steps for parallel execution. As a result, A and B will run in parallel but the steps inside each subprocedure will run serially.

If you placed all five steps inside the top-level procedure, there would be no way to achieve this effect.

**How do you evolve procedures?**

After you start using ElectricFlow for managing your build and test processes, it will not be long before you encounter the following situation:
You have a set of ElectricFlow procedures that work fine on all existing versions of the product, but you are about to change the product in a way that affects ElectricFlow procedures. For example, you might be adding a new component, or perhaps you are going to change the way the product is installed for testing, or perhaps you have restructured the product to allow more steps to run concurrently. As a result, you need to change ElectricFlow procedures for the current version. At the same time, you need older product versions to continue building as well.

In most cases, the easiest way to handle these situations is to leave the current ElectricFlow procedures alone and keep using them for your older product version. This ensures you will not "break" older versions. Make copies of the procedures that need to change, then modify the copies and use them for your new software version.

You will have one version of procedures for each significant version of the product. For example, at Electric Cloud, we incorporate the version number into the procedure names: "Master-1.0" is the version of the Master procedure used with the 1.0 release, "Master-1.1" is used for 1.1, and "Master" with no version number is used for our current development.

Another approach would be to make a copy of the entire project for each release. This method may be easier if other information in the project, such as property values, needs to evolve also.

The "copying" approach gets more and more complicated as you add more and more versions of the procedure. To minimize this complexity, try to structure your procedures so they do not have to change frequently. Some techniques you can use:

- Use parameters for things that do change frequently, such as the branch of software to build.
- Where possible, store scripts and other information [used by the procedure] as part of the source code for the project as described above, so this information is versioned automatically, along with your source code.

**Porting existing scripts**

You probably already have scripts you have been using to build and test software, before switching to ElectricFlow.

Over time, you will probably want to do quite a bit of restructuring to take full advantage of ElectricFlow. However, you probably do not need to do major restructuring to get started with ElectricFlow. Here are some steps you might take to "get up and running" with ElectricFlow as quickly as possible and gradually convert to make the best use of the system.

*To begin,* see if you can take your existing script and run it monolithically as a single step in a procedure under ElectricFlow. This will get you running and start providing some ElectricFlow benefits for resource management, error analysis, and reporting.

*Next,* start dividing your previous script into separate steps for ElectricFlow. Begin with the steps easiest to separate from the rest of the script, such as the commands to compile your software. One of the challenges you face is how to pass data from one step to another. In a monolithic script, you can keep the data in variables that persist throughout the job. As you divide the script into steps, you need to figure out which variables are used only in a single step and which variables pass from step to step. For variables that pass between steps, use ElectricFlow properties to store their values. In many cases you can compute shared
data values in a single step at the beginning of the job, store their values in properties on the job, then access those values read-only in later job steps.

**After dividing the steps**, you can do finer-grain reporting. Start using the `postp` postprocessor to scan your log files and generate statistics and diagnostics. Over time you will probably discover you have a few error and warning messages peculiar to your site, and are not captured by `postp`'s patterns. Learn how to extend `postp` with additional patterns to capture all the information that matters to you.

**Now that reporting statistics are being recorded**, you may wish to develop your own reports to summarize those statistics. You can easily use `ectool` to read statistics from the properties where they are stored.

**Something else you can do** after steps are divided: start tuning the performance of your procedures. For example, you can start marking steps to run in parallel, and you can choose resources on a step-by-step basis to finish your jobs faster and share resources more effectively.

**ElectricFlow project version control**

We recommend exporting your ElectricFlow project data at regular intervals and saving it in the same configuration management system you use for your source code (use the "export" `ectool` command to generate an XML file representing the contents of a project or procedure). This process allows you to track project changes and also allows you to "look back" at older versions if that should become desirable. Also, you should snapshot a version of ElectricFlow project data at the time of each major software release, so you can revert to the exact ElectricFlow configuration used to generate that release if necessary.

**ElectricFlow Installed Tools**

This reference topic can acquaint you with some tools you may not know about or provide quick access to information for tools you use already. Select from the links in the table below to go directly to information for that tool.

<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>eccert</strong></td>
<td>A command-line tool to manage the ElectricFlow Certificate Authority (CA) and the certificates configured in ElectricFlow Server and ElectricFlow Agent installations.</td>
</tr>
<tr>
<td><strong>ecconfigure</strong></td>
<td>A command-line tool that can change configuration values for any locally installed ElectricFlow server, web, agent, or repository service. <code>ecconfigure</code> is a more user-friendly mechanism for configuring aspects of ElectricFlow that would otherwise require manual configuration file updates. <code>ecconfigure</code> actually manipulates relevant service configuration files on your behalf.</td>
</tr>
</tbody>
</table>

**IMPORTANT:** You must have root privileges to use the `--webPluginsDirectory=path` option.
### Tool Name | Description
--- | ---
**ecdaemon** | A "wrapper" program that can be used to start another program from an ElectricFlow job step—the "started" program will run as a daemon process. The ElectricFlow agent uses the facilities of the underlying operating system to make sure the process runs in a separate process group on a UNIX-based system, or outside of the normal "Windows Job" grouping in a Windows system. In either case, the ElectricFlow agent does not treat the process as one it should wait for or one it should try to "kill" if ElectricFlow needs to abort the step.

**ecproxy** | A driver script with built-in support for SSH. Every major operation can be overridden by defining a Perl function in the Proxy Customization field on the New Proxy Resource panel, available from the Resources page.

**ecremotefilecopy** | **Remote file copy**: When ElectricFlow agents (on platforms other than Linux or Windows) run steps that create log files in a workspace the ElectricFlow web server cannot access (through Linux or Windows agents), use ecremotefilecopy to recreate job logs so they are visible on those ElectricFlow agents, which then enables the web server to retrieve and render those log files.

**ZKConfigTool** | A command-line tool that imports your ElectricFlow database configuration information into your ZooKeeper server.

**ClusterInfoTool** | A command-line tool that displays information on the running ElectricFlow server cluster from ZooKeeper.

---

### eccert

A command-line tool used to manage the ElectricFlow Certificate Authority (CA) and the certificates configured in ElectricFlow Server and ElectricFlow Agent installations.

#### Usage

```
eccert [ options ] command [ arg ... ]
```

#### Commands
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>addTrustedServer crt</td>
<td>Add a server CA certificate to the agent's keystore.</td>
</tr>
<tr>
<td>getCRL</td>
<td>Retrieve the contents of the current certificate revocation list.</td>
</tr>
<tr>
<td>initAgent [ --local</td>
<td>--remote ] [ options ]</td>
</tr>
<tr>
<td>--local</td>
<td>Use the local server CA to sign the agent certificate.</td>
</tr>
<tr>
<td>--remote</td>
<td>Connect to a remote ElectricFlow server to sign the agent certificate.</td>
</tr>
<tr>
<td>--force</td>
<td>Replace any existing keystore.</td>
</tr>
<tr>
<td>--cname name</td>
<td>Use the specified name as the common name (CN) in the agent certificate subject. This is normally the fully qualified domain name used by clients to connect to the agent.</td>
</tr>
<tr>
<td>--altNames entries</td>
<td>Use the specified list of entries (comma or space separated) as the subjectAlternateNames list in the agent certificate. Simple names are interpreted as dns entries. Entries may begin with &quot;dns:&quot; or &quot;ip:&quot; to indicate the type (for example, &quot;ip:192.168.0.1&quot; or &quot;dns:myHost&quot;). If no entries are specified, then reverse DNS is used to look up the registered names of the host's IP addresses.</td>
</tr>
<tr>
<td>initCA</td>
<td>Initialize the server CA. Creates a new CA key and certificate.</td>
</tr>
</tbody>
</table>
**initServer [ options ]**

Initialize the server keystore. Creates and signs the server certificate. Installs the CA certificate and the signed server certificate into the server's keystore.

- **--force**
  
  Replace any existing keystore.

- **--cname name**
  
  Use the specified name as the common name (CN) in the server certificate subject. This is normally the fully qualified domain name used by clients to connect to the server.

- **--altNames entries**
  
  Use the specified list of entries (comma or space separated) as the subjectAlternateNames list in the server certificate. Simple names are interpreted as dns entries. Entries may begin with "dns:" or "ip:" to indicate the type (for example, "ip:192.168.0.1" or "dns:myHost"). If no entries are specified, then reverse DNS is used to look up the registered names of the host's IP addresses.

**list [ --agent | --server | --index [ --verbose ]**

Display certificate information for agent and/or server keystores or the CA certificate index. If no options are specified, both the agent and server keystores are listed.

- **--agent**
  
  List the contents of the agent keystore.

- **--server**
  
  List the contents of the server keystore.

- **--index**
  
  List the contents of the CA issued certificates index.

- **--verbose**
  
  Display additional details.

**refreshCRL**

Refresh the certificate revocation list from the ElectricFlow server.
Revoke a previously issued certificate by index.

Sign the certificate signing request provided in file csr and write the signed result to the file crt. The request is rejected by the CA if there is a matching certificate already in the CA database.

Install a previously signed certificate crt into the agent's keystore.

**Server Communication Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--server host</td>
<td>Address of the ElectricFlow server. Defaults to the value of the COMMANDER_SERVER environment variable. If that does not exist, it defaults to localhost.</td>
</tr>
<tr>
<td>--securePort port</td>
<td>HTTPS listener port on the server. Defaults to 8443.</td>
</tr>
</tbody>
</table>

**Global Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--help</td>
<td>Print the Help message.</td>
</tr>
<tr>
<td>--version</td>
<td>Print the version message.</td>
</tr>
</tbody>
</table>

**Examples**

**Example 1: Configure an agent to talk to any server (untrusted mode)**

This example generates a new self-signed certificate for the agent and recreates the keystore with no trusted authorities.

```bash
$ eccert initAgent --force

Generating keys
Generating certificate request
  cname=myAgent.company.com
  san=dns:myAgent.company.com
```

**Example 2: Configure an agent to accept connections only from a single remote ElectricFlow server**

This example generates a new certificate for the agent that is signed by the remove server's certificate authority and installs the signed certificate and its associated trust chain in the agent's keystore. After this point, the agent
will only accept requests from the specified server and will be used as a trusted resource by the server.

$ ectool --server myserver login admin pw
$ eccert --server myserver initAgent --remote

Generating certificate request
   cname=myAgent.company.com
   san=dns:myAgent.company.com
Asking server 'myserver' to sign certificate
Importing 'CA:myserver.company.com' certificate
Importing 'jetty' certificate

Example 3: Configure an ElectricFlow server with additional host names in the certificate

This example regenerates the ElectricFlow Server Certificate, the specified common name, and alternate subject names to allow trusted connections with multiple external dns names.

$ eccert initServer --force --cname "myServer.company.com" --altNames "myServer,server2.company.com"

Generating keys
Generating certificate request
   cname=myserver.company.com
   san=dns:myserver,dns:server2.company.com
Signing server certificate
Importing 'CA:myserver.company.com' certificate
Importing 'jetty' certificate

ecconfigure
A command-line tool for changing values in configuration files for any locally-installed ElectricFlow server, web server, repository server, or agent. ecconfigure is an easier way to configure ElectricFlow settings than manually editing configuration files.

Usage

econfigure [options]

Agent Options
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--agentAcceptQueueSize=max</code></td>
<td>The maximum number of pending connections the agent will queue up.</td>
</tr>
<tr>
<td><code>--agentArtifactCache=path</code></td>
<td>The directory containing cached artifactVersions.</td>
</tr>
<tr>
<td><code>--agentCrlFile=relativepath</code></td>
<td>Relative path of the file containing the agent's certificate revocation list for SSL.</td>
</tr>
<tr>
<td><code>--agentDomainName=domain</code></td>
<td>The domain name that the agent uses for fully-qualified names.</td>
</tr>
<tr>
<td><code>--agentDuplicateDetectionListSize=size</code></td>
<td>The size of the list of recently seen requests used in duplicate request detection.</td>
</tr>
<tr>
<td>`--agentEnableProxySettings=&lt;1</td>
<td>0&gt;`</td>
</tr>
<tr>
<td><code>--agentIdleConnectionTimeout=milliseconds</code></td>
<td>Idle connection timeout, in milliseconds.</td>
</tr>
<tr>
<td><code>--agentIdleOutboundConnectionTimeout=seconds</code></td>
<td>Idle time after which an outbound connection is closed, in seconds.</td>
</tr>
<tr>
<td><code>--agentIdlePostRunnerTimeout=seconds</code></td>
<td>Idle time after which a PostRunner thread is terminated, in seconds.</td>
</tr>
<tr>
<td><code>--agentIdleServerRequestWorkerTimeout=seconds</code></td>
<td>Idle time after which a ServerRequestWorker thread is terminated, in seconds</td>
</tr>
<tr>
<td><code>--agentIdleWorkerTimeout=seconds</code></td>
<td>Idle time after which a Worker thread is terminated, in seconds.</td>
</tr>
<tr>
<td><code>--agentInitMemory=percent</code></td>
<td>Initial java heap size as a percentage of the total system memory.</td>
</tr>
<tr>
<td><code>--agentInitMemoryMB=size</code></td>
<td>Initial java heap size in MB.</td>
</tr>
<tr>
<td><code>--agentKeystore=path</code></td>
<td>Location of the keystore file used by the agent to support SSL connections from the server.</td>
</tr>
<tr>
<td><code>--agentKeystorePassword=password</code></td>
<td>Password used to access the agent's keystore.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>`--agentLoadProfile=true</td>
<td>yes</td>
</tr>
<tr>
<td><code>--agentLocalPort=port</code></td>
<td>Port used by the Commander agent for http communication on the localhost network interface.</td>
</tr>
<tr>
<td><code>--agentLogFile=path</code></td>
<td>Path where the C++ agent log file should be written.</td>
</tr>
<tr>
<td>`--agentLogLevel=TRACE</td>
<td>DEBUG</td>
</tr>
<tr>
<td><code>--agentLogMaxFiles=max</code></td>
<td>Maximum number of log files the C++ agent will accrue.</td>
</tr>
<tr>
<td><code>--agentLogMaxSize=max</code></td>
<td>Maximum size of each log file from the C++ agent. The value may be suffixed with a unit (MB, KB, B). Without a unit, the value is interpreted as bytes.</td>
</tr>
<tr>
<td><code>--agentMaxConnections=max</code></td>
<td>Maximum number of network connections for the agent.</td>
</tr>
<tr>
<td><code>--agentMaxConnectionsPerRoute=max</code></td>
<td>Maximum number of network connections per route for the agent.</td>
</tr>
<tr>
<td><code>--agentMaxHttpThreads=max</code></td>
<td>Maximum number of threads for handling inbound requests.</td>
</tr>
<tr>
<td><code>--agentMaxLoggedMessageLength=max</code></td>
<td>Maximum message length, used when logging requests/responses to/from the Commander server.</td>
</tr>
<tr>
<td><code>--agentMaxMemory=percent</code></td>
<td>Maximum java heap size as a percentage of the total system memory.edom.</td>
</tr>
<tr>
<td><code>--agentMaxMemoryMB=size</code></td>
<td>Maximum java heap size in MB.</td>
</tr>
<tr>
<td><code>--agentNoProxyHosts=hosts</code></td>
<td>Comma delimited list of hosts that should be reached directly, bypassing the proxy server.</td>
</tr>
<tr>
<td><code>--agentOutboundConnectTimeout=milliseconds</code></td>
<td>Timeout for the agent establishing outbound connections, in milliseconds.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td><code>--agentOutboundRequestInitialRetryInterval=seconds</code></td>
<td>Initial delay between retries for sending outbound requests to a server, in seconds.</td>
</tr>
<tr>
<td><code>--agentOutboundRequestMaxRetryInterval=seconds</code></td>
<td>Maximum delay between retries for sending outbound requests to a server, in seconds.</td>
</tr>
<tr>
<td><code>--agentOutboundRequestTimeout=hours</code></td>
<td>Timeout after which the agent gives up trying to send a request to a server, in hours.</td>
</tr>
<tr>
<td><code>--agentPluginsDirectory=path</code></td>
<td>The path used by the agent to get to the plugins directory of the Commander server where its resource definition lies.</td>
</tr>
<tr>
<td><code>--agentPort=port</code></td>
<td>Port used by the Commander agent for https communication on any network interface.</td>
</tr>
<tr>
<td>`--agentProtocol=&lt;http</td>
<td>https&gt;`</td>
</tr>
<tr>
<td><code>--agentProxyHost=host</code></td>
<td>The IP address of the proxy server.</td>
</tr>
<tr>
<td><code>--agentProxyPort=port</code></td>
<td>The port of the proxy server.</td>
</tr>
<tr>
<td><code>--agentServerSessionsFile=relativepath</code></td>
<td>Relative path to the persisted server sessions file.</td>
</tr>
<tr>
<td><code>--agentUnixShellPattern=pattern</code></td>
<td>Windows-only: ordinarily, the agent creates script-files with CRLF line termination. But some shells on Windows require script files to be LF line-terminated, like Unix. This option sets a regular expression pattern for such shells. Defaults to a pattern that matches sh and bash, which in modern versions of Cygwin require LF-terminated script files.</td>
</tr>
<tr>
<td><code>--agentWrapperConsoleFormat=format</code></td>
<td>Format of output for the agent wrapper console.</td>
</tr>
<tr>
<td><code>--agentWrapperEcwrapperWriteMaxAttempts=max</code></td>
<td>Workspace write maximum attempts count</td>
</tr>
<tr>
<td><code>--agentWrapperEcwrapperWriteRetryInterval=milliseconds</code></td>
<td>Workspace write interval between two attempts, in milliseconds.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>--agentWrapperJavaAdditional=nnnn=value</td>
<td>Set a custom line of the form wrapper.java.additional.nnnn=value in the agent's wrapper.conf file. nnnn must be an integer &gt;= 10000.</td>
</tr>
<tr>
<td>--agentWrapperJavaClasspath=n=path</td>
<td>The Java classpath. n must be an integer &gt;= 1.</td>
</tr>
<tr>
<td>--agentWrapperJavaLibraryPath=n=path</td>
<td>The Java Library Path (location of Wrapper.DLL or libwrapper.so). n must be an integer &gt;= 1.</td>
</tr>
<tr>
<td>--agentWrapperLogfile=path</td>
<td>Log file to use for agent wrapper output logging.</td>
</tr>
<tr>
<td>--agentWrapperLogfileFormat=format</td>
<td>Format of output for the agent wrapper log file.</td>
</tr>
<tr>
<td>--agentWrapperLogfileLoglevel=loglevel</td>
<td>Log Level for agent wrapper log file output.</td>
</tr>
<tr>
<td>--agentWrapperLogfileMaxsize=size</td>
<td>Maximum size that the log file will be allowed to grow before the log is rolled. Size is specified in bytes, kilobytes with a 'k' suffix, or megabytes with an 'm' suffix.</td>
</tr>
<tr>
<td>--agentWrapperLogfileMaxfiles=max</td>
<td>Maximum number of rolled log files which will be allowed before old files are deleted.</td>
</tr>
<tr>
<td>--agentWrapperNtserviceDependency=n=service</td>
<td>NT service dependencies. Add dependencies as needed starting from 1. n must be an integer &gt;= 1.</td>
</tr>
<tr>
<td>--agentWrapperNtserviceStarttype=</td>
<td>Mode in which the NT service is installed.</td>
</tr>
<tr>
<td>&lt;AUTO_START</td>
<td>DEMAND_START&gt;</td>
</tr>
<tr>
<td>--agentWrapperNtserviceInteractive=&lt;true</td>
<td>false&gt;</td>
</tr>
<tr>
<td>--agentWrapperPingInterval=seconds</td>
<td>Java virtual machine-wrapper heartbeat interval, in seconds.</td>
</tr>
<tr>
<td>--agentWrapperPingTimeout=seconds</td>
<td>Java virtual machine-wrapper heartbeat timeout, in seconds.</td>
</tr>
<tr>
<td>--agentWrapperRequestThreadDumpOnFailedJvmExit=&lt;true</td>
<td>false&gt;</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><code>--agentWrapperShutdownTimeout=seconds</code></td>
<td>The wrapper's shutdown timeout, in seconds.</td>
</tr>
<tr>
<td><code>--agentWrapperStartupTimeout=seconds</code></td>
<td>The wrapper's startup timeout, in seconds.</td>
</tr>
<tr>
<td><code>--agentWrapperSuccessfulInvocationTime=seconds</code></td>
<td>The amount of time the agent has to be up before the wrapper considers it a 'successful' invocation. If there are 5 or more consecutive failed invocations, the wrapper will no longer start up the agent.</td>
</tr>
<tr>
<td><code>--agentWrapperSyslogLoglevel=loglevel</code></td>
<td>Log Level for sys/event agent wrapper log output.</td>
</tr>
<tr>
<td><strong>Apache Web Server Configuration Options</strong></td>
<td></td>
</tr>
<tr>
<td><code>--webHostName=host</code></td>
<td>The host name of the current machine in the form that users will typically use in their browser to access the web server.</td>
</tr>
<tr>
<td><code>--webHttpPort=port</code></td>
<td>The HTTP port of the web server.</td>
</tr>
<tr>
<td><code>--webHttpsPort=port</code></td>
<td>The HTTPS port of the web server.</td>
</tr>
<tr>
<td><code>--webTargetHostName=host</code></td>
<td>The host name of the Commander server to which the web server points.</td>
</tr>
<tr>
<td><code>--webTargetHttpPort=port</code></td>
<td>The HTTP port of the Commander server to which the web server points.</td>
</tr>
<tr>
<td><code>--webTargetHttpsPort=port</code></td>
<td>The HTTPS port of the Commander server to which the web server points.</td>
</tr>
<tr>
<td><code>--webTimeZone=timezone</code></td>
<td>The Olson TimeZone format (example: America/Los Angeles) for the php web server.</td>
</tr>
<tr>
<td><code>--webPluginsDirectory=path</code></td>
<td>The path used by the web server to get to the plugins directory of the Commander server to which it points.</td>
</tr>
<tr>
<td><code>--webProxyUrl=url</code></td>
<td>The IP address and port of the proxy server in the following format. http://&lt;IP_ADDRESS_PROXY&gt;:&lt;PROXY_PORT&gt;</td>
</tr>
<tr>
<td><code>--webNoProxyHosts=hosts</code></td>
<td>Comma delimited list of hosts that should be reached directly, bypassing the proxy server.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>`--webEnableProxySettings=&lt;1</td>
<td>0&gt;`</td>
</tr>
<tr>
<td><code>--webDLC=url</code></td>
<td>The URL to use for downloadable content requests.</td>
</tr>
<tr>
<td>`--webDisableHttpsRedirection=&lt;1</td>
<td>0&gt;`</td>
</tr>
<tr>
<td>`--webCsrfProtection=&lt;true</td>
<td>false&gt;`</td>
</tr>
<tr>
<td><strong>Commander Server Configuration Options</strong></td>
<td></td>
</tr>
<tr>
<td><code>--serverFileTransferPort=port</code></td>
<td>The file transfer port of the server.</td>
</tr>
<tr>
<td><code>--serverCommanderPort=port</code></td>
<td>The HTTP port of the server.</td>
</tr>
<tr>
<td><code>--serverCommanderHttpsPort=port</code></td>
<td>The HTTPS port of the server.</td>
</tr>
<tr>
<td><code>--serverDatabaseName=name</code></td>
<td>The name of the database the Commander server uses for its operation.</td>
</tr>
<tr>
<td><code>--serverDatabaseUsername=name</code></td>
<td>The user name for the database the Commander server uses for its operation.</td>
</tr>
<tr>
<td><code>--serverName=host</code></td>
<td>The name the Commander server, usually its fully-qualified domain name, or for a cluster the fully-qualified domain name of the load balancer.</td>
</tr>
<tr>
<td><code>--serverHttpPort=port</code></td>
<td>The HTTP port of the server, default value 8000.</td>
</tr>
<tr>
<td><code>--serverHttpsPort=port</code></td>
<td>The HTTPS port of the server, default value 8443.</td>
</tr>
<tr>
<td><code>--serverInitMemory=percent</code></td>
<td>Initial java heap size as a percentage of the total system memory.</td>
</tr>
<tr>
<td><code>--serverMaxMemory=percent</code></td>
<td>Maximum java heap size as a percentage of the total system memory.</td>
</tr>
<tr>
<td><code>--serverInitMemoryMB=size</code></td>
<td>Initial java heap size in MB.</td>
</tr>
<tr>
<td><code>--serverMaxMemoryMB=size</code></td>
<td>Maximum java heap size in MB.</td>
</tr>
<tr>
<td><code>--serverPasskeyFile=path</code></td>
<td>Path to the server's passkey file.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>--serverProxyHost=host</td>
<td>The IP address of the proxy server.</td>
</tr>
<tr>
<td>--serverProxyPort=port</td>
<td>The port of the proxy server.</td>
</tr>
<tr>
<td>--serverNoProxyHosts=hosts</td>
<td>Comma delimited list of hosts that should be reached directly, bypassing the proxy server.</td>
</tr>
<tr>
<td>--serverEnableProxySettings=&lt;1</td>
<td>0&gt;</td>
</tr>
<tr>
<td>--serverZooKeeperConnection=host:port [,host:port,host:port] [host:port,host:port]]</td>
<td>Comma-separated list of host IP/FQDN and ports for the ZooKeeper servers for a clustered configuration.</td>
</tr>
<tr>
<td>--serverExhibitorConnection=host [:port] [,host,host[host,host]]</td>
<td>Comma-separated list of host IP/FQDN for the Exhibitor servers for a clustered configuration, if you are using Exhibitor. To use a port number other than 80, add the port number after the first host IP/FQDN: the same port number will be used for all hosts.</td>
</tr>
<tr>
<td>--serverEnableClusteredMode=&lt;1</td>
<td>0&gt;</td>
</tr>
<tr>
<td>--wrapperJavaAdditional=n1nnn=value</td>
<td>Set a line wrapper.java.additional=value in the server's wrapper.conf file. n1nnn must be an integer &gt;= 10000.</td>
</tr>
</tbody>
</table>

**MySQL Database Configuration Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--databaseMemoryBufferSize=size</td>
<td>Size of the database memory buffer. The value may be suffixed with a unit (K, M, G). Without a unit, the value is interpreted as bytes.</td>
</tr>
<tr>
<td>--databasePort</td>
<td>The database port.</td>
</tr>
</tbody>
</table>

**Repository Server Configuration Options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--repositoryPort</td>
<td>The repository server port.</td>
</tr>
<tr>
<td>--repositoryInitMemory=percent</td>
<td>Initial java heap size as a percentage of the total system memory.</td>
</tr>
<tr>
<td>Environment Configuration</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><code>--repositoryMaxMemory=percent</code></td>
<td>Maximum java heap size as a percentage of the total system memory.</td>
</tr>
<tr>
<td><code>--repositoryInitMemoryMB=size</code></td>
<td>Initial java heap size in MB.</td>
</tr>
<tr>
<td><code>--repositoryMaxMemoryMB=size</code></td>
<td>Maximum java heap size in MB.</td>
</tr>
<tr>
<td><code>--repositoryStorageDirectory=path</code></td>
<td>Path to the repository backing store. The artifact repository will use this directory to store artifacts.</td>
</tr>
<tr>
<td><code>--repositoryTargetHostName=host</code></td>
<td>The host name of the Commander server to which the repository server points.</td>
</tr>
<tr>
<td><code>--repositoryTargetHttpPort=port</code></td>
<td>The HTTP port of the Commander server to which the repository server points.</td>
</tr>
<tr>
<td><code>--repositoryTargetHttpsPort=port</code></td>
<td>The HTTPS port of the Commander server to which the repository server points.</td>
</tr>
<tr>
<td>`--repositoryTargetProtocol=&lt;http</td>
<td>https&gt;`</td>
</tr>
<tr>
<td><code>--repositoryProtocol</code></td>
<td>The protocol that the repository server uses to talk to client applications.</td>
</tr>
<tr>
<td><code>--repositoryProxyHost=host</code></td>
<td>The IP address of the proxy server.</td>
</tr>
<tr>
<td><code>--repositoryProxyPort=port</code></td>
<td>The port of the proxy server.</td>
</tr>
<tr>
<td><code>--repositoryNoProxyHosts=hosts</code></td>
<td>Comma delimited list of hosts that should be reached directly, bypassing the proxy server.</td>
</tr>
<tr>
<td>`--repositoryEnableProxySettings=&lt;1</td>
<td>0&gt;`</td>
</tr>
<tr>
<td>`--repositoryValidateFromDisk=&lt;1</td>
<td>0&gt;`</td>
</tr>
</tbody>
</table>

**Examples**

**Setting initial and maximum memory settings**
For example, to set the ElectricFlow Server initial memory percentage to 21% and the maximum memory percentage to 31%, specify:

```
ecconfigure --serverInitMemory 21 --serverMaxMemory 31
```

If your ElectricFlow server, web server, or repository server is deployed behind a proxy server that inhibits certain Internet access, you can use `ecconfigure` to set proxy settings for each server in your installation.

To use the following perl scripts, remove the brackets (“< >”), and replace the bracketed example text with the values you need.

- To set ElectricFlow Server proxy settings:

  ```
  ecconfigure --serverProxyHost <IP_ADDRESS_PROXY> --serverProxyPort <PORT>
  --serverNoProxyHosts "<HOST1,HOST2>"
  ```

- To set Repository Server proxy settings:

  ```
  ecconfigure --repositoryProxyHost <IP_ADDRESS_PROXY> --repositoryProxyPort <PORT>
  --repositoryNoProxyHosts "<HOST1,HOST2>"
  ```

- To set Web Server proxy settings:

  ```
  ecconfigure --webProxyUrl <http://IP_ADDRESS:PORT> --webNoProxyHosts <HOST1,HOST2,HOST3>
  ```

### Changing the Apache web server port

Run `ecconfigure` with `--webHttpPort` and `--webHttpsPort`.

You web server port setting will be changed appropriately in `httpd.conf`, `ssl.conf`, and `config.php`.

### Configuring the backing store location for the Artifact Repository

```
ecconfigure --repositoryStorageDirectory <new-path>
```
Use Cases

- `ecdaemon` is useful in the case where you are trying to deploy a "server-style" program in an ElectricFlow step. You do not want ElectricFlow to wait for that step to complete because it may run continuously, but you do want ElectricFlow to start the server program and then continue on to the next step.

- `ecdaemon` is useful if you want to "pre-load" some type of background process

`ecdaemon` launches the command and exits. Optionally, it sets a property in ElectricFlow with the pid of the program it spawned to make it possible for a later step to "kill" the daemonized program if desired.

For example:

`ecdaemon c:/install.exe a b c`

Using `ecdaemon`

```
$ ecdaemon
Usage: ecdaemon [options] cmd cmdArg1 cmdArg2 ...
   ecdaemon --version

Required:
  command                               The command to daemonize, followed by its args, if any.

Options:
  --pidProperty=prop-path               A property to set with the pid of the daemonized process.
  --version                             Print the version of this program and exit.
```

Command-line parsing

`ecdaemon` supports the standard UNIX-style '---' flag to indicate there are no more `ecdaemon` options and all subsequent options should be treated as simple arguments to the command.

This is particularly important for commands that themselves take '---' arguments.

For example:

```
ecdamon /usr/bin/myserver --config /etc/myserver.conf
```

will not run properly because `ecdaemon` will attempt to parse the `--config` option instead of passing it to the `myserver` program.

The correct way to invoke `ecdaemon` in this case is:

```
ecdamon -- /usr/bin/myserver --config /etc/myserver.conf
```

If you want to store the daemonized process's pid in a property, do so as follows:

```
ecdamon --pidProperty /myJob/serverPid -- /usr/bin/myserver --config
/etc/myserver.conf
```

As a daemon process, any output goes to /dev/null, therefore no output file is generated.
ec-perl considerations

Use the perl system() call to start ecdaemon.

System() returns an exit status, "backticks" capture and return output that waits for the daemonized command to complete on Windows, and exec never returns at all if it is successful.

ecproxy

A driver script with built-in support for SSH. Every major operation can be overridden by defining a Perl function in the Proxy Customization field on the New Proxy Resource panel, available from the Resources page (by specifying which operation this function re-implements. These operations must have certain "signatures" for the driver to invoke them properly—the operations are listed and described below. For more detail, see the SSH implementation in ecproxy.pl.

ecproxy Algorithm

cproxy invokes the operations detailed below to perform the following actions:

1. Uploads the command-file to a "workingDirectory" on the proxy target, using the protocol specified in the proxy config. Currently, only SSH is supported.
2. Creates a wrapper sh shell script that CD's to workingDirectory, sets "COMMANDER_environment variables" that exist in the proxy agent's environment, and runs the command-file previously uploaded.
3. Uploads the wrapper script to workingDirectory on the proxy target.
4. Runs the wrapper script on the proxy target and streams its output to the proxy agent's stdout.
5. Deletes the local wrapper shell script, the remote wrapper, and remote command-file.
6. Exits using the exit code of running the wrapper script.

ecproxy Operations

getDefaultWorkingDirectory

<table>
<thead>
<tr>
<th>Description</th>
<th>Computes the default working directory where a command needs to run on the proxy target, if the step is not defined with a working directory.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>None</td>
</tr>
<tr>
<td>Returns</td>
<td>The path to a directory as it would be accessed on the proxy target.</td>
</tr>
<tr>
<td>SSH implementation function</td>
<td>Not SSH-specific, so the function is 'getDefaultWorkingDirectory'</td>
</tr>
</tbody>
</table>
Existing Implementation

<table>
<thead>
<tr>
<th>Reason to override</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return $ENV(COMMANDER_WORKSPACE_UNIX);</td>
</tr>
</tbody>
</table>
| If the "Working Directory" field is empty on a step that is going to run on a proxy target, the working directory for the step should be the workspace, just as it would be if the step were running on a non-proxy ElectricFlow agent.  
ecproxy is guaranteed to run in the workspace directory on the proxy agent, but it is not guaranteed that the proxy target has the same path to the workspace.  
For example, the workspace on a Windows proxy agent is not the same as the path a Unix proxy target uses to access the workspace—so the existing implementation of this operation simply returns the UNIX path to the workspace. However, if the proxy target has a different path for accessing the workspace, the existing implementation will give the wrong answer. Thus, a user can provide a different implementation that gives the right answer. |

**Note:** This operation is applicable only if "Working Directory" is empty, and is used as the working directory on the proxy target in that case for running the command.

### getDefaultTargetPort

<table>
<thead>
<tr>
<th>Description</th>
<th>Computes the default port where the proxy target is listening for this protocol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>None</td>
</tr>
<tr>
<td>Returns</td>
<td>The default port.</td>
</tr>
<tr>
<td>SSH implementation function</td>
<td>ssh_getDefaultTargetPort</td>
</tr>
</tbody>
</table>

**Note:** This operation is applicable only if the resource definition specifies no port value.

### connect

<table>
<thead>
<tr>
<th>Description</th>
<th>Opens a connection to the proxy target using the desired protocol.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>host, port (optional)</td>
</tr>
</tbody>
</table>

Returns | "connection-context hash-ref" on successful connection. This context can contain anything other functions can use to perform their tasks (for example, a connection handle).
---|---
Example 1 | my $context = connect('myhost', 22)
Example 2 | my $context = connect('myhost')
SSH implementation function | ssh_connect

**Note**: Because the port is optional, the implementation of `connect` can default to whatever is reasonable for the protocol. This means the 'Proxy Target Port' need not be specified in the ElectricFlow web UI for proxied agents reachable on the default port.

**uploadFile**

| Description | Uploads the given srcFile to the proxy target as tgtFile.
|---|---
| Arguments | context, srcFile (typically simple file-name), tgtFile (typically workingDirectory/file-name)
| Returns | Nothing; on failure it does a 'die' with an appropriate error message.
| Example | uploadFile($context, 'agent123.tmp', '/opt/work/joe/agent123.tmp')
| SSH implementation function | ssh_uploadFile

**generateWrapperScript**

| Description | Generates the script body that will run the command-file on the proxy-target in the workingDirectory.
|---|---
| Arguments | workingDirectory, cmd, cmdArg1, ..., cmdFileName (just the base-name, no directory)
| Returns | A string containing the script to execute on the proxy target.
| Example | generateWrapperScript('/opt/work/joe', 'perl', 'agent123.tmp')
### SSH implementation function

<table>
<thead>
<tr>
<th>Description</th>
<th>Not SSH-specific, so the function is 'generateWrapperScript'</th>
</tr>
</thead>
</table>

### Existing implementation

- cd workingDirectory; set COMMANDER_ environment variables; run command-file, properly quoting the command and args.

### Reason to override

If the proxy target does not have `sh`, the wrapper script needs to be written in a language available on the target.

### uploadWrapperScript

<table>
<thead>
<tr>
<th>Description</th>
<th>Uploads the wrapper-script code to the proxy target.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>context workingDirectory, wrapperScriptBody</td>
</tr>
<tr>
<td>Returns</td>
<td>The path to the wrapper-script on the proxy target.</td>
</tr>
<tr>
<td>Example</td>
<td>my $wrapperFile = uploadWrapperScript($context, '/opt/work/joe', 'cd /opt/work/joe; perl agent123.tmp')</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SSH implementation function</th>
<th>3.1, 3.1.1: <code>ssh_uploadWrapperScript</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.2 and later</td>
<td>Not SSH-specific anymore, so the function is 'uploadWrapperScript'</td>
</tr>
</tbody>
</table>

### Notes:

1. This function must generate a uniquely named file that will not conflict with other ecproxy invocations that might be occurring in parallel steps. The recommended approach is to generate a file name containing the job-step-id.

2. Depending on the protocol and facilities available in the Perl implementation, you may or may not need to create a local `tmp` file to upload to the proxy target. If you do, record that fact in the context and clean up the local file in the cleanup operation. Setting the local wrapper file path in `$context->[wrapperFile]` is recommended because the default cleanup operation implementation looks for that string.
generateWrapperInvocationCommand

<table>
<thead>
<tr>
<th>Description</th>
<th>Generates the command-line for running the wrapper script on the proxy target.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>remoteWrapperFile (path on proxy target)</td>
</tr>
<tr>
<td>Returns</td>
<td>A string containing the command-line for running the wrapper script file on the proxy target.</td>
</tr>
<tr>
<td>Example</td>
<td>my $wrapperCmdLine = generateWrapperInvocationCommand($wrapperFile)</td>
</tr>
<tr>
<td>SSH</td>
<td>Not SSH-specific, so the function is 'generateWrapperInvocationCommand'</td>
</tr>
<tr>
<td>implementation function</td>
<td></td>
</tr>
<tr>
<td>Existing implementation</td>
<td>Return &quot;sh $remoteWrapperFile&quot;;</td>
</tr>
<tr>
<td>Reason to override</td>
<td>The default implementation of this function returns something like 'sh $wrapperFile'. If the wrapper script is not an sh script, or if you want to pass different arguments to the shell, you must override this function.</td>
</tr>
</tbody>
</table>

runCommand

<table>
<thead>
<tr>
<th>Description</th>
<th>Runs the given command-line on the proxy target.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments:</td>
<td>context, cmdLine</td>
</tr>
<tr>
<td>Returns</td>
<td>exit-code from running the command on the proxy target, undef if the command could not be run for some reason.</td>
</tr>
<tr>
<td>Example</td>
<td>runCommand($context, $wrapperCmdLine)</td>
</tr>
<tr>
<td>SSH</td>
<td>ssh_runCommand</td>
</tr>
<tr>
<td>implementation function</td>
<td></td>
</tr>
</tbody>
</table>
### cleanup

<table>
<thead>
<tr>
<th>Description</th>
<th>Performs any cleanup task after the command has completed on the proxy target. Typically, it deletes any locally created temp files and uploaded files on the proxy target.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>context, cmdFile, wrapperFile (both are of the form workingDirectory/file-name)</td>
</tr>
<tr>
<td>Returns</td>
<td>1 on success, undef on failure.</td>
</tr>
<tr>
<td>Example</td>
<td>cleanupTarget($context, '/opt/work/joe/agent123.tmp', '/opt/work/joe/cmdwrapper.123.tmp')</td>
</tr>
<tr>
<td>SSH implementation function</td>
<td>3.1, 3.1.1: ssh_cleanup</td>
</tr>
<tr>
<td>3.1.2 and later</td>
<td>Not SSH-specific anymore, so the function is cleanup</td>
</tr>
</tbody>
</table>

**Note:** The default implementation deletes the locally created wrapper script file whose path is stored in $context->{wrapperFile}, if it exists. Thus, if the uploadWrapperScript operation is overridden, it is recommended the overriding function set this attribute—that way, cleanup need not be overridden.

### ping

<table>
<thead>
<tr>
<th>Description</th>
<th>A test to see if the proxy target is usable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>host, port (optional)</td>
</tr>
<tr>
<td>Returns</td>
<td>1 on success, undef on failure.</td>
</tr>
<tr>
<td>Example</td>
<td>ping('myhost', 22)</td>
</tr>
<tr>
<td>SSH implementation function</td>
<td>Not SSH-specific, so the function is ping.</td>
</tr>
<tr>
<td>Existing implementation</td>
<td>Opens a socket connection to the proxy target on the desired port.</td>
</tr>
<tr>
<td>Reason to override</td>
<td>The existing implementation may be deemed too simple for doing a ping; overriding ping to open a connection and do some protocol-specific handshaking might be more appropriate for some protocols / use cases.</td>
</tr>
</tbody>
</table>
Available Helper Functions

To make proxy customization easier, ecproxy provides the following helper functions.

**mesg**

<table>
<thead>
<tr>
<th>Description</th>
<th>Debug logging function. Writes to the file referenced in the ECPROXY_DEBUGFILE environment variable (if it exists). No-op otherwise.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>message</td>
</tr>
<tr>
<td>Example</td>
<td>mesg(&quot;myCleanup: about to delete $cmdFile on proxy target&quot;);</td>
</tr>
<tr>
<td>Note: This function</td>
<td>This function automatically adds a newline to whatever it emits, so the caller does not have to incorporate a newline in message.</td>
</tr>
</tbody>
</table>

**readFile**

<table>
<thead>
<tr>
<th>Description</th>
<th>Reads a file.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>fileName</td>
</tr>
<tr>
<td>Returns</td>
<td>Contents of the file. If there is an error, it returns an empty string.</td>
</tr>
<tr>
<td>Example</td>
<td>my $data = readFile(&quot;foo.txt&quot;);</td>
</tr>
</tbody>
</table>

**writeFile**

<table>
<thead>
<tr>
<th>Description</th>
<th>Creates a local file containing data.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>fileName, data</td>
</tr>
<tr>
<td>Returns</td>
<td>1 on success, undef on failure.</td>
</tr>
<tr>
<td>Example</td>
<td>writeFile(&quot;myWrapper.$ENV{COMMANDER_JOBSTEPID}.cmd&quot;, &quot;perl foo.pl&quot;)</td>
</tr>
</tbody>
</table>
Automation Platform

initDispatcher
Description

Initialize the operation dispatcher map to point to
functions for the given protocol. For each operation,
initDispatcher checks if a function named
protocol_operation exists, and if so, assigns
that function as the implementation for that
operation.

Arguments

protocol

Example

initDispatcher("ssh") sets the
"connect" operation to run "ssh_
connect", "uploadFile" => "ssh_
uploadFile", etc.

setOperation
Description

Sets the implementation of an operation to be a
particular function.

Arguments

operation, function. The 'function' argument
may be the name of a function or a reference to a
function.

Example

setOperation("ping", "my_ping"); sets
the "ping" operation to run the "my_
ping" function

Example

setOperation("ping", \&my_ping); same as
above, but using a function ref

Note: This function manipulates the gDispatcher hash, but provides a safe
interface to it.

loadFile
Description

Load proxy customizations from a file.

Arguments

fileName

Example

loadFile("custom.pl")

595


setSSHKeyFiles

<table>
<thead>
<tr>
<th>Description</th>
<th>Set the paths to the public and private key files that ssh will use to authenticate with the proxy target.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>publicKeyFile, privateKeyFile</td>
</tr>
<tr>
<td>Example</td>
<td>setSSHKeyFiles('c:\foo\pub.key', 'c:\foo\priv.key')</td>
</tr>
</tbody>
</table>

**Note:** This is very useful on Windows proxies, where there is no reasonable default for ssh to use.

setSSHUser

<table>
<thead>
<tr>
<th>Description</th>
<th>Set the name of the user to authenticate with the proxy target.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arguments</td>
<td>userName</td>
</tr>
<tr>
<td>Example</td>
<td>setSSHUser('user1')</td>
</tr>
</tbody>
</table>

**Note:** By default, the user name the agent is "running as" is used to log into the proxy target. If key-based authentication is configured on the target system such that 'agentUser' can log into the 'user1' account on the proxy target, this function leverages that configuration.
useMultipleSSHSessions

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normally, ecproxy uses one ssh session with a number of &quot;channels&quot; to perform tasks like uploading files, running the command, and running a cleanup command on the proxy target. Some SSH servers don't allow this. This method configures ecproxy to use a separate SSH session for each operation; this requires authenticating with the SSH daemon on the proxy target several times, and thus it may perform worse than the single-session-multi-channel mode.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>useMultipleSSHSessions()</td>
</tr>
</tbody>
</table>

Examples

Specify public/private key files for SSH

1. Set the proxyCustomization property on the resource like this: ?setSSHKeyFiles ('c:\foo\pub.key', 'c:\foo\priv.key');
2. Set the ECPROXY_SSH_PRIVKEYFILE and ECPROXY_SSH_PUBKEYFILE environment variables on the proxy agent as system environment variables.

Override one of the operations (for example, to enable SSH connection with username/password)

Set the proxyCustomization property on the resource like this: ?sub myConnect($$) {...} setOperation("connect", \\myConnect);

Load proxy customizations from a file rather than having all the logic in the proxyCustomization property on the resource

Set the proxyCustomization property on the resource like this: ?loadFile('c:\foo\custom.pl');

Implement a whole new protocol

Specify protocol as 'myproto' and have a proxy customization block like this:

```perl
sub myproto_getDefaultTargetPort() {
  ...
}  
sub myproto_connect($;$) {
  ...
}  
sub myproto_uploadFile($$$) {
```
...}

sub myproto_uploadWrapperScript($$$) {
    # Note: As of 3.1.2, the default implementation is likely good enough, so
    it may not be necessary to define this override
    ...
} sub myproto_runCommand($$) {
    ...
} sub myproto_cleanup($$$) {
    # Note: As of 3.1.2, the default implementation is likely good enough, so
    it may not be necessary to define this override
    ...
} # Initialize the dispatcher to run these functions
initDispatcher("myproto");

**Override ping to do a connect operation** (which does a full protocol handshake, authentication, and so on)

Write a specialized ping function for the proxy customization like this:

sub heavy_ping($$) {
    my ($host, $port) = @_;
    return ssh_connect($host, $port);
}

setOperation("ping", \heavy_ping);

"Real World" Examples

**ClusterExec**

A basic integration for using *clusterupload* and *clusterexec* to reach a proxy target is here. It has been
tested on a Windows target with a Cygwin installation. It will not work "out-of-the-box" because it makes the
following assumptions:

- The proxy target has *sh* and other UNIX tools (for example, *rm*).
- The locations of the *clusterexec* and *clusterupload* binaries are hard-coded at the top of the proxy
customization.

To make this proxy customization work on a Windows machine that does not have Cygwin, the
generateWrapperScript operation would need to be overridden with a function that generates a *cmd* batch
script, and the generateWrapperInvocationCommand operation would have to be overridden to generate a
"cmd /c ..." command rather than "sh ...".

**MySQL**

The idea here is that the proxy target need not be a host for running arbitrary commands. It could be a special
t entity like a *db*. This integration uses the *mysql* *clt* to run the *step* command (which should be SQL) on the *db*
referenced by the proxy target host and port.

A bare-bones integration with MySQL:

- Set the path to the *mysql* binary; if the directory is in the proxy agent's
- PATH, this variable can simply contain the name of the executable.
my $gMySQL = "c:/cygwin/usr/local/tools/i686_win32/bin/mysql.exe";

sub mysql_getDefaultTargetPort() {
    return 3306;
}

sub mysql_connect($;$) {
    # This "protocol" implementation is just going to use the mysql
    # command-line tool, so just save off host/port.
    my $host = $_[0];
    my $port = $_[1] || mysql_getDefaultTargetPort();

    return {host => $host,
            port => $port};
}

sub mysql_uploadFile($$$) {
    my ($context, $cmdFile, $rmtCmdFile) = @_;  

    # We do not need to upload the command-file to the proxy target.
    # We are going to run the mysql clt on the proxy agent to run
    # the query (contained in the local command-file),
    # so just save off the name of the command-file.

    $context->{cmdFile} = $cmdFile;
}

sub mysql_uploadWrapperScript($$$) {
    my ($context, $workingDir, $wrapperScript) = @_;  

    # This has no meaning for this integration. No-op.
}

sub mysql_runCommand($$) {
    my ($context, $cmdLine) = @_;  

    # cmdLine is a command-line for running the wrapper script, which
    # has no meaning for this integration. We just want to run
    # 'mysql' for the desired host/port with the command-file.

    system("$gMySQL -D commander -h $context->{host} -P $context->{port} " .
            "-u commander -pcommander -e \"source $context->{cmdFile}\"");
}

sub mysql_cleanup($$$) {
    # We didn't create any temp files. No-op.
}

# Initialize the dispatcher to run these functions
initDispatcher("mysql");

**Android**

This example uses the adb tool to upload files to the device and run commands on it. Initial testing has been only against the android emulator, but it is implemented in such a way that it should work against a real android device attached using USB to the proxy agent, or a device on the network.

A first attempt at proxying to android devices:
# Set the path to the adb binary; if the directory is in the proxy agent's
# PATH, this variable can simply contain the name of the executable.

my $gADB = "c:/android-sdk-windows-1.6_r1/tools/adb.exe";

sub android_getDefaultTargetPort() {    
    # Not sure what a good meaningful value is here.
    return 0;
}

sub android_connect($;$) {    
    # This "protocol" implementation uses the adb
    # command-line tool. Depending on the value of
    # host, construct the appropriate adb command-line
    # argument.

    my $host = $_[0];
    my $context = {};
    
    # if ($host eq "emulator") {
    if ($host eq "localhost") {
        # We want to talk to the emulator running on this host.
        $context->{targetArg} = "-e";
    } elsif ($host eq "usb") {
        # We want to talk to the single android device connected
        # to the computer via a USB.
        $context->{targetArg} = "-d";
    } else {
        # This must be the serial number of some device somewhere.
        $context->{targetArg} = "-s $host";
    }
    return $context;
}

sub android_uploadFile($$$) {    
    my ($context, $srcFile, $tgtFile) = @_;    
    my($filename, $directories) = fileparse($tgtFile);

    my $result = `"$gADB $context->{targetArg} push $srcFile  
        /data/tmp/$filename" 2>&1`;
    if ($? != 0) {    
        die "android_uploadFile: Error uploading file $srcFile to 
        /data/tmp/$filename: $result\n";
    }
}

sub android_runCommand($$) {    
    my ($context, $cmdLine) = @_;    

    # cmdLine is a command-line for running the wrapper script, which    
    # has no meaning for this integration. We just want to run    
    # 'adb' for the desired device with the command-file.

    system("$gADB $context->{targetArg} shell $cmdLine");
}

sub android_cleanup($$$) {    
    my ($context, $remoteCmdFile, $remoteWrapperFile) = @_;    

    # This was copied from ssh_cleanup except that we do "rm",    
    # not "rf -f".

mesg("cleaning up");

# Delete the locally generate wrapper file.
unlink($context->"wrapperFile");

# Delete the cmd-file and wrapper script file on the proxy target.
$gDispatcher("runCommand")($context,
    "rm $remoteWrapperFile $remoteCmdFile");
}

sub android_ping($) { 
    my ($host, $port) = @_; 
    $port = $gDispatcher("getDefaultTargetPort")() unless isPortValid($port);

    my $socket = IO::Socket::INET->new(PeerAddr => $host, 
        PeerPort => $port, 
        Proto => "tcp", 
        Type => SOCK_STREAM) 
        or die "Couldn't connect to $host:$port : $@
    ;
}

# Initialize the dispatcher to run these functions
initDispatcher("android");
1;

ecremotefilecopy

When ElectricFlow agents (on platforms other than Linux or Windows) run steps that create log files in a workspace the ElectricFlow web server cannot access (through Linux or Windows agents), use ecremotefilecopy to recreate job logs so they are visible on those ElectricFlow agents, which then enables the web server to retrieve and render those log files.

Using postp and ecremotefilecopy, the log file is populated and recreated in a workspace accessible to the ElectricFlow web server, allowing the Job Details page to display the log file. Although this functionality is supported, it is not a recommended method of operation. This method should be used only as a last resort when a shared file system (between alternate agents and primary platform agents [Linux and Windows]) is not possible.

The reasons ecremotefilecopy is not recommended are:

- You will not see logs in real time. Logs are not visible until the "recreate step" has completed running.
- There is a performance penalty, especially when running with large files.

Setting up the process

- Create a "Setup" step in your procedure
- Update the Postprocessor field for each step whose results you want to see on the server.
- Add a step (one or more times) to the procedure to recreate the ElectricFlow server log files.
Creating a Setup Step

In your procedure, create a step called "Setup". This step needs to be in your procedure before any step running on a remote workspace.

**Note:** This is your top-level procedure, not a subprocedure.

- Navigate to your procedure.
- To create a new step, click the Command step link.
- Set the fields as follows:
  - **Step Name:** Setup
  - **Command(s):** ecremotefilecopy setup
  - **Resource:** local
  - **Workspace:** You have two choices:
    - use default
    - use: alternateWorkspaceForDisplay
      There is a property on the Workspace called alternateWorkspaceForDisplay, which is a secondary location to look for workspace files. This secondary location is used when the workspace files are not accessible to the web server. If the Apache server cannot locate the file in the original workspace, it looks in the alternate one.

Update the Postprocessor field for steps in your procedure

This step defines a postprocessor that will run at the end of the steps you specify. Add the following information to every step running on a remote agent if you want to see its results in the web interface.

- Navigate to a procedure and a step.
- In the Postprocessor field, enter:
  
  ```
  postp --check none --loadProperty /myJob/jobSteps[Setup]/postpExtensions
  ```

- If you are using postp in this step to scan your step log for errors, warnings, and so on also, omit "--check none" from the invocation line.

Add a Final Step to your procedure

This step adds a new step at the end of your existing procedure. This step finds all properties created by the postprocessor, then reads the properties and creates local log files based on the properties, then deletes the properties.

- Navigate to your procedure.
- To create a new step, click the Command step link.
- Set the fields as follows:
  - **Step Name:** Recreate the Log Files
  - **Always run step:** (Check the box)
  - **Command(s):** ecremotefilecopy recreateFiles
After the final step runs, you should see links (icons) displayed in the Log column on the Jobs Details page.

Click the icon to display the log file.

### Copying Other Files from the Workspace

By default, ecremotefilecopy copies only postp log and diag files, and step logs. You can also copy other files from the workspace using a function named postpEndHook2.

You must do the following in your step:

1. Make sure that the file you want to copy is in the step workspace. (It can be copied there, created there, etc.)
2. For your procedure, create a property (named postpEndHook2, for example).
3. Define a function named postpEndHook2 inside the property. For example:

   ```
   sub postpEndHook2() {

   # Missing param does not cause an error
   $::gCommander->abortOnError(0);

   # Add filename to a "special" property such that it will be picked up by ecr remotefilecopy
   my $fileName = 'paul.txt';
   copyFileToProperty ($fileName);

   # Restore default error handling
   $::gCommander->abortOnError(1);
   }
   
   4. Add the following line in the Postprocessor field of this step:

   postp --check none --loadProperty /myJob/jobSteps[Setup]/postpExtensions --loadProperty /myProcedure/postpEndHook2
   ```

### ZKConfigTool

You can ZooKeeper server with configuration information that all ElectricFlow server nodes will use in a clustered configuration. This command-line tool that imports your ElectricFlow database configuration information into your ZooKeeper server. The following minimum set of files is imported:

- database.properties
- keystore
- passkey
- commander.properties
Prerequisites

- The ElectricFlow Tools package must be installed on the system.
- The system must be running a version of Java supported by ElectricFlow. Java is automatically installed on a system with the ElectricFlow software as part of the Tools install.
- The ZooKeeper software must be installed on the network.

Command

$ java -jar zk-config-tool-jar-with-dependencies.jar -<options>

Usage: ZKConfigTool

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-commanderPropertiesFile <code>&lt;path_to_file&gt;</code></td>
<td>Import the ElectricFlow commander.properties file.</td>
</tr>
<tr>
<td>-help</td>
<td>Show the command Help.</td>
</tr>
<tr>
<td>-keyStoreFile <code>&lt;path_to_file&gt;</code></td>
<td>Import the ElectricFlow keystore file.</td>
</tr>
<tr>
<td>-passkeyFile <code>&lt;path_to_file&gt;</code></td>
<td>Import the ElectricFlow passkey file.</td>
</tr>
<tr>
<td>-wrapperConfFile <code>&lt;path_to_file&gt;</code></td>
<td>Import the wrapper.conf file.</td>
</tr>
<tr>
<td>-writeFile <code>&lt;path_on_zookeeper&gt; </code>&lt;path_to_file&gt;`</td>
<td>Write the specified file to the ZooKeeper server.</td>
</tr>
</tbody>
</table>

Import Files

Run the ClusterTool command to completely populate the ZooKeeper server with configuration information. The system must have the Tools install and can be able to communicate with ZooKeeper.

- If you run the command with defined file options, the tool immediately attempts to contact the specified ZooKeeper system and import the specified files.

Example command:
If you run the command without defined file options, the tool displays a series of prompts for the required ElectricFlow information. Once the correct information is entered, the tool contacts the specified ZooKeeper system to import the specified files.

Example command:

```
$ COMMANDER_ZK_CONNECTION=10.168.33.10:2181 java -jar zk-config-tool.jar-with-dependencies.jar
```

## ClusterInfoTool

Use `ClusterInfoTool` to get information on the running ElectricFlow server cluster from ZooKeeper.

### Prerequisites

- The ElectricFlow server cluster must be installed and running on the network.
- Configuration files that all ElectricFlow server nodes will use in a clustered configuration must be uploaded to Apache ZooKeeper server using the ZKConfigTool.
- The ZooKeeper cluster must be running an odd number of Zookeeper nodes and there must be a leader node.
- The system must be running a version of Java supported by ElectricFlow. Java is automatically installed on a system with the ElectricFlow software as part of the Tools installation.

### Locations

The ElectricFlow installer adds the `ClusterInfoTool` to the following default locations:

- **Windows**: `C:\Program Files\Electric Cloud\ElectricCommander\server\bin\cluster-info-tool.jar-with-dependencies.jar`
- **Linux**: `/opt/electriccloud/electriccommander/server/bin/cluster-info-tool.jar-with-dependencies.jar`

### Command

```
$ java -DCOMMANDER_ZK_CONNECTION=<ZooKeeper_Server1_IP>:2181,<ZooKeeper_Server2_IP>:2181,<ZooKeeper_Server3_IP>:2181 -jar cluster-info-tool.jar-with-dependencies.jar
```

where `COMMANDER_ZK_CONNECTION` must point to the ZooKeeper system to which the ElectricFlow server cluster is connected.

### Output

This is sample output generated by `ClusterInfoTool`:

Checking /commander/jgroups/hornetq:

```
582d3642-9736-e87f-4e19-c22d7776ccab ->
```
How to interpret ClusterInfoTool output:

- The nodes `/commander/jgroups/hornetq` and `/commander/jgroups/commander` contain information on these JGroups clusters:
  - `commander` for the ElectricFlow server cluster
  - `hornetq` for the HornetQ cluster

- The children nodes under each of the JGroups nodes represent the participating ElectricFlow servers in the cluster. Each child node entry is in this form:

  `<Logical Name>  <UUID>  <IP address>:<port>  T|F`

- The number of entries in both JGroups nodes should be the same, with matching IP addresses but with different port numbers and distinct logical names and UUIDs. The coordinator node in each JGroups cluster is identified with a ‘T’ against its entry.

Security Issues

This topic describes how to resolve security issues.

Cross-Site Request Forgery Protection

Cross-Site Request Forgery (CSRF) is an attack that forces end users to execute unwanted actions on a web application in which they are currently authenticated. CSRF attacks specifically target state-changing requests, not data theft, because the attacker cannot see the response to the forged request. Using social engineering (such as sending a link via email or chat), an attacker may trick the users of a web application into executing actions of the attacker’s choosing. If the victim is a normal user, a successful CSRF attack can force the user to perform state changing requests like transferring funds, changing their email address, and so on. If the victim is an administrative account, CSRF can compromise the entire web application. For more information about CSRF, go here.
CSRF protection is disabled by default. You can enable or disable CSRF protection as follows:

- To enable CSRF protection, enter `ecconfigure --webCsrfProtection=true`.

Examples using the default directory:

- For Linux, enter
  `/opt/electriccloud/electriccommander/bin/ecconfigure --webCsrfProtection=true`
- For Windows, enter
  `C:\Program Files\Electric Cloud\ElectricCommander\bin>ecconfigure --webCsrfProtection=true`

- To disable CSRF protection, enter `ecconfigure --webCsrfProtection=false`.

Examples using the default directory:

- For Linux, enter
  `/opt/electriccloud/electriccommander/bin/ecconfigure --webCsrfProtection=false`
- For Windows, enter
  `C:\Program Files\Electric Cloud\ElectricCommander\bin>ecconfigure --webCsrfProtection=false`

**Automation Platform Tasks**

All the topics in this section are about a particular feature or function in the ElectricFlow automation platform. They are the same as the topics in the "Web Interface Help" section of the Help system on the automation platform UI.

From the automation platform UI, you can access the topics as follows:

- All ElectricFlow Help topics above this directory are expanded, user-guide style Help topics about a particular ElectricFlow feature or function. Direct access to these Help topics is from the Help system Table of Contents. Although these topics are not directly linked within the ElectricFlow product, many "page-specific" Help topics contain links to one or more of these topics to provide more detailed information quickly.

- The Help topics listed below this directory are "page-specific" Help topics, which means each of these topics contains specific information for the automation platform web page you are viewing. To access these Help topics while using ElectricFlow, click the Help link at the top-right corner on any automation platform web page. (The topics in this section of the AllHelp directory are listed singularly or in groups as is appropriate.)

**Access Control**

Use this GUI page to view and modify access privileges for a particular ElectricFlow object. Depending on the object where you want to set permissions, you will see that object's name as part of the page title (above the tables).
For example, if you clicked the Access Control link from a Project Details page, you will see the project name as part of the Access Control page title.

Reading and Using This Page

- This page displays one or more access control lists. The top list contains entries for the object itself (specified in the page title) and also identifies the object. For example, if the heading for the top list reads "Privileges for Procedure: buildAndTestAll," you are viewing access privileges for a procedure named "buildAndTestAll". Click the object name to view the main page for that object.

- Typically, you will see more than one list on the page. Each list below the first one contains privileges for an object that "contains" the objects above it. For example, a project contains all of its procedures and a procedure contains all of its steps. Privileges for the top-level object are determined by all the privileges in all of the displayed lists. The lists form an "inheritance chain" where each object "inherits" permissions from the objects below it on the page.

- When a user attempts a particular operation on the object, ElectricFlow examines the lists on this page from top to bottom. If there is an entry specifying "deny" for the user (or a group containing the user) in the top list, access is denied. Otherwise, if an entry specifies "allow" for the user (or a group containing the user) in the top list, access is allowed. If access is neither allowed nor denied by the top list, ElectricFlow proceeds to the next list and processes it in the same way.

  **Note:** If access is neither allowed nor denied by any list, ElectricFlow denies access.

- The inheritance mechanism makes it easy to control access for a large number of objects in a single place. For example, project access control entries automatically apply to new objects created within the project. Each new object in the project has an empty access control list, but will inherit from the project.

Using the Links...

Use these links to add or increase Access Control for an object.

- **Add User** - Use this link to add permissions for a specific user.

- **Add Group** - Use this link to add permissions for a specific group, which means all users in that group would have the permissions allowed to the group.

- **Add Project** - Use this link to set or redefine permissions for a project.

  **Break Inheritance - Caution: Be very careful if you break inheritance**! If you use the "Break Inheritance" action for any list, no additional inheritance occurs **below** that list and you no longer see other lists on this page. This action is useful if you want privileges for an object to be totally different than its containing object. If an object has no entries in its access control list and you break inheritance for that object, you make the object **completely inaccessible** - you will not even have the "Change Permissions" privilege, so you cannot restore inheritance. If this occurs, see your system administrator to restore inheritance.

- **Actions:**
  - **Edit** - Use this link to modify current permissions, but be careful if you modify permissions in an inherited access control list. Modifying inherited access control affects all other objects that inherit from the same list.
  - **Delete** - Deletes the current privileges granted for that user, group, or project.
**Privilege Definitions**

The following four privilege types (for each ElectricFlow object) can be assigned *allow, deny, or inherit* permission.

- **Read** - Allows object contents to be viewed.
- **Modify** - Allows object contents (but not its permissions) to be changed.
- **Execute** - If an object is a procedure or it contains procedures (for example, a project), this privilege allows object procedures to be invoked as part of a job. For resource objects, this privilege determines who can use this resource in job steps.
- **Change Permissions** - Allows object permissions to be modified.

*For more information*, see the main Access Control Help topic. This Help topic also contains two examples that illustrate how you might use Access Control to increase ElectricFlow security.

**Access Control - defining entries**

Use this page to define access control entries selected from a filtered list of ElectricFlow users, groups, or projects, or by providing an explicit name.

Enter information in the fields as follows:

*Note:* The following instructions are generic. For example, if you chose Add User, the Filter field will be labeled "User Filter".

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio selector</td>
<td>Choose between selecting &quot;Search for existing...&quot; or select &quot;Provide explicit ... name&quot;. Providing an explicit name bypasses the search and allows you to enter an arbitrary name.</td>
</tr>
<tr>
<td>Filter</td>
<td>Enter a partial name to retrieve a list of all users/groups/projects that include the partial name you supplied.</td>
</tr>
<tr>
<td>Include Inactive</td>
<td>[User/Group only] - Use this checkbox only if requesting external LDAP or Active Directory providers. If &quot;checked,&quot; all available users or groups are returned. If not checked, only those users or groups known to the ElectricFlow server are returned, for example, users who have logged in or groups containing users who have logged in.</td>
</tr>
</tbody>
</table>

Click **OK** to retrieve your information.
If you entered filter criteria, the page will refresh with a list of matches. Select any row in this table to create an access control entry for that principal.

**Column descriptions**

- **Name** - The name of the user/group/project.
- **Location** - Only viewable for users or groups from non-local directory providers. The name combined with the location is the unique identifier for this user or group, local to the ElectricFlow server.

**Privileges - create new or edit existing privileges**

Use this page to create or modify an access control list entry. Each entry names a principal, which can be either an individual user or a group, and defines four privileges for the principal.

For each of the four privileges, Read, Modify, Execute, or Change Permissions:
- Creating a new entry or modifying an existing entry allows you to select either Inherit, Allow, or Deny access entries.
- On the server access control table, "Don't Care" replaces the "Inherit" option.

For more information about access control, see the Access Control Help topic.

**Artifacts**

This page displays all artifacts available on this ElectricFlow server.

You can search for artifacts and save the artifact search filters for later use. See Context Searching and Filtering on page 757 for details on using the search capabilities on this page.

**Links and actions at the top of the table**

- **Create Artifact** - Use this link to go to the New Artifact page to create a new artifact.
- The "star" icon allows you to save this page to your Home page for quick access.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the artifact—a system-generated name created by combining the Group Id and Artifact Key components. <strong>Note</strong>: Selecting an artifact name takes you to the Artifact Details page for that artifact.</td>
</tr>
<tr>
<td>Group Id</td>
<td>The user-generated group name for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.</td>
</tr>
<tr>
<td>Column Name</td>
<td>Description / Actions</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Artifact Key</td>
<td>The &quot;key&quot; component of the artifact name.</td>
</tr>
<tr>
<td>Description</td>
<td>The plain text or HTML description previously supplied for this artifact.</td>
</tr>
</tbody>
</table>
| Actions | **Edit** - Use this link to go to the Edit Artifact page to modify the artifact on this row.  
**Delete** - Use this link to delete the artifact on this row. |

Artifact Details

This page displays detailed information about an artifact.

**Links and actions at the top of the table**

- **Edit** - Use this link to go to the Edit Artifact page to make any necessary changes for this artifact's description or artifact version name template.
- **Access Control** - Use this link to set privileges for this artifact. *For more information*, see the [Access Control Help topic](#).
- The "star" icon allows you to save this job information to your Home page.

**General Information section**

This section displays the artifact name (Artifact), Group Id, Artifact Key, and any Description previously supplied for this artifact.

![Artifact Details](exports:project)

**The "tabbed" sections**

The next section of tabs allows you to select the type of information you want to see.

**Artifact Versions table**

This table displays all artifact versions included in this artifact.
Column descriptions
Artifact Version - Click on an artifact version name to go to the Artifact Version Details page for that artifact version.
Description - The previously supplied description, if any, for this artifact version.
Actions
  ○ Click the Edit link to go to the Edit Artifact Version page.
  ○ Click the Delete link to delete this artifact version from the artifact.

Properties table
This table contains custom properties for this artifact.
- Click on a Property Name to edit that property.
- If a "folder icon" precedes a property name, it denotes a Nested Property Sheet.
- This section also provides Create Property, Create Nested Sheet, and Access Control links to add more custom properties or change or set privileges on this artifact.

Artifact - create new or edit existing artifact

To create a new artifact
Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Id</td>
<td>Enter a group name of your choice for this artifact. A Group Id (groupId) acts as a namespace for grouping related artifacts. The idea is that artifact &quot;sdk&quot; for group &quot;platform&quot; can co-exist with artifact &quot;sdk&quot; in group &quot;ui&quot; without there being any name collisions. This field is limited to alphanumeric characters, spaces, underscores, hyphens, and periods.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Artifact Key</td>
<td>Enter an identifier of your choice for this artifact. This field is limited to alphanumeric characters, spaces, underscores, hyphens, and periods.</td>
</tr>
</tbody>
</table>
| Description         | A plain text or HTML description for this object. If using HTML, you must surround your text with `<html> ... </html>` tags. The only HTML tags allowed in the text are: `<a> <b> <br> <div> <dl> <font> <i> <li> <ol> <p> <pre> <span> <style> <table> <tc> <td> <th> <tr> <ul>.

<table>
<thead>
<tr>
<th>Artifact Version Name Template</th>
<th>A template for the names of artifact versions published to this artifact.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For example: <code>/${myArtifactVersion/groupId}:${myArtifactVersion/artifactKey}:${myArtifactVersion/version}</code>.</td>
</tr>
<tr>
<td></td>
<td>Produces a name like: platform:dk:1.0.0-36.</td>
</tr>
<tr>
<td></td>
<td>Only absolute property paths and <code>/myArtifactVersion-based paths are supported. If not specified, the </code>&quot;Artifact Version name template&quot; server setting is used.`</td>
</tr>
</tbody>
</table>

Click **OK** after filling-in the fields and to go to the Artifacts page to see your new artifact listed in the first column.

**To edit an artifact**

- Click the **Access Control** link at the top of the page to add permissions to this artifact.
- You can add a **Description** or modify your existing description.
- You can add an **Artifact Version Name Template** or modify your existing template.
- Click **OK** to save your changes and return to the Artifacts page.

**Artifact Versions**

This page displays all artifact versions available on this ElectricFlow server.

You can search for artifact versions and save the search filters for later use. See Context Searching and Filtering on page 757 for details on using the search capabilities on this page.

**Links and actions at the top of the table**

- The "star" icon allows you to save this page to your Home page for quick access.
**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the artifact version. Select an artifact version name to go to the Artifact Version Details page for that artifact version.</td>
</tr>
<tr>
<td>Artifact</td>
<td>The name of the artifact. Select an artifact name to go to the Artifact Details page for that artifact.</td>
</tr>
<tr>
<td>Group Id</td>
<td>The name of the group where this artifact version is a member.</td>
</tr>
<tr>
<td>Artifact Key</td>
<td>The &quot;key&quot; identifier for this artifact version.</td>
</tr>
<tr>
<td>Version</td>
<td>The artifact version represented, by default, as <code>major.minor.patch-qualifier-buildNumber</code>. <strong>Note:</strong> You will not see all 5 artifact version components specified if only 3 components were defined.</td>
</tr>
<tr>
<td>State</td>
<td>The current state of this artifact version. Possible values are: `available</td>
</tr>
<tr>
<td>Modify Time</td>
<td>The last time this artifact version was modified.</td>
</tr>
</tbody>
</table>
| Actions     | **Edit** - Use this link to go to the Edit Artifact Version page to modify the artifact version on this row.  
**Delete** - Use this link to delete the artifact version on this row. |

**Artifact Version Details**

This page displays detailed information about an artifact version.

**Links and actions at the top of the table**

- **Edit** - Use this link to go to the Edit Artifact Version page.
- **Access Control** - Use this link to set privileges for this artifact version. *For more information*, see the Access Control Help topic.
- The "star" icon allows you to save this artifact version information to your Home page.
General Information section

This section lists current information about the artifact version. While most of the information is static, two items link to other pages:

Artifact - Click the artifact name to go to the Artifact Details page for the "owning" artifact.

Published By - Click this link to go to the Job Details page for the job that published this artifact version. If this artifact version was published by an end user outside of a job context, this field will display None.

The "tabbed" sections

The next section of tabs allows you to select the type of information you want to see.

Files

This section shows the collection of files included in this artifact version. The left-pane displays the artifact version directory structure and the right-pane displays files and subdirectories for the currently selected folder in the left-pane. This structure is similar to Windows Explorer.

Retrievers table

This table lists the 50 most recent jobs that retrieved this artifact version and includes links to the Job Details page for those jobs.

Dependent Artifact Versions table

This section displays dependent artifact version queries registered with the artifact version during a publish operation. These queries are evaluated during retrieval and the most current artifact version that matches each query is returned along with the primary artifact version.
Properties table

This table contains custom properties for this artifact version.

- Click on a Property Name to edit that property.
- If a "folder icon" precedes a property name, it denotes a Nested Property Sheet.
- This section also provides Create Property, Create Nested Sheet, and Access Control links to allow you to add more custom properties.

Artifact Version - edit an existing artifact version

This page displays an existing artifact version you can modify.

**Links and actions at the top of the table**

- **Access Control** - Use this link to add or change permissions for this artifact version.
- The "star" icon allows you to save this page to your Home page for quick access.

To edit an artifact version

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>You can type-over the artifact version name in this field to change or modify the existing name.</td>
</tr>
<tr>
<td>Description</td>
<td>You can add a description or modify your existing description.</td>
</tr>
<tr>
<td>Publisher</td>
<td>This is the job that completed the publish operation. Click this link to go to the Job Details page for this job. If this artifact version was published outside of a job context (for example, from ectool), the value for this field is &quot;None&quot;.</td>
</tr>
</tbody>
</table>
An artifact version can be in one of three states: available, unavailable, and publishing.

If the artifact version is:

- in the Publishing state, the artifact version cannot be retrieved, but it will transition to the Available state when the publishing operation is complete. The web interface does not allow you to change the state if it is currently Publishing.
- in the Available state, the artifact version can be retrieved. To confirm this state, the checkbox is "checked," and unchecking this box makes the artifact version unavailable.
- in the Unavailable state, the artifact version cannot be retrieved. "Checking" the box changes the artifact version state to Available.

Repositories

This page displays all artifact repositories available to this ElectricFlow server.

**Links and actions at the top of the table**

- **Add Repository** - Use this link to go to the New Repository page to add another artifact repository.
- The "star" icon allows you to save this page to your Home page for quick access.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repository Name</td>
<td>The name of the artifact repository. Select a repository name to go to the Edit Repository page if you need to modify that repository. <strong>Note:</strong> If you have multiple repositories and want to change the search order for retrieving artifacts, drag the icon (in the far left column) up or down to reposition an artifact to the order you need.</td>
</tr>
<tr>
<td>Zone</td>
<td>The name of the zone where this repository resides.</td>
</tr>
</tbody>
</table>
### Column Name | Description / Actions
---|---
**URL**  | The server URL is in the form protocol://host:port/. Typically, the repository server is configured to listen on port 8200 for https requests, so a typical URL looks like https://host:8200/
**Enabled** | Select this checkbox to enable or disable this artifact repository. By disabling this repository, users will not be able to retrieve any artifacts stored in this repository.
**Description** | A plain text or HTML description previously supplied for this repository.
**Actions** | Delete - Use this link to delete the artifact repository on this row.

### Repository - create new or edit existing repository

**To create a new repository**

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter any name of your choice for this repository.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code>.</td>
</tr>
<tr>
<td>URL</td>
<td>The server URL is in the form protocol://host:port/. Typically, the repository server is configured to listen on port 8200 for https requests, so a typical URL looks like <a href="https://host:8200/">https://host:8200/</a>.</td>
</tr>
<tr>
<td>Zone</td>
<td>Use the drop-down menu to select a zone for this repository. If no zone is selected, this repository will reside in the default zone.</td>
</tr>
<tr>
<td>Enabled</td>
<td>Select this checkbox to enable this repository. If this repository is disabled (“unchecked”), users will not be able to retrieve any artifacts stored in this repository.</td>
</tr>
</tbody>
</table>

Click **OK** after filling-in the fields and to return to the Repositories page to see your new repository listed in the first column.
To edit a repository

You can:

- Use the **Access Control** link at the top of the table to set permissions on this repository
- Change the repository name
- Add a description or modify the existing description
- Modify the URL
- Select a different zone.
- Enable or disable the repository

Click **OK** after making any modifications and to return to the Repositories page.

**Database Configuration**

If you choose not to use the ElectricFlow built-in database, use this page to configure your MySQL, SQL Server, or Oracle database to communicate with ElectricFlow.

**Note:** The ElectricFlow built-in database is not recommended for production use.

Fill in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Type</td>
<td>Select your database type from the drop-down menu. If &quot;Built-in&quot; is selected, no other information is required.</td>
</tr>
<tr>
<td>Database Name</td>
<td>Enter your database name.</td>
</tr>
<tr>
<td>Host Name</td>
<td>Enter the host name for your database server.</td>
</tr>
<tr>
<td>Port</td>
<td>Use the default port or enter a new port number.</td>
</tr>
<tr>
<td>Database Credentials</td>
<td>User Name—Accept the default “commander” user name or enter the appropriate user name for your database. Password—Enter the database password.</td>
</tr>
</tbody>
</table>

**IMPORTANT:** When you set the SQL server as the database, you can only use a non-named database.

Click **Save and Restart Server** after entering information in all fields.

**Note:** You may need to consult with your Database Administrator if you do not have all of the information required on this web page.

*For more information*, consult the *ElectricFlow Installation Guide*. 
Defect Tracking Configurations

This page displays Defect Tracking configurations known to the ElectricFlow server—ElectricFlow integrates, using plugins, with numerous defect tracking systems.

Link at the top of the table

Use the Create Configuration link to create a new Defect Tracking configuration.

Column descriptions

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration Name</td>
<td>The name you provided to the configuration you created.</td>
</tr>
<tr>
<td>Description</td>
<td>This column describes the Defect Tracking configuration type.</td>
</tr>
<tr>
<td>Plugin</td>
<td>The name of the plugin where the Defect Tracking integration resides.</td>
</tr>
<tr>
<td>Actions</td>
<td><strong>Edit</strong> - Click this link to modify an existing configuration.</td>
</tr>
<tr>
<td></td>
<td><strong>Delete</strong> - Click this link to remove the configuration.</td>
</tr>
</tbody>
</table>

Defect Tracking - create new or edit existing configuration

Use this page to define a new defect tracking configuration or modify an existing defect tracking configuration. A configuration is a collection of properties that define how ElectricFlow communicates with a particular defect tracking system.

After creating a defect tracking configuration, your entry will appear in the table on the Defect Tracking Configurations web page—to see this web page, select the Administration > Defect Tracking tabs.

To create a defect tracking configuration

From the Defect Tracking Type drop-down menu, select your defect tracking system—ElectricFlow integrates with numerous defect tracking systems. Each integration was created using plugin technology.

Click the Submit button and a set of fields is displayed to enter information to create your configuration.

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration Name</td>
<td>Enter a unique name for this defect tracking configuration—any name you choose.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: `&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</td>
</tr>
<tr>
<td>Login As</td>
<td>User Name - This is the name ElectricFlow needs to use to communicate with your defect tracking system. For example, you may be using a special &quot;read-only&quot; user name similar to &quot;Build&quot; for your user name.</td>
</tr>
<tr>
<td></td>
<td>Password - This is the password for the specified User Name.</td>
</tr>
<tr>
<td></td>
<td>Retype Password - Type the password again.</td>
</tr>
<tr>
<td></td>
<td>URL - This is the URL to use to connect to a JIRA server. For example, you might use something similar to: <code>http://10.10.10.10:8080</code> or <code>http://yourJIRAserver</code></td>
</tr>
</tbody>
</table>

Click **Submit** to save your information.

**Using the defect tracking integration**

Go to Projects > select a project > select a procedure.

- To create a New Step for defect tracking, select the Plugin link.
- In the Choose Step panel, select Defect Tracking from the left pane, then select the defect tracking system you configured.
- The right-pane now shows the types of steps available for your configuration. Select the step you need and automatically go to the New Step page.
- On the New Step page, notice the Subprocedure section now contains the defect tracking integration you configured and the step you chose.
- Enter the remaining information to create your defect tracking step.

See the Defect Tracking Help topic for more information.

**To edit an existing defect tracking configuration**

Modify any of your defect tracking configuration information by "typing-over" any previously entered information.

Click **Submit** to save your modified defect tracking information.
Defect Tracking Reports

This is a report of URLs to JIRA defects associated with the ElectricFlow job.

The report was compiled by searching job properties for JIRA defect IDs then querying the configured JIRA server for the current defect state.

For more information about Defect Tracking, see the main Defect Tracking Help topic.

If you would like to create a defect tracking configuration, go to Administration > Defect Tracking and click the Create Configuration link to see the New Defect Tracking Configuration web page. Access the Help link on that page for more information.

Email Configurations

This GUI page displays all previously configured email configurations.

- Click on a Configuration Name to go to the Edit Email Configuration web page to modify an existing email configuration.
- Click on the Add Configuration link to create new email configuration.
- Action column - This column contains two links to Copy or Remove an Email Configuration.

Notice this page also lists the email server name and who the email notification was from.

Email Configuration - create new or edit existing email configuration

Use this web page to specify an email server to ElectricFlow. If you do not create an Email Configuration, you will not be to send Email Notifications to individuals or groups.

If you have multiple users or groups in remote locations that use a different mail server, create additional Email Configurations to accommodate those locations if they need to receive ElectricFlow notifications.

To create a new email configuration

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique name to identify the Email Configuration.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td>Mail Protocol</td>
<td>Either SS SMTP or SMTP</td>
</tr>
</tbody>
</table>
### Field Name | Description
---|---
**Mail Host** | The name of the mail server.

**Mail Port** | The port number for the mail server, but may not need to be specified. Protocol software determines the default value (25 for SMTP and 465 for SSMT). Specify a value for this argument when a non-default port is used.

**Mail From** | An individual name or a generic name like "ElectricFlow" or "build."

**Mail Username** | An individual name or a generic name like "ElectricFlow."

**Mail Password** | The password for the mail user name account.

Click **Save** after filling-in all fields.

Click the **Test** button to run a test to make sure your email configuration works. Enter an email address in the pop-up box and click **Send**.

**To edit an existing email configuration**

Use the **Access Control** link at the top of the page to add or change existing permissions.

You can modify any of the information already supplied or add new information.

Click **OK** after completing your edits.

**Email Notifier - create new or edit existing email notifier**

Use this page to set up email notifiers.

**Note:** You must have already set up an email configuration so ElectricFlow knows which email server to use when sending any notifications. If you have not configured an email server to communicate with ElectricFlow, click the **Administration > Email Configurations** tabs to do this configuration now.

For jobs and job steps, two types of email notifiers:

- **On Start Notifier** – Sends an email when a job or job step starts.
- **On Completion Notifier** – Sends an email when a job or job step completes.

For workflow states, three types of email notifiers:

- **On Enter Notifier** – Sends an email when the state becomes the workflow's active state.
- **On Start Notifier** – Sends an email after the state's subjob or subworkflow starts. If no subjob or subworkflow is defined for that state, the notifiers will not be sent.
- **On Completion Notifier** – Sends an email after the state's subjob or subworkflow completes. If no subjob or subworkflow is defined for that state, the notifiers will not be sent.
Using email notifiers:

- Attaching an email notifier to a procedure results in a corresponding email notifier associated with the job that is created when the procedure is executed.
- Attaching an email notifier to a procedure step results in a corresponding email notifier associated with the job step created when the procedure referencing the procedure step is executed.
- Attaching an email notifier to a state definition results in a corresponding email notifier associated with the state that is created when the workflow is executed.

To create a new email notifier

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>This name can be an arbitrary text string.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;  &lt;b&gt;  &lt;br&gt;  &lt;div&gt;  &lt;dl&gt;  &lt;font&gt;  &lt;i&gt;  </code>&lt;li&gt;  <code>&lt;ol&gt;  </code>&lt;p&gt;  <code>&lt;pre&gt;  </code>&lt;span&gt;  <code>&lt;style&gt;  </code>&lt;table&gt;  <code>&lt;tc&gt;  </code>&lt;td&gt;  <code>&lt;th&gt;  </code>&lt;tr&gt;  <code>&lt;ul&gt;</code></td>
</tr>
<tr>
<td>Condition</td>
<td>Use the pull-down menu to select the type of condition you need for this email notifier. Edit the auto-supplied condition in the text box or add a completely new script for your purpose. The condition specifies whether the notifier should send a message depending on the result of a property expansion. If the result is empty or non-zero, the message is sent. If the result is &quot;0&quot;, the message is not sent</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Use the pull-down menu to select from a list of global, ready-to-use formatting templates. Depending on the type of email notifier you are creating, the available template choices in the drop-down menu will be different. Make sure the content is formatted correctly, i.e., no illegal characters or spacing.</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>To customize your template, edit the auto-supplied text in the Formatting Template text box or you can add a completely new script for your purpose. Any edits made in this text box will not be saved to the global template.</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Note: See the “Email notifier templates” section at the end of this Help topic for a list of available templates and instructions for making global modifications to these templates.</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>To create a custom template, the basic structure is:</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>• zero or more email header lines</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>• blank line</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>• message body</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>The template undergoes property expansion in a job, jobStep, or state context. In addition to normal property paths, an additional event object is accessible via /myEvent/.</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>The following example is a sample formatting template for a job:</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Subject: Job '[$[jobName]]' from procedure '[$[procedureName]]' /[/myEvent/type] - ElectricFlow notification</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>cc: <a href="mailto:owner@example.org">owner@example.org</a></td>
</tr>
<tr>
<td>Formatting Template</td>
<td>bcc: <a href="mailto:admin@example.org">admin@example.org</a></td>
</tr>
<tr>
<td>Formatting Template</td>
<td>ElectricFlow Notification - from email notifier</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>'[/myEvent/notifier]'</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Job '[$[jobName]]' /[/myEvent/type] at: $[/myEvent/time]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Project: $[projectName]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Procedure: $[procedureName]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Started: $[start]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Completed: $[finish]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Directory Name: $[directoryName]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Launched by User: $[launchedByUser]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Outcome: $[outcome]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Error Code: $[errorCode]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>Error Message: $[errorMessage]</td>
</tr>
<tr>
<td>Formatting Template</td>
<td>This example demonstrates how you can send this notification using CC or</td>
</tr>
</tbody>
</table>
Field Name | Description
--- | ---
BCC | BCC fields in addition to specified Destinations. Because headers are interpreted by SMTP, normal email rules apply.
Email Configuration | Click inside this field or start typing to bring up a list of possible email configuration names. An email notifier that does not specify an email configuration will use the configuration named 'default' if it exists.
Destinations | A space-separated list of valid email addresses, email aliases, or ElectricFlow user or group names, or a property reference that expands into such a list, or you can enter an LDAP DL name (group name).

Click **OK** to save your email notifier configuration.

**To edit an existing email notifier**

Modify or add information to any of the fields and click **OK** to save your changes.

**Email notifier templates**

The table below lists global email notifier templates for your use. Each template name is a link to an example of the template output and the script.

Global templates are stored as property sheets under the "*/server/ec_notifierTemplates*" property sheet. You can modify template properties or add new global templates if you have modify privileges on the server property sheet. An email notifier will be updated if changes are made to its global template.
<table>
<thead>
<tr>
<th>Template Name</th>
<th>Format</th>
<th>Usage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Summary text notification</td>
<td>Plain text</td>
<td>Procedure</td>
<td>Formatting template for Procedure starting/completion notifications using the long form of property names (for example, $[/myJob/jobName])</td>
</tr>
<tr>
<td>Step summary text notification</td>
<td>Plain text</td>
<td>Procedure step</td>
<td>Formatting template for Procedure Step starting/completion notifications using the long form of property names (for example, $[/myJobStep/jobStepId])</td>
</tr>
<tr>
<td>State summary text notification</td>
<td>Plain text</td>
<td>State</td>
<td>Formatting template for State notifications using the long form of property names (for example, $[/myWorkflow/workflowName])</td>
</tr>
<tr>
<td>Job summary HTML notification</td>
<td>HTML</td>
<td>Procedure</td>
<td>HTML formatting template for Procedure starting/completion notifications</td>
</tr>
<tr>
<td>Step summary HTML notification</td>
<td>HTML</td>
<td>Procedure step</td>
<td>HTML formatting template for Procedure Step starting/completion notifications displaying information about the Job and the Job Step</td>
</tr>
<tr>
<td>Template Name</td>
<td>Format</td>
<td>Usage</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>--------</td>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>All steps HTML notification</td>
<td>HTML</td>
<td>Procedure step</td>
<td>HTML formatting template for Procedure Step starting/completion notifications displaying information about the Job and many Job Steps</td>
</tr>
<tr>
<td>Approval request HTML notification</td>
<td>HTML</td>
<td>State</td>
<td>HTML formatting template for State notifications displaying information about the workflow and all of its states</td>
</tr>
<tr>
<td>Workflow summary HTML notification</td>
<td>HTML</td>
<td>State</td>
<td>HTML formatting template for State notifications providing the recipient with links to view or take a manual transition</td>
</tr>
</tbody>
</table>

**Email Notifier Template - Html_JobStepTempl_AllSteps.txt**

If you use this template, the following screen example is similar to how your email notifier will look.
1. Go to the corresponding template available in `<installDir>`\`src\samples\notifier`

2. Copy the script into a text editor to edit it for your purpose

3. "Copy and paste" your version into the Formatting Template field.

**Email Notifier Template - Html_JobStepTempl_SingleStep.txt**

If you use this template, the following screen example is similar to how your email notifier will look.
Note: In the following script, myJob.steps and myJob.jobSteps return an array of step names.

1. Go to the corresponding template available in `<installDir>/src/samples/notifier`.
2. Copy the script into a text editor to edit it for your purpose.
3. "Copy and paste" your version into the Formatting Template field.

Email Notifier Template - Html_JobTempl.txt

If you use this template, the following screen example is similar to how your email notifier will look.
1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

**Email Notifier Template - Html_StateTemplate_ApproveWorkflow.txt**

If you use this template, the following screen example is similar to how your email notifier will look.
1. Go to the corresponding template available in `<installDir>\src\samples\notifier`.
2. Copy the script into a text editor to edit it for your purpose.
3. "Copy and paste" your version into the Formatting Template field.

**Email Notifier Template - Html_StateTemplate_FullWorkflow.txt**

If you use this template, the following screen example is similar to how your email notifier will look.
1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

**Email Notifier Template - JobStepTempl_FullProps.txt**

If you use this template, the following screen example is similar to how your email notifier will look.
1. Go to the corresponding template available in `<installDir>\src\samples\notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

**Email Notifier Template - JobTempl_FullProps.txt**

If you use this template, the following screen example is similar to how your email notifier will look.
1. Go to the corresponding template available in `<installDir>/src/samples/notifier`
2. Copy the script into a text editor to edit it for your purpose
3. "Copy and paste" your version into the Formatting Template field.

**Email Notifier Template - StateTemplate_FullPropertyPaths.txt**

If you use this template, the following screen example is similar to how your email notifier will look.
Event Log

This page displays a log of events generated anywhere in the system, including jobs and workflows.

- To see only events for a single workflow, select the Workflows tab, then a workflow Name to go to the Workflow Details page and click the View Log link at the top of the page.
- To see only events for a single job, select the Jobs tab, then the Job name to go to the Job Details page and click the View Log link at the top of the page.

  Note: When running a job in a cluster, the name of the server managing the job is recorded in the job-log. If the management of the job moves to a different node (if the current node crashes for example) the change is logged into the job log as well.

- To see only events for a specific object, select the Search tab to go to the Searching and Filtering page.

For example:
You might want to select the Object Type, "Log Entry", then click the Add Intrinsic Filter link. Select the down-arrow where you see "Container" auto-populated and select "Container Type". Use the "equals" operator, then select the next down-arrow to choose an object. Click OK to start the search.

  Note:
From the Administration tab, the default view for this Event Log page is the warning (WARN) level.

For workflow and job event logs, the default view from their respective pages is the information (INFO) level.

Column descriptions

Time - This is the time the event was logged.

Severity - Severity can be either INFO, WARN, or ERROR. Use the pull-down menu at the top of the table to change between these views.

User - The user associated with the event—the user of the session at the time the event was generated. Clicking on a project link in this column takes you to the Project Details page for that project.

Container - Typically, this is the type and name of the workflow or job with a corresponding ID. Clicking on a link in this column takes you to the Job Details page for that job or workflow.

Subject - The object associated with the message. Clicking on a link in this column takes you the source for this object.

Message - The message text will either be informational or display the warning or error message. The message may contain important information about a resource or workspace issue.

Configuring the Event Log

Because log entries can accumulate in large numbers, you can configure the Event Log for auto-deletion. By default, Event Log retention is 30 days. The ElectricFlow server automatically marks old log entries for deletion and the background deleter cleans out old log entries along with its other tasks.

To change the default settings, go to Administration > Server > Settings.

Modify the following two fields:

- Event log retain time - Default is 30 days (in "minute" units).
  
  **Note:** Setting the "retain" period to "0" disables the automatic deletion mechanism, allowing you to use an external cleanup script to implement a custom cleanup policy.

- Maximum background delete delay - Default is 3600 seconds (or one hour).

Click **OK** to save your changes.

Automation Platform Home Page

- Job Configurations
- Shortcuts
- Jobs Quick View
- Reports
Overview

This page provides a convenient console for running jobs and viewing results.

- This web page is your ElectricFlow Dashboard for tracking project health.
- You can customize the page to display only the jobs that interest you and to provide one-click access to the jobs you run frequently. Each of the Home page sections can be customized.
- The Reports section allows you to see thumbnail report images that are updated each time the report is generated.
- This page provides shortcuts for quick access to pages you use most frequently in the automation platform or anywhere on the web.

IMPORTANT: If you are using or plan to use the EC-Homepage plugin to share your Home page sections, you will not see some links normally available to you. For example, if a particular Jobs Quick View category is shared, you cannot Delete or Modify that category. You can perform these functions only if the category belongs to you alone.

For information on sharing your Home page configuration, see the "Home page configurations" section in the "Customizing the ElectricFlow Platform UI on page 554" Help topic.

Job Configurations

Procedures in ElectricFlow can contain complex sets of parameters—making it difficult to remember the correct parameters for a particular situation and tedious to re-enter those parameters every time the procedure is invoked. Job Configurations provide a one-click solution to this problem. When you create a job configuration, you enter all the information needed to run a procedure, including parameters and/or a credential. All job configurations are displayed here on the Home page. Invoke a particular configuration by clicking its name in the Job Configurations section.

Create Job Configurations three ways

- On the Home page, create a job configuration from "scratch" by clicking the Create link in the Job Configurations section.
  - In the Create Configuration pop-up menu, select the project and procedure you want to use for creating this configuration.
- From the Job Details page for a previously invoked job, click the Save Configuration link at the top of the page.
  Your saved job configuration is displayed on your Home page.
- From the Edit Schedule page, click the Save Configuration link at the top of the page.
  Your saved configuration is displayed on your Home page.

Shortcuts

Use shortcuts to save frequently visited ElectricFlow web pages, so those pages are immediately accessible. You can create a shortcut to any page on the web also.
Create Shortcuts two ways

- Mouse-over the "star" icon at the top of any automation platform page and click "Add current page" to add that page to the shortcut list. Mouse-over the star icon again and click "Remove current page" to remove the shortcut for that page. The star icon is yellow for pages saved as a shortcut and gray for those pages not saved as a shortcut.

- Click the Create link in the Shortcut section and provide a name and URL to create a shortcut.

To modify or update a shortcut, click the Edit link adjacent to the shortcut you want to change.

Shortcuts can be accessed conveniently from any automation platform web page. Mousing-over the star icon displays a list of shortcuts saved by the current user. Click on a shortcut name to view the page.

**Note:** The Shortcut section may contain static entries that cannot be deleted. And if you "share" your Home page, the Edit link will not be available for shared items.

Jobs Quick View

Perhaps only a few jobs on this server are of interest to you. For example, you may care about jobs you launch manually and official builds for the products you work on, but you may not care about production builds for other products or personal jobs for other users.

The Jobs Quick View allows you to define job categories that are interesting to you.

The Home page displays the most recent jobs in each category, and you can easily click-through to get more details about any of those jobs. For example, clicking on a job name takes you to that job’s Job Details page.

Create a job category

- Click the Add Category link in the Jobs Quick View section. After creating a category, results are displayed on the Home page. Clicking the Details link displays a summary to the right of the category. In addition to job status and other diagnostic information, the summary displays running steps and failed steps (containing errors and warnings).

- Click the Modify link to edit the Jobs Quick View category or the Delete link to remove that job from the Jobs Quick View category.

- Click on the Details link to see job summary information—the summary remains visible, regardless of mouse location, until you click somewhere else on the page.

**Note:** If you "share" your Home page, the Modify and Delete links will *not* be available for shared items.

Reports

You can configure reports you would like to see on a regular basis and display a "thumbnail" report graphic in this section.

- Click the Add Report link to go to the New Reports page. After filling-in the information on the New Reports page, you will see a thumbnail view of your report (after it runs) on your Home page.

  **Note:** If the drop-down menu on this page is empty, click the Help link on the New Report page for more information.

- Click the Collapse/Expand (+/-) box to see the full thumbnail report or just the report title.
Click the **Rename** link if you need to rename your report.

Click the **Remove** link if you need to remove this report from your Home page.

**Note:** If you "share" your Home page, the Rename and Remove links will not be available for shared items.

### Job Configuration

To create a new job configuration

Enter information in the fields as follows:

- **Name** - Type a name you choose for the job configuration.
- **Procedure** - Displays the current project and procedure. Click **Change** to use the pop-up menu to select a new project/procedure.

**Parameters**

Depending on the Project and Procedure you selected, a set of Parameters is displayed. Enter all parameter values or just the required values if differentiated.

**Advanced**

- **Priority**:
  
  Use the drop-down menu to select the priority for this run procedure. Available priorities are: low, normal (default), high, or highest.
  
  - You can select the job's priority here, on Run Procedure web page, or when you schedule the procedure to run at a regular time or interval. When a job is launched, its priority cannot be changed.
  
  - Priorities take effect when two or more job steps in different jobs are waiting for the same resource. When the resource is available, it will be used by the job step that belongs to the job with the highest priority. If the priority level is the same, the resource will be used by the job step that belongs to the job with the lowest job ID number. If the job steps are in the same job, the resource will be used first by the step with the lowest job step ID number.
  
  - If using ectool, the priority can be set by passing "--priority=\<low\|normal\|high\|highest\>" to a `runProcedure`, `createSchedule`, or `modifySchedule` operation.

**Note:** To raise the job priority level above "normal," the user who launches the procedure must have execute permission on the system-level access control list for priorities.

**Impersonation**:

Click one of the three "radio" buttons to determine the default login user to use when the configuration is run.

- Use pre-defined credential - If you select this option, ElectricFlow looks for a credential first in the top-level procedure and then in its project. If it finds a credential, it uses the login from that credential as the default for the job. If there is no credential in either place, by default, the job's
steps run as the user under which the agent for the step is running.

- Use specific credential - If you select this option, you can choose a particular credential from those defined for the project containing the procedure - the login user from that credential is used as the default for the job.
- Use a specific user - If you select this option, you can enter a login name. When the configuration is run, you will be asked to enter the password for that account. The specified login will be used as the default for the job.

For more information on credentials and user impersonation, see the Credentials and User Impersonation Help topic.

Click OK when all selections are complete. Return to the Home page to see your new job configuration displayed.

To edit an existing job configuration

Change or modify any of your previously specified information.

Click OK when all selections are complete.
Return to the Home page to see your edited job configuration displayed.

Shortcuts

Use this page to create a New Shortcut or Edit an existing Shortcut.

Shortcuts appear on your Home page and provide quick access to other web pages, either in ElectricFlow or elsewhere.

- To create a new shortcut, type-in a shortcut name and the URL.
- To edit an existing shortcut, re-type the new shortcut name or URL (or both).

The easiest way to create a shortcut to an ElectricFlow automation platform page, such as the page for a particular project or procedure, is to navigate to that page and then click the "star" icon in the upper-right corner. This action automatically creates a shortcut and the star turns yellow to indicate a shortcut is in effect for the page.

If you click on the star icon again, the shortcut for that page is canceled.

Click OK to save your new or edited information and see your new/edited shortcut on the Home page.

Jobs Quick View

A quick view category provides a convenient way to select a group of jobs that interest you, such as "all production builds for product xyz version 3.6" or "all jobs I invoke manually." ElectricFlow displays the most recent jobs for each category on your Home page so you can review them easily.
To create a new jobs quick view category

Enter information in the fields as follows:

- **Name**—Type a name for your new job category.
- **Number of Jobs**—Type the maximum number of jobs you want to see in your quick view summary. The summary displays the most recent applicable jobs.
- **Include Last Success**—Select this check box if you want to see the last successful job in this category, even if it was not one of the most recent jobs.

Two Filter categories:

- **Intrinsic filters**—These filters provide a convenient way to access certain well-defined fields for jobs.
- **Custom filters**—These filters allow you to access a much broader range of values, including custom properties. Any values accessible through an intrinsic filter can be checked using a custom filter also (though not as conveniently).

Each filter specifies three values: the name of a particular property to check, a value it should be compared with, and relational operators such as "equals" or "less than." For example, if you select "Outcome" in an intrinsic filter with operator "not equals" and value "Success," the filter selects jobs that did not complete successfully because they had errors or warnings.

For an intrinsic filter, select a property by choosing one of several predefined properties from a list. For a custom filter, enter a property name. This name can be either the name of an intrinsic property for the job (such as "status" or "procedureName"), or the name of a property defined in the global property sheet for that job, or the name of a parameter for that job.

For the relational operator, select one of the values in the list. The behavior of the relational operators is determined by the underlying database. In most cases, comparisons are done using string comparison; operators such as "less than" may not be useful on numbers because "12" is considered less than "9." For some built-in properties, the database treats values according to a specific type such as number or date, so comparisons are implemented in the way appropriate for that type.

The relational operator "like" invokes an SQL wildcard comparison where "%" is the wildcard character. For example %test% matches "first test" and "tests failed" but not "Test 44".

**Note:** Job Quick View filters allow property path references. However, property path references are not allowed in search parameters on the Search page.

Click **OK** after making your selections to save your new job category and see it on the Home page.

To edit an existing jobs quick view category

Keep or change any of the previously entered information.

See the Filter information above to add or change existing custom or intrinsic filters.

Click **OK** after making your selections to save your modified job category and see it on the Home page.

**New Report**
Enter information in the following fields to define a new report to display on your Home page.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>The name of the project that contains the report you want to view.</td>
</tr>
<tr>
<td>Report</td>
<td>The report name you entered in the Report Title field when you configured this report. If you did not specify a &quot;thumbnail&quot; view when you defined your report, you will not see it here.</td>
</tr>
<tr>
<td>Title</td>
<td>This is the report title you want to see on your Home page to identify this report.</td>
</tr>
</tbody>
</table>

Click **OK** to continue.

After the report runs, the report you specified will be displayed on your Home page and updated whenever the report is generated again.

**To populate the drop-down menu**

- Go to the Project Details page for the project containing the reports you want to view.
- Select the Report tab.
- Click the **Create Report** link.
- Check the **Create thumbnail?** check box, which enters this report's name in the New Reports drop-down menu.

**Note:** All reports, except the Procedure Usage report, are available as "thumbnail" reports on your Home page.

**Jobs**

This page displays all jobs in the ElectricFlow system, both running and completed jobs. You can:

- Sort the Job, Status, Elapsed Time, and Start Time columns by clicking on the column name.
- Search for jobs and save the job search filters for later use. See Context Searching and Filtering on page 757 for details about using the search capabilities on the Jobs page.
Column descriptions

Job - click on Job to sort the column alphabetically or click on a job name to go to that job's Job Details page.

Status - click on Status to sort this column by Running, Success, Warning, Error, or Aborted.

Priority - displays the job's priority set by a "run procedure" command or by the job's schedule.

Procedure - in this column you can click on a project name to go to the Project Details page or click on the procedure name to go to the Procedure Details page for that procedure.

Launched By - click on a name in this column to go to the page for the schedule (Edit Schedule page) or the user that ran the job.

Elapsed Time - click Elapsed Time to sort the time values from longest to shortest time, or the reverse.

Start Time - click Start Time to sort this column from the start time of the first job to the start time of the most recent job, or the reverse.

Actions - use this column to Abort a running job or Delete a completed job.

- Aborting a job requires the execute privilege on the job—not just the modify privilege.

When you click Abort, the following dialog box appears:

Select either OK or Force to abort the job, or Cancel if you change your mind.

- Deleting a job on this page causes removal of job information from the ElectricFlow database, but information in the job's on-disk workspace area is not affected. You must delete workspace information manually.
Tips

If you use RSS, an active RSS icon is provided in Windows Explorer on this page for your convenience. If you use Firefox, click **Bookmarks** > Subscribe to this page to display the feed. You can then add the feed URL to a viewer of your choice.

**Job Step Details**

This page displays detailed information about a job step.

**Links and actions at the top of the table**

- **Access Control** - Use this link to set privileges for this job step. For more information, see the Access Control Help topic.
- "star" icon - click this icon to add this page to your Home for quick one-click access in the future.

**Summary section (at the top of the page)**

Notice [in the screen example below] that the name of the job step you are viewing is adjacent to the page title, Job Step Details.

The Summary section provides:

- The job's Start, Wait (waiting for a resource), and Elapsed times
- You will see wait times specified if your job steps were restricted by resource, workspace, a precondition, or license availability. For example, you will see the license wait time if a job step could not run because your license-allowed maximum concurrent step limit was met or exceeded, meaning no steps will run until the number of concurrent steps is reduced.
- A General Information section with links to get you to the job step's Job Details, Project Details, Procedure Details, or Edit Step pages.
- If the job created any custom reports, they appear in the summary area to the right of General Information. Reports on this page are for command steps only.

**Reports**

To create a special-purpose HTML report for a job: In the top-level of any of the job's workspaces, add a file that contains the word "report" or "Report" and ends in the .html file extension. The link is automatically created when the Job Details page is displayed. The job's workspace must be accessible to the web server. The link will be in the Reports section, within the Summary section.

**Links**

This page can include a Links section also, which will appear on the far right-side of the Summary section.
To add a link to this section:

- **Create a link to any file:**
  To add a link, run a command in any job's job step using this format (this works for both local [disconnected] and non-local workspaces):

  `ectool setProperty "[/myJobStep/report-urls/<myReportName>" "/commander/jobSteps/<jobStepId>/<artifactDirectoryName>/<file-path>"

  **Example command:**
  `ectool setProperty "[/myJobStep/report-urls/Test Report]" "/commander/jobSteps/$[myJobStep/jobStepId]/testreport/index.html"

  **Note:** If you are using this format (from ElectricCommander 4.2 and earlier):

  `ectool setProperty "[/myJob/report-urls/<myReportName>]" "/commander/jobs/<jobId>/<workspaceName>/<artifactDirectoryName>/<file-path>"

  **Example command:**
  `ectool setProperty "[/myJob/report-urls/Test Report]" "/commander/jobs/$[myJob/jobId]/$[myJobStep/workspaceName]/testreport/index.html"

  It will continue to work only for non-local workspaces. We recommend, however, that you change the command to use the newer format.

- **Create a link to any directory:**
  To add a link, run the following style command in any job's job step:

  `ectool setProperty "[/myJobStep/report-urls/Main Job Workspace]" 
  "file://WinStor2/scratch/chron55build/$[myJob/jobName]"

  **Note:** Links to a directory automatically work in Internet Explorer, but if using Firefox, local links are disabled unless the default security policy is modified or an extension is used. Refer to [http://kb.mozillazine.org/Links_to_local_pages_don%27t_work](http://kb.mozillazine.org/Links_to_local_pages_don%27t_work) for more details.

The "tabbed" Sections

The next section of tabs allows you to select the type of information you want to see. You may see six or fewer tabs, depending on the type of job step you are viewing.

Child Steps table

**Note:** The Child Steps table is available for subprocedure and broadcast steps only.

- Click on a Step Name to go to that step's Job Step Details page.
- Click the Log "icon" to see that job step's log information.
- **Status** - This column provides the job's step status.
  - Aborted - The step or job was aborted.
  - Canceled - The step did not run because the job was aborted or a previous step was aborted.
  - Error - The command failed or postp detected an error in the output.
○ Running - The step is currently running or a step inside the subprocedure call is running.
○ Skipped - The step did not run because the run condition evaluated to "false".
○ Success - The step completed with no errors or warnings.
○ Waiting for Resource or Workspace - The step is waiting to run as soon as a resource or workspace is available.
○ Warning - postp detected a warning message.

**Note:** The Status field can be over-ridden by postp to include more specific information. postp information may be linked directly to diagnostic information—also available by selecting the Diagnostics tab.

- Click on a Resource name to go to the Edit Resource page.
- Click the **Edit** link in the Action column to go to the Edit Step page.

**General table**

This section displays basic information including the step ID, step name, create and end times, and whether the step invoked a subprocedure or ran a command.

**Diagnostics table**

If the job step or child step (for subprocedure and broadcast steps) generated warning or error messages, you will see those messages here. This section contains one or more diagnostics, each of which is a portion of a step's log file that was identified as "interesting" by the step's postprocessor. Typically, each diagnostic relates to an error or warning detected by the postprocessor. All diagnostics for a particular job step appear together.

**Parameters table**

This section displays parameter values supplied to the top-level procedure when the job step was invoked and has these columns:
• Name
• Value

Note: This table is available for steps with child steps only.

Properties table

This section displays information computed and/or used by the job step while it is running. After the job step completes, these properties are normally read-only.

• Click on a Property Name to edit that property.
• If a "folder icon" precedes a property name, it denotes a Nested Property Sheet.
• This section also provides Create Property, Create Nested Property, and Access Control links to update or enter additional information for the next time this job step is run. For more information on properties, see the Properties Help topic.

Notifiers table

If you have designated certain persons or groups to be notified of details for specific job steps, this section displays who receives an email notification, the type of notification, any condition, and a description [if supplied]. If a notifier is available, you can click on its name to view details or make modifications.

Job Step Time and waitTime Properties Explained

• start - The time when this job step began executing.
  
  When the ElectricFlow server assigns a resource to run the step, it issues a <runcommand> request containing the expanded command body to that resource's agent. The "start" time is when that <runcommand> is sent to the agent.

• finish - The time when this job step completed.
  
  When a command finishes executing, the ElectricFlow agent issues a <finishcommand> request containing the exit code and other metadata back to the ElectricFlow server. The "finish" time is when the <finishcommand> is received by the server.

• elapsedTime - The number of milliseconds between the start and end times for the job.
  
  This is exactly "finish" - "start".
• totalWaitTime - The sum of resource, workspace, and license wait times for this job step.

The sum of resourceWaitTime, licenseWaitTime, and workspaceWaitTime.

• waitTime - The number of milliseconds the step spent between runnable and running (for example, waiting for a resource).

Covers known reasons why a step couldn’t run as soon as it became runnable (same as totalWaitTime), plus any other possible reason (slow transaction commits, system paging, etc).

• resourceWaitTime - The length of time this job step stalled because it could not get a resource. This could indicate that eligible resources for the step have reached their step limit, are in-use but the step requires a resource exclusively, or resources are down.

For subprocedure steps, this is the sum of all child steps.

• licenseWaitTime - The length of time this job step had to wait to process because the license limit was reached or exceeded.

For subprocedure steps, this is the sum of all child steps.

• workspaceWaitTime - The time this job step had to wait because no workspace was found or available.

For subprocedure steps, this is the sum of all child steps.

When it is time to schedule the step, ElectricFlow checks the license and starts counting time against licenseWaitTime until the license is satisfied (e.g., running this step would not exceed the maximum number of licensed hosts). After the step is scheduled, ElectricFlow sends a runCommand message to the agent. If it fails because ElectricFlow cannot talk to the agent, ElectricFlow accrues time against resourceWaitTime. If ElectricFlow can talk to the agent, but it has trouble manipulating the workspace (for example, it cannot create the workspace dir, map the drive [on Windows], or create files), ElectricFlow accrues time against workspaceWaitTime.

It is possible for the following to occur:

1. A job step becomes stalls due to a license issue.
2. The license limit is no longer exceeded and ElectricFlow tries to run the step but hits a bad resource.
3. When the resource is good, the step stall because of a license again (adding more time to the licenseWaitTime),
4. When the license is satisfied, ElectricFlow reaches the resource, and everything runs.

This is why ElectricFlow continues cycling through these states until everything is satisfied.
The first 4 blocks (resourceWaitTime, workspaceWaitTime, licenseWaitTime, and external factors) can occur in any order. External factors could include things such as system paging, slow transaction commits, etc.

Licenses

This page displays all license information known to the ElectricFlow server. Typically, a single license is displayed, which describes the usage to which you are entitled. The license on the server may be based on concurrent resources, concurrent users, concurrent steps, registered hosts, or any combination of these licenses.

All Licenses

Click **Import License** to import a new license file.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td>The name of the company or organization to which the license was granted. If this is not your company, please contact Electric Cloud Customer Support.</td>
</tr>
<tr>
<td>Feature</td>
<td>The type of license.</td>
</tr>
<tr>
<td>Expiration</td>
<td>The last day when this license is no longer valid. After your license expires (and after any grace period), running jobs will complete, but no new jobs can be launched.</td>
</tr>
<tr>
<td>Grace Period (days)</td>
<td>If this field is nonzero, you may continue using ElectricFlow for this many days after the expiration date. However, you will be warned frequently during the grace period that your license has expired.</td>
</tr>
</tbody>
</table>
### Column Name | Description / Actions
---|---
**Actions** | ![Image](image1.png)Click the **View License** button to see additional details about this license.
| ![Image](image2.png)Click the **Delete** button to delete this license.

### Current Usage

You see some or all of the following fields depending on the type of license or licenses you use for ElectricFlow.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Concurrent Steps</td>
<td>The maximum number of concurrent steps allowed by this license.</td>
</tr>
<tr>
<td>Concurrent Steps</td>
<td>The number of concurrent steps running now.</td>
</tr>
<tr>
<td>Maximum Concurrent Hosts In Use</td>
<td>The maximum number of unique host names defined in concurrent resources (non-proxy resources), where steps can run at any time.</td>
</tr>
<tr>
<td>Concurrent Hosts in Use</td>
<td>The number of unique host names defined in concurrent resources where steps are currently running.</td>
</tr>
<tr>
<td>Maximum Proxied Hosts In Use</td>
<td>The maximum number of unique host names defined in proxied resources, where steps can run at any time.</td>
</tr>
<tr>
<td>Maximum Concurrent Hosts</td>
<td>The maximum number of unique host names allowed to use ElectricFlow concurrently at any given time.</td>
</tr>
<tr>
<td>Concurrent Hosts in Use</td>
<td>The number of unique host names defined in concurrent resources where steps are currently running.</td>
</tr>
<tr>
<td>Maximum Proxied Host</td>
<td>The maximum number of unique host names define in proxied resources.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Proxied Hosts in Use</td>
<td>The number of unique host names defined in proxied resources where steps are currently running.</td>
</tr>
</tbody>
</table>

The following fields are specific to a concurrent user-based license.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Concurrent Users</td>
<td>The number of users allowed to use ElectricFlow concurrently at any given time.</td>
</tr>
<tr>
<td>Active Users</td>
<td>The number of users with an active license.</td>
</tr>
<tr>
<td>User IP</td>
<td>The &quot;user@IP&quot; combination that holds an active license.</td>
</tr>
<tr>
<td>Expiration</td>
<td>The time when the license will be released.</td>
</tr>
<tr>
<td>Last Use</td>
<td>The time when the license was last used.</td>
</tr>
</tbody>
</table>

The following fields are specific to a registered host-based license.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Registered Hosts</td>
<td>The maximum number of registered hosts allowed by this license.</td>
</tr>
<tr>
<td>Registered Hosts in Use</td>
<td>The number of registered hosts where steps are currently running.</td>
</tr>
<tr>
<td>Maximum Applications</td>
<td>The maximum number of applications that ElectricFlow can deploy at any given time.</td>
</tr>
<tr>
<td>Applications in Use</td>
<td>The number of applications that are currently running.</td>
</tr>
</tbody>
</table>

License Types

Concurrent Resource License

This license controls the number of unique host names on which steps can be scheduled at any time. Two properties, `maxHosts` and `maxProxiedHosts`, are defined on a license to control the maximum number of concurrent and proxied hosts that can be in use at the same time. The host named "localhost" and "127.0.0.1" refer to the local agent installed on the ElectricFlow server machine, and these host names are not part of the total count for hosts in use.

If two or more steps are running concurrently on the same host, the host name still counts once only towards the license limit. There is no limit to the number of resources pointing to a single host; from a licensing perspective, they all count as a single host. When the host limit is met, any new job step that attempts to run on a host [not already in use] will stay in the "runnable" state until its host is available. Current license usage statistics are
displayed at the top of the Resources page in the web interface. If no license is available, jobs cannot be launched. When a license expires, running jobs are allowed to complete, but no new jobs can be launched.

A concurrent resource license can be a standard or enterprise license.

This is an example of an enterprise license:

![Enterprise License Example](image)

This is an example of a standard license:
Concurrent User License

If the `maxConcurrentUsers` property is set on the license, its value defines the maximum number of users who can actively use the ElectricFlow server. A unique license is defined by the combination of the user's name and the IP address from which the user is making requests. A user can have multiple active sessions (through the web UI and ectool) from the same machine while only using a single license.

If a user makes a licensed API call without an active license, the server automatically attempts to assign a license. If a license is available (because the maximum has not been met), the user is assigned a license. If no licenses are available, the user will see a NoAvailableLicenses error and be redirected to the licenses page. Currently held licenses and their expiration dates can be viewed by calling the `getLicenseUsage` API or by viewing the Active Users table on the Licenses web page. When a license becomes available, the first user to make a licensed API call will be assigned that license. The only API calls not licensed are `login`, `getLicenseUsage`, `getAdminLicense`, `getServerStatus`, and `getServerInfo`.

When a license is first acquired, its expiration is set to 1 hour in the future. After the initial hour has passed, each time the user makes a licensed API call, the license is extended another 10 minutes (a configurable server setting). When a user's license passes the expiration date, it is released. When the user makes another licensed API call, a license is assigned automatically if one is available, otherwise the NoAvailableLicenses error is displayed.

A single administrator license can be used in an emergency. All users who have `execute` permission on the system-level licensing access control list can use the administrator license by calling the `getAdminLicense` API. This license has no expiration as long as all regular licenses are in use, but this license abides by the regular license expiration policy if regular licenses are available.
A concurrent user license can be a standard or enterprise license.

This is an example of an enterprise license:

![Enterprise License Example]

This is an example of a standard license:
ElectricFlow

This ElectricFlow license controls the number of unique steps you are allowed to run in the system at the same time (in parallel). The maxConcurrentSteps property, defined on a license, controls the maximum number of steps that can be running at the same time.

Registered Host License

Registered hosts are dedicated hosts on which a procedure or step can always run. This license controls the number of unique registered host names. Two properties, maxHosts and maxProxyedHosts, are defined on a license to control the maximum number of registered and proxied hosts that can be in use at the same time. The host named "localhost" and "127.0.0.1" refer to the local agent installed on the ElectricFlow server machine, and these host names are not part of the total count for hosts in use. Concurrent hosts cannot be used with registered hosts.

If two or more steps are running concurrently on the same host, the host name still counts once only towards the license limit. There is no limit to the number of resources pointing to a single host; from a licensing perspective, they all count as a single host. When the host limit is met, any new job step that attempts to run on a host (not already in use) stays in the "runnable" state until its host is available. Current license usage statistics are displayed at the top of the Resources page in the web interface. If no license is available, jobs cannot be launched. When a license expires, running jobs are allowed to complete, but no new jobs can be launched.

This an example of a registered host license:
View License

This page displays all available license details for a single license.

Use the Delete link to remove this license.

**Information**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Name</td>
<td>The name of the company or organization to which the license was granted. If this is not your company, contact Electric Cloud Customer Support.</td>
</tr>
<tr>
<td>Product Name</td>
<td>Product to which this license applies (if it is not &quot;ElectricFlow,&quot; it will not apply here).</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Feature Name</td>
<td>Product feature to which this license applies: must be &quot;Server&quot; for ElectricFlow licenses.</td>
</tr>
<tr>
<td>Maximum Concurrent Steps</td>
<td>The maximum number of concurrent steps allowed by the license.</td>
</tr>
<tr>
<td>Maximum Concurrent Hosts In Use</td>
<td>The maximum number of unique host names defined in concurrent resources (non-proxy resources), where steps can run at any time.</td>
</tr>
<tr>
<td>Maximum Proxied Hosts In Use</td>
<td>This is the maximum number of unique host names defined in proxied resources, where steps can run at any time.</td>
</tr>
<tr>
<td>Maximum Registered Hosts</td>
<td>The number of registered hosts on which a procedure or step can always run.</td>
</tr>
<tr>
<td></td>
<td>This appears when the license on the ElectricFlow server is based on a combination of concurrent and registered hosts or only registered hosts.</td>
</tr>
<tr>
<td>Maximum Concurrent Users</td>
<td>The number of users allowed to use ElectricFlow concurrently at any given time.</td>
</tr>
<tr>
<td>Expiration Date</td>
<td>The last day when this license is no longer valid. After your license expires (and after any grace period), running jobs will complete, but no new jobs can be launched.</td>
</tr>
<tr>
<td>Grace Period</td>
<td>If this field is non-zero, you may continue using ElectricFlow for this many days after the expiration date. However, you will be warned frequently during the grace period that your license has expired.</td>
</tr>
</tbody>
</table>

**Import License**

Use this page to provide a new license for ElectricFlow.

You should have received a license (as a block of text) from Electric Cloud already. If you have not received a license, contact Electric Cloud Customer Support or your sales representative.

- Use a text editor to open the license file.
- Copy the text into the Contents field.
- Click OK.

You will see your license information on the Licenses page.
Plugin Manager

A plugin is a collection of one or more features that can be added to ElectricFlow.

- Plugins are delivered as a JAR file containing the features implementation.
- When a plugin is installed, the ElectricFlow server extracts the JAR contents to disk into a configurable plugins directory.
- A plugin has an associated project that can contain procedures and properties required by the implementation.
- A plugin can provide one or more new pages for the web interface and may also provide a configuration page so you can provide any additional information that may be necessary to implement the plugin.

ElectricFlow provides default/bundled plugins, installed during the ElectricFlow installation. These plugins are "authored" and generally supported by Electric Cloud. For a complete list of bundled plugins, see Plugins That are Bundled with ElectricFlow on page 1138.

The information Plugin Manager displays across the top of the table:

Tab and field descriptions above the table

**Currently Installed** - The Plugin Manager default page view displays currently installed plugins. If you install additional ElectricFlow plugins from other sources, including those plugins you may create, they will also appear on this page.

**Install from File/URL** - Select this tab to see the following screen for plugin installation options:

- **File Install** - Use this method to upload and install a local "jar" file from the machine running your web browser. Click **Upload** after specifying the path you need.
- **URL Install** - install a plugin from a location specified by an URL. This location can either be an external web server (using **http://**), or a file on the ElectricFlow server host (using **file://**)

Install a plugin from the command-line:

- **ectool** - the command-line tool, contains a full set of commands to perform plugin tasks. For more information on available ectool plugin commands, see the "API Commands - Plugin Management" topic in the ElectricFlow API Guide.

**Note:** The server has a configurable maximum file upload size that defaults to 50MB. Refer to the server "Maximum upload size" setting to adjust the default.

**View Catalog** - This page displays all plugins available for installation. If you do not see an Install option in the Actions column, you may not have the necessary access control permissions to install a plugin.

**Catalog Install** - click on the **Install** action (next to a plugin listed in the catalog) to download and install the plugin.

Category: a drop-down menu to filter the plugin list by a specific category.
## Column descriptions

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plugin Label</td>
<td>The name of the plugin. Click on the label of an installed plugin to go to the Project Details page for that plugin.</td>
</tr>
<tr>
<td>Author</td>
<td>Identifies the person or organization that created the plugin and optionally provides a link to contact the author.</td>
</tr>
<tr>
<td>Version</td>
<td>The plugin version. Promoted plugin versions are also shown in this column. A promoted version number is labeled &quot;(promoted)&quot; immediately after the version number.</td>
</tr>
<tr>
<td>Category</td>
<td>The plugin type. Plugins that provide similar types of functionality are grouped into categories.</td>
</tr>
<tr>
<td>Description</td>
<td>A short text string that describes the plugin purpose or function.</td>
</tr>
</tbody>
</table>
### Using a plugin

Multiple methods for adding plugin functionality to ElectricFlow are available.

- To configure ElectricFlow to recognize your SCM plugin, see the [Configuring ElectricFlow](#) Help topic and select the Setting Up a Source Control Configuration section.
  - For additional plugin Help, see the [Customizing the ElectricFlow UI](#) Help topic.
  - For additional help using your SCM plugin with ElectricFlow Preflight, Default Tracking, and ElectricSentry, see those Help topics: Preflight Builds, Defect Tracking, ElectricSentry
- To add a subprocedure step using the Edit Step or New Step page in the ElectricFlow UI:
  1. Select the Projects tab and choose an existing project or click the Create Project link if you need to create a new project.
2. On the Project Details page, select an existing procedure or click the **Create Procedure** link if you need to create additional procedures.

3. On the Procedure Details page, to create a New Step using a plugin, select the **Plugins** link to go to the Choose Step panel.
   
   - In the left pane, select a plugin category and then choose a plugin.
   
   - In the right pane, select the step type you want, which will take you to the New Step page to add a new subprocedure step (using your selected plugin).

4. On the New Step page, notice that the plugin you selected is already displayed in the Subprocedure section.

5. Enter information in the Parameters section fields. These fields are specific to the plugin you chose. (These fields are frequently different for each plugin.)

### Configuring the plugins directory

For instructions on configuring the plugins directory for your ElectricFlow server, remote agents, and/or remote web servers, see the *ElectricFlow Installation Guide*.

### Procedure Details

This page displays procedure component tables, including a table for Procedure Steps, Parameters, Email Notifications, and Custom Procedure Properties. A procedure describes a process to execute that consists of one or more step.

*Use this page to create steps.*

### Procedure Steps

This table displays all steps in the procedure [named at the top of the page]. The steps execute in order from top to bottom. Normally only one step executes at a time, but if a group of adjacent steps is marked as "parallel," all of those steps will execute simultaneously.

**Important:** If you want to change the order of the steps, click on the icon to the left of the step name and drag it up or down to the new step position.

**Note:** This table displays only a few of the fields for each step. To view (and modify) the complete details for a step, click on the step’s name to go to the Edit Step page.

### Links at the top of the page

- Use the **Run** link [hovering your mouse over the small down-arrow on the right-side of the link] to choose Run Immediately or Run...
  
  - Run Immediately - Selecting this option runs the procedure immediately as set.
  
  - Run... - Selecting this option displays the Run Procedure web page where you may alter any existing parameters for this procedure, or set an existing credential.

- Click the **Access Control** link to go to the Access Control page to add privileges for this procedure.

- Click the **Edit** link to go to the Edit Procedure page so you can make modifications if necessary.
• Use the Copy link in the Actions column to make an exact copy of this step.
• Choose one of the New Step links to create the type of step you need.

Creating a new step

The following list describes some of the more common steps you can create.

• Command - this link takes you directly to the New Step page to write your own step. A Command(s) text box is available to add a script. This step invokes a bat, cmd, shell, perl script, or similar.
• Subprocedure - the Choose Subprocedure Step dialog is displayed, allowing you to select a project or plugin from which you want to call an existing procedure to create a step. This step invokes another ElectricFlow procedure and will not complete until all subprocedure steps have finished.
• Plugin - this link opens the Choose Step panel. The left pane displays plugin categories and the right pane displays available pre-configured steps for your left-pane selection. To quickly find your application/plugin, type your selection name in the Search box. Select the step you want to create and ElectricFlow takes you to the New Steps page.
  ○ On the New Step page, notice that the plugin step you selected is already displayed in the Subprocedure section.
  ○ Enter information in the Parameters section fields. These fields are specific to the plugin you chose. (These fields are different for each plugin.)

Enter information in any remaining fields to complete your step. See the New Step Help topic for more information.

A note about plugins

Plugins are the vehicle ElectricFlow uses to integrate source control systems (such as Subversion or Perforce), defect tracking applications (such as JIRA or MKS), reporting functionality, code analysis applications, build applications, and much more. For a complete list of plugins, see Plugins That are Bundled with ElectricFlow on page 1138.

Note: If you do not see the SCM system or defect tracking system you prefer, a Plugin Catalog is available from the Plugin Manager also. All plugins in the catalog are available for installation into ElectricFlow.

Parameters

Each procedure can define parameters, which are values provided to the procedure when it is invoked. Each parameter value is placed in a property associated with the job and the procedure can use the property to control its execution. For example, a parameter might specify a particular branch of a product to build; another parameter might indicate whether unit tests should be run during this build.

When you define a parameter, indicate whether the parameter is required (meaning the procedure will not run unless a value is provided for the parameter). Also, you can provide a default parameter value and a description to help callers understand how to use the parameter.

• Click the Create Parameter link to go to the New Parameter page.
• Click on the Parameter Name to edit its contents.
Email Notifiers

Use the Create On Start Email Notifier or Create On Completion Email Notifier links to go to one of the respective pages to create an email notifier for this procedure.

After creating an email notifier, click on the "bread crumb" link at the top of the page to return to the Procedure Details page.

Custom Procedure Properties

- To add new properties to this procedure, click the Create Property, Created Nested Sheet, or Access Control links.
- Click on the Property Name to edit its contents.
- Nested Property Sheets appear in this table preceded by a folder icon.

Tip

Want to rename this procedure or change its description? Click the Edit link at the top of the page.

Procedure - create new or edit existing procedure

To create a new procedure

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a name for the procedure. This name must be unique within the project.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
</tbody>
</table>
### Field Name Description

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Name Template</td>
<td>This is the template used to determine the default name of jobs launched from the procedure.</td>
</tr>
<tr>
<td></td>
<td>For example:</td>
</tr>
<tr>
<td></td>
<td><code>$[projectName]_${/increment /myproject/jobCounter}_${/timestamp}</code></td>
</tr>
<tr>
<td></td>
<td>Produces a name like:</td>
</tr>
<tr>
<td></td>
<td><code>projectFoo_1234_20140102130321</code></td>
</tr>
<tr>
<td></td>
<td>Enter any combination of elements to create procedure names more meaningful to you. For example, you could choose to include the build number.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Electric Cloud does not recommend using the ElectricFlow-generated <code>jobId</code> because it is no longer a human-readable integer so it does not provide any identifiable information and cannot be used as a counter.</td>
</tr>
<tr>
<td>Default Resource</td>
<td>Enter a resource name. This name must be unique among other resource names or click <strong>Browse</strong> to select a resource.</td>
</tr>
<tr>
<td>Default Workspace</td>
<td>Enter the name of the workspace or click <strong>Browse</strong> to select a workspace name.</td>
</tr>
<tr>
<td>Time Limit</td>
<td>If no time limit was specified on the calling step, time limits are copied to the calling step from the procedure. If the procedure is called from <code>runProcedure</code> (or a schedule), the time limit acts as a global job timeout.</td>
</tr>
<tr>
<td></td>
<td>The &quot;timer&quot; for the procedure starts as soon as the calling step/job becomes runnable (all preconditions are satisfied).</td>
</tr>
<tr>
<td></td>
<td>Specify a number and then use the pull-down menu to select the &quot;time units&quot; of the number you specified.</td>
</tr>
<tr>
<td><strong>Impersonation Credential</strong></td>
<td></td>
</tr>
<tr>
<td>Credential Project</td>
<td>Default Credential Project is the current project, or select the other button and Browse for the project name you need.</td>
</tr>
<tr>
<td>Credential Name</td>
<td>The name of the credential for the project - you may need to Browse to find this name.</td>
</tr>
</tbody>
</table>

Click **OK** to save the information to create a new procedure.
To edit an existing procedure

Use this page to modify certain overall information about a procedure. Additional information, such as procedure steps and properties, can be viewed and modified on the Procedure Details page. To access this page, click the **Project Name** link on the location path (breadcrumb), then select a Procedure name.

To learn more about a particular field on the form, mouse-over the field to pop-up descriptive text under the mouse or click the **Help** link at the top of the page.

**Tip**

Want to rename the procedure? Enter a new procedure name in the Name field, click **OK**.

**Step - create new or edit existing step**

Use this page to define a new step or to modify an existing step. The following information describes the common fields you need to enter to create any type of step.

**Note**: If you chose to create a step using the Plugin link, additional help is available in the Parameters section by clicking the "?" icon. The Parameter section is populated according to type you chose to create. Different step types require different information.

To create a new command or subprocedure step

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General section (for all step types)</strong></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Enter a name for the step that must be a unique name within the procedure.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td><strong>Command section (for command steps only)</strong></td>
<td></td>
</tr>
<tr>
<td>Command(s)</td>
<td>A script to execute the step functions that is passed to the step's shell for execution.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Resource</td>
<td>Enter a unique resource or resource pool name or click Browse to select a resource. If you leave this field blank, the procedure or project provides a default resource.</td>
</tr>
<tr>
<td></td>
<td>• The job step must have the execute privilege on the resource or resource pool. If it does not, the job step will be canceled with an access denied error.</td>
</tr>
<tr>
<td></td>
<td>• The resource or resource pool must be enabled. If the resource or pool is not enabled, no error is generated, and the step remains in the runnable state until the pool is enabled.</td>
</tr>
<tr>
<td>Postprocessor</td>
<td>If this field remains blank, no postprocessor runs for the step. If this field is not blank, it specifies a command (passed to the step's shell for execution) that analyzes the log file for the step and collects diagnostic information for reporting. For more information, see the Postprocessors Help topic.</td>
</tr>
</tbody>
</table>

**Subprocedure section (for subprocedure steps only)**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure</td>
<td>Displays the current project and procedure. Click Change to use the pop-up menu to select a new project or procedure.</td>
</tr>
<tr>
<td>Resource</td>
<td>Enter a unique resource name or click Browse to select a resource. If you leave this field blank, the procedure or project provides a default resource.</td>
</tr>
</tbody>
</table>

**Parameters section (for subprocedure steps only)**

This section expands automatically, entering the fields you need specifically for the Subprocedure you chose in the previous section. For additional help with field descriptions, click the "?" icon if available.

To toggle between the standard view and property view for this section, click the icon. This icon appears in the standard form when one or more of the parameter types are not Text entry or Text area. It appears in the custom form for all the supported parameter types when the form has at least one parameter.

**Advanced section (for both command and subprocedure steps)**
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Precondition** | By default, if this field is blank, the step has no precondition and will run when scheduled. Set this property to make a step wait until one or more dependent conditions are met. When a job step is eligible to transition from pending to runnable, a *precondition* is evaluated.  
A *precondition* is a fixed text or text embedding property reference that is evaluated to TRUE or FALSE. An empty string, a "0" or "false" is interpreted as FALSE. Any other result string is interpreted as TRUE. The step will block until the precondition is TRUE.  
Precondition example:  
Assume we defined these 4 steps:  
1. Build object files and executables  
2. Build installer  
3. Run unit tests  
4. Install bits on test system  
Step 1 is an ordinary serial step.  
Steps 2 and 3 can run in parallel because they depend only on step 1's completion.  
Step 4 depends on step 2, but not step 3.  
You can achieve optimal step execution order with preconditions:  
- Make steps 2-4 run in parallel.  
- Step 2 needs a job property set at the end of its step to indicate step 2 is completing (/myJob/buildInstallerCompleted=1).  
- Set a precondition in step 4:  
  $[/myJob/buildInstallerCompleted] |
| **Run Condition** | By default, if this field is blank the step will always run. This field accepts "fixed text" or text embedding property references that are evaluated into a logical TRUE or FALSE. A "0" or "false" is interpreted as FALSE. An empty string or any other result is interpreted as TRUE.  
The property reference can be a JavaScript expression, for example, this expression could test whether the name of a step is equal to the value of a property called "restartStep".  
$[/javascript (myStep.stepName == myJob.restartStep)] |
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| Error handling | This field determines what happens to the procedure if the step fails. The first choice, "procedure continues, but overall status will be error" means an error in the step does not abort the procedure; subsequent steps will run as usual. However, an error will be reflected in the overall outcome of the procedure. If this is the top-level procedure in the job, the job will have an error outcome. If this is a subprocedure, the step invoking the subprocedure will have an error outcome, which still could cause the job to abort, depending on the error handling for that step. The second choice for this field is "abort procedure but allow running steps to continue." In this case, if an error occurs, no new steps are initiated in this procedure except those where "always run" was selected. Any steps currently running are allowed to complete, then the procedure will abort and its outcome will be set to error as described previously. Six error handling options are:  
• `failProcedure` - The current procedure continues, but the overall status is error (default).  
• `abortProcedure` - Aborts the current procedure, but allows already-running steps in the current procedure to complete.  
• `abortProcedureNow` - Aborts the current procedure and terminates running steps in the current procedure.  
• `abortJob` - Aborts the entire job, terminates running steps, but allows `alwaysRun` steps to run.  
• `abortJobNow` - Aborts the entire job and terminates all running steps, including `alwaysRun` steps.  
• `ignore` - Continues as if the step succeeded. |
<p>| Time Limit    | The maximum amount of time the step can execute. If the step exceeds this time, it will be aborted. Specify a number and then use the pull-down menu to select the &quot;time units&quot; of the number you specified. |
| Run in parallel | If this box is &quot;checked,&quot; this step will run concurrently with any adjacent steps marked as parallel. If this box is not checked, the step will NOT run until all previous steps in the procedure have completed, and it will complete before any following steps execute. |</p>
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always run step</td>
<td>If a procedure is aborted (either because of an error in a step or because the job was aborted), under normal conditions no new steps will start in the procedure. However, if this box is “checked,” the step will run even if the procedure is aborted. This facility is most commonly used for steps at the end of a job that generate reports or perform cleanup operations. <strong>Note:</strong> Remember that the Run Condition field is still evaluated and may cause the step to be skipped even if this box is checked.</td>
</tr>
<tr>
<td>Retain Exclusive</td>
<td>Select one of the following options:</td>
</tr>
<tr>
<td></td>
<td>• None - the &quot;default&quot;, which does not retain a resource.</td>
</tr>
<tr>
<td></td>
<td>• Job - keeps the resource for the duration of the job. No other job can use this resource, regardless of its step limit, until this job completes or &quot;Release Exclusive&quot; is used in a step. Future steps for this job will use this resource in preference to other resources—if this resource meets the needs of the steps and its step limit is not exceeded.</td>
</tr>
<tr>
<td></td>
<td>• Step - keeps the resource for the duration of the step.</td>
</tr>
<tr>
<td></td>
<td>• Call - keeps the resource for the duration of the procedure that called this step, which is equivalent to &quot;job&quot; for top level steps.</td>
</tr>
<tr>
<td>Workspace</td>
<td>Use this field to define a workspace for the step to use. You can either type-in a workspace name or click Browse to select a workspace. If you leave this field blank, the workspace is determined by the procedure or project.</td>
</tr>
<tr>
<td></td>
<td><strong>These &quot;Advanced&quot; fields are used for command steps only</strong></td>
</tr>
<tr>
<td>Broadcast</td>
<td>&quot;Checking&quot; this box means replicate the step to execute (in parallel) on each of the specified resources (for example, if a resource pool is specified, run the step on each resource in the pool).</td>
</tr>
<tr>
<td>Release Exclusive</td>
<td>Select one of the following options:</td>
</tr>
<tr>
<td></td>
<td>• <strong>none</strong> - the &quot;default&quot; - no action if the resource was not previously marked as &quot;retain&quot;.</td>
</tr>
<tr>
<td></td>
<td>• <strong>release</strong> - releases the resource at the end of this step. If the resource for the step was previously acquired with &quot;Retain exclusive&quot; (either by this step or some preceding step), the resource exclusivity is canceled at the end of this step. The resource is released in the normal way so it may be acquired by other jobs.</td>
</tr>
<tr>
<td></td>
<td>• <strong>releasetojob</strong> - allows a step to promote a Step exclusive resource to a Job exclusive resource.</td>
</tr>
</tbody>
</table>
## Field Name | Description
--- | ---
**Shell** | This shell will be used to execute the step’s commands on a resource. For example, using `sh` or `cmd /c`, the agent saves the command block to a temporary file with a `.cmd` extension and runs it:

```
sh foo.cmd or cmd /c foo.cmd
```

If you do not specify a shell on a step, at step run-time the server looks at the resource shell. If a resource shell is not set, the shell line used by the agent is platform dependent:

- **Windows**: `cmd /q /c "{0}.cmd"
- **UNIX**: `sh -e "{0}.cmd"

When you specify a shell (in the step or resource), and omit the `cmd-file` marker, the agent notices the omission and takes the correct action.

For example: a user specifies `sh -x`.

The agent converts this to `sh -x "{0}.cmd"`

Two alternate forms of shell syntax where ElectricFlow uses a "marker," `{0}`, as a placeholder for the command file argument:

- `<myShell> {0} <potential extra shell args>`
  
  In this example, the command file is not meant to be the last argument in the final command line.
  
  For example, `mysql -e "source {0}"`

  This shell example runs the `mysql` command against this step’s command containing `sql`.

- `<myShell> {0}.<file extension> <potential extra shell args>`
  
  In this example, the shell requires the command file to end in an extension other than `.cmd`.
  
  For example, `powershell "& '{0}.ps1'"`

  This shell example runs Microsoft PowerShell against this step’s command containing PowerShell commands.

### Notes:

- When the agent parses the shell, it will parse the extension as everything after `{0}`. until it sees a space or non-alphanumeric character.

- If your script uses International characters (non-ascii), add the following block to the top of your ec-perl command block:

```
use utf8;
ElectricCommander::initEncodings
```
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Directory</td>
<td>The directory where the commands for this step execute. A relative name is interpreted relative to the root directory for the job workspace. If you leave this field blank, the step’s working directory will be the top-level directory in the job workspace. <strong>Note:</strong> If this step will run on a proxy resource, this directory must exist on the proxy target. The step will run in this directory on the proxy target.</td>
</tr>
<tr>
<td>Log File</td>
<td>The step's log file name, specified relative to the root directory in the job workspace. If you leave this field blank, ElectricFlow picks a unique name for the log file based on the step name.</td>
</tr>
</tbody>
</table>

**Impersonation section (for both command and subprocedure steps)**

<table>
<thead>
<tr>
<th>Credential Project</th>
<th>By default, the Current project is used, or click Browse and select a different project.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credential Name</td>
<td>If you select a credential in this field, the step runs under the account from that credential. This field is usually blank, which means a default credential is used. For more detailed information about credentials, see the <a href="#">Credentials and User Impersonation</a> Help topic.</td>
</tr>
</tbody>
</table>
topic for more information. For more information about Access Control, go to the main Access Control Help topic.

Click OK to save your modified step information.

Publish Artifact Version Step

Use the EC-Artifact plugin to create a step to publish a new artifact version.

The following parameters are available to create this step:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artifact</td>
<td>Artifact name, in the form &lt;groupId&gt;:&lt;artifactKey&gt;. If the artifact does not exist, it will be created if this procedure's launching user or this project principal has the required permissions.</td>
</tr>
<tr>
<td>Version</td>
<td>A full version string takes the form: &lt;major&gt;.&lt;minor&gt;.&lt;patch&gt;-&lt;qualifier&gt;-&lt;buildNumber&gt;. The version specification must be unique across all of this artifact's versions.</td>
</tr>
<tr>
<td>Repository</td>
<td>Name of the repository where this new artifact version will be published.</td>
</tr>
<tr>
<td>Enable Compression</td>
<td>Check this box to compress the artifact version before it is stored in the repository.</td>
</tr>
<tr>
<td>From Directory</td>
<td>Name of the directory in the job's workspace containing files that comprise the artifact version to be published. If not specified, the entire workspace is used.</td>
</tr>
<tr>
<td>Include Patterns</td>
<td>List file &quot;include&quot; patterns one pattern per line, to limit which files are published. If no patterns are specified, all files are included.</td>
</tr>
<tr>
<td>Exclude Patterns</td>
<td>List file &quot;exclude&quot; patterns one pattern per line, to limit which files are published. If no patterns are specified, no files are excluded.</td>
</tr>
<tr>
<td>Dependent Artifact Versions</td>
<td>List dependent artifact versions one per line, each in the form &lt;groupId&gt;:&lt;artifactKey&gt;:&lt;versionRange&gt;. All dependent artifact versions must exist for this artifact version to be retrievable. When this artifact version is successfully retrieved, its dependent artifact versions are retrieved also.</td>
</tr>
</tbody>
</table>

Retrieve Artifact Version Step
Use the EC-Artifact plugin to create a step to retrieve an artifact version.

The following parameters are available to create this step:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artifact</td>
<td>Artifact name, in the form <code>&lt;groupId&gt;:&lt;artifactKey&gt;</code>.</td>
</tr>
<tr>
<td>Version</td>
<td>Select the latest version (Latest), the exact version of the artifact (Exact), or a version range (Range). Version is in the form: <code>&lt;major&gt;.&lt;minor&gt;.&lt;patch&gt;-&lt;qualifier&gt;-&lt;buildNumber&gt;</code></td>
</tr>
<tr>
<td>Retrieve to directory</td>
<td>If you want to retrieve this artifact version to a specific directory location, select the check box, then specify the full path to the directory where you want to retrieve this artifact version.</td>
</tr>
</tbody>
</table>
| Overwrite  | Use the drop-down menu to select one of the following options:  
  - true - deletes previous content in the directory and replaces the content with your new version.  
  - false - (existing behavior) if the directory does not exist, one will be created and filled with the artifact’s content. If the directory exists, a new directory is created with a unique name and the artifact contents is supplied there.  
  - update - this is similar to a merge operation—two artifact versions can be moved into the same directory, but individual files with the same name will be overwritten. |
Field Name | Description
--- | ---
Retrieved Artifact Location Property | Name or property sheet path used by the step to create a property sheet. This property sheet stores information about the retrieved artifact versions as XML in the artifactVersionXML child property, and the file system location of the retrieved artifact version in the cacheLocation child property.

The initial value of this field includes `${assignedResourceName}` as one of the levels in the property path because different resources may have different cache directories, and you do not want a retrieval on one resource to clobber the data regarding a retrieval on a different resource.

Typically, a step that needs to use files from an artifact retrieved by this step will specify it in a Perl script similar to this:

```perl
my $cmdr = new ElectricCommander();
my $xpath = $cmdr->getProperty("/myJob/retrieveArtifactVersions/${assignedResourceName}/MyGrp:MyKey/cacheLocation");
my $retrieveDir = $xpath->findvalue("//value")->value();
system("java", "-cp", "$retrieveDir/lib/bar.jar", "Bar");
```

This example shows how to retrieve the location of the retrieved MyGrp:MyKey artifact version on the resource, and add a file (bar.jar) in its lib directory to classpath, so the Bar class can be run.

Filters | Enter search filters, one per line, applicable to querying the ElectricFlow database for the artifact version to retrieve.

Artifact Retrieval Dependency Order Explained

The order of dependencies registered for an artifact version are significant.

Consider this scenario:

- A depends on B (any version) and C [1.0, 2.0)
- B depends on C (any version)
- C versions 1.0, 2.0, and 3.0 exist

When retrieving A, the dependency algorithm evaluates B first. The algorithm finds that the max version of B depends on any version of C, so the algorithm looks for max version C and finds C 3.0. Because this chain is satisfied, the algorithm returns to A and evaluates its next dependency "C [1.0, 2.0]". This results in matching C 1.0.

The returned artifacts are: A, B, C 1.0, and C 3.0.
Consider if the A dependency is changed to:

- A depends on C [1.0, 2.0), B (any version)

The algorithm will choose C 1.0 first. Then the algorithm evaluates B, determines that its "C (any version)" is satisfiable by the already chosen C 1.0.

The returned artifacts are A, B, and C 1.0.

**Note:** In the version range syntax [], indicates inclusive, () indicates exclusive.

**Send Email Step**

Use the EC-SendEmail plugin to create a step to send email notifications.

The following parameters are available to create this step:

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email Configuration</td>
<td>The name of the email configuration to use. If no configuration is specified, the configuration named &quot;default&quot; is used.</td>
</tr>
<tr>
<td>To</td>
<td>List the &quot;To&quot; recipients for the email message, one per line. A recipient can be a user or group name or a complete email address.</td>
</tr>
<tr>
<td>CC</td>
<td>List the &quot;CC&quot; recipients for the email message, one per line. A recipient can be a user or group name or a complete email address.</td>
</tr>
<tr>
<td>BCC</td>
<td>List the &quot;BCC&quot; recipients for the email message, one per line. A recipient can be a user or group name or a complete email address.</td>
</tr>
<tr>
<td>Subject</td>
<td>The subject line for the email message.</td>
</tr>
<tr>
<td>Message</td>
<td>The body of the email message or a workspace file containing the body. If both a plain text and an HTML message are provided, both values are sent as alternates in a multipart message. If a raw message is provided, both values are sent as alternates in a multipart message. If a raw message is provided, the value should be a properly formatted RFC822 message.</td>
</tr>
</tbody>
</table>

**Advanced options**

<p>| Multipart Mode | The multipart mode of the email message. Defaults to &quot;none&quot; unless there are multiple parts, in which case it defaults to &quot;mixedRelated&quot;. |
| Header(s) | One or more RFC822 email header lines (for example: &quot;reply-to: <a href="mailto:user@host.com">user@host.com</a>&quot;). |</p>
<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attachment(s)</td>
<td>One or more files from the job’s workspace to send as attachments. The filename extension is examined to determine the content-type.</td>
</tr>
<tr>
<td>In-line Attachment(s)</td>
<td>One or more inline attachments specified as a contentId and a workspace filename. The filename extension is examined to determine the content-type.</td>
</tr>
</tbody>
</table>

**New Extract Preflight Sources Step**

Choose one of the preflight plugins to create a step to retrieve an artifact version. There are numerous source code management (SCM) plugins. For example, Accurev, Bazaar, CVS, ClearCase, Git, Mercurial, Perforce, SVN, StarTeam, Team Foundation Server, and Vault.

Enter the following information:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step Name</td>
<td>Enter a unique name for your preflight step. You can use any name of your choice.</td>
</tr>
<tr>
<td>SCM Configuration</td>
<td>Use the pull-down menu to select a source control configuration. If a configuration for your source control type does not appear in the drop-down menu, select the Administration &gt; Source Control tabs to configure your source control system.</td>
</tr>
<tr>
<td>Destination Directory</td>
<td>This field appears after specifying your SCM from the pull-down menu. If this field does not specify “Required”, you do not need to enter this information. The Destination Directory is a path relative to the job's workspace, where the source tree will be created.</td>
</tr>
</tbody>
</table>

Click **Submit** after entering your information.

After clicking **Submit**, the Edit Step page is displayed.

Use the Edit Step page to specify additional information for your preflight step. Also, you can attach a credential, create an email notifier, add custom properties, and so on to your step. For assistance using the Edit Step page, access the **Help** link in the upper right corner of the page.

For more information about preflight builds, see the Preflight Builds Help topic.

**Parameter - create new or edit existing parameter**
To create a new parameter

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique name to specify the parameter when a procedure or workflow is invoked.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt;</code> ... <code>&lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; </code>&lt;u&gt;`</td>
</tr>
<tr>
<td>Type - Select the parameter type from the drop-down menu. The following &quot;types&quot; are available.</td>
<td></td>
</tr>
<tr>
<td>Text entry</td>
<td>Allows a short text entry in the Default Value field.</td>
</tr>
<tr>
<td>Text area</td>
<td>Expands the Default Value field to allow adding a longer script-type entry.</td>
</tr>
<tr>
<td>Dropdown menu</td>
<td>Creates a drop-down menu from which to select a value when the parameter is presented.</td>
</tr>
<tr>
<td></td>
<td>- Enter options - Click <code>+ Add Option</code> to add a new row. Type-in the text and value for each option. The text is what will be displayed in the menu, and the value is the parameter value if that option is selected.</td>
</tr>
<tr>
<td></td>
<td>- Load options from list - Enter a pipe-separated list of options (for example, `foo</td>
</tr>
<tr>
<td></td>
<td>- Load options from property sheet - Enter the path to property sheet that contains options for the parameter. The property sheet must be created in a specific format:</td>
</tr>
<tr>
<td></td>
<td>- An optionCount property must exist whose value is the number of options.</td>
</tr>
<tr>
<td></td>
<td>- For each option, create a nested property sheet called <code>optionN</code>, where N is the option number, starting with 1.</td>
</tr>
<tr>
<td></td>
<td>- In each nested sheet, create two properties - <code>text</code> and <code>value</code>. The value of the property <code>text</code> will be displayed in the menu. The value of the property <code>value</code> is the parameter value if that option is selected.</td>
</tr>
<tr>
<td></td>
<td>- If <code>optionCount</code> is set to 3, you must create three nested sheets - <code>option1</code>, <code>option2</code>, and <code>option3</code>.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description / Action</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------</td>
</tr>
</tbody>
</table>
| Radio selector | Creates "radio" buttons to select an entry when the parameter is presented.  
- Enter options - Click + Add Option to add a new row. Type-in the text and value for each option. The text is what will be displayed in the menu, and the value is the parameter value if that option is selected.  
- Load options from list - Enter a pipe-separated list of options (for example, foo|bar|baz). The text and value for the options will be the same.  
- Load options from property sheet - Enter the path to property sheet that contains options for the parameter. The property sheet must be created in a specific format:  
  - An optionCount property must exist whose value is the number of options.  
  - For each option, create a nested property sheet called optionN, where N is the option number, starting with 1.  
  - In each nested sheet, create two properties - text and value. The value of the property text will be displayed in the menu. The value of the property value is the parameter value if that option is selected.  
  - If optionCount is set to 3, you must create three nested sheets - option1, option2, and option3. |
| Checkbox | Creates a checkbox for a value to select (or not) when the parameter is presented.  
- Value when unchecked - The value of the parameter when the checkbox is unchecked.  
- Value when checked - The value of the checkbox when the checkbox is selected.  
- Initially checked - Whether or not the checkbox should be checked initially. If true, set the "Default value" to match the "Value when checked". If false, set the "Default value" to match the "Value when unchecked". |
| Credential | Selecting this option requires the user to specify a user name and password to use this parameter at runtime.  
**Note**: Credential parameters are not supported on state definitions. |
<p>| Project | Creates a project selector field on the Run Procedure page to choose a different project name where the parameter needs to find additional information. |</p>
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saved Filter</td>
<td>Use this option to reference any saved filters, which is a passing the filter into the procedure at runtime (primarily used for reports). Saved Filters are stored as a property in your chosen project.</td>
</tr>
<tr>
<td>Default Value</td>
<td>You can specify a default value to assign to the parameter if no explicit value is provided.</td>
</tr>
<tr>
<td>Required?</td>
<td>Click the checkbox to select the parameter as &quot;required.&quot; If the parameter is required, the procedure or workflow will not run without entering a value for that parameter. In this case, the default value is ignored. After the procedure or workflow begins execution, the parameter value is available in the job or workflow's property sheet with the same name as the parameter.</td>
</tr>
<tr>
<td>Defer Expansion?</td>
<td>Click the checkbox to set the parameter expansion to be &quot;deferred.&quot; Deferred means the parameter value will not be expanded when the procedure call is expanded, but can be expanded from a command step instead.</td>
</tr>
</tbody>
</table>

Click **OK** after filling-in the fields.

To edit an existing parameter

You may change any information or add new information as necessary.

For example: Want to rename a parameter? Enter a new parameter name in the Name field, click **OK**.

*For more information* on property sheets, see the Properties Help topic.

**Projects**

This page displays all projects available on this ElectricFlow server—the projects you create, ElectricFlow-supplied default projects, and ElectricFlow solutions. From this page you can navigate into projects to view its procedures, steps, schedules, credentials, workflows, and other components.

You can search for projects and save the search filters for later use. See **Context Searching and Filtering on page 757** for details on using the search capabilities on this page.
A project is a top-level container within ElectricFlow. Most information about software production processes, such as procedures, schedules, jobs, and workflows are contained within a project.

- The drop-down menu (at the top of the table) displays all "tags" you previously defined to mark, label, or group related or similar type projects. When you select a tag, the project list changes to display only the projects with that tag.
- When you search for projects, the search result is limited to the projects with the selected tag if a tag was selected.
- To add a tag:
  1. Click the **Edit** link for the project you want to tag.
  2. On the Edit Project page, enter a tag name in the Tags field.
     After creating a tag, the tag name will appear in the drop-down menu.

**Note:** For more information on "tagging" projects, see the **Edit Project** Help topic.

- To create a new project, click the **Create Project** link.
- To **Edit**, **Copy**, or **Delete** an existing project, click a corresponding link in the Actions column.

  **Note:** If deleting a project, the "background deleter" will mark the project for deletion, but the deletion process may not start until the server completes other tasks already queued or in progress. Deleting a project could take considerable time depending on the size of your project. For example, a project containing hundreds of jobs, steps, and other objects will take longer to delete than a simple project with 3 procedures and 10 steps.

- To see project details, click on a project name in the Project column to go to the Project Details page.

**Projects have two purposes**

1. Projects allow you to create separate work areas for different purposes or groups of people so they do not interfere with each other.

   For example, different projects can reuse the same names internally without conflict, and each project has its own access control that determines who can use and modify the project.

   In a small organization, you might choose to keep all work within a single project, but in a large organization, you may want to use projects to organize information and simplify management.
2. Projects simplify sharing.

You can create library projects containing shared procedures and invoke these procedures from other projects.

After creating a library project, you can easily copy it to other ElectricFlow servers to create uniform processes across your organization.

**ElectricFlow includes default projects**

Currently, ElectricFlow includes the following projects:

- **EC-Utilities**—This project contains procedures to perform basic ElectricFlow tasks. Also, these procedures can be used as examples—copy a procedure to another project and then modify it for your purpose.

  **Note**: By default, only the "admin" user has execute privileges on the EC-Utilities project. The admin user can enable privileges for additional users or groups.

- **EC-Examples**—This project contains templates for procedures that perform basic ElectricFlow tasks.

- **Electric Cloud**—This project contains procedures to manage ElectricSentry, specifically the Sentry Monitor for schedules and also contains ElectricFlow global reports.

Procedures within each of these projects are maintained by Electric Cloud.

**IMPORTANT**: When you create project names, do not use "Electric Cloud" or any other ElectricFlow-supplied project name. Duplicating a project name creates a conflict. Also, the "EC-" prefix is reserved for ElectricFlow-supplied project names.

**ElectricFlow Solutions**

ElectricFlow solutions are developed in the field by Electric Cloud SEs—our field team has the best experience in applying ElectricFlow "best practices" to solve real problems. In addition, ElectricFlow solutions can be contributed by ElectricFlow users from any customer site.

Potentially, any available solution can be considered a new ElectricFlow feature "waiting" to be included in the product if that solution gains wide, general appeal within the ElectricFlow customer base. However, because solutions are not part of the ElectricFlow product, and not developed by the ElectricFlow Engineering team, they are not supported by the Electric Cloud Technical Support team. If and when a solution becomes an integral part of the product, that solution will then have full Technical and Engineering support like any other ElectricFlow feature.

Currently, ElectricFlow solutions are posted to the Electric Cloud Forum Site at [http://forums.electric-cloud.com/ecforums/](http://forums.electric-cloud.com/ecforums/) - each solution, accompanied by its own installation instructions and Help file, can be downloaded from the forum site. If you have a solution you would like to contribute, the Electric Cloud / ElectricFlow Forum is where you need to post it.

When you install a solution on your ElectricFlow server, it will be displayed on the Projects web page as a project.

**Installing an ElectricFlow Solution**

Add new or upgrade existing ElectricFlow solutions by running the built-in setup script:
1. Download the ElectricFlow `<solution name>.jar` file from the Electric Cloud Community Forums website.
   For this example, the "solution name" is Test.
2. Save your download to a temporary directory on the system that hosts your ElectricFlow server.
3. Unpack the jar file in the temporary directory—the file creates a directory named Test.
   - If Java JDK is installed, use the included jar utility to unpack the `.jar` file: `%jar xf Test.jar`
   - For Linux, use any unzip utility, for example: `unzip Test.jar`
   - For Windows, use Windows Explorer to access the jar contents if you rename the file to `Test.zip`
4. Run the included setup.pl script in the jar through the ec-perl interpreter (installed in the bin directory). You must have "admin" or equivalent privileges to run the setup script.
   ```
   ectool login admin
   %cd <test>
   %ec-perl setup.pl
   ```

**Project - Create New or Edit Existing Project**

**Creating a New Project**

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique project name. You may want your project names to describe the work groups or teams that will be using them. For example, you may set project names based on the products they support.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: `&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</td>
</tr>
<tr>
<td>Default Resource</td>
<td>Enter a resource name, or select Browse to find one. If you have not set up resource names or locations yet, click the Resources tab and then the Resources tab to see the Resources page. <strong>Note:</strong> This field is optional. If you specify a resource in this field, it will be used as the default for all jobs that run under the project. This is a convenient way to use a single resource for an entire project. You can change the resource by changing the value. There are several other places where you can specify resources, such as procedures and individual job steps. If you specify a resource in another location, it will take precedence over the one specified in this field.</td>
</tr>
</tbody>
</table>
### Field Name

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default Workspace</td>
<td>Enter a workspace name, or select Browse to find one. If you have not set up workspace names or locations yet, click the Resources tab and then the Workspaces tab to see the Workspaces page. <strong>Note:</strong> This field is optional. If you specify a workspace in this field, it will be used as the default for all jobs that run under the project. This is a convenient way to use a single workspace for an entire project. You can change the workspace by changing the value. There are several other places where you can specify workspaces, such as procedures and individual job steps. If you specify a workspace in another location, it will take precedence over the one specified in this field.</td>
</tr>
</tbody>
</table>

Click **OK** to save the information you entered.

Your new project name will appear on the Projects page.

**Editing an Existing Project**

- To rename the project, enter a new name in the project Name field and click **OK**.
- You may modify the description or enter a text description if this field is blank.
- You can modify any previously entered information.
- If you would like to use a particular credential (by default) for all jobs that run under this project, select it here. If you leave this field blank, credential information from other sources is used.

**Tags** - (Optional) Enter a tag if you want to categorize or "mark" this project to identify its relationship to one or more other projects or groups. For example, you may want to tag a group of projects as "production" or "workflow", or you may want to use your name so you can quickly sort the project list to see only those projects that are useful to you.

- The tag name you enter in this field is displayed in the drop-down menu on the Projects page. When you select a specific tag from the drop-down menu, you see only the projects with that tag.
- Assigning a tag creates an "ec_tag" property that can be seen (with its value - the tag name you chose) after selecting the Properties subtab from the Project Details page.
- Do not use "spaces" in tag names. For example, if you want to mark a project with the tag name, "Eng Team A", you need to specify, "eng_team_a".
- Do not use symbols in a tag name—results are unpredictable.
- If a project is related to several project categories, you can enter a space-delineated list to add numerous tags at the same time.
  Type a new name in the project Name field and click **OK**.
- To delete a tag, select the text and use your Delete key.
**Impersonation Credential**

Credential Project - The default Credential Project is the current project, or select the other button and Browse for the project name you need.

Credential Name - This is the name of the credential for the project. You can select **Browse** to find it.

Click **OK** after entering new or updated information.

For more information, see the **Credentials and User Impersonation** Help topic.

**Project Details**

This page displays project components, including procedures, workflow specifications, jobs, schedules, any credentials, properties, and reports.

**Links and actions at the top of the page**

- **Edit** - use this link to go to the Edit Project page.
- **Access Control** - use this link to go the Access Control page for this project.
- The "star" icon allows you to save this job information to your Home page.
- The "curved arrow" icon returns you to the Projects page.
- Pagination - Use the "previous" and "next" arrow icons to view the previous or next project. The numbers between the arrow icons display the number of projects you can view and the first number indicates which project [in the list] you are viewing.

**The "tabbed" sections**

The tabs at the top of the table allow you to select the type of information you want to see. See the 8 tabs illustrated in the following screen example:

The Project Details page opens with the Procedures tab highlighted, so the first table you see is the Procedures table.

**Procedures tab**

The following links and actions are available in the Procedures table:

- Click the **Create Procedure** link (at the top of the table) to go to the New Procedure page to create another procedure.
- Click on a procedure name (first column) to go to the Procedure Details page for that procedure.
- Action column - click on any of the available links (**Run, Edit, Copy, or Delete**) to perform that function for the procedure listed in that row.
Note: The Run link provides two choices when you hover the mouse over the down-arrow. Select Run Immediately or Run... .

- Run Immediately - This option runs the procedure "as-is" immediately.
- Run... - This option produces the Run Procedure web page where you can modify any existing parameters for this procedure, or set an existing credential.

Workflow Definitions tab

This tab provides a table listing all defined workflow definitions and includes the following functionality:

- Click the Create Workflow Definition link to go to the New Workflow Definition page to define additional definitions.
- Name column - Click on a workflow definition name to go to the Workflow Definition Details page (for that workflow definition).
- Action column
  - Run - use the down-arrow to select Run... or Run Immediately
    Selecting Run... takes you to the Run Workflow page where you can set the starting state for the workflow.
    Selecting Run Immediately runs the workflow "as-is", immediately.
  - Copy - use this link to make an exact copy of an existing workflow definition.
  - Edit - use this link to edit an existing workflow definition or just to change the name of the copy you created.
  - Delete - deletes an existing workflow definition on the same row.

Jobs tab

This tab provides a project-specific job table. Selecting the Jobs tab on the Project Details page displays only those jobs for the project you selected.

This table is a subset of the main Jobs tab that displays all jobs, regardless of the project of origin, and all Jobs page functionality is basically the same on either Jobs tab.

The following links and actions are available on this Jobs page:

- Job - click on Job to sort the column alphabetically or click on a job name to go to that job's Job Details page.
- Status - click on Status to sort this column by Running, Success, Warning, Error, or Aborted.
- Priority - displays the job's priority set by a "run procedure" command or by the job's schedule.
- Procedure - click on a Procedure name to go to the Procedure Details page for that procedure.
- Launched By - click on a name in this column to go to the page for the schedule (Edit Schedule page) or the user that ran the job.
- Elapsed Time - click Elapsed Time to sort the time values from longest to shortest time, or the reverse.
- Start Time - click Start Time to sort this column from the start time of the first job to the start time of the most recent job, or the reverse.
• Actions - use this column to Abort a running job or Delete a completed job. If your job has finished running, you will not see the Abort link.
  ◦ Aborting a job requires the execute privilege on the job—not just the modify privilege.

When you click **Abort**, the following dialog box appears:

![Abort job dialog box](image)

Select either **OK** or **Force** to abort the job, or **Cancel** if you change your mind.

**Note:** Deleting a job on this page causes removal of job information from the ElectricFlow database, but information in the job's on-disk workspace area is not affected. You must delete workspace information manually.

**Workflows tab**

The Workflows tab provides the following functionality:

- **Name column** - Click on a workflow name to go to its Workflow Details page.
- **State column** - Click on a state name to go to its State Details page.
- **Modify Time** - This time value represents the most recent workflow activity.
- **Workflow Definition column** - Click on a workflow definition name to go to the Workflow Definition Details page.
- **Completed column** - a "checkmark" in this column identifies this workflow as completed.
- **Actions column** - Click the Delete link to remove the workflow in that row.

For more information about workflows, see the **Workflow Help topic**.

**Schedules tab**

The Schedules tab provides the following functionality:

- To create a new schedule for this project, click either the Schedule link to create a new standard schedule to run at specific and/or days or the CI Configuration link to setup a new continuous integration schedule.
  ◦ Choosing "Schedule" displays the New Schedule page.
  ◦ Choosing "CI Configuration" displays the New CI Configuration page.
Table column descriptions

- To edit an existing schedule, click on the schedule name (first column).
- Select the check box in the Enabled column to enable or disable the schedule in that row.
- The Priority column displays the job’s priority you selected while creating the schedule for this procedure.
- Action column links –
  - Run - runs the schedule with the permissions of the logged in user.
    For example, if this schedule is timed to run every day at 11:00 pm, you might decide to run the schedule at 6:00 pm on a particular Thursday, without changing the regular schedule settings. However, if you do not have the appropriate permissions to run this schedule, it will fail.
  - Copy - makes a copy of the schedule on that row.
  - Delete - deletes the schedule in that row.

The following screen example illustrates the Schedules table:

![Schedules Table Example](image)

For information on creating a standard schedule, see the Schedule - create new or edit existing schedule Help topic.

For information about CI Manager and adding a configuration, click the Home tab, the Continuous Integration subtab, then click the Help link in the upper-right corner of the page.

Credentials tab

The Credentials tab provides the following functionality:

- To create a new credential for this project, click the Create Credential link at the top of the table.
- To edit an existing credential, click on the credential name (first column).
- Action column - the Delete link deletes the credential on that row.

For information about credentials and access control, see the Credentials and User Impersonation or Access Control Help topics.

Properties tab

The Properties tab provides the following functionality:

- To create a new property for this project, click the Create Property or Create Nested Sheet link.
- To view or change privileges on the property sheet, click the Access Control link.
• To edit an existing property, click on the property name (first column).
• Action column - the Delete link deletes the property on that row.

For more information about properties, see the Properties Help topic.

Reports tab

Selecting this subtab yields different results, depending on whether or not you have installed the additional ElectricFlow-supplied optional reports or have created custom reports for the specific information you need. Generally, if you have not yet configured additional reports, you will see the three installed, default ElectricFlow reports (Cross Project Summary, Daily Summary, and Resource Summary) as illustrated in the screen example below.

• When a report runs, the report "folder" is populated with the completed report.
  Reports are listed by date and time.
• Each individual report "date/time" entry is a link to see the full report.
• To create a new report, click the Create Report link to go to the web page to create a Multiple Series, Category, Count Over Time, or Procedure Usage report.

This is an example of the information on the Reports page:

For more information about reports, see the Reports Help topic series.

Tips

Want to rename this project?
Click the Edit link at the top of this page and enter a new name.

Want to rename a procedure in this project?
Click the Edit link for the procedure (on this page) and enter a new name.

Run Procedure

Using the Run Procedure page

• You may see a message informing you that no parameters were defined for this procedure.
  If this is the case, click Run to run the procedure.
- If parameters were defined for this procedure, you will see specific fields based on those parameters. You may make changes to any field you choose if you want to run this procedure under different parameters at this time. However, any changes you make are specific to this run procedure only. Your changes on this web page will not affect previously defined parameters for this procedure. Click Run to run the procedure.

- You may see a "Required" field. To run the procedure, you must enter the required parameter previously defined on the Procedure Details page.

Click Run to run the procedure.

**Advanced section**

**Priority:**

Use the drop-down menu to select the priority for this run procedure. Available priorities are: low, normal (default), high, or highest.

- You can select the job's priority here on the Run Procedure web page or when you schedule the procedure to run at a regular time or interval. When a job is launched, its priority cannot be changed.

- Priorities take effect when two or more job steps in different jobs are waiting for the same resource. When the resource is available, it will be used by the job step that belongs to the job with the highest priority. If the priority level is the same, the resource will be used by the job step that belongs to the job with the lowest job ID number. If the job steps are in the same job, the resource will be used first by the step with the lowest job step ID number.

- If using ectool, the priority can be set by passing "--priority=<low|normal|high|highest>" to a runProcedure, createSchedule, or modifySchedule operation.

**Note:** To raise the job priority level above "normal," the user who launches the procedure must have execute permission on the system-level access control list for priorities.

**Impersonation:**

Select one of the following:

- **Use pre-defined credential** - (Default option) Use this option if you have not defined a credential for this procedure. ElectricFlow looks for a credential first in the top-level procedure and then in its project. If it finds a credential, it uses the login from that credential as the default for the job. If there is no credential in either place, by default, the job's steps run as the user under which the agent for the step is running.

- **Use specific credential** - If you select this option, more fields are displayed for you to choose a particular credential and enter its name from those defined for the project containing the procedure. The login user from that credential will be used as the default for the job.

- **Use a specific user** - If you select this option, more fields are displayed to enter a User Name and Password. The specified login is used as the default for the job.

Click Run to run the procedure.

*For more information* on credentials and user impersonation, see the *Credentials and User Impersonation* Help topic.
Schedule - create new or edit existing schedule

Use this page to create or edit a standard schedule that specifies a set of times and days when a particular procedure should run. If you need to create a continuous build integration instead, see the Help information available from the Continuous Integration Dashboard web page.

For any schedule, click the "star" icon to add this schedule to the Shortcut section on your Home page.

To create a new standard schedule

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General section</strong></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Enter a Schedule name. This must be a unique name among other schedule names in this project.</td>
</tr>
<tr>
<td>Procedure</td>
<td>Displays the current project and procedure. Click Change to use the pop-up menu to select a new project or procedure.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with &lt;html&gt; ... &lt;/html&gt; tags. The only HTML tags allowed in the text are: &lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</td>
</tr>
<tr>
<td><strong>Parameters section</strong></td>
<td></td>
</tr>
<tr>
<td>If the procedure has parameters, enter information in their values in this section. The procedure cannot execute unless all required parameters are provided. If you move the mouse over a field for a particular parameter, inline Help displays the description of that parameter if one was provided in the procedure's definition.</td>
<td></td>
</tr>
<tr>
<td><img src="Add.png" alt="Add" /></td>
<td>Click this icon to displays fields to add one or more parameters.</td>
</tr>
<tr>
<td><strong>Frequency section</strong></td>
<td></td>
</tr>
<tr>
<td>Run at ??</td>
<td>This is a summary section: As you make selections for the following Days and Repetition sections, a summary of what you have selected appears here.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Days</td>
<td>Select weekdays, month days, or create a custom frequency when you want the schedule to run. <strong>Note</strong>: The &quot;day&quot; applies to the start time if the time range spans two days, that is, if the time range crosses the midnight boundary.</td>
</tr>
<tr>
<td>Repetition</td>
<td>If Run Once - the schedule will run once per selected day, at the time you specify. If Run Every - the procedure will execute repeatedly during the specified time range. For example, if you select a time range from 11:00-14:00 and an interval of 40 minutes, the procedure will execute 5 times on each of the selected days: at 11:00am, 11:40am, 12:20pm, 1:00pm, and 1:40pm. If Run Continuously - as soon as one job ends, the scheduler will trigger immediately to run the job again.</td>
</tr>
</tbody>
</table>

**Advanced section**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>If this box is &quot;checked,&quot; the schedule will run. You can disable this schedule whenever necessary.</td>
</tr>
</tbody>
</table>
| Misfire Policy | Choose between two options to manage how a schedule resumes in cases where the normal scheduled time is interrupted. The server may not be able to trigger a job at the scheduled time for several reasons: 1) a running job extends past the next scheduled runtime, or 2) the server cannot find enough available resources and a delay occurs, or 3) the server is down or disconnected from the network for a period that overlaps one or more scheduled times. If any of these situations occur, the misfire policy defines two possible responses: 

  - **skip** - all misfires are ignored and the job runs at the next scheduled time. 
  - **run once** - after one or more misfires, the job runs at the soonest time that occurs within an active region. For example, at server startup a scheduled job will not trigger immediately on startup. |
| Time Zone  | Default is the time zone of the ElectricFlow server, or select a county from the first pull-down menu, then select an area from the second pull-down menu. Another option: Select "other" from the first pull-down menu, then select GMT [or another selection] from the second pull-down list. |
Use the pull-down menu to select one of four priorities for this procedure.

Also, you can select the job's priority on the Run Procedure web page. When a job is launched, its priority cannot be changed.

Priorities take effect when two or more job steps in different jobs are waiting for the same resource. When the resource is available, it will be used by the job step that belongs to the job with the highest priority.

If the priority level is the same, the resource will be used by the job step that belongs to the job with the lowest job ID number. If the job steps are in the same job, the resource will be used first by the step with the lowest job step ID number.

If using ectool, the priority can be set by passing

```
--priority=<low|normal|high|highest>
```

to a runProcedure, createSchedule, or modifySchedule operation.

**Note:** Schedules are launched by the project principal user. To raise the priority above "normal," this user must have execute permission on the system-level access control list for priorities.

### Impersonation Credential section

If you select a credential for the schedule, it will be used as the default for jobs run from the schedule. For example, job steps will run under the login account specified in the credential. However, the schedule's credential is low in priority: it will be used only if there is no credential specified in the procedure or its project. Also, individual steps can override the credential with a specific credential for that step.

For more information, see the Credentials and User Impersonation Help topic.

Impersonation credentials are used to set the top-level impersonation credential for a job. If specified, the impersonation credential [on the job] is used as the default impersonation credential for all steps in the job.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Credential Project</strong></td>
<td>The name of the credential for the project. By default, the current project is selected. Enter a different project name or select Browse to find this name.</td>
</tr>
<tr>
<td><strong>Credential Name</strong></td>
<td>The name of the credential for the project - you may need to Browse to find this name.</td>
</tr>
</tbody>
</table>

Click **OK** to save your schedule information.
To create a new continuous integration "schedule"

If you selected the CI Configuration link, the New CI Configuration page is displayed. For information on populating these fields, see the "Continuous Integration Manager" Help topic - click the Help link in the upper-right corner of the New CI Configuration page.

See the Standard Schedule information [above] to enter information in the fields common to both types of schedules.

To edit an existing schedule

Modify any of the information you previously specified.

The following additional links are available at the top of the page:

- **Save Configuration** - if you click this link, the information in this schedule will be copied into a new Job Configuration and displayed on your Home page for easy access.

- **Access Control** - click this link if you need to set permissions for this schedule.

Attached Credentials

Click the Attached Credential link if you need to attach an existing credential to this schedule. If you need to create a new credential for this schedule, return to the Project Details page.

Custom Schedule Properties

Select the Create Properties, Create Nested Sheet, or Access Control links if you want to assign properties to this schedule.

For more information on Properties or Access Control, see the following main Help topics: Properties, Access Control

Click OK to save your modifications for this schedule.

**Credentials - create new or modify existing credential**

To create a new credential

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique name of the credential object.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: `&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>User Name</td>
<td>Enter the user name you choose to use for login.</td>
</tr>
<tr>
<td>Password</td>
<td>Enter the password that identifies the user account.</td>
</tr>
</tbody>
</table>

Click **OK** to save your new credential information.

**To edit a credential**

Modify any previously entered credential information and click **OK** to save your changes.

Use the **Access Control** link to add or change existing permissions.

You can add Custom Credential Properties for this credential also. Click the **Create Property, Create Nested Sheet**, or **Access Control** link in this section if you need to specify any of these items.

**For more information**, see the following Help topics:

- Credentials and User Impersonation
- Properties
- Access Control

**Property - create new or edit existing property**

Use this pop-up window to create or modify a custom property attached to an object.

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| Name       | The property name can be an arbitrary text string, but unless you are an experienced ElectricFlow user avoid using slashes and brackets as a part of the property name.  
**Note**: The names "properties" and "project" are not valid property names. |
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td>Value</td>
<td>This value can be an arbitrary text string.</td>
</tr>
<tr>
<td>Expandable</td>
<td>Do not select this check box if you do not want to allow property expansion.</td>
</tr>
</tbody>
</table>

Click **OK** to save your new or modified property information.

*For more information* on creating and using properties, see the Properties Help topic.

**Nested Property Sheet**

Use this pop-up window to define or modify a nested property sheet.

1. Enter information in the fields as follows:
   - **Name**– The property name can be an arbitrary text string.
   - **Description**– A plain text or HTML description for this object. If using HTML, you must surround your text with `<html> ... </html>` tags. The only HTML tags allowed in the text are: `<a> <b> <br> <div> <dl> <font> <i> <li> <ol> <p> <pre> <span> <style> <table> <tc> <td> <th> <tr> <ul>`

2. Click **OK** to save your new or modified nested property sheet information.

For more information, see the Properties Help topic.

**Reports**

If you have upgraded ElectricFlow this page displays historical reports (Cross Project Summary, Daily Summary, and Resource Summary) from your previous ElectricFlow version. These reports are no longer being updated.

Click the Historic/web server local reports link to see any previously created custom reports.

- **Cross Project Summary** - this is a 30-day report summary
- **Daily Summary** - this is a daily report showing all the procedures that ran
- **Resource Summary** - this report shows resource usage for a specific day
- **Historic/web server local reports**

For more information, see the Reports Help topic.
Create a new report

Use this page to create a new report. Select one of the report-type tabs to begin.

Multiple Series Report

Field and pull-down menu descriptions:

<table>
<thead>
<tr>
<th>Field/Menu Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Title</td>
<td>This is your report title. Type over the default report name, choosing any unique name for your report. <strong>IMPORTANT:</strong> Do not use special characters in the report title. Some examples of special characters are: / ? # [ ] @ ! $ &amp; ' ( ) * + , ; =</td>
</tr>
<tr>
<td>Saved Filter</td>
<td>Project - Click your mouse inside this field to see a list of projects from which to make a selection. Filter - After selecting a project, this drop-down menu will contain any available filters for this project.</td>
</tr>
<tr>
<td>Time Period</td>
<td>Use the drop-down menu to select the time period.</td>
</tr>
<tr>
<td>Create thumbnail?</td>
<td>Check this box if you would like to make a thumbnail view of this report available on your Home page.</td>
</tr>
<tr>
<td>Object Type</td>
<td>Use the drop-down menu to select an object.</td>
</tr>
<tr>
<td>Table column choices</td>
<td>Chart Type - Use the drop-down menu to choose the chart type. Function - Use the drop-down menu to choose the function you need. Property Name - Use the default property value or delete the text and click your mouse in the blank field to see a list of possible properties. Display Name - You can choose a different unique Display Name. Stacked - Select this checkbox to see your report results &quot;stacked&quot; versus overlaid. The &quot;X&quot; icon - Click this icon to delete any row you no longer need.</td>
</tr>
</tbody>
</table>
### Field/Menu Name | Description
--- | ---
**Add Series** button | Select the **Add Series** button if you would like to create additional table entries for additional report information.

**Chart Options** | Use the down-arrow to adjust the Time Grouping and see the defaults for the X and Y axis.

**Table Options** | Use the down-arrow to adjust the Time Grouping and see the default for the Time Column label.

**Advanced** | Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.

**Run Report** button | Use this button to go to the Job Details page to run the report.

**Create Schedule** button | This button displays a box with a default schedule name that you can change if you choose. Click **OK** to go to the Job Details page.

**Cancel** button | Use this bottom to cancel the create report operation.

---

**Category Report**

Field and pull-down menu descriptions:

| Field/Menu Names | Description |
--- | ---
**Report Title** | This is your report title. Type over the default report name, choosing any unique name for your report. **IMPORTANT:** Do not use special characters in the report title. Some examples of special characters are: / ? [ ] @ !, $ & ' ( ) ^ + ; : =

**Saved Filter** | Project - Click your mouse inside this field to see a list of projects from which to make a selection. Filter - After selecting a project, this drop-down menu will contain any available filters for this project.

**Time Period** | Use the drop-down menu to select the time period.
### Field/Menu Names

<table>
<thead>
<tr>
<th>Field/Menu Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create thumbnail?</td>
<td>Check this box if you would like to make a thumbnail view of this report available on your Home page.</td>
</tr>
<tr>
<td>Object Type</td>
<td>Use the drop-down menu to select an object.</td>
</tr>
<tr>
<td>Object Property</td>
<td>You can delete the default value and click your mouse inside the blank field to see a list of properties from which to choose.</td>
</tr>
<tr>
<td>Advanced</td>
<td>Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.</td>
</tr>
<tr>
<td>Run Report button</td>
<td>Use this button to go to the Job Details page to run the report.</td>
</tr>
<tr>
<td>Create Schedule button</td>
<td>This button displays box with a default schedule name that you can change if you choose. Click OK to go to the Job Details page.</td>
</tr>
<tr>
<td>Cancel button</td>
<td>Use this bottom to cancel the create report operation.</td>
</tr>
</tbody>
</table>

### Count Over Time Report

Field and pull-down menu descriptions:

<table>
<thead>
<tr>
<th>Field/Menu Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report Title</td>
<td>This is your report title. Type over the default report name, choosing any unique name for your report.</td>
</tr>
<tr>
<td><strong>IMPORTANT:</strong> Do not use special characters in the report title. Some examples of special characters are: / ? # [ ] @ ! , $ &amp; ' ( ) * + , ; =</td>
<td></td>
</tr>
<tr>
<td>Saved Filter</td>
<td>Project - Click your mouse inside this field to see a list of projects from which to make a selection. Filter - After selecting a project, this drop-down menu will contain any available filters for this project.</td>
</tr>
<tr>
<td>Time Period</td>
<td>Use the drop-down menu to select the time period.</td>
</tr>
</tbody>
</table>
### Field/Menu Name | Description
---|---
Create thumbnail? | Check this box if you would like to make a thumbnail view of this report available on your Home page.
Object Type | Use the drop-down menu to select an object.
Chart Options | Use the down-arrow to adjust the Time Grouping and see the defaults for the X and Y axis.
Table Options | Use the down-arrow to adjust the Time Grouping and see the default for the Time Column label.
Advanced | Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.
Run Report button | Use this button to go to the Job Details page to run the report.
Create Schedule button | This button displays box with a default schedule name that you can change if you choose. Click OK to go to the Job Details page.
Cancel button | Use this bottom to cancel the create report operation.

### Procedure Usage Report

Field and pull-down menu descriptions:

### Field/Menu Name | Description
---|---
Report Title | This is your report title. Type over the default report name, choosing any unique name for your report.

**IMPORTANT:** Do not use special characters in the report title. Some examples of special characters are: / ? [ ] @ ! , $ & ’ ( ) * + ; =
<table>
<thead>
<tr>
<th>Field/Menu Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Click your mouse inside this blank field to see a list of projects. This does not have to be the current project. You can generate reports that show when one project's procedures call procedures in another project. You can also use the '%' wildcard, for example, Project: % or Project: D%</td>
</tr>
<tr>
<td>Procedure pattern</td>
<td>Enter a SQL string match pattern for procedures to include in the report. The default '%' will use all procedures.</td>
</tr>
<tr>
<td>Advanced</td>
<td>Use the down-arrow to select a Locale or add a Credential. Delete the Resource if you choose, then click your mouse in the blank field to see a list of other resources you might prefer to use.</td>
</tr>
<tr>
<td>Run Report button</td>
<td>Use this button to go to the Job Details page to run the report.</td>
</tr>
<tr>
<td>Create Schedule button</td>
<td>This button displays box with a default schedule name that you can change if you choose. Click OK to go to the Job Details page.</td>
</tr>
<tr>
<td>Cancel button</td>
<td>Use this bottom to cancel the create report operation.</td>
</tr>
</tbody>
</table>

**Resources**

The **Cloud > Resources** page displays all resources known to this ElectricFlow server and provides easy access to resource configuration and all other resource management functionality.

- Each resource has a logical name—a unique name to distinguish this resource from other resource names.
- Each resource refers to an agent machine by its host name.
- Each resource can be assigned to one or more pools.

A *pool* is a group of interchangeable resources. For example, you may have a pool of Windows servers.

If you name a pool in a procedure step, ElectricFlow can assign any resource in the pool to that step, which allows ElectricFlow to choose a lightly loaded resource. You can change the resources in a pool without having to modify any procedures that use the pool.
• Each resource can be assigned to a zone. A default zone is created during installation and all resources, by default, are members of that zone until they are assigned to a different zone.

A zone is a collection of agents. Every agent, and all resources defined on that agent, belong to only one zone. When ElectricFlow is installed, a default zone is created. If a zone is deleted, all agents in that zone are moved to the default zone. The ElectricFlow server resides in the default zone.

Note: The default zone cannot be deleted.

• Several resources can correspond to the same physical host or agent machine.

• When you specify a resource name in a procedure step, the step executes on that resource.

Supported Resource Categories

• **Standard**—This category specifies a machine running the ElectricFlow agent on one of the supported agent platforms, as specified in the *ElectricFlow Installation Guide*.

• **Proxy**—This category requires SSH keys for authentication. You can create proxy resources (agents and targets) for ElectricFlow to use on other remote platforms or hosts that exist in your environment.

  • **Proxy agent**—This is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported platform. A proxy agent is an ElectricFlow agent, channeling to a proxy target.
  
  • **Proxy target**—This is a machine on an unsupported platform that can run commands through an SSH server. Proxy targets have limitations, such as the inability to work with plugins or communicate with ectool commands.

Help topic "Best Practice": We recommend reviewing this Help topic in its entirety to become familiar with new resource management features and expanded functionality. Later, when using the Resources page, use the following quick links to go to the Help section that you need to review.

  Icons, Links, and Buttons Above the Table
  
  Table View - Column Descriptions
  
  Grid View
  
  Filters Pane
  
  New Resource Panel
  
  New Proxy Resource Panel
  
  Edit Resource Panel
  
  Edit Proxy Resource Panel
  
  Resource Details Panel
  
  Switching a Non-Trusted Agent to Trusted
  
  Installing or Upgrading Remote Agents

Resource Page Information and Functions

Immediately after the *Resources* title above the table, you can see how many licensed resources are in use.
Links, Icons, and Buttons Above the Table

Hover your mouse over an icon or button to see the available actions. You can select one of these actions on a single resource or on multiple resources (selected using the check box in the first column) to perform the action on one or more resources at the same time.

- Select one or more resources from the table, and then select the button to perform the task or action.

- **Exception:** When you click the **Action** icon and select **Create Resource** or **Create Proxy Resource**, a panel opens where you can create one of these new objects. You can create only one object at a time.

<table>
<thead>
<tr>
<th>Icon or Link Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| ![Add Resource](image) | Select one of these actions:  
  - **Create Resource**—The **New Resource** panel opens. For information about the fields, see the **New Resource** section.  
  - **Create Proxy Resource**—The **New Proxy Resource** panel opens. For information about the fields, see the **New Proxy Resource** section.  
  - **Install Resource(s)**—A dialog box opens where you enter information about the agents to install. For more information, see Installing or Upgrading Remote Agents on page 718.  
    
    **Note:** If you are upgrading one or more agents or resources, the label on this option is **Upgrade Resource(s)**.  
    
    **IMPORTANT:** If the EC-AgentManagement plugin is not installed, you will not see this option. |
| ![Copy](image) | **Copy Resource**—Makes a duplicate copy of one or more resources that you selected. |
| ![Delete](image) | **Delete Resource**—Deletes one or more resources that you selected.  
  
  **Note:** If a resource is on a "gateway agent", the gateway will be deleted. |
| ![Ping](image) | **Ping Resource**—ElectricFlow pings one or more resources to check if they are available.  
  
  When ElectricFlow pings a resource, it sends a message to the agent (for the resource) to make sure the agent is alive and running a version of software compatible with the ElectricFlow server. After the ping completes (or fails), the page refreshes to reflect the current resource state.  
  
  **Note:** A gateway must exist before you ping a resource in a remote zone. |
<table>
<thead>
<tr>
<th>Icon or Link Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✅</td>
<td><strong>Enable Resource</strong>—Enables one or more resources that you selected in the check boxes in the first column.</td>
</tr>
<tr>
<td>⬅️</td>
<td><strong>Disable Resource</strong>—Disables one or more resources that you selected in the check boxes in the first column.</td>
</tr>
<tr>
<td>✏️</td>
<td><strong>Select one of these actions:</strong>&lt;br&gt;• When you click the button with no resources selected, the <em>Select some resources to edit</em> message appears.&lt;br&gt;• When you select resources and click this button, these options appear:&lt;br&gt;  • <strong>Add to Pool</strong>—Adds the selected resources to a pool.&lt;br&gt;  • <strong>Remove from Pool</strong>—This is available only if all the selected resources have at least one pool in common. If not, this link becomes <em>Remove from Pool &lt;name&gt;</em>.&lt;br&gt;  • <strong>Move to Zone</strong>—Moves the selected resources to a zone.&lt;br&gt;  • <strong>Set Trusted</strong>—This is not available if the selected resources are already <em>trusted</em>. If not, all the selected resource will be changed to <em>trusted</em>.&lt;br&gt;  • <strong>Unset Trusted</strong>—This is available only if all the selected resources are trusted. If not, the selected resources will be changed to <em>untrusted</em>.</td>
</tr>
<tr>
<td>⭐️ ⭐️</td>
<td><strong>Select this button to add this Resources page to your Home page for one-click access to return to this page. If the icon is yellow, the page is already accessible from your Home page.</strong></td>
</tr>
<tr>
<td><strong>New Search link</strong></td>
<td><strong>Use this link to go to the Searching and Filtering page if you need to search for a particular object or set of objects. For example, job, resource, artifact, workflow, and so on.</strong>&lt;br&gt;<strong>Use the “back” button to return to the Resources page.</strong></td>
</tr>
</tbody>
</table>

**Table View — Column Descriptions**

Not all resource configuration information appears within the table, but you can see all other information about the resource when you edit the resource or access other slide-out panels. For example, the action to see or add access control privileges to a resource is available on the Edit Resource panel or from the **Access Control** link on that panel.

**Note:** Most column headings can be sorted. Click on a column heading to re-sort the information in that column.
<table>
<thead>
<tr>
<th>Column name / icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Select this check box to enable the corresponding resource in that row for a single or batch action. For example, deleting or enabling multiple resources at the same time is a batch action.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> If you select this icon in the table header row, it will select or deselect all resources in the table.</td>
</tr>
<tr>
<td></td>
<td>Status of the agent. If an agent machine is not available, any resources associated with that host will not be available.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> If an agent is down, the ElectricFlow server is not able to provide additional information about the cause.</td>
</tr>
<tr>
<td>Name</td>
<td>Name of the resource. The icon to the left of the resource name indicates whether this resource is enabled or disabled. These icons are: Enabled or Disabled</td>
</tr>
<tr>
<td></td>
<td>If a resource is disabled, no job steps are assigned to it. If a step requests a particular resource and that resource is disabled, the step waits until the resource becomes enabled again. If the resource is in a pool, ElectricFlow uses any enabled resource in the pool to satisfy the request for the resource. Other actions:</td>
</tr>
<tr>
<td></td>
<td>* To change the enabled or disabled icon, select the check box (in first column) in the row for one or more resources, and then select the enabled or disabled icon above the table. Select multiple resources if this is a batch change.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> You can change the resource enable/disable specification from the Edit Resource panel too, but this is an individual operation for one particular resource.</td>
</tr>
<tr>
<td></td>
<td>* Click on a resource name to see the Resource Details panel - this panel displays how your resources is configured currently. To make changes, click the Edit link to go to the Edit Resource panel.</td>
</tr>
<tr>
<td>Pools</td>
<td>A space-separated list of pool names where this resource is a member.</td>
</tr>
<tr>
<td></td>
<td><strong>Note:</strong> Spaces are not allowed within a pool name.</td>
</tr>
<tr>
<td>Column name / icon</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| **Type**           | A resource can be static or dynamic.  
  - A static resource is part of your system or network (not in the cloud), such as a server, database, or agent machine.  
  - A dynamic resource is a cloud resource that can be provisioned and later spun up on-demand when an application is deployed. |
| **Resource Template Name** | The name of the resource template to which the resource is applied.  
  **Note:** Only dynamic resources can be applied to a resource template. |
| **Time running**   | If the resource is a dynamic resource, how long it has been running. |
| **Job Status**     | Indicates the current job status with the following icons:  
  ![Running job](image)  
  Running job - a job is still running, which means the resource is currently being used for one or more jobs. The names of all jobs using the resource are displayed next to the icon.  
  ![Success](image)  
  Success - the job running on this resource completed successfully.  
  ![Error](image)  
  Error - the job running on this resource encountered an error and may or may not have completed. One or more error messages will be listed in this column.  
  ![Warning](image)  
  Warning - the job running on this resource encountered a warning and may or may not have completed. One or more warning messages will be listed in this column.  
  ![Busy](image)  
  Busy - ElectricFlow is attempting to refresh the job status, but the resource is not responding or the UI cannot parse the response. Changing the value of 'Agent Host Name' to the IP address can sometimes resolve this issue. |
<p>| <strong>Description</strong>    | A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code>. |
| <strong>Zone</strong>           | The name of the zone where this resource is a member. |</p>
<table>
<thead>
<tr>
<th>Column name / icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTPS &amp; Host</td>
<td>The “Connection Type” you specified when this resource was created.</td>
</tr>
<tr>
<td><strong>Step Load</strong></td>
<td>Resource load is indicated by one of the following:</td>
</tr>
<tr>
<td></td>
<td>- this notation indicates 1 step is using this resource and an unlimited number of steps can use this resource at the same time. If 5 steps are using this resource, you would see &quot;5 of unlimited&quot;.</td>
</tr>
<tr>
<td></td>
<td>- this notation indicates that no steps are running on this resource and the step limit is set to 4. The bar indicates graphically how close you are to the step limit.</td>
</tr>
</tbody>
</table>

**Note:** Use the Create/Edit Resource panels to define the number of steps that can run on a resource. Setting the Step Limit to "0" or leaving the field blank defaults to NO step limit.

<table>
<thead>
<tr>
<th>Actions</th>
<th>Actions you can perform on the resource, including:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Copy</strong>—Create a new resource by copying the this resource.</td>
</tr>
<tr>
<td></td>
<td><strong>Delete</strong>—Delete this resource.</td>
</tr>
<tr>
<td></td>
<td><strong>Tear Down</strong>—Remove (decommission) the dynamic resource from a dynamic environment.</td>
</tr>
<tr>
<td><strong>Track Changes</strong></td>
<td>--Open the Change History for the resource.</td>
</tr>
</tbody>
</table>

**Grid View**

Two icons above the Filters pane:
- The first icon (on the left) is the default *Table view* icon.
- The second icon (on the right) displays the resource *Grid view*.

Use the drop-down menus to filter the Grid view:
Grouping – Select the resource "grouping" you want to see—choose Pool, Job, Operating System, Platform, Proxy Agent, Version, or Zone.

For example, if you have multiple resource pools defined and chose Pool, you will see groups labeled with your various pool names and a group (No Pool) for resources not included in a pool.

Coloring – Select what you want to view in each group—choose Platform, Step Count/Limit, Status, Held Exclusive, Version, or Operating System to sort your group.

Note: Colors are dynamically assigned per the view you select. Within a single view, the same color "square" implies similar information.

Hovering your mouse over a grid "square" provides more detailed information about that resource.

Filters pane

Use the Filters pane to filter resources shown in either the Table or Grid view. The fields in the Filter pane correspond to columns in the Table view.

Enter the Filter criteria as follows:

<table>
<thead>
<tr>
<th>Actions / Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save Filters</td>
<td>Click this link to save your filter criteria. A dialog box appears so you can name your filter. For easy, repeat access, filters are saved in a &quot;saved filters&quot; box above the link. When you select a saved filter name, the Filter pane fields populate automatically.</td>
</tr>
<tr>
<td>Reset</td>
<td>Use this link to clear all entries in the Filter pane.</td>
</tr>
<tr>
<td>Quick Search field</td>
<td>Enter any text for your search. For example, enter a host name. You do not need to enter a full name or text string - this field filters on a partial text entry, sometimes 2-3 characters are all you might need.</td>
</tr>
<tr>
<td>Status</td>
<td>The status for the agent machine.</td>
</tr>
<tr>
<td>Drop-down menu</td>
<td>Default is both enabled and disabled resources. Use the drop-down arrow to choose enabled or disabled only.</td>
</tr>
<tr>
<td>Pools field</td>
<td>List one or more pool names, separated by a space. (No spaces are allowed within a pool name). Pool names must be entered exactly - a shorten version of the pool name will not yield a successful result.</td>
</tr>
<tr>
<td>Hosts field</td>
<td>List one or more full host names as shown in the Table view &quot;HTTPS &amp; Host&quot; column (each name separated by a space). Entering a partial name will not yield a successful result.</td>
</tr>
<tr>
<td>Actions / Field</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Step Limit</strong> drop-down menu</td>
<td>Choose the step limit corresponding to your desired search.</td>
</tr>
<tr>
<td><strong>Proxy Agent</strong> drop-down menu</td>
<td>Select No if not searching for a proxy agent or Yes if you are trying to locate a proxy agent.</td>
</tr>
<tr>
<td><strong>Filter</strong> button</td>
<td>Select this button after you complete the fields/selections to define your filter criteria.</td>
</tr>
</tbody>
</table>

**New Resource Panel**

To define a new standard resource, enter information in the following fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name</strong></td>
<td>Enter a unique name for this resource. <strong>Do not use</strong> &quot;spaces&quot; in a resource name. This is the name used to select the resource for a job step—it need not be the same as the host name for the machine.</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td><strong>Agent Host Name</strong></td>
<td>Enter the domain name or IP address of the agent machine for this resource. This is the name all other machines in this agent/resource's zone will use to communicate with this agent host.</td>
</tr>
<tr>
<td><strong>Agent Port Number</strong></td>
<td>Enter the port number to use when connecting to the agent for the resource, Default port is 7800.</td>
</tr>
<tr>
<td><strong>Default Workspace</strong></td>
<td>Enter the workspace name or leave blank to use the local, default workspace. The workspace specification can be overridden at the project, procedure, or step level.</td>
</tr>
<tr>
<td><strong>Pool(s)</strong></td>
<td>A space-separated list of arbitrary names indicating the pools associated with this resource. <strong>Do not use</strong> &quot;spaces&quot; in a pool name.</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| Host Type  | Use the drop-down menu to select the host type:  
|            | • Concurrent  
|            | • Registered  

Depending on the license installed on the ElectricFlow server, this field may appear.  

• If the license on the server is a concurrent resource license, the host type defaults to **Concurrent** and this field does not appear.  
• If the license on the server is a registered host license, the host type defaults to **Registered** and this field does not appear.  
• If the license on the server is a mixed-mode license (concurrent resources and registered hosts), you must specify the host type when adding a resource.
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
</table>
| Default Shell         | The name of the shell program used to execute the step's commands on a resource. For example, using `sh` or `cmd /c`, the agent saves the command block to a temporary file with a `.cmd` extension and runs it: `sh foo.cmd` or `cmd /c foo.cmd`. If you do not specify a shell on a step, at step run-time the server looks at the resource shell. If a resource shell is not set, the shell line used by the agent is platform dependent:  
  - **Windows**: `cmd /q /c "(0).cmd"`  
  - **UNIX**: `sh -e "(0).cmd"`  
  When you specify a shell (in the step or resource), and omit the `cmd-file` marker, the agent notices the omission and takes the correct action. For example: a user specifies `sh -x`. The agent converts this to `sh -x "(0).cmd"`.  
  Two alternate forms of shell syntax where ElectricFlow uses a "marker," `{0}`, as a placeholder for the command file argument:  
    - `<myShell> {0} <potential extra shell args>`  
      In this example, the command file is not meant to be the last argument in the final command line. For example, `mysql -e "source {0}"`  
      This shell example runs the mysql command against this step's command containing `sql`.  
    - `<myShell> {0}.<file extension> <potential extra shell args>`  
      In this example, the shell requires the command file to end in an extension other than `.cmd`. For example, `powershell "& '{0}.psl'"`  
      This shell example runs Microsoft PowerShell against this step's command containing PowerShell commands.  
  **Notes:**  
    - When the agent parses the shell, it will parse the extension as everything after `{0}. until it sees a space or non-alphanumeric character.  
    - If your script uses International characters (non-ascii), add the following block to the top of your `ec-perl` command block:  
      ```perl  
      use utf8;  
      ElectricCommander::initEncodings  
      ```
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step Limit</td>
<td>The maximum number of steps that can execute simultaneously on this resource—a step limit applies to a particular resource only, not to its underlying host. For example, if you define two resources, resource1 with a step limit of 5 and resource2 with a step limit of 1, both specifying the same host machine, it is possible for a total of 6 steps to execute simultaneously on the underlying host. The Resource Details panel displays this information. <strong>Note</strong>: Setting the Step Limit to &quot;0&quot; or leaving the field blank defaults to NO step limit.</td>
</tr>
<tr>
<td>Artifact Cache Directory</td>
<td>The directory on this resource’s agent host from which artifact versions are retrieved and made available to job steps. Enter an absolute path to the resource containing this cache directory.</td>
</tr>
<tr>
<td>Zone</td>
<td>The name of the zone where this resource is or will be a member—a zone is a top-level network containing one or more mutually accessible resources.</td>
</tr>
<tr>
<td>Repository Names</td>
<td>A &quot;new-line&quot; delimited list of repository names for this resource, if needed. When a step attempts to retrieve artifact versions from an ElectricFlow repository, it queries repositories specified here. If no repositories are specified, it will &quot;fallback&quot; to the default repository.</td>
</tr>
</tbody>
</table>
| Connection Type | Use the drop-down menu to select your Connection Type:  
  - **HTTP** - choose this option if you are not using SSL and the agent does not need to be "trusted".  
  - **HTTPS** - choose this option if you are using SSL, but this agent does not need to be "trusted".  
  - **Trusted HTTPS** - choose this option if you are using SSL and this agent must be "trusted". A trusted agent is "certificate verified"—the agent verifies the server or "upstream" agent's certificate.   

Agents can be either **trusted** or **untrusted**:  
  - **trusted** - the ElectricFlow server verifies the agent's identity using SSL certificate verification.  
  - **untrusted** - the ElectricFlow server does not verify agent identity. Potentially, an untrusted agent is a security risk. |
Click **OK** to save your settings and see your new resource listed in the table.

### New Proxy Resource Panel

These are the definitions of a proxy agent and proxy target:

- **Proxy agent**—This is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported platform.
- **Proxy target**—This is a machine on an unsupported platform that can run commands via an SSH server.

To define a new proxy resource, enter information in the following fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Enter a unique name for this resource. <strong>Do not use</strong> spaces in a resource name. This is the name used to select the resource for a job step; it does not need to be the same as the host name for the machine.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt;</code> ... <code>&lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tt&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td>Proxy Agent Host Name</td>
<td>Enter the domain name or IP address of the proxy agent machine corresponding to this resource.</td>
</tr>
<tr>
<td>Proxy Agent Port Number</td>
<td>Enter the port number to use when connecting to the agent for the resource.</td>
</tr>
<tr>
<td>Default Workspace</td>
<td>Enter the workspace name for leave blank to use the local, default workspace.</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pool(s)</td>
<td>Enter a space-separated list of arbitrary names, indicating the pools associated with this resource. <em>Do not use</em> spaces in a pool name.</td>
</tr>
<tr>
<td>Host Type</td>
<td>Use the drop-down menu to select the host type:</td>
</tr>
<tr>
<td></td>
<td>- Concurrent</td>
</tr>
<tr>
<td></td>
<td>- Registered</td>
</tr>
<tr>
<td></td>
<td>Depending on the license installed on the ElectricFlow server, this field may appear.</td>
</tr>
<tr>
<td></td>
<td>- If the license on the server is a concurrent resource license, the host type defaults to <code>Concurrent</code> and this field does not appear.</td>
</tr>
<tr>
<td></td>
<td>- If the license on the server is a registered host license, the host type defaults to <code>Registered</code> and this field does not appear.</td>
</tr>
<tr>
<td></td>
<td>- If the license on the server is a mixed-mode license (concurrent resources and registered hosts), you must specify the host type when adding a resource.</td>
</tr>
<tr>
<td>Step Limit</td>
<td>Specify the maximum number of steps that can execute simultaneously on this resource—a step limit applies to a particular resource only, not to its underlying host. For example, if you define two resources, resource1 with a step limit of 5 and resource2 with a step limit of 1, both specifying the same host machine, it is possible for a total of 6 steps to execute simultaneously on the underlying host.</td>
</tr>
<tr>
<td>Zone</td>
<td>The name of the zone where this resource will be a member.</td>
</tr>
<tr>
<td>Connection Type</td>
<td>Use the drop-down menu to select your Connection Type:</td>
</tr>
<tr>
<td></td>
<td>- HTTP - choose this option if you are not using SSL and the agent does not need to be &quot;trusted&quot;.</td>
</tr>
<tr>
<td></td>
<td>- HTTPS - choose this option if you are using SSL, but this agent does not need to be &quot;trusted&quot;.</td>
</tr>
<tr>
<td></td>
<td>- Trusted HTTPS - choose this option if you are using SSL and this agent must be &quot;trusted&quot;. A trusted agent is &quot;certificate verified&quot;—the agent verifies the server or &quot;upstream&quot; agent's certificate.</td>
</tr>
<tr>
<td></td>
<td>Agents can be either trusted or untrusted:</td>
</tr>
<tr>
<td></td>
<td>- trusted – The ElectricFlow server verifies the agent's identity using SSL certificate verification.</td>
</tr>
<tr>
<td></td>
<td>- untrusted – The ElectricFlow server does not verify agent identity. Potentially, an untrusted agent is a security risk.</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Enabled</td>
<td>Select this box to enable this resource.</td>
</tr>
<tr>
<td></td>
<td>When this box is checked, the resource is enabled, which means job steps will be assigned to it. If a job step requests a pool containing this resource, the step executes on a resource in that pool.</td>
</tr>
<tr>
<td></td>
<td>If disabled, and this is the only resource that satisfies a particular job step, the step's execution is delayed until the resource is re-enabled. If a resource is disabled while job steps are running on it, the running steps continue to completion but no new steps are assigned to that resource.</td>
</tr>
<tr>
<td>Proxy Target</td>
<td></td>
</tr>
<tr>
<td>Proxy Target Host Name</td>
<td>Enter the domain name or IP address of the proxy target machine corresponding to this resource.</td>
</tr>
<tr>
<td>Proxy Target Port Number</td>
<td>Enter the port number to use when connecting to the proxy target host or leave blank to use the default. The default port is 22, the SSH server port.</td>
</tr>
<tr>
<td>Field</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| Proxy Target Default Shell | The name of the shell program used to execute commands on this [the proxy target] resource—may be overridden at the step level.  
This shell will be used to execute the step's commands on a resource. For example, using `sh` or `cmd /c`, the agent saves the command block to a temporary file with a `.cmd` extension and runs it: `sh foo.cmd` or `cmd /c foo.cmd`.  
If you do not specify a shell on a step, at step run-time the server looks at the resource shell. If a resource shell is not set, the shell line used by the agent is platform dependent:  
**Windows:** `cmd /q /c "{0}.cmd"`  
**UNIX:** `sh -e "{0}.cmd"`  
When you specify a shell (in the step or resource), and omit the `cmd-file` marker, the agent notices the omission and takes the correct action. For example: a user specifies `sh -x`. The agent converts this to `sh -x "{0}.cmd"`.  
Two alternate forms of shell syntax where ElectricFlow uses a "marker," `{0}`, as a placeholder for the command file argument:  
- `<myShell>{0} <potential extra shell args>`  
  In this example, the command file is not meant to be the last argument in the final command line.  
  For example, `mysql -e "source {0}"`  
  This shell example runs the `mysql` command against this step's command containing sql.  
- `<myShell>{0} <file extension> <potential extra shell args>`  
  In this example, the shell requires the command file to end in an extension other than `.cmd`.  
  For example, `powershell "& '{0}.ps1'"`  
  This shell example runs Microsoft PowerShell against this step's command containing PowerShell commands. |
| Proxy Customizations | This is proxy-specific customization data. Default is "none". |
Click **OK** to save your settings.

**Edit Resource Panel**

All of the fields on this panel are the same as those on the New Resource panel:

- All information you previously provided to create this resource is filled-in for you.
- You can change any information already supplied.
- You can add information in any blank fields.

Click **OK** to save your modifications.

**IMPORTANT:** If you want to change the Connection Type, using the UI by itself is insufficient. You must also use the `ecconfigure` utility to change the protocol. Run: `ecconfigure --agentProtocol [http|https]`

**Edit Proxy Resource Panel**

All of the fields on this panel are the same as those on the New Proxy Resource panel:

- All information you previously provided to create this resource is filled-in for you.
- You can change any information already supplied.
- You can add information in any blank fields.

Click **OK** to save your modifications.

**Resource Details panel**

This panel displays how this resource is configured with the ElectricFlow server. Some of the information supplied is linked to its source. For example, the zone name for this resource is a link to its Zone Details panel.

- The name of the resource is shown below the panel title.
- The resource description is shown under the resource name.
- Links at the top of the panel:
  - Use the **View Usage** link to go to the Job Step Search Results page.
  - Use the **Edit** link to modify the resource specifications.
  - Use the **Access Control** link [at the top of the panel] to specify or view access privileges for this resource.
- The tabs:
  - General - by default, the panel opens to display the "general" resource configuration.
Properties - select this tab to add properties to this resource or see existing resource properties if already configured.

**Custom Resource Properties**

You can define custom properties for any ElectricFlow object. For example, if configuration information varies from resource to resource, use custom properties to store this information and then reference it from procedure steps where it is needed.

For example, if you have a pool of test machines with test hardware in a different location on each machine, you could define a property named "testLocation" on each resource, then pass this property to procedure steps using a reference such as `@[myResource/testLocation]`.

**Switching a Non- Trusted Agent to Trusted**

If you have upgraded to ElectricCommander 4.2 or later, none of your existing agents were converted to "trusted" during the upgrade process. By default, the local agent is not trusted during a new or upgrade installation.

After an upgrade, if you want to use a trusted configuration, any pre-existing agent/host machines must be manually switched to "trusted."

Manually switching a non-trusted agent to trusted status

Perform the following steps on the agent machine to change the agent status to trusted in your environment and in the customer's site.

1. Enter `ectool --server <COMMANDER_SERVER_IP> login admin` to log into the server and save the session ID.
2. Enter `ecert --server <COMMANDER_SERVER_IP> initAgent --remote --force` to install the agent with a self-signed certificate that needs to be overwritten.
3. Restart the agent.
   
   If you do not restart the agent, it tries to use a previously cached certificate if one exists. The old certificate is invalid because a new one was just created.
4. In the ElectricFlow UI, ping the agent.

**Installing or Upgrading Remote Agents**

You can install or upgrade remote hosts that are running Linux (x86 or x64), Windows (x86 or x64), MacOS, Solaris, Solaris x86, or HP-UX.

**Prerequisites**

**General Prerequisites**

- You must have an artifact repository server installed.
- The user that you specify in the **Authentication Options** dialog box must have administrator privileges on the target machines.
- The agent service user of the driving agent must have administrator rights on the target machine.
Linux and UNIX Prerequisites

- The target machines must be running the SSH daemon.
- For SSH, the user account on the target machine must have passwordless sudo configured for running the installer with root privileges.
  
  For example, in the `/etc/sudoers` file, you must add "<username> ALL=(ALL) NOPASSWD:ALL".
- For each target machine that you want to upgrade, ensure that `PasswordAuthentication=yes` in the `/etc/ssh/sshd_config` file. For example:
  
  ```
  # To disable tunneled clear text passwords, change to no here!
  PasswordAuthentication yes
  ```

  On SUSE platforms, `PasswordAuthentication=no` is the default.

Windows Prerequisites

**Windows Driving Resources**

- They must be in the same Windows domain as the remote windows hosts where you will install the agents.
- They must be in the same zone as the zone where you will install the agents.
- Windows Powershell 3.0 or newer must be installed on older versions of Windows.
- Windows Remote Management (WinRM) must be installed and configured.
  - WinRM is installed automatically with all currently-supported versions of Windows.
  - The WinRM service starts automatically on Windows Server 2008. On Windows Vista, the service must be started manually.

  Before using a domain user to install agents on remote hosts, you must enable multi-hop support for WinRM on the driving resource system and on each remote host. For details, see the *Enabling Multi-Hop Support for Windows Remote Management Before Installing or Upgrading Remote Agents* KB article at [https://helpcenter.electric-cloud.com/hc/en-us/sections/200516863-ElectricFlow-KB](https://helpcenter.electric-cloud.com/hc/en-us/sections/200516863-ElectricFlow-KB).

  You can enable the WS-Management protocol on the local system and set up the default configuration for remote management by using the `winrm quickconfig` command.

**Remote Windows Hosts**

- WinRM must be installed and configured.
  - WinRM is installed automatically with all currently-supported versions of Windows.
  - The WinRM service starts automatically on Windows Server 2008. On Windows Vista, the service must be started manually.

  You can enable the WS-Management protocol on the local computer and set up the default configuration for remote management by using the `winrm quickconfig` command.
Installing Remote Agents Using the Web Interface

In the Cloud > Resources page, click the (add) menu and then click Install Resource(s) to install resources on host machines to use as agent hosts for your ElectricFlow resources.

**Note:** On Solaris platforms, the installation directory path must have fewer than 70 characters.

The **Install Resource(s)** dialog box appears:

<table>
<thead>
<tr>
<th>Platform</th>
<th>Published Latest Version</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux x86</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
<tr>
<td>Linux x64</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
<tr>
<td>Windows x86</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
<tr>
<td>Windows x64</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
<tr>
<td>MacOS</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
<tr>
<td>Solaris</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
<tr>
<td>Solaris x86</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
<tr>
<td>HP-UX</td>
<td>Not published</td>
<td>Publish Installer</td>
</tr>
</tbody>
</table>

If an ElectricFlow agent installer is already published and available for your desired platform, then you can select it to continue with the installation. Otherwise, click the appropriate Publish Installer link for the appropriate platform, then click Next.

The **Run Procedure / Publish Installer** page opens:
Enter the following information:

Parameters

- **fromDir**–Directory on the resource used for publishing. For example, enter `/var/tmp` for Linux or `C:\<temp>` for Windows.
- **platform**–Host platform type.
- **repository**–Repository name. Use `default` to use the repository installed during the ElectricFlow installation or enter another name.
- **resource**–Name of the resource used for publishing.
- **version**–Build version for the ElectricFlow installation. For example, enter `5.0.0.56390`. You can find the build version from the file name of the ElectricFlow installer.

(Optional) Advanced

Set advanced options if needed.

Click Run.

When the Publish Installer procedure runs, you can see the job status on the Job Details page.

If you want to see the published installers, click the Artifacts tab and then click the `com.electriccloud:installer` artifact. The Artifact Details page lists the published installers.

**Note:** You can republish a new agent installer version. To do so, return to the Cloud > Resources page and choose (add) > **Install Resource(s)** and click the radio button for the installer.

The Install Targets dialog box appears:
Enter the information for the target host machines as follows:

- **(Required) Installation target hostnames or IP addresses**–One or more host names or IP addresses in a space-separated list. Host names cannot contain spaces.

- **(Required) Zone**–Zone where you are installing agents.

  You can install agents to only one zone at a time. A functioning gateway must exist before an agent can be installed into the nondefault zone, so installing the first agent into a zone must be done manually.

- **(Required) Driving Resource**–Resource to perform all actions for installing a host on behalf of the server. This is the agent that installs the agents on the remote hosts.

  The driving resource must belong to the same platform and zone as the hosts being installed or upgraded. Also, on Windows systems containing the driving resource, Windows PowerShell 3.0 or newer must be installed on older Windows versions.

- **Resource Name Format**–Naming scheme for newly-created resources to correspond to the hosts on which to perform the installation.

  Choosing **Custom** from this menu lets you specify a custom template for resource naming. The value in this field undergoes property expansion in a global context and is scanned for the (name) and (counter) special tokens.

Click **Next**.

One of two **Authentication Settings** dialog boxes appears depending on the platform.
Linux- or UNIX-Based Platforms

From the Authentication Type menu, choose SSH User or SSH Key and enter authentication information required to connect to the remote machines:

- **SSH User:**
  - (Required) **User Name**—User name. This user must have administrator privileges on the target machines.
  - (Required) **Password**—Password for the user name.

- **SSH Key:**
  - (Required) **User Name**—User name. This user must have administrator privileges on the target machines.
  - (Required) **Public Key Path**—Path to the SSH public key file.
  - (Required) **Private Key Path**—Path to the SSH private key file.
  - (Optional) **Passphrase**—Passphrase for unlocking the private key file.
Windows Platforms

**Note:** Before using a domain user to install agents on remote hosts, you must enable multi-hop support for WinRM on the driving resource system and on each remote host. For more information, see the *Enabling Multi-Hop Support for Windows Remote Management Before Installing or Upgrading Remote Agents* KB article at https://helpcenter.electric-cloud.com/hc/en-us/sections/200516863-ElectricFlow-KB.

Enter the authentication information required to connect to the remote machines:

- (Required) **User Name**—User name. This user must have administrator privileges on the target machines.
- (Required) **Password**—Password for the user name.
- (Required) **Domain**—User's Windows domain.

Click **Next**.

One of two **Agent Configuration** dialog boxes appears depending on the platform.
Linux- or UNIX-Based Platforms

Provide the agent settings to be passed to the ElectricFlow agent installer. The agent settings appear in two sections: Information for the user account to be used to run the agent and the agent or resource configurations such as agent port:

- (Required) **Agent Service User**—User that the ElectricFlow agent runs as.
- (Required) **Agent Service Group**—Group that the ElectricFlow agent runs as.
Windows Platforms

Provide the agent settings to be passed to the ElectricFlow agent installer. The agent settings appear in two sections: Information for the user account to be used to run the agent and the agent or resource configurations such as agent port:

- **Local User:**
  - (Required) **User Name**–User name.
  - (Required) **Password**–Password for the user name.

- **Domain User:**
  - (Required) **User Name**–User name.
  - (Required) **Password**–Password for the user name.
  - (Required) **Domain**–User's Windows domain.

- **Built-in User Account:**
  - (Required) **Service Account**–**LocalSystem** is the only option available in this release.
All Platforms

- **Agent type**—Agent type. (This menu appears only if a mixed-mode license is installed on the server for both registered and concurrent hosts.)

  - If the license on the server is a concurrent resource license, the host type defaults to **Concurrent**, and this menu does not appear.
  
  - If the license on the server is a registered host license, the host type defaults to **Registered**, and this menu does not appear.
  
  - If the license on the server is a mixed-mode license (concurrent resources and registered hosts), you must choose the host type when adding a resource.

(Optional) Click **Advanced** to view additional options:

![Advanced options](image)

Complete the advanced options as follows:

- **Agent Port**—Port for communication between the local agent and the server. The default is 7800.

- **Install Directory**—Path to the install directory. Spaces are allowed. Do not use quotation marks.

- **Data Directory**—Path to the directory where your modified ElectricFlow files are stored (configuration and log files). Spaces are allowed. Do not use quotation marks.

- **Trusted Agent**—Check this check box if all agent machines being installed or upgraded are trusted.

  For more information, see **Switching a Non-Trusted Agent to Trusted** on page 718.

- **Workspace**—Name of the workspace to set as the default workspace for the new resource(s).

Click **Next**.
A summary dialog box appears. For example:

![Install / Upgrade Resources dialog box]

For more than five hosts, the number of hosts appears (instead of a space-separated list of host names).

Review your settings in the Review Settings dialog box, then click Finish to start the installation or upgrade. The Job Details page appears.

When the installation or upgrade finishes, you can return to the Resources page to see the hosts that were just installed. To verify a resource version, click a resource name (in table view) to open the Resource Details panel for that resource.

**Installing Remote Agents Using the API**

You can automate remote installations by using scripts that call the following ElectricFlow APIs. These APIs provide the same remote installation capability as the web interface.

**Parameters for Running the Procedure to Publish an Installer to the Artifact Repository**

The Publish Installer procedure is used to publish an ElectricFlow installer to the artifact repository. The parameters for the Publish Installer procedure appear below. These parameters have equivalent options in the web interface.
### Parameters for Running the Procedure to Perform the Installations

A top-level wrapper procedure named **Centralized Agent Management** is used for installer publishing. This procedure calls the **Install Agent** procedure to publish installers to the repository.

The parameters for the **Centralized Agent Management** procedure appear below. Most of these parameters have equivalent options in the web interface.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Windows Support</th>
<th>Other Platform Support</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>isUpgrade</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Specifies whether you are installing agents or upgrading existing agents. Use 0 if installing agents and 1 if upgrading agents.</td>
</tr>
<tr>
<td><strong>resources</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>(Upgrades only) Space-delimited list of resources to upgrade. The resources should belong to the same platform (such as Windows or Linux) and the same zone.</td>
</tr>
<tr>
<td><strong>hostnames</strong></td>
<td></td>
<td></td>
<td>(Installations only) Space-delimited list of hostnames or IP addresses on which to install the agent. The hosts should belong to the same platform and the same network.</td>
</tr>
<tr>
<td><strong>zoneName</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>ElectricFlow zone in which the agents will be installed or upgraded.</td>
</tr>
<tr>
<td>Field</td>
<td>Is Provided</td>
<td>Is Required</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>drivingResource</td>
<td>Yes</td>
<td>Yes</td>
<td>Existing resource within the selected zone that will be used to perform all proxy commands for installing or upgrading the target hosts. The driving resource must belong to the same platform and the same zone as the hosts.</td>
</tr>
<tr>
<td>resourceNameTemplate</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) String templates. Used for naming the resources in ElectricFlow for the corresponding installation target hosts. The special tokens {name} and {counter} can be used as place holders for the host name and for incrementing counters in the template value. For example, {name}-Win-{counter}.</td>
</tr>
<tr>
<td>version</td>
<td>Yes</td>
<td>Yes</td>
<td>Version of the agent previously published to the repository server to use. For example, 7.0.0.110954.</td>
</tr>
<tr>
<td>platform</td>
<td>Yes</td>
<td>Yes</td>
<td>Platform of the resources being upgraded or installed. The possible values are Linux_x86, Linux_x64, Windows_x86, Windows_x64, Darwin, SunOS, SunOSx86, or HP-UX.</td>
</tr>
<tr>
<td><strong>Connection Parameters for Communicating With The Target Hosts</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>connectionType</td>
<td>Yes</td>
<td>Yes</td>
<td>Type of authentication to use when connecting to the target machines. Use WINDOWS when installing or upgrading resources on Windows. Otherwise, use either SSH_PASSWORD or SSH_KEY depending on whether the SSH user name and password will be used or an SSH key will be used.</td>
</tr>
<tr>
<td>connectionCredential</td>
<td>Yes</td>
<td>Yes</td>
<td>Connection credentials based on the type of authentication used for connecting to the target hosts. Use the user account name and password if connectionType is WINDOWS or SSH_USER. Use the user name and SSH key passphrase if connectionType is SSH_KEY.</td>
</tr>
<tr>
<td>connectionDomain</td>
<td>Yes</td>
<td>–</td>
<td>(Windows platforms only) Name of the windows domain for the specified user account.</td>
</tr>
<tr>
<td>connectionPublicKey</td>
<td>–</td>
<td>Yes</td>
<td>Path to the SSH public key file on the driving resource.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Required</td>
<td>Optional</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------</td>
<td>----------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>connectionPrivate Key</td>
<td>–</td>
<td>Yes</td>
<td>Path to the SSH private key file on the driving resource.</td>
</tr>
<tr>
<td><strong>Agent Configuration Parameters Used by the Agent Installer for Installing Agents on the Target Hosts</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>agentPort</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) Port that will be used by the agents installed on the target hosts. The default is 7800.</td>
</tr>
<tr>
<td>installDirectory</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) Path to the installation directory on the target hosts.</td>
</tr>
<tr>
<td>dataDirectory</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) Path to the data directory on the target hosts.</td>
</tr>
<tr>
<td>agentWorkspaceName</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) Name of the workspace that will be used by the agents installed on the target hosts.</td>
</tr>
<tr>
<td>agentCredential</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) Password for the user account that the installed agent service should run as. (This is not applicable if you are using LocalSystem as the agent user on Windows.)</td>
</tr>
<tr>
<td>agentDomain</td>
<td>Yes</td>
<td>–</td>
<td>(Installations only) Windows domain name for the agent user, if the user account belongs to a domain.</td>
</tr>
<tr>
<td>trustedAgent</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) Specifies whether the agent will be installed as a trusted agent. A trusted agent is &quot;certificate verified,&quot; which means that the agent verifies the server or upstream agent's certificate. If this is set to 1, the agent will be installed as a trusted agent.</td>
</tr>
<tr>
<td>agentGroup</td>
<td>–</td>
<td>Yes</td>
<td>(Installations only) Group of the user account that the installed agent service should run as.</td>
</tr>
<tr>
<td>hostType</td>
<td>Yes</td>
<td>Yes</td>
<td>(Installations only) Host type when the service is licensed for both concurrent and registered agent hosts. Specify CONCURRENT to install concurrent host agents. Specify REGISTERED to install registered host agents.</td>
</tr>
</tbody>
</table>
Examples for Publishing an ElectricFlow Installer to the Artifact Repository

As mentioned above, Publish Installer is a procedure used to publish an ElectricFlow installer to the artifact repository. Note that the ec-perl and DSL scripts below contain commands for using the promoted plugin version without hard-coding the version.

**ec-perl Example**

Publish Installer is a procedure used to publish an ElectricFlow installer to the artifact repository.

```perl
use strict;
use ElectricCommander;
my $ec = new ElectricCommander();
my $xpath = $ec->getPlugin("EC-AgentManagement");
my $pluginProject = $xpath->findvalue('//projectName')
my $jobId = $ec->runProcedure($pluginProject, {
  procedureName => "Publish Installer",
  actualParameter => [
    { actualParameterName => 'fromDir',
      value => '/home/build' },
    { actualParameterName => 'platform',
      value => 'Linux_x64' },
    { actualParameterName => 'repository',
      value => 'default' },
    { actualParameterName => 'resource',
      value => 'local' },
    { actualParameterName => 'version',
      value => '7.0.0.110576' }
  ])->findvalue('//jobId')
print "jobId is: $jobId"
```

**ectool Example**

```bash
ectool runProcedure EC-AgentManagement-1.2.0.111083 --procedureName "Publish Installer"
--actualParameter "fromDir=/home/build"
--actualParameter "platform=Linux_x86"
--actualParameter "repository=default"
--actualParameter "resource=local"
--actualParameter "version=7.0.0.110576"
```

**DSL Example**

```bash
ectool evalDsl "
def pluginProject = getPlugin(pluginName: 'EC-AgentManagement').projectName;
runProcedure(pluginProject, procedureName: 'Publish Installer',
  actualParameter: [
```
Examples for Installing Remote Agents

As mentioned above, Centralized Agent Management is a top-level wrapper procedure that calls the Install Agent procedure for installing or upgrading individual agents on the agent hosts. Note that the DSL scripts below contain commands for using the promoted plugin version without hard-coding the version.

tool Example (Linux)

tool runProcedure EC-AgentManagement-1.2.0.111083 --procedureName "Centralized Agent Management"
--actualParameter "isUpgrade=0"
--actualParameter "platform=Linux_x64"
--actualParameter "version=7.0.0.110954"
--actualParameter "zoneName=default"
--actualParameter "hostnames=192.168.4.208 192.168.4.210"
--actualParameter "drivingResource=local"
--actualParameter "resourceNameTemplate=prefix-{counter}"

--actualParameter "agentCredential=agentCredential"
--actualParameter "agentGroup=remote"
--actualParameter "agentPort=7800"

--actualParameter "trustedAgent=0"
--actualParameter "hostType=CONCURRENT"

--actualParameter "connectionType=SSH_PASSWORD"
--actualParameter "connectionCredential=connectionCredential"

--credential connectionCredential=remote
--credential agentCredential=remote

tool Example (Windows)

tool runProcedure EC-AgentManagement-1.2.0.111083 --procedureName "Centralized Agent Management"
--actualParameter "isUpgrade=0"
--actualParameter "platform=Windows_x64"
--actualParameter "version=7.0.0.110954"
--actualParameter "zoneName=default"
--actualParameter "hostnames=10.1.216.227"
--actualParameter "drivingResource=3EC-IT-3614"
--actualParameter "resourceNameTemplate={name}"
DSL Example (Linux)

In the following example, agentGroup is the group for the Linux user to connect to the remote machines.

```
ectool evalDsl "
def pluginProject = getPlugin(pluginName: 'EC-AgentManagement').projectName;
runProcedure(pluginProject, procedureName: 'Publish Installer',
    actualParameter: [
        isUpgrade: '0',
        platform: 'Linux_x64',
        version: '7.0.0.110954',
        zoneName: 'default', hostnames: '192.168.4.210',
        drivingResource: 'local',
        resourceNameTemplate: 'prefix-{counter}',
        agentCredential: 'agentCredential',
        agentGroup: 'remote',
        agentPort: '7800',
        trustedAgent: '0',
        hostType: 'CONCURRENT',
        connectionType: 'SSH_PASSWORD',
        connectionCredential: 'connectionCredential'
    ],
    credential: [
        [credentialName: 'connectionCredential',
         userName: 'remote',
         password: '"Rem0te4"
        ],
        [credentialName: 'agentCredential',
         userName: 'remote',
         password: '"Rem0te4"
        ]
    ]
"
```

DSL Example (Windows)

In the following example, connectionDomain is the Windows domain for the Windows user to connect to the remote machines.

```
ectool evalDsl "
def pluginProject = getPlugin(pluginName: 'EC-AgentManagement').projectName;
runProcedure(pluginProject, procedureName: 'Publish Installer',
    actualParameter: [
        isUpgrade: '0',
        platform: 'Windows_x64',
```
Upgrading Remote Agents Using the Web Interface

In the Cloud > Resources page, check the check boxes for resources that you want to upgrade on agent hosts. If the selected resources have different platforms or zones, an error message appears:

Resources belonging to different platforms and zones cannot be upgraded at the same time. Please select resources belonging to the same platform and the same zone.

If any selected resource is a proxy resource, an error message appears:

Proxy resources are not supported for upgrade. Select the resources acting as proxy agents directly for upgrade.

Then click the (add) menu and then click Upgrade Resource(s).

Note: On Solaris platforms, the installation directory path must have fewer than 70 characters.

The Upgrade Resources dialog box appears. For example:
**Note:** You can republish a new agent installer version. To do so, return to the **Cloud > Resources** page and choose (add) > **Install Resource(s)** and click the radio button for the installer.

Either one or two platforms for the selected resource are listed. Two platforms are listed if the platform (such as Linux x86 or Linux x64) could not be determined.

Click the appropriate **Publish Installer** link for the target platform, then click **Next**.

The **Run Procedure / Publish Installer** page opens:

Enter the following information:
Parameters

- (Required) **fromDir**—Directory on the resource used for publishing. For example, enter `/var/tmp` for Linux or `C:/<temp>` for Windows.
- (Required) **platform**—Host platform type.
- (Required) **repository**—Repository name. Use `default` to use the repository installed during the ElectricFlow installation or enter another name.
- (Required) **resource**—Name of the resource used for publishing.
- (Required) **version**—Build version for the ElectricFlow installation. For example, enter `5.0.0.56390`. You can find the build version from the file name of the ElectricFlow installer.

(Optional) **Advanced**

Set advanced options if needed.

When the Publish Installer procedure runs, you can see the job status on the **Job Details** page.

If you want to see the published installers, click the **Artifacts** tab and then click the **com.electriccloud:installer artifact**. The **Artifact Details** page lists the published installers.

Click **Run**.

The **Upgrade Targets** dialog box appears. For example:

![Install / Upgrade Resources](image)

The **Installation target hostnames or IP addresses** field is prefilled with a space-separated list of target resource names that you selected. The **Zone** field displays the zone of the selected resources for upgrade.

**Driving Resource** is the resource to perform all actions for installing or upgrading a host on behalf of the server. This is the agent that upgrades the agents on the remote hosts.

Click **Next**.

One of two **Authentication Settings** dialog boxes appears depending on the platform.
Linux- or UNIX-Based Platforms

From the Authentication Type menu, choose SSH User or SSH Key and enter authentication information required to connect to the remote machines:

- **SSH User**:
  - (Required) **User Name**—User name. This user must have administrator privileges on the target machines.
  - (Required) **Password**—Password for the user name.

- **SSH Key**:
  - (Required) **User Name**—User name. This user must have administrator privileges on the target machines.
  - (Required) **Public Key Path**—Path to the SSH public key file.
  - (Required) **Private Key Path**—Path to the SSH private key file.
  - (Optional) **Passphrase**—Passphrase for unlocking the private key file.
Windows Platforms

Enter the authentication information required to connect to the remote machines:

- (Required) **User Name**—User name. This user must have administrator privileges on the target machines.
- (Required) **Password**—Password for the user name.
- (Required) **Domain**—User's Windows domain.

Click **Next**.

A summary dialog box appears. For example:
For more than five hosts, the number of hosts appears (instead of a space-separated list of host names).

Review your settings in the **Review Settings** dialog box and click **Finish** to start the installation or upgrade. The **Job Details** page appears.

When the installation or upgrade finishes, you can return to the **Resources** page to see the hosts that were just upgraded. To verify a resource version, click a resource name (in table view) to open the **Resource Details** panel for that resource.

**Upgrading Remote Agents Using the API**

You can automate remote upgrades for multiple resources by using scripts that call ElectricFlow APIs to run those upgrades. These APIs provide the same remote upgrade capability as the web interface.

**Parameters for Running the Procedure to Perform the Installations**

See *Parameters for Running the Procedure to Perform the Installations* on page 729 above.

**Examples for Upgrading Remote Agents**

As mentioned above, **Centralized Agent Management** is a top-level wrapper procedure that calls the **Install Agent** procedure for installing or upgrading individual agents on the agent hosts. Note that the DSL scripts below contain commands for using the promoted plugin version without hard-coding the version.

**ectool Example (Linux)**

```bash
ectool runProcedure EC-AgentManagement-1.2.0.111083 --procedureName "Centralized Agent Management"
--actualParameter "isUpgrade=1"
--actualParameter "platform=Linux_x64"
--actualParameter "version=7.0.0.110954"
--actualParameter "zoneName=default"
--actualParameter "resources=4.208 4.210"
```
ectool Example (Windows)

```
ectool runProcedure EC-AgentManagement-1.2.0.111083 --procedureName "Centralized Agent Management"
--actualParameter "isUpgrade=1"
--actualParameter "platform=Windows_x64"
--actualParameter "version=7.0.0.110954"
--actualParameter "zoneName=default"
--actualParameter "resources=10.1.216.227"
--actualParameter "drivingResource=EC-IT-3614"
--actualParameter "connectionDomain=electric-cloud"
--actualParameter "connectionCredential=connectionCredential"
--actualParameter "agentCredential=agentCredential"
--credential connectionCredential=build
--credential agentCredential=build
```

DSL Example (Linux)

```
ectool evalDsl "
def pluginProject = getPlugin(pluginName: 'EC-AgentManagement').projectName;
runProcedure(pluginProject, procedureName: 'Publish Installer',
  actualParameter: [
    isUpgrade: '1',
    platform: 'Linux_x64',
    version: '7.0.0.110954',
    zoneName: 'default',
    resources: '4.208',
    drivingResource: 'local',
    connectionType: 'SSH_PASSWORD',
    connectionCredential: 'connectionCredential',
    agentCredential: 'agentCredential'
  ],
  credential: [
  [ credentialName: 'connectionCredential',
    userName: 'remote',
    password: ''Rem0te4''
  ],
  [ credentialName: 'agentCredential' ]
]
"
```

DSL Example (Windows)

```
ectool evalDsl "
def pluginProject = getPlugin(pluginName: 'EC-AgentManagement').projectName;
runProcedure(pluginProject, procedureName: 'Publish Installer',
  actualParameter: [
    isUpgrade: '1',
    platform: 'Windows_x64',
    version: '7.0.0.110954',
    zoneName: 'default',
    resources: '10.1.216.227',
    drivingResource: 'local',
    connectionType: 'SSH_PASSWORD',
    connectionCredential: 'connectionCredential'
  ],
  credential: [
  [ credentialName: 'connectionCredential',
    userName: 'remote',
    password: ''Rem0te4''
  ],
  [ credentialName: 'agentCredential' ]
]
"
```
Resource Pools

This page displays all resource pools currently available to ElectricFlow.

- To create a new resource pool, click the **Create Resource Pool** link.
- To find an existing resource pool, use the **New Search** link.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pool Name</td>
<td>This is the name you supplied for this resource pool. Click on a Pool Name to go to the Resource Pool Details page.</td>
</tr>
<tr>
<td>Enabled</td>
<td>If this box is &quot;checked&quot;, this resource pool is enabled.</td>
</tr>
<tr>
<td>Auto Delete</td>
<td>If this column is selected with a check mark, the pool will be deleted when the last resource is deleted or removed.</td>
</tr>
<tr>
<td>Column Name</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: &lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</td>
</tr>
<tr>
<td>Actions</td>
<td>Use the <strong>Copy</strong> link to make an exact duplicate of an existing resource pool, then select the copy to go to the Resource Pool Details page to change the resource pool name or add or remove resources from the pool. Use the <strong>Delete</strong> link to delete the resource pool on the same row. <strong>Note:</strong> Deleting a resource pool does not delete the resources referenced by the pool.</td>
</tr>
</tbody>
</table>

**Resource Pool – Create a New Pool or Edit Existing Pool**

**Creating a new resource pool**

Enter information in the following fields:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pool Name</td>
<td>Enter a name for the resource pool. This name must be unique within a list of multiple resource pool names and cannot be the same as any resource name.</td>
</tr>
<tr>
<td>Enabled</td>
<td>Select this check box to enable the resource pool.</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>A resource can be <strong>static</strong> or <strong>dynamic</strong>.</td>
</tr>
<tr>
<td></td>
<td>- A static resource is part of your system or network (not in the cloud), such as a server, database, or agent machine.</td>
</tr>
<tr>
<td></td>
<td>- A dynamic resource is a cloud resource that can be provisioned and later spun up on-demand when an application is deployed.</td>
</tr>
<tr>
<td># Resources</td>
<td>Number of resources in the resource pool.</td>
</tr>
<tr>
<td>Resource Template</td>
<td>The name of the resource template to which the resource is applied.  <strong>Note:</strong> Only dynamic resources can be applied to a resource template.</td>
</tr>
</tbody>
</table>

**Field Name**

- **Pool Name**: Enter a name for the resource pool. This name must be unique within a list of multiple resource pool names and cannot be the same as any resource name.
- **Enabled**: Select this check box to enable the resource pool.
- **Type**: A resource can be **static** or **dynamic**.
  - **Static** resource is part of your system or network (not in the cloud), such as a server, database, or agent machine.
  - **Dynamic** resource is a cloud resource that can be provisioned and later spun up on-demand when an application is deployed.
- **# Resources**: Number of resources in the resource pool.
- **Resource Template Name**: The name of the resource template to which the resource is applied. **Note:** Only dynamic resources can be applied to a resource template.
### Field Name | Description
--- | ---
Auto Delete | If you select this check box, the pool is deleted when the last resource is deleted or removed.
- The `autoDelete` property flag is automatically set to "true" if the pool was created on the Create Resource page, as a side-effect of the resource API calls.
- By default, resource pools created explicitly on the Create Resource Pool page, have the `autoDelete` flag set to false—the checkbox is "unchecked".
Description | A plain text or HTML description for this object. If using HTML, you must surround your text with `<html>` ... `</html>` tags. The only HTML tags allowed in the text are: `<a>`, `<b>`, `<br>`, `<dl>`, `<font>`, `<i>`, `<li>`, `<ol>`, `<p>`, `<pre>`, `<span>`, `<style>`, `<table>`, `<tc>`, `<td>`, `<th>`, `<tr>`, `<ul>`
Actions | Actions you can perform on the resource pool, including:
- **Copy**—Creates a new resource by copying the this resource pool.
- **Delete**—Deletes this resource pool.
- **Tear Down**—Removes (decommissions) the dynamic resource pool from a dynamic environment.
- **Track Changes**—Opens the Change History for the resource pool.

Click **OK** to save the information to create a new resource pool. You will see your new resource pool listed on the Resource Pools page.

**Note:** Resource pools cannot be nested, which means if the name of a resource pool is added to a resource pool, it will be ignored.

A resource pool can override the default algorithm by providing a JavaScript fragment in the Ordering Filter (`orderingFilter`) intrinsic property. The JavaScript environment for this fragment is:
- A variable named `resourceList`—an array of the resources in the pool, sorted as described above
- A variable named `resourcePool`—the pool object
- The job step being scheduled is configured as the context object for property resolution

The evaluation result is expected to be an array of resources, in the order they should be considered by the scheduler.

Before evaluation, the JavaScript fragment is wrapped as a function, to make it possible to use the `return` statement in the script.
It is possible to return any resources in the result, not just those grouped in a pool, so this feature enables true dynamic resource selection. Resources are still subject to the "usable" criteria. See the "Unusable resources" section at the end of this Help topic.

Examples for the Ordering Filter field:

- Sort by resource name in descending order:
  ```javascript
  return resourceList.sort(function(a,b) {
    return b.resourceName.localeCompare(a.resourceName);
  });
  ```
- Ignore the default resources and return different resources:
  ```javascript
  var result = new Array();
  result[0] = resources["resource1"];  
  result[1] = resources["resource2"];  
  return result;
  ```

Editing an existing resource pool

Use this page to modify any specifications for the resource pool.

Click OK to save the information and update the resource pool.

Unusable resources

Resources, whether in a pool or not, are not considered usable if any of the following are true:

- The resource does not exist.
- The resource is disabled.
- The resource does not have a host name.
- The agent where the resource is associated is not reachable.
- The number of steps running on the resource is equal to the resource step limit.
- The resource is exclusive to a different job using the job exclusiveMode.
- The resource is exclusive to a step in a different job using the step or call exclusiveMode.
- The resource is exclusive to a different step in the same job using the call exclusiveMode. and the other step is not an ancestor of the step.
- The resource is exclusive to a different step in the same job using the step exclusiveMode.
- The job step does not have execute privileges on the resource.
- The resource assignment exceeds the license limit (if any).

Resource Pool Details

This page displays information for the resource pool you selected, including a summary of the specifications supplied to create the resource pool, current resources assigned to this pool, and the ability to add or remove resources.
**Links and actions at the top of the page**

- **Edit** - use this link to go to the Edit Resource Pool page.
- **Access Control** - use this link to go the Access Control page for this resource pool.
- The "star" icon allows you to save this information to your Home page.
- The "curved arrow" icon returns you to the Resource Pools page.
- **Pagination** - Use the "previous" and "next" arrow icons to view the previous or next project. The numbers between the arrow icons display the number of projects you can view and the first number indicates which project [in the list] you are viewing.

**The "tabbed" sections**

The tabs at the top of the table allow you to select the type of information you want to see. The Resource Pool Details page opens with the Resources tab highlighted, so the first table you see is the Resources table. See the following screen example.

This table displays the resources currently included in this pool. The name of the pool ("custom" in our example) follows the Resource Pool Details page title.

![Resource Pool Details](image)

The summary section at the top of the table contains information previously defined when the pool was created:

- **Description** - The text previously supplied for this object when it was created.
- **Ordering Filter** - The Javascript ordering filter (see the New Resource Pool Help topic for more information) or "empty" if no filter was applied.
- **Auto Delete** - When "yes" is specified, the pool will be deleted when the last remaining resource is removed or deleted from the pool.
- **Enabled** - "yes" specifies this pool is enabled for use.

**Links at the top of the table**

- **Add Resources to Pool** - Click this link to see a pop-up dialog to enter a resource name to add to this pool. You can type a name or select from a list of existing resource names. If other resources are already configured, you will see a list from which to select a resource. Click **OK** to add new resources to the pool.
**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Name</td>
<td>The name of the resource. Click on a resource name to go to the Edit Resource page.</td>
</tr>
<tr>
<td>Status</td>
<td>Indicates the current status of the resource.</td>
</tr>
<tr>
<td>Enabled</td>
<td>Indicates whether the resource is enabled. If a resource is disabled, no job steps will be assigned to it. ElectricFlow will use other resources within the pool to satisfy requests for the pool.</td>
</tr>
<tr>
<td>Description</td>
<td>The text previously supplied for this object when it was created.</td>
</tr>
<tr>
<td>Host</td>
<td>Steps assigned to run on this resource will use this host.</td>
</tr>
<tr>
<td>Proxy Agent</td>
<td>The name or IP address of the proxy agent machine.</td>
</tr>
<tr>
<td>Version</td>
<td>The version of the ElectricFlow agent installed on this resource.</td>
</tr>
<tr>
<td>HTTPS</td>
<td>A &quot;checkmark&quot; indicates HTTPS was selected when this resource was created.</td>
</tr>
<tr>
<td>Step Limit</td>
<td>The maximum number of steps that can execute simultaneously on this resource.</td>
</tr>
</tbody>
</table>

**Actions**

- **Ping** - Use this link to check the status of the resource.
- **Remove** - Use this link to remove a resource from this pool.

**Properties tab**

This tab provides a table listing all properties for the resource pool and includes the following functionality:

**Links at the top of the table**

- To create a new property for this resource pool, click the **Create Property** or **Create Nested Sheet** link.
- To view or change privileges on the property sheet, click the **Access Control** link.
**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Name</td>
<td>The name of the property. Click on a property name to edit that property.</td>
</tr>
<tr>
<td>Value</td>
<td>Indicates the value assigned to this property</td>
</tr>
<tr>
<td>Description</td>
<td>A text description previously supplied for your reference only.</td>
</tr>
<tr>
<td>Actions</td>
<td>🗑️ Delete - Use this link to delete this property.</td>
</tr>
</tbody>
</table>

**Zones**

This page displays zones currently available to ElectricFlow and provides other zone operations—create, edit, delete, and so on.

- A zone is a way to partition a collection of agents to secure them from use by other groups. For example, you might choose to create a developers zone, a production zone, and a test zone—agents in one zone cannot directly communicate with agents in another zone.
- A default zone is created during the ElectricFlow installation. The server implicitly belongs to the default zone, which means all agents in this zone can communicate with the server directly (without the use of a gateway).
- Every agent, and all resources defined on that agent, can belong to one zone only.
- Within a zone, agents can be either trusted or untrusted.
  - trusted - the ElectricFlow server verifies the agent's identity using SSL certificate verification.
  - untrusted - the ElectricFlow server does not verify agent identity. Potentially, an untrusted agent is a security risk.

**Links and actions at the top of the table**

- To create a new zone, click the Create Zone link.
- The "star" icon allows you to save this zone information to your Home page.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name supplied when this zone was created. Click on a Zone Name to see the Zone Details panel for that zone.</td>
</tr>
</tbody>
</table>
Zone Details panel

This panel displays the zone name and description for the zone you selected.

**Links and actions at the top of the table**

- **Resources**—Use this link to go to the Resources page.
- **Edit**—Click this link to display the Edit Zone panel. On the Edit Zone panel, you can change the zone name, or you can add or change the zone Description. Click OK after making any changes.
- **Access Control** - Use this link to go to the Access Control page for this zone.
  - Current access privileges are displayed, if any.
  - Add the access control privileges you need for this zone.

Select the Properties tab to view any properties created for this zone, or use the "create" property links to create properties for this zone.

Creating a new zone

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a name of your choice for this zone. The name must be unique among other zone names.</td>
</tr>
</tbody>
</table>
### Field Name | Description
--- | ---
Description | A plain text or HTML description for this object. If using HTML, you must surround your text with `<html> ... </html>` tags. The only HTML tags allowed in the text are: `<a>`, `<b>`, `<br>`, `<div>`, `<dl>`, `<font>`, `<i>`, `<li>`, `<ol>`, `<p>`, `<pre>`, `<span>`, `<style>`, `<table>`, `<td>`, `<th>`, `<tr>`, `<ul>`.  

Click **OK** to see your new zone displayed in the table.  
To add resources to this zone, go to the Resources page.

**Access Control notes**

Resource and Resource Pool continue to inherit from Resources privileges. To create a resource, you must have modify privileges on Resources (this has not changed) and you must have modify privileges on the zone. In addition, to move a resource from one zone to another, you must have modify privileges on both zones and the resource you want to move.

**Gateways**

To communicate with a resource, workspace, or artifact repository server in another zone, a "gateway" must be created. A gateway object contains two resource (agent) machines, for example, GatewayResource1 and GatewayResource2—each configured to communicate with the other. One gateway resource resides in the *source zone* and the other in the *target zone*. A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).

If your company requires the added security of a firewall between zones, gateway agents can be configured to communicate with/through the firewall. Gateway agents can be trusted or untrusted (meaning that they just use HTTPS).

This page displays all gateways currently defined in ElectricFlow and provides other gateway operations—create, edit, delete, and so on.

- A firewall between zones—A gateway resource can be configured to communicate with an intermediary firewall in its path as a proxy to communicate with its peer on the other side of the gateway.

**IMPORTANT:** If the actual gateway agents are behind a load balancer, do not register resources for them in ElectricFlow. The actual gateway agents should be pinged by ElectricFlow only via the load balancer.

- Each gateway records the host/port combination each gateway agent/resource must use to communicate with its peer on the other side of the gateway.
Multiple gateways can be defined for a zone if required. For example, you may have multiple resources in zoneA that need to communicate with each other, but some of those resources also need to communicate with zoneB, while others need to communicate with zoneC only. In this scenario, zoneA would require two gateways—one to zoneB and one to zoneC.

One resource can participate in multiple gateways. For example, assume we have 3 zones, zone1, zone2, and zone3, each created to contain agent/resource machines for a different, specific purpose (production, testing), but we want to share or pass data from a resource in zone1 to another resource in zone2 or zone3:

- We need two gateways:
  - Gateway1 connects ResourceA in zone1 to ResourceC in zone3
  - Gateway2 connects ResourceA in zone1 to ResourceB in zone2
- With this gateway-resource configuration, ResourceA can communicate directly with zone2 or zone3.

**Links and actions at the top of the table**

- To create a new gateway, click the *Create Gateway* link.
- The "star" icon allows you to save this gateway information to your Home page.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The gateway name specified when this gateway was created. Click a gateway name to see the Gateway Details panel for that gateway.</td>
</tr>
<tr>
<td>Enabled</td>
<td>A checkmark in the box indicates that this gateway is enabled.</td>
</tr>
<tr>
<td>Resource 1</td>
<td>The first of two resources required to create a gateway. For actual gateway agents that are behind a load balancer, this is the resource for the inbound or outbound load balancer (not the actual agent).</td>
</tr>
<tr>
<td>Host 1</td>
<td>The external name that Resource 2 uses to communicate with Resource 1. This contains the host name or IP address of Resource 1. If this is blank, the Agent Host Name attribute in Resource 1's definition is used at runtime.</td>
</tr>
<tr>
<td>Resource 2</td>
<td>The second of two resources required to create a gateway. For actual gateway agents that are behind a load balancer, this is the resource for the inbound or outbound load balancer (not the actual agent).</td>
</tr>
<tr>
<td>Host 2</td>
<td>The external name that Resource 1 uses to communicate with Resource 2. This contains the host name or IP address of Resource 2. If this is blank, the Agent Host Name attribute in Resource 2's definition is used at runtime.</td>
</tr>
<tr>
<td>Column Name</td>
<td>Description / Action</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: `&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</td>
</tr>
<tr>
<td>Actions</td>
<td><strong>Delete</strong>—Use this link to delete the gateway on the same row.</td>
</tr>
</tbody>
</table>

**Gateway Details Panel**

This panel displays properties and access control privileges assigned to this gateway. Select the **Properties** tab to see any existing properties or to create properties for this gateway.

**Links and actions at the top of the panel**

- **Edit**—Click this link to display the **Edit Gateway** panel. On the **Edit Gateway** panel, you can change the gateway name or add or change the gateway description.
- **Access Control**—Click this link to go to the **Access Control** page to set access privileges for this gateway.

**Create Gateway Panel**

Enter the following information:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description / Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Name of your choice for this gateway. The name must be unique among other gateway names.</td>
</tr>
<tr>
<td>Description</td>
<td>Plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: `&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;.</td>
</tr>
<tr>
<td>Enabled</td>
<td>Enables the gateway.</td>
</tr>
<tr>
<td>Resource 1</td>
<td>Name of your choice for the first of two required gateway resources. Do not include spaces in a resource name. For actual gateway agents that are behind a load balancer, specify the resource for the inbound or outbound load balancer (not the actual agent).</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description / Action</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Host 1</td>
<td>Agent host name where Resource 1 resides. This external host name is used by Resource 2 to communicate with Resource 1. Specify only the host name or IP address of Resource 1. To use the host name from Resource 1’s definition, leave this field blank.</td>
</tr>
<tr>
<td>Port 1</td>
<td>Port number used by Resource 1. The default is the port number used by the resource.</td>
</tr>
<tr>
<td>Resource 2</td>
<td>Name of your choice for the second of two required gateway resources. Do not include spaces in a resource name. For actual gateway agents that are behind a load balancer, specify the resource for the inbound or outbound load balancer (not the actual agent).</td>
</tr>
<tr>
<td>Host 2</td>
<td>Agent host name where Resource 2 resides. This external host name is used by Resource 1 to communicate with Resource 2. Specify only the host name or IP address of Resource 2. To use the host name from Resource 2’s definition, leave this field blank.</td>
</tr>
<tr>
<td>Port 2</td>
<td>Port number used by Resource 2. The default is the port number used by the resource.</td>
</tr>
</tbody>
</table>

Click **OK** to see your new gateway displayed in the table.

**Edit Gateway Panel**

This panel is populated with previously supplied information to define the gateway. You can change any existing specifications or add new information. Click **OK** to save your changes.

**Access Control Note**

A gateway inherits privileges from the ZonesAndGateways ACL. See the Access Control ("Server Objects" section) Help topic for more information.

**Accessing the Resource Templates in the Automation Platform**

You can generate new resource pools in ElectricFlow by accessing the resource templates from the automation platform UI.
1. Go to Cloud > Pools.

   **Example:**

   ![Resource Pool Example Image]

2. Click Resource Templates.

   The Resource Templates list opens.

   **Example:**

   ![Resource Templates Example Image]

3. (Optional) To view details about a resource template, choose a template and click the Menu button ( ) for it.

   The Context menu opens.

4. Click one of these options:
   - **Details**—The Edit Resource Template Details dialog box opens.
     The tabs that appear in the dialog box depend on the cloud provider specified in the resource template.
   - **Properties**—The Properties dialog box opens.
     You can view and edit the properties that apply to the resource template.
   - **Access Control**—The Access Control page opens.
   - **Track Changes**—The Change History for the resource template opens.
5. To provision the resource template, choose a resource template, click the Menu button ( ), and select Details > Provision.

The Provision Cloud Resources dialog box opens.

**Example:**

![Provision Cloud Resources dialog box](image)

6. Enter the resource pool name, an optional description, and the number of resources in the pool, and then click OK.

**Example:**

![Provision Cloud Resources dialog box](image)

You go to the Job Details page in the automation platform.

**Searching and Filtering**

The page allows you to search for any supported object type.
Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object Type</td>
<td>Use the drop-down menu to select the object you wish to search.</td>
</tr>
</tbody>
</table>
| Criteria         | Click **Add Criteria** one or more times to further define the criteria for your search.  
|                  | • Use the drop-down arrow to select a criteria argument. These arguments are properties. For a description of any of these properties, see the Properties Help topic.  
|                  | • Use the drop-down arrow to select an operator for the search.  
|                  | • Enter a value to search that is based on the selected operator and argument. For example, if you selected Project Name to begin your search and "contains" as the operator, you might want to enter the actual project name in this field or the first few letters if you have multiple projects named in a similar pattern.  |
| Custom Criteria  | Click **Add Custom Criteria** one or more times to enter custom criteria to further define your object search. Type the property name to search, and then select your search operator and the search value.  |

Click **OK** after filling in the fields and to go to the Search Results page.

**Notes:**

- Only the first 450 characters of a property string are searchable. For example, if your property value happens to contain 1500 characters and the information you are trying to find is 800 characters into the property string, the search mechanism will not find it.
- When defining a search on this page, property path references are **not** allowed in search parameters. However, property path references are allowed in the Home page Quick View filters.
- The maximum number of search results that will be returned on the Search Results page is controlled by the server property `ec_ui/maxIds/default`. The out-of-the-box default for this property is 1000. This default can be overridden for a specific object type. For example, the maximum number of jobs to display is controlled using the server property `ec_ui/maxIds/job` that is set to 500 out-of-the box.
The default page size of 100 will be used to display the search results on the Search Results page, unless a user-specified page size is set (this user-specified setting will be used). You can save a user-specified page setting by changing the value in the Records Per Page drop-down field at the bottom of the Search Results page.

The Records Per Page drop-down options are controlled through a server property ec_ui/pageSizeOptions with 10, 20, 50, 100, 250, or 500 as the out-of-the-box value.

Any changes to the properties within the server property sheet ec_ui/maxIds or the server property ec_ui/pageSizeOptions take effect after you log in again.

Context Searching and Filtering

Context searching allows you to search for objects on the current page without having to navigate to a separate Search page. It is available on these pages:

- Projects
- Jobs
- Artifacts
- Artifact versions
- Workflow

In-context search has these capabilities:

- Quick search: Type the search criteria in the text box and click OK to run a quick search.
- Search filters: Enter criteria to filter the results by specific attributes or properties on the selected object, and click OK to run the search.
- Saved searches: Save a search as a named saved search for later use.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Quick search</td>
</tr>
<tr>
<td></td>
<td>The <strong>OK</strong> button also applies to the search filters.</td>
</tr>
<tr>
<td>2</td>
<td>Search filters</td>
</tr>
<tr>
<td>3</td>
<td>Saved searches</td>
</tr>
</tbody>
</table>
Example

**Running Quick Searches**

On the Jobs page, if you do a quick search for "mysql", you get these results:

![Quick search results for "mysql"](image1)

If you do a quick search for "mariadb", you get these results:

![Quick search results for "mariadb"](image2)

**Saving Filters**

To save the filter for jobs containing "mysql" in the job name:

1. Click **Save**.

   Example:

   ![Save filter button](image3)

   The **Save Filter** dialog box opens.
2. Enter the filter name in the **Filter Name** field and click **OK**.

**Example:**

![Filter Name dialog box](image)

The **Saved Filter** field now shows that there is a saved filter called `mysql`.

![Saved filter example](image)

When you have more than one saved filter, click on the down arrow to see the list of filters you have saved. The saved filters are user-specific so you will only see your saved filters and not other users' filters.

![Filter list example](image)

**Setting Search Filters**

To add filters for search:

1. Click **Show** to show the filters.

   The **Add Criteria** and **Add Custom Criteria** options appear along with the filter fields.

2. Click **Add Criteria** to add criteria.

3. In the first field, select the search filter argument.

4. In the second field, select the operator for the filter.
5. In the third field, select the criteria to narrow down your search. The available options depend on the argument you selected.

6. To add another filter, enter a value in the Quick Search text box, click Add Criteria, or click Custom Criteria.

7. Repeat the previous step to add as many filters as you want.

8. To run the search, click OK.

This is an example of a search with three filters:

You can also save this filter as "High priority jobs".

Search Results

This page displays the results of the search you defined.

- If the results were not as expected, click the Edit Search link to modify your search criteria.
- Click the New Search link to define a new object you need to find.
• Click the **Save Report Filter** link if you want to save this filter for future use in a report. In the pop-up screen, enter a name for the filter and click **OK**. The Saved Filter will be stored as a property in your chosen project.

• To continually monitor the status of your found object, click the **Refresh Search** link.

**Notes:**

If you need to refer to this page on a regular basis, mouse-over the "star" icon to add this page to the Shortcut section on your Home page.

If you use RSS, an active RSS icon is provided in Windows Explorer on this page for your convenience. If you use Firefox, click **Bookmarks** > **Subscribe to this page** to display the feed. You can then add the feed URL to a viewer of your choice.

**Server**

This page displays overall information about the ElectricFlow server.

These links are at the top of the table:

• Click the **Settings** link to go to the Edit Server Settings page.
  Use this page to edit properties for the ElectricFlow server.

• Click the **Access Control** link to go to the Access Control page for the server.
  See the **Access Control** Help topic for more information.

The tables have this Information:

• The System Access Control table displays top-level properties.
  Click on an item in the Category column to see, add, or modify privileges for that object.

• In the Custom Server Properties table, click on a Property Name to view the property content.
  If using **ectool**, these properties can be accessed using the property name starting with "/server".

  See the **Properties** Help topic for more information.

These links are provided within the table:

○ **Create Property** - Use this link to create a new server property.

○ **Create Nested Property** - Use this link to create a new nested server property.

○ **Access Control** - This access control link allows you to create or edit privileges for the property sheet.

• The Actions column allows you to Edit or Delete the property in that row.

**Settings - edit existing property settings**

Use this page to edit property settings for the ElectricFlow server or any integrations that you use with ElectricFlow. If you access this page from the Server page, the page is named Edit Server Settings. This page contains fields for editing ElectricFlow server properties. From Perforce, the page is named Edit Perforce Settings, and the editable fields are specific to Perforce functionality.
The following screen example is from the Edit Server Settings page. For more information about any setting, click the setting name to see a tooltip that describes the setting.

Click **OK** to save the settings.

If you must change these settings frequently, add this page to your Home page for quick access by clicking the star icon in the upper right corner.

**Source Control Configurations**

This web page displays all source control configurations you have created to communicate with ElectricFlow.

**Link at the top of the table**

- Use the **Create Configuration** link to create a new or additional source control configuration.

**Table column definitions**

- **Configuration Name** - This is the name you chose for this source control configuration.
Description - This is the plain text or HTML description you provided for this source control configuration.

Plugin - This is the ElectricFlow plugin associated with this source control configuration.

Actions -

Edit - Use this link to modify information previously supplied to configure this source control system.

Delete - Use this link to remove this source control configuration.

Source Control Configurations - create new or edit existing configuration

Use this page to define a new source control configuration (SCM) or modify an existing source control configuration. A configuration is a collection of properties that define how to communicate with a particular source control system.

ElectricFlow bundles and supports numerous source control types.

- After creating a source control configuration, your entry will appear in the table on the Source Control Configurations web page— to see this web page, select the Administration > Source Control tabs.
- Other SCM systems are bundled with ElectricFlow and available in the Plugin Catalog. Each integration contains options specific to that SCM.
- The following SCM integrations are provided as examples.

AccuRev
ClearCase
File
Git
Perforce
Property
Subversion

**Note:** If you need a different SCM, not specified in this Help topic, go to the Plugin Manager page to locate your SCM (Administration > Plugins). See the Help topic associated with your plugin - located on the Plugins page. At a minimum, you need to enter a name for your configuration and you may want a minimal text description.

**AccuRev**

Enter information in the fields as follows:

Configuration Name - Type a name for the configuration— any name you choose, but the name must be unique. For example, you might use "myAccuRevServer."

Description - You can change or modify the default text description - ElectricFlow does not use this information.
Login As

User Name - The name ElectricFlow needs to use to communicate with your AccuRev system. For example, you may be using a special "read-only" user name similar to "Build" for your user name.

Password - The password for the specified User Name.

Retype Password - Type the password again.

Click **Submit** to save your information.

ClearCase

Enter information in the fields as follows:

Configuration Name - Type a name for the configuration—any name you choose, but the name must be unique. For example, you might use "myClearCaseServer."

Description - You can change or modify the default text description - ElectricFlow does not use this information.

Click **Submit** to save your information.

File

You may want to use this configuration with ElectricSentry to "watch" for changes in any files.

Enter information in the fields as follows:

Configuration Name - Type a name for the configuration—any name you choose, but the name must be unique.

Description - You can change or modify the default text description - ElectricFlow does not use this information.

Click **Submit** to save your information.

Git

Enter information in the fields as follows:

Configuration Name - Type a name for the configuration—any name you choose, but the name must be unique.

Description - You can change or modify the default text description - ElectricFlow does not use this information.

Click **Submit** to save your information.

Perforce

Enter information in the fields as follows:

Configuration Name - Type a name for the configuration—any name you choose, but the name must be unique. For example, you might use "myPerforceServer."
Description - You can change or modify the default text description - ElectricFlow does not use this information.

Login As

User Name (P4USER) - The name ElectricFlow needs to use to communicate with your Perforce system. For example, you may be using a special "read-only" user name similar to "Build" for your user name.

Password (P4PASSWORD) - The password for the specified User Name.

Retype Password - Type the password again.

P4PORT - Sets the hostname and port number ElectricSentry uses to contact the Perforce server (hostname:1234).

P4HOST - The name of the host machine to impersonate.

P4TICKETS - The full path name of the ticket file used by the "p4 login." This value is set as an environment variable, not as a command-line option (fullPathAndFileName)

P4CHARSET - Sets the character set used for translation of Unicode files (charsetSet)

P4COMMANDCHARSET - Used to support UTF-16 and UTF-32 character sets (commandCharSet).

Click Submit to save your information.

Property

You may want to use this configuration with ElectricSentry to "watch" for any property changes.

Enter information in the fields as follows:

Configuration Name - Type a name for the configuration—any name you choose, but the name must be unique.

Description - You can change or modify the default text description - ElectricFlow does not use this information.

Click Submit to save your information.

Subversion

Enter information in the fields as follows:

Configuration Name - Type a name for the configuration—any name you choose, but the name must be unique. For example, you might use "mySubversionServer."

Description - You can change or modify the default text description - ElectricFlow does not use this information.

Login As

User Name - This is the name ElectricFlow needs to use to communicate with your Subversion system. For example, you may be using a special "read-only" user name similar to "Build" for your user name.

Password - This is the password for the specified User Name.
Retype Password - Type the password again.

Click Submit to save your information.

Checking out code from a source control system

Go to Projects > select a project > select a procedure.
To create a New Step for source code management, select the Plugin link.
- In the Choose Step panel, select Source Code Management from the left pane, then select the SCM you configured.
- The right-pane now shows the types of steps available for your configuration. Select the step you need and automatically go to the New Step page.
- On the New Step page, notice the Subprocedure section now contains the SCM integration you configured and the step you chose.
- Enter the remaining information to create your SCM step.

To edit an existing source control configuration

Modify any of your source control configuration information by "typing-over" any previously entered information.

Click Submit to save your modified source control information.

Active Users

This page displays all users known to this ElectricFlow server, including users defined locally within the server and those defined in external repositories such as LDAP or ActiveDirectory.

Active Users are those persons who have logged into ElectricFlow, although if a another user views a selection of user accounts, those users [viewed] will appear on the Active Users page also.

Click the Show Inactive Users link to go to the All Users web page—this page lists all users: local, LDAP or Active Directory, active, or inactive. If you delete an LDAP or Active Directory user from this [Active Users] page, the user will not be deleted from the All Users page.

- To edit local user content, click on the user name you want to modify.
- To create a new local user, click the Create Local User link at the top, right-side of the table.
- To delete a local user, click the Delete link in the Action column for that user.
- Click the "star" icon at the top, right-side of the table if you want to add this page to your Shortcut section on the Home page.

While you can view external user content, you must go to the LDAP or ActiveDirectory repository to edit external user information. However, you may associate properties with external users and then use those properties in ElectricFlow.

In the Filter field, enter a string to be used to filter users. The filter will automatically apply a trailing "*" to find all users starting with the entered text. Use * for wildcards (for example, searching for "foo" will return all users that include the string foo).
To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

**Users and Groups**

Use this page to view a filtered list of ElectricFlow local users or groups.

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter</td>
<td>Enter a partial name to retrieve the list of all users or groups that match that name.</td>
</tr>
<tr>
<td>Maximum Results</td>
<td>Enter the number of results you would like to see returned. Default is 100.</td>
</tr>
<tr>
<td></td>
<td><strong>Caution:</strong> Currently, ElectricFlow has no upward limit, but if you enter a number of 1000 or higher, you may overload your browser, which will result in performance degradation or worse.</td>
</tr>
<tr>
<td>Include Inactive [User/Group]</td>
<td>Use this check box only if requesting external LDAP or Active Directory providers.</td>
</tr>
<tr>
<td></td>
<td>• If &quot;checked,&quot; all available users or groups are returned.</td>
</tr>
<tr>
<td></td>
<td>• If not checked, only those users or groups known to the ElectricFlow server are returned, for example, users who have logged in or groups containing users who have logged in.</td>
</tr>
</tbody>
</table>

Click **OK** to begin the search.

**Links at the top of the page**

**Create Local [User/Group]** - Click this link to create a new user or group - for users or groups **local** to the ElectricFlow server.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the user or group. The name combined with the location is the unique identifier for this user or group, <strong>local</strong> to the ElectricFlow server. Click the name to see more information.</td>
</tr>
<tr>
<td>Column Name</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Repository</td>
<td>The repository where the user or group is located. &quot;Local&quot; means local to the ElectricFlow server. Other names in this column refer to defined directory providers.</td>
</tr>
<tr>
<td>Location</td>
<td>Only viewable for users or groups from non-local directory providers.</td>
</tr>
<tr>
<td>Real Name (users only)</td>
<td>The full name of the user.</td>
</tr>
<tr>
<td>Email (users only)</td>
<td>The email address for the user.</td>
</tr>
<tr>
<td>Actions</td>
<td><strong>Edit</strong> - Only available for local users and groups. Click to edit the user or group definition.</td>
</tr>
<tr>
<td></td>
<td><strong>Delete</strong> - Click to delete the user from the ElectricFlow server.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong>: This delete function does not delete non-local users from an LDAP or Active Directory repository.</td>
</tr>
</tbody>
</table>

**User - create new or edit existing local user**

Use this page to create or modify a *local* user *only*.

ElectricFlow supports two kinds of user accounts: those defined externally in an LDAP or Active Directory system, and *local* users defined in this ElectricFlow server.

Local users are not visible outside ElectricFlow.

We recommend using external accounts whenever available, but you may need to create local users if you do not have a shared directory service or if you need special accounts to use for ElectricFlow only.

**To create a new local user**

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Name</td>
<td>Enter the name of the user account to be used for login</td>
</tr>
<tr>
<td>Real Name</td>
<td>Enter the user’s real (given) name.</td>
</tr>
<tr>
<td>Email</td>
<td>Enter the user’s email address.</td>
</tr>
<tr>
<td>Password</td>
<td>Enter the user’s login password.</td>
</tr>
</tbody>
</table>

Click **OK** to save the new local user data.
Note: If you do not assign a password when creating the user, the user cannot log into ElectricFlow. You can use this mechanism while you are setting up the user account. Once the user account is fully set up, you only need to assign a password.

To edit an existing local user

- You may highlight and type-over any previously entered user information.
- If you leave the password fields blank and click OK, the existing password remains unchanged.
- To change the user’s password, enter the new password for the user, AND also enter the current admin password.

Click OK to save the modified user data.

Use this page to modify user properties or assign Custom User Properties. Select the Create Property, Create Nested Sheet, or Access Control links to set the properties you need.

Note: To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow click the Administration > Directory Providers tabs.

User Details

This page displays external user information retrieved from a repository such as LDAP or Active Directory.

To edit external user information, you must connect directly to the repository to modify external user content. However, you can associate properties with an external user and then use those properties in ElectricFlow.

Use this page to modify user properties or assign Custom User Properties. Select the Create Property, Create Nested Sheet, or Access Control links to set the properties you need.

Definitions for summary information at the top of page:

- **Name**: The name this user is known by in the system.
- **Repository**: Usually LDAP or Active Directory.
- **Real Name**: The real, given name for user.
- **Email**: The user's email address as known within the system.
- **Groups**: This field displays all groups where this user is a member. Clicking on a group name displays the Group Details page, which lists all members who belong to that group.
• **Parent Groups**: This field is displayed only for remote or external users if the repository (directory provider) to which the user belongs is configured to **Recursively Traverse Group Hierarchy** (the **Recursively Traverse Group Hierarchy** option is selected when directory provider is defined). This field displays all the groups in the LDAP or Active Directory server hierarchy in which the user's immediate groups are members.

If a user is in this hierarchy:

- The user belongs to "SFO" group.
- The "SFO" group belongs to "California" group.
- The "California" group belongs to "US" group.

Then the **Parent Groups** field for the user will display "California, US" while the **Groups** field will display "SFO".

**Note**: To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

**Edit User Settings**

Use this page to modify your User Settings for the product tab view. Depending on which view you choose, you can have limited access to ElectricFlow features and functions.

In the Tab View, use the pull-down menu to make a new selection:

- **Default**: Selecting this view provides all regular/standard product tab views, including plugins, which by default are installed into this view.
- **Base**: This view removes the ability to use a plugin. You can see the plugin list (accessed by selecting the Plugins tab), but you are denied access to configure, install, uninstall, or promote a plugin.
- **Inherit**: Frequently this view is set for a group. The UI searches for the property, `ec_ui/defaultView`, first on the user, second in any groups the user belongs to, and last, on the server. The inherit setting clears the user's private defaultView setting and then picks up the first value from the rest of the search path.

Click **OK** after selecting a different tab view.

**Groups**

This page displays all groups known to this ElectricFlow server, including groups defined locally within the server and those groups defined in external repositories such as LDAP.

- To edit a **local** group, click on its name.
- To create a new local group, click the **Create Local Group** link.
- Click on an **external** group to view its contents, but you cannot edit the content through ElectricFlow. Instead, you must go to the group's repository directly. You can, however, associate properties with external groups, which can then be used in ElectricFlow.
In the **Filter** field, enter a string to be used to filter groups. The filter will automatically apply a trailing '*' to find all groups starting with the entered text. Use '*' for wildcards (for example, searching for '*foo*' will return all groups that include the string 'foo').

To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

**Group - create new or edit existing local group**

**To create a new local group**

Enter information in the fields as follows:

- **Name**: Type a name for the group. Choose any name, but it must be unique among other local group names.
- **Users**: Type a list of users who need to belong to this group—type one user per line.

Click **OK** after populating the group.

**To edit a local group**

- You can highlight the existing group name and type a new name—or
- You can scroll to the bottom of the list of users and type-in additional members for this group, one name per line—or
- You can highlight a user name and press the delete key (on your keyboard) to delete that user from the group.
- Click **OK** after completing your changes.

Also, you can associate custom properties with a group. Select either the **Create Property**, **Create Nested Sheet**, or the **Access Control** links to set up the properties you need.

**Group Details**

This page displays external group information retrieved from a repository such as LDAP or ActiveDirectory.

- To edit external group information, you must connect directly to the repository to modify an external group.
  However, you can associate properties with an external group and then use those properties in ElectricFlow.
- Click the **Access Control** link (at the top of the table) to see the privileges assigned to this group, inherited privileges, add a user or group, and so on.
- You can associate also custom properties with a group. Select the **Create Property**, **Create Nested Sheet**, or the **Access Control** links to set up the properties you need.

**Definitions for summary information at the top of page:**

- **Name**: The name this user is known by in the system.
- **Repository**: Usually LDAP or Active Directory.
• **Users**: This field displays all users that are members of this group.

• **Nested Groups**: This field is displayed only for remote or external groups if the repository (directory provider) to which the user belongs is configured to **Recursively Traverse Group Hierarchy** (the **Recursively Traverse Group Hierarchy** option is selected when directory provider is defined). This field displays all the nested groups that are members of this group's hierarchy in the LDAP or Active Directory server.

If the "SFO" a group is a member of the "California" group and the "California" group is a member of the "US" group, the **Nested Groups** field for the "US" group will display "California, SFO".

**Note**: To configure your existing LDAP and Active Directory account repositories to communicate with ElectricFlow, click the **Administration > Directory Providers** tabs.

### Directory Providers

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository.

*Local* users and groups are defined within ElectricFlow.

**Links at the top of the table**

Click the **Add Active Directory Provider** or the **Add LDAP Provider** link to go to a new web page to configure your Directory Provider.

After configuring your directory provider, that name will appear in the All Providers table, the Provider Name column.

### Column descriptions

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider Name</td>
<td>Click on a Provider Name to make changes to an existing directory provider.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
</tbody>
</table>
| Actions | **Copy** - Use this link to make a copy of the Provider Name configured on this row.  
**Remove** - Use this link to remove the Provider Name on this row. |

Detailed Help for defining a directory provider in ElectricFlow is available from the **New Active Directory Provider** or the **New LDAP Provider** web page.

Click the **Help** link from either web page. The Help text also contains examples you may find useful.
Directory Providers - create new or edit existing directory providers

ElectricFlow supports Active Directory and LDAP directory providers.

This Help topic contains instructions for creating an Active Directory or LDAP directory provider and editing those configurations if you need to make changes at a later time. Use the following links to go the section you need:

- To create a new Active Directory provider
- To create a new LDAP directory provider
- Examples for directory provider field descriptions
- To edit an existing directory provider

To create a new Active Directory provider

Enter information in the fields as follows to specify your existing Active Directory users and groups to communicate with ElectricFlow. For examples of information you enter in these fields, see the table after the following description sections.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General section</strong></td>
<td></td>
</tr>
<tr>
<td>Provider Name</td>
<td>This name identifies users and groups that come from this provider.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt;</code> ... <code>&lt;html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code>, <code>&lt;b&gt;</code>, <code>&lt;br&gt;</code>, <code>&lt;div&gt;</code>, <code>&lt;dl&gt;</code>, <code>&lt;font&gt;</code>, <code>&lt;i&gt;</code>, <code>&lt;li&gt;</code>, <code>&lt;ol&gt;</code>, <code>&lt;p&gt;</code>, <code>&lt;pre&gt;</code>, <code>&lt;span&gt;</code>, <code>&lt;style&gt;</code>, <code>&lt;table&gt;</code>, <code>&lt;tc&gt;</code>, <code>&lt;td&gt;</code>, <code>&lt;th&gt;</code>, <code>&lt;tr&gt;</code>, <code>&lt;ul&gt;</code></td>
</tr>
<tr>
<td>URL Discovery</td>
<td>Select the method to retrieve the URL for the Active Directory server. Auto-discovery using DNS automatically discovers Active Directory servers on the given domain. Alternatively, you can specify a custom URL to an Active Directory server.</td>
</tr>
<tr>
<td>Domain Name</td>
<td>The domain where Active Directory servers are automatically discovered. For example, <code>my-company.com</code></td>
</tr>
<tr>
<td>Use SSL</td>
<td>Select this box if you want to use SSL when the ElectricFlow server contacts your Active Directory server.</td>
</tr>
</tbody>
</table>

**Note:** Transport Layer Security (TLS) has replaced Secure Sockets Layer version 3.0 (SSLv3) on the ElectricFlow web server and the ElectricFlow server.
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>URL</td>
<td>This is an explicit URL to the Active Directory server. The URL is in the form <code>protocol://host:port/basedn</code>. Protocol is either <code>ldap</code> or <code>ldaps</code> (for secure LDAP). The port is implied by the protocol, but you can override the port if you cannot use the default location (default is port 389 for <code>ldap</code> or 636 for <code>ldaps</code>). The <code>basedn</code> is the path to the top-level directory that contains users and groups at this site. Typically, this is the domain name where each part is listed with a <code>dc=</code> and separated by commas. <strong>Note:</strong> Spaces in the <code>basedn</code> must be URL encoded (use <code>%20</code> for spaces). If your site uses redundant directory servers for failover, you can enter multiple URLs separated by spaces.</td>
</tr>
<tr>
<td>Query User Name</td>
<td>The name of a user who has read-only access to user and group directories in Active Directory. This is the user name to use for fetching user and group information. When you provide a domain name, you can provide the simple name, for example, <code>myuser</code>. When you provide an explicit URL, you need to provide a distinguished name, for example: <code>cn=myuser,ou=Users,dc=electric-cloud,dc=com</code>.</td>
</tr>
<tr>
<td>Query User Password</td>
<td>The password for the query user.</td>
</tr>
</tbody>
</table>

**Membership Options section**

**Note:** The membership options control whether the nested group hierarchy in the configured Active Directory server will be used by ElectricFlow. See [LDAP Group Hierarchy](#) on page 859 for details on how the nested group hierarchy in Active Directory is used by ElectricFlow.

<table>
<thead>
<tr>
<th>Recursive Traverse Group Hierarchy</th>
<th>Select this to enable recursive traversal of the group hierarchy for nested group membership information.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: If <strong>Recursively Traverse Group Hierarchy</strong> is selected, select the <code>LDAP_MATCHING_RULE_IN_CHAIN</code> template for both the <strong>Membership Filter</strong> and <strong>Group Member Filter</strong> fields in the “Group Options” section to allow Active Directory to return the nested group membership information.</td>
<td></td>
</tr>
<tr>
<td>Membership Filter</td>
<td>Active Directory filter to use when searching for groups to which an Active Directory user or group belongs.</td>
</tr>
<tr>
<td>Include Nested Group Users in Notifications</td>
<td>Select this to include users in nested Active Directory groups when notifications for a parent Active Directory group are sent and <strong>Recursively Traverse Group Hierarchy</strong> is selected.</td>
</tr>
</tbody>
</table>
### Field Name

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Include Nested Group Users as Approvers</td>
<td>Select this to allow users in nested Active Directory groups to complete or approve a manual task when a parent Active Directory group is assigned as an assignee or an approver for the task and <strong>Recursively Traverse Group Hierarchy</strong> is selected. <strong>Note:</strong> Because users who are authorized to approve the manual task will typically also be notified of the approval request, we recommend that <strong>Include Nested Group Users in Notifications</strong> be selected (enabled) when <strong>Include Nested Group Users as Approvers</strong> is selected.</td>
</tr>
</tbody>
</table>

**User Options section**

**Note:** When creating an Active Directory provider, the ElectricFlow server automatically sets default values for any options (fields) that are empty. The default values match the most common Active Directory configurations. After the provider is created, you can view and modify defaults by modifying the provider.

<table>
<thead>
<tr>
<th>User Base</th>
<th>This string is prepended to the <code>basedn</code> to construct the directory DN containing user records.</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Search Filter</td>
<td>This LDAP query is performed in the context of the user directory to search for a user by account name. The string <code>{0}</code> is replaced with the user's login ID. Typically, the query compares a user record attribute to the substituted user login ID.</td>
</tr>
<tr>
<td>User Name Attribute</td>
<td>This is the attribute in a user record that contains the user's account name.</td>
</tr>
<tr>
<td>Full User Name Attribute</td>
<td>(optional) This is the attribute in a user record that contains the user's full name (first and last) for display in the UI. If this attribute is not specified or the resulting value is empty, the user's account name is used instead.</td>
</tr>
<tr>
<td>User Email Attribute</td>
<td>(optional) This is an attribute in a user record that contains the user's email address. If this attribute is not specified, the account name and domain name are concatenated to form an email address.</td>
</tr>
<tr>
<td>Search User Subtree</td>
<td>Select this check box to search the specified directory by the user base and all directories below. If this check box is not selected, the search is limited to the specified directory only.</td>
</tr>
</tbody>
</table>
### Group Options section

**Note:** If you do not need group information at this time, do not enter information in the Group section, the group test fails without this information, but the test successfully authenticates users if both "user tests" are successful.

When creating an Active Directory provider, the ElectricFlow server automatically sets default values for the options/fields that remain empty. These default values match the most common Active Directory configurations. After the provider is created, you can view and modify the defaults by modifying the provider.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable Groups</td>
<td>Select this check box to enable external groups for this directory provider.</td>
</tr>
<tr>
<td>Group Base</td>
<td>(optional) This string is prepended to the basedn to construct the directory DN containing group records.</td>
</tr>
<tr>
<td>Group Member Filter</td>
<td>(optional) This LDAP query is performed in the groups directory context to identify groups that contain a specific user. Two common forms of group records in LDAP directories are: POSIX style groups where members are identified by account name, and groupOfNames or uniqueGroupOfNames records where members are identified by the full user DN. ElectricFlow supports both forms, so the query is passed two parameters: &quot;[0]&quot; is replaced with the full user record DN, and &quot;[1]&quot; is replaced with the user's account name.</td>
</tr>
<tr>
<td>Group Member Attributes</td>
<td>(optional) This is a comma-separated attribute name list that identifies a group member. Most LDAP configurations only specify a single value, but if a mixture of POSIX and LDAP style groups exist in the directory, multiple attributes might be required.</td>
</tr>
<tr>
<td>Group Search Filter</td>
<td>(optional) This LDAP query is performed in the context of the groups directory to enumerate group records. You can choose from common templates that include either security or distribution groups (or both). These templates are based on the most common Active Directory settings.</td>
</tr>
<tr>
<td>Unique Group Name Attribute</td>
<td>(optional) This is the group record attribute that contains the group name. To prevent group name overlap between multiple directory providers (or within the same provider in a multi-forested Active Directory server), we recommend setting this attribute to the distinguishedName.</td>
</tr>
<tr>
<td>Common Group Name Attribute</td>
<td>The Unique Group Name Attribute may not be searchable if using the distinguishedName. In this case, the Common Group Name Attribute can be used to search for groups, depending on the filter used.</td>
</tr>
</tbody>
</table>
After filling-in all fields, click the Test button.

Three tests validate the information you supplied:
  - user authentication
  - user identified in Active Directory
  - find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest.

Click Save after successful test results.

New, defined directory providers will appear in the table on the Directory Provider web page.

To create a new LDAP directory provider

Enter information in the fields as follows to specify your existing LDAP users and groups to communicate with ElectricFlow. For examples of information you enter in these fields, see the table after the following description sections.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General section</strong></td>
<td></td>
</tr>
<tr>
<td>Provider Name</td>
<td>This name identifies users and groups that come from this provider.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: `&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</td>
</tr>
<tr>
<td>URL</td>
<td>The LDAP server URL is in the form <code>protocol://host:port/basedn</code>. Protocol is either <code>ldap</code> or <code>ldaps</code> (for secure LDAP). The port is implied by the protocol, but you can override the port if you cannot use the default (default port is 389 for <code>ldap</code> and 636 for <code>ldaps</code>). The <code>basedn</code> is the path to the top-level directory that contains users and groups at this site. Typically, this is the domain name where each part is listed with a <code>dc=</code> and separated by commas. <strong>Note:</strong> Spaces in the <code>basedn</code> must be URL encoded (use <code>%20</code> for spaces). If your site uses redundant directory servers for failover, you can enter multiple URLs separated by spaces.</td>
</tr>
<tr>
<td>Realm</td>
<td>This is the realm of the LDAP directory provider, which is used to create unique user names when you have multiple providers. For example, if the realm is <code>my-company.com</code>, users are saved as <code>myuser@my-company.com</code>.</td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Query User Name</td>
<td>This is the name of a user who has read-only access to the user and group directories in LDAP. This is the user name to use for fetching user and group information. When providing a domain name, you can provide the simple name, for example, myuser. When providing an explicit URL, you need to provide a distinguished name, for example: cn=myuser,ou=Users,dc=electric-cloud,dc=com.</td>
</tr>
<tr>
<td>Query User Password</td>
<td>This is the password for the query user.</td>
</tr>
<tr>
<td><strong>Membership Options section</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Note:</strong> The membership options control whether nested group hierarchy in the configured LDAP server will be used by ElectricFlow. See LDAP Group Hierarchy on page 859 for details on how the nested group hierarchy in the LDAP server is used by ElectricFlow.</td>
<td></td>
</tr>
<tr>
<td>Recursively Traverse Group Hierarchy</td>
<td>Select this to enable recursive traversal of the group hierarchy for nested group membership information.</td>
</tr>
<tr>
<td>Membership Attribute</td>
<td>Attribute defined on an LDAP user or group entry that is used by the LDAP provider for specifying the group membership. memberOf is the membership attribute used by most LDAP servers.</td>
</tr>
<tr>
<td>Nested Groups Depth Limit</td>
<td>Maximum number of group hierarchy levels that will be traversed for retrieving nested group membership information.</td>
</tr>
<tr>
<td><strong>Note:</strong> Setting a high value for this option will impact the system performance when traversing the LDAP group hierarchy because a higher group hierarchy depth will result in a proportionally large number of network calls between the Electric Flow system and the LDAP server. The actual performance will depend on the system configurations of the ElectricFlow servers, the LDAP server, and the network latency.</td>
<td></td>
</tr>
<tr>
<td>Include Nested Group Users in Notifications</td>
<td>Select this to include users in nested LDAP groups when notifications for a parent LDAP group are sent and Recursively Traverse Group Hierarchy is selected.</td>
</tr>
</tbody>
</table>
## Field Name | Description
---|---
Include Nested Group Users as Approvers | Select this to allow users in nested LDAP groups to complete or approve a manual task when a parent LDAP group is assigned as an assignee or an approver for the task and **Recursively Traverse Group Hierarchy** is selected.

**Note:** Because users who are authorized to approve the manual task will typically also be notified of the approval request, we recommended that **Include Nested Group Users in Notifications** be selected (enabled) when **Include Nested Group Users as Approvers** is selected.

### User Options section

<table>
<thead>
<tr>
<th>User Base</th>
<th>This string is prepended to the <code>basedn</code> to construct the directory DN containing user records.</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Search Filter</td>
<td>This LDAP query is performed in the context of the user directory to search for a user by account name. The string <code>&quot;{0}&quot;</code> is replaced with the user's login ID. Typically, the query compares a user record attribute to the substituted user login ID.</td>
</tr>
<tr>
<td>User Name Attribute</td>
<td>This is the attribute in a user record that contains the user's account name.</td>
</tr>
<tr>
<td>Full User Name Attribute</td>
<td>(optional) This is the attribute in a user record that contains the user's full name (first and last) for display in the UI. If this attribute is not specified or the resulting value is empty, the user's account name is used.</td>
</tr>
<tr>
<td>User Email Attribute</td>
<td>(optional) This is the attribute in a user record that contains the user's email address. If the attribute is not specified, the account name and domain name are concatenated to form an email address.</td>
</tr>
<tr>
<td>Search User Subtree</td>
<td>Select this check box to search the specified directory by the user base and all directories below. If this check box is not selected, the search is limited to the specified directory only.</td>
</tr>
</tbody>
</table>

### Groups Options section

**Note:** If you do not need group information at this time, do not enter information in the Group section, the group test fails without this information, but the test successfully authenticates users if both user tests are successful.

<p>| Enable Groups | Select this checkbox to enable groups. |</p>
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Base</td>
<td>(optional) This string is prepended to the <code>basedn</code> to construct the directory DN containing group records.</td>
</tr>
<tr>
<td>Group Member Filter</td>
<td>(optional) This LDAP query is performed in the groups directory context to identify groups containing a specific user. Two common forms of group records in LDAP directories are: POSIX style groups where members are identified by account name, and <code>groupOfNames</code> or <code>uniqueGroupOfNames</code> records where members are identified by the full user DN. ElectricFlow supports both forms, so the query is passed with two parameters: &quot;{0}&quot; is replaced with the full user record DN, and &quot;{1}&quot; is replaced with the user's account name.</td>
</tr>
<tr>
<td>Group Member Attributes</td>
<td>(optional) This is a comma-separated attribute name list identifying a group member. Most LDAP configurations only specify a single value, but if you have a mixture of POSIX and LDAP style groups in the directory, multiple attributes might be required.</td>
</tr>
<tr>
<td>Group Search Filter</td>
<td>(optional) This LDAP query is performed in the context of the groups directory to enumerate group records.</td>
</tr>
<tr>
<td>Unique Group Name Attribute</td>
<td>(optional) This is the group record attribute containing the group name.</td>
</tr>
<tr>
<td>Common Group Name Attribute</td>
<td>The Unique Group Name Attribute may not be searchable if using <code>distinguishedName</code>. In this case, the Common Group Name Attribute is used if searching for groups, depending on the filter.</td>
</tr>
</tbody>
</table>

*After filling-in all fields*, click the **Test** button.

Three tests validate the information you supplied:

- user authentication
- user identified in LDAP
- find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest.

Click **Save** after successful test results.

New, defined directory providers will appear in the table on the Directory Provider web page.

**Examples for directory provider field descriptions**

The following table provides examples for filling in the fields described above:
<table>
<thead>
<tr>
<th><strong>Field Name</strong></th>
<th><strong>LDAP example</strong></th>
<th><strong>ActiveDirectory example</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider Type</td>
<td>LDAP</td>
<td>ActiveDirectory</td>
</tr>
<tr>
<td>Domain Name</td>
<td>N/A</td>
<td>my-company.com</td>
</tr>
<tr>
<td>Realm</td>
<td>my-company.com</td>
<td>N/A</td>
</tr>
<tr>
<td>URL</td>
<td><code>ldap://dir.company.com/dc=company,dc=com</code></td>
<td><code>ldaps://server/dc=company,dc=com</code></td>
</tr>
<tr>
<td>Query User Name</td>
<td><code>uid=JohnDoe,ou=People,dc=company,dc=com</code></td>
<td><code>cn=myuser,cn=Users,dc=company,dc=com</code></td>
</tr>
<tr>
<td>Query User Password</td>
<td>mypw</td>
<td>mypw</td>
</tr>
<tr>
<td>User Base</td>
<td><code>ou=People</code></td>
<td><code>cn=Users</code></td>
</tr>
<tr>
<td>User Search Filter</td>
<td><code>uid={0}</code></td>
<td><code>(&amp;(userPrincipalName={0}) (sAMAccountName={0})) (objectClass=user) </code></td>
</tr>
<tr>
<td>User Name Attribute</td>
<td>uid</td>
<td><code>userPrincipalName</code></td>
</tr>
<tr>
<td>Full User Name Attribute</td>
<td>gecos</td>
<td>name</td>
</tr>
<tr>
<td>User Email Attribute</td>
<td>mail</td>
<td>mail</td>
</tr>
<tr>
<td>Field Name</td>
<td>LDAP example</td>
<td>ActiveDirectory example</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Group Base</td>
<td>ou=Group</td>
<td>cn=Groups</td>
</tr>
<tr>
<td>Group Member Filter</td>
<td>(</td>
<td>(member={0})(memberUid={1}))</td>
</tr>
<tr>
<td>Group Member Attribute</td>
<td>member,memberUid</td>
<td>member</td>
</tr>
<tr>
<td>Group Search Filter</td>
<td>(</td>
<td>(objectClass=groupOfNames)  (objectClass=posixGroup))</td>
</tr>
<tr>
<td>Unique Group Name Attribute</td>
<td>distinguishedName</td>
<td>distinguishedName</td>
</tr>
<tr>
<td>Common Group Name Attribute</td>
<td>cn</td>
<td>cn</td>
</tr>
</tbody>
</table>

**To edit an existing directory provider**

You may change any previously supplied information in the fields. After editing any fields, click the **Test** button. The same three tests validate the information you supplied:

- user authentication
- user identified in the directory provider
- find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest. Click **Save** after successful test results.

Edited, redefined directory providers will appear in the table on the Directory Provider web page.
Test Directory Provider

You must enter a valid User Name and Password on this page. Omitting or using an incorrect User Name and/or Password results in the test not completing or completing with an error. In either case, you will not obtain successful test results even if the Directory Provider information you supplied is valid and correctly entered into ElectricFlow.

Three tests validate the information you supplied:

- user authentication
- user identified in a directory provider
- find all groups where the user is a member

If there is a test failure, correct the information you supplied and retest by clicking the Test button.

If you do not need group information at this time, and did not enter information in the Group section, the group test fails without this information, but the test successfully authenticates users if both user tests are successful.

Workflows

This page displays all workflows in the ElectricFlow system, both running and completed workflows.

You can search for workflows and save the workflow search filters for later use. See Context Searching and Filtering on page 757 for details on using the search capabilities on this page.

Links and actions at the top of the table

- Sort the Name, Project, State, Modify Time, Workflow Definition, and Completed columns by clicking on the column name.
  After sorting a column, the page changes to a Workflow Search Results page and more search options are available.
- The "star" icon allows you to save this web page to your Home page.
**Column descriptions**

Name - This is the ElectricFlow-generated workflow name, which is defined by the Workflow Name Template setting. Click on any workflow name to go to that workflow's Workflow Details page.

Project - The name of the project containing this workflow. Click on any project name to go to the Project Details page for that project.

State - The current state of the workflow.

Modify Time - The time this workflow was modified.

Workflow Definition - The name of the workflow definition that ran to create this workflow. Click on any workflow definition name to go to that workflow definition's Workflow Definition Details page.

Completed - A "checkmark" in this column indicates the workflow has completed.

Actions - **Delete** - Use this link to delete the workflow on the same row.

**Workflow Definition - create new or edit existing workflow definition**

To create a new workflow definition

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique workflow definition name of your choice. You may want your workflow definition name to reflect the project where it belongs or its purpose. For example, you might set a name based on a product or team using this workflow.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td>Field Name</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Workflow Name Template           | This is the template used to determine the default name of jobs launched from the workflow definition. For example:  

```
${[projectName]}${/increment}myproject/workflowCounter}${/timestamp}
```

(substitute your values for the names above)  

Produces a workflow name like:  

`projectFoo_123_20140102130321`  

Enter any combination of elements to create workflow names more meaningful to you. For example, you could choose to include the build number.  

**Note:** Electric Cloud does not recommend using the ElectricFlow-generated `workflowId` because it is no longer a human-readable integer so it does not provide any identifiable information and cannot be used as a counter. |

Click **OK** to save the information you entered.  

Your new workflow definition will appear on the Project Details > Workflow Definitions page.  

**To edit an existing workflow definition**  

1. To rename the workflow definition, type a new name in the **Name** field and click **OK**.  
2. Change or add to the description or modify the template.  
3. Click **OK** when your edits are complete.  

**Workflow Definition Details**  

This Help topic provides a detailed overview for all views and functionality on this web page. You may want to read this topic in its entirety if this is your first experience with the ElectricFlow Workflow feature. If you are an experienced workflow user, the following quick links will take you to a specific topic section for quick review.  

**A note to existing workflow users:** We recommend reviewing the Graph view section because workflow functionality previously found on other ElectricFlow web pages is now combined for ease-of-use on the Graph page.  

**Graph view**  

To create a New State  

To create a State Definition  

Action
To create a Transition Definition

Using the graph's quick-access features

Show Legend

List view

Properties view

This page displays workflow definition components, including state and transition definition names, types, actions, descriptions, and various links to create additional transitions, state definitions, define access control, run the workflow, and so on. You can view any previously defined workflow objects and create new properties too.

Opening to the Graph view, your first glance at this page will look similar to the following:

Links and actions at the top of the page:

- Above the Workflow Definition Details page title you see (in this example) "Project: Upgrade-End to End". This breadcrumb information tells you which project you are viewing or working with and provides a link back to the project, itself.

- Immediately after the page title, you see "workflow_9", which (for our example) is the name of this workflow.

- Track Changes ( )—Click this to open the Change History page.
Run - Use this link to run the workflow definition. Hover your mouse over the drop-down arrow to see these choices:

- Selecting Run... - allows you to pick the "starting state" to run the workflow. After clicking OK from the Run Workflow pop-up dialog box, the Run Workflow page is displayed. If you previously created parameters for this workflow, they are displayed. You can accept the parameter values or change them before running the workflow.
- Selecting Run Immediately - this option uses the first (default) "starting state" to run the workflow. Note: Clicking Run, without using the down-arrow to make a selection, is the same as selecting Run Immediately.

Access Control - Use this link to set privileges for this workflow definition. For more information, see the Access Control Help topic.

The "star" icon allows you to save this workflow definition to your Home page.

Navigation and view summary

Each button has its own expanded description section following this summary.

- Graph - the page opens in this view. The main portion of this view contains the work area for visually creating your workflow.
- List - this view provides a table displaying states, transitions, and so on in list form.
- Properties - this view provides a table displaying previously created properties and provides links to create additional properties.
- Show Legend - displays a legend for workflow objects.
- Create State - this button produces the State Definition panel where you can create new states as you build or modify your workflow.
- The multi-square directional icons allow you to change your workflow graph from vertical to horizontal, depending on how you choose to see the graph.
- The drop-down menu for percentages allows you to diminish or expand the workflow graph size.

Graph view

To create a workflow, minimally you need to create state definitions and transition definitions. Optimally, those objects will have parameters and properties, and you will want to create or enforce access control and perhaps create one or more email notifiers too. To begin, the following sections describing functionality in this view will familiarize you with how to create workflow objects and end with exploring the graph's quick-access features.

Click the Create State button to create a new state using the State Definition panel.

In the following screen example, you see a New State object added next to the Start state in an existing workflow graph.
To create a new state

After clicking the Create State button, enter information in the State Definition panel as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>(Required) Provide any name of your choice. The name must be unique to this workflow definition. If you do not provide a name, a system-generated name is created: New State, New State 2, and so on.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code>, <code>&lt;b&gt;</code>, <code>&lt;br&gt;</code>, <code>&lt;div&gt;</code>, <code>&lt;dl&gt;</code>, <code>&lt;font&gt;</code>, <code>&lt;i&gt;</code>, <code>&lt;li&gt;</code>, <code>&lt;ol&gt;</code>, <code>&lt;p&gt;</code>, <code>&lt;pre&gt;</code>, <code>&lt;span&gt;</code>, <code>&lt;style&gt;</code>, <code>&lt;table&gt;</code>, <code>&lt;tc&gt;</code>, <code>&lt;td&gt;</code>, <code>&lt;th&gt;</code>, <code>&lt;tr&gt;</code>, <code>&lt;ul&gt;</code>.</td>
</tr>
<tr>
<td>Startable</td>
<td>Select this checkbox if you want this state to be your workflow &quot;starting&quot; state. The first state in any workflow definition is saved as Startable, but you can change this later.</td>
</tr>
</tbody>
</table>

Click OK and the State Definition panel provides options to configure your new State Definition.
To configure the new State Definition

In the State Definition Panel, the state name appears at the top. In this example in this topic, "New State" is the state name.

Configure the following settings.

**Links at the top of the panel**

- **Access Control** - use this link to add or modify access control privileges for this state (link not illustrated in the State Definition panel example above).
- **Edit** - use this link to modify this state's name, description, or whether or not the state is **Startable**.
- **View in list** - displays the List view to see the state definition in the Workflow Definition Details table. This state will be highlighted in the List view.
- **Create Transition** - displays the Transition Definition panel to create a transition for this state.

**The "tabbed" or button sections**

**Action**

As each state in a workflow becomes active, it performs an action. The state’s action can be to create a job from a procedure or to start a workflow from a workflow definition. When the job or called workflow completes, On Completion transitions are evaluated to see if the workflow should change to a different state, possibly based on the outcome of the action.

Selecting **No action**, **Procedure**, or **Workflow** changes the fields that appear under these choices.

- **No action** - if selected, no other information is required. Click **OK**.
- **Procedure** - this selection displays the following fields:
  - **Current** - this selection refers to the project that contains the workflow definition.
  - **Project** - if selected to call a different project, start typing in the text box to display a list of (non-plugin) projects from which to select. Only the first 10 matches are displayed. Type more characters to refine the list.
  - **Plugin** - if selected, start typing in the text box to display a list of plugin projects from which to choose. Only the first 10 matches are displayed. Type more characters to refine the list.
- Procedure - start typing in this field to see a list of available procedures from which to select, depending on your previous choice of Current, Project, or Plugin. Only the first 10 matches are displayed. Type more characters to refine the list.

- Workflow - this selection displays the following fields:
  - Similar to selecting Procedure (above), select Current, Project, or Plugin.
  - Workflow - if selected to call another workflow definition, start typing in this text box to display a list of workflow definitions from which to choose. Only the first 10 matches are displayed. Type more characters to refine the list.
  - Starting State - start typing in this field to see a list of available starting states definitions in the workflow definition you selected. Only the first 10 matches are displayed. Type more characters to refine the list.

After selecting the procedure or starting state, press the <Tab> key to leave the field and see a list of parameters for the selected action. After entering any procedure values, click OK to save the changes.

**Notifiers**

Select this tab to see a list of email notifiers previously created for this state definition or to create an email notifier. Notifiers are commonly used to inform interested parties about transitions to the state being defined.

**Note:** Before you can set up an email notifier, you need an email configuration. If you have not already defined an email configuration, you can do it now. Go to Administration > Email Configurations and select the Add Configuration link.

The Notifiers table contains a list of all previous created notifiers for this state definition.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>The name of the email notifier. Select a name to go to the “edit” page for that notifier if you need to make changes.</td>
</tr>
<tr>
<td>Type</td>
<td>The type of email notifier specified during creation.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td>Actions</td>
<td><strong>Delete</strong> - Use this link to delete the notifier on that row.</td>
</tr>
</tbody>
</table>
To create an email notifier, click the Create Notifier link to access the Email Notifier panel.

Enter information in the fields as follows:
<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>(Required) This name can be any text string you choose. The name must be unique among other notifier names in this project, on procedures or workflow definitions called from other projects.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt; &lt;b&gt; &lt;br&gt; &lt;div&gt; &lt;dl&gt; &lt;font&gt; &lt;i&gt; &lt;li&gt; &lt;ol&gt; &lt;p&gt; &lt;pre&gt; &lt;span&gt; &lt;style&gt; &lt;table&gt; &lt;tc&gt; &lt;td&gt; &lt;th&gt; &lt;tr&gt; &lt;ul&gt;</code></td>
</tr>
<tr>
<td>Type</td>
<td>Use the pull-down menu to choose a type:</td>
</tr>
<tr>
<td></td>
<td>• On Completion Notifier - sends an email after the state's job or workflow completes. If no job or workflow is defined for that state, these notifiers will not be sent.</td>
</tr>
<tr>
<td></td>
<td>• On Enter Notifier - sends an email when the state becomes the workflow's active state.</td>
</tr>
<tr>
<td></td>
<td>• On Start Notifier - sends an email after the state's job or workflow starts. If no job or workflow is defined for that state, these notifiers will not be sent.</td>
</tr>
<tr>
<td>Condition</td>
<td>Use the pull-down menu to select the type of condition you need for this email notifier. Edit the auto-supplied condition in the text box or add a completely new script for your purpose. The condition specifies whether the notifier should send a message depending on the result of a property expansion. If the result is empty or non-zero, the message is sent. If the result is &quot;0&quot;, the message is not sent.</td>
</tr>
<tr>
<td>Template</td>
<td>Use the pull-down menu to select from a list of global, ready-to-use formatting templates. Depending on the type of email notifier you are creating, the available template choices in the drop-down menu will be different.</td>
</tr>
<tr>
<td></td>
<td>(Required) To customize your template, edit the auto-supplied text in the text box or you can add a completely new script for your purpose. Any edits made in this text box will not be saved to the global template.</td>
</tr>
<tr>
<td></td>
<td>To create a custom template, the basic structure is:</td>
</tr>
<tr>
<td></td>
<td>• zero or more email header lines</td>
</tr>
<tr>
<td></td>
<td>• blank line</td>
</tr>
<tr>
<td></td>
<td>• message body</td>
</tr>
</tbody>
</table>
### Email Configuration

Click inside this field or start typing to bring up a list of possible email configuration names. An email notifier that does not specify an email configuration will use the configuration named 'default' if it exists.

### Destinations

(Required) This is a space-separated list of valid email addresses, email aliases, or ElectricFlow user or group names, or a property reference that expands into such a list, or you can enter an LDAP DL name (group name).

Click **OK** to save your email notifier configuration. The next time you view the Notifier table, you will see this notifier in the list.

### Parameters

Similar to Notifiers, a parameter table is displayed containing all formal parameters defined for this state definition. Parameters are presented when launching the workflow definition (if it is startable), or when taking a manual transition to the state. A transition may enter values for some or all of the formal parameters defined by the state definition, in which case only the unmapped parameters are presented to the user.

- **Create Parameter** - Use this link to go to the New Parameter page to create a parameter for this state definition.

If you need assistance with creating a parameter, click the **Help** link in the upper-right corner of the New Parameter page.

### Properties

Similar to the Notifiers and Parameters table, a properties table is displayed containing available properties for this state definition. If no properties were defined for this state definition, the table does not exist.

Click one of the available links to create one or more properties that will be displayed in the table when created:

- **Create Property** - Click this link to go to the New Property pop-up box to create a new property for this state definition.

- **Create Nested Sheet** - Click this link to go the New Nested Property Sheet pop-up box to create a nested property.

- **Access Control** - Click this link to go to the Access Control page for the property sheet.

The property pop-up boxes contain a Help link if you need assistance creating a property.

### To create a Transition Definition

On the State Definitions panel, click the **Create Transition** link to see the Transition Definition panel:
Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>(Required) Enter a unique name for the transition definition. It can be any name you choose, but the name must be unique within the state definition. If you do not provide a name, a system-generated name is created: New Transition, New Transition 2, and so on.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code>, <code>&lt;b&gt;</code>, <code>&lt;br&gt;</code>, <code>&lt;div&gt;</code>, <code>&lt;dl&gt;</code>, <code>&lt;font&gt;</code>, <code>&lt;i&gt;</code>, <code>&lt;li&gt;</code>, <code>&lt;ol&gt;</code>, <code>&lt;p&gt;</code>, <code>&lt;pre&gt;</code>, <code>&lt;span&gt;</code>, <code>&lt;style&gt;</code>, <code>&lt;table&gt;</code>, <code>&lt;tc&gt;</code>, <code>&lt;td&gt;</code>, <code>&lt;th&gt;</code>, <code>&lt;tr&gt;</code>, <code>&lt;ul&gt;</code></td>
</tr>
<tr>
<td>Target State</td>
<td>This field displays the &quot;best guess&quot; for the target state. If not correct, or you intended to create a transition for a different state, use the down-arrow to choose an available target state from the list.</td>
</tr>
</tbody>
</table>
### Field Name: Trigger

Use the drop-down menu to choose the transition type.

The four types of transitions are:

- **On Completion** - transition occurs when the action completes. These transitions are ignored if no action is specified for the source state.  
  **Note:** On Completion transitions are taken only if the state is still active when the action completes, and are ignored if the workflow has transitioned to another state—this can occur if an On Start or Manual transition occurred before the action completed.
- **On Enter** - transition occurs before sending notifiers or starting the action.
- **On Start** - transition occurs immediately after starting the action. These transitions are ignored if no action is specified for the source state.
- **Manual** - transition occurs when a user selects the transition in the UI and specifies parameters. The same action can occur using ectltool or the Perl API by calling `transitionWorkflow`. Only users who have "execute" permission on the transition are allowed to use a Manual transition.

### Field Name: Condition

Use the drop-down menu to choose a condition. After selection, the text box is populated with a sample JavaScript string to edit for your purposes.

**Note:** If you select Custom, no sample is provided. Enter a script in the text box. We recommend using JavaScript.

Click **OK** to save your transition definition.

Notice the new links and options available now:

- **Access Control**—Use this link to add or modify access control privileges to this transition definition.
- **Edit**—Use this link to modify the transition definition.
- **View in list**—Use this link to see the new transition definition in the List view (table) on the Workflow Definition Details page. You can use the List view to move the transition to a different position within the state definition.
- **Parameters**—If parameters were defined on the State Definition Details page, you will not see them here. If parameters are defined on this page, you need to enter values. Manual transitions allow you to defer parameter assignment until transition time.
- **Properties**—Displays properties available for this object or you can create one or more properties at this time.

**Using the graph's "quick-access" features**

The following screen example is a portion of a workflow graph.
In the graph, states and transitions are links:

- Click on a state to open the State Definition panel to modify that state.
- Click on a transition to open the Transition Definition panel to modify that transition.

(Hover your mouse over a transition or transition name and click when it changes color.)

However, if you right-click on a state or transition, a context-sensitive menu with other options is available. In the following example, right-clicking on the "Process" state provided the quick-link pop-up menu.

Available pop-up links include:

- For states calling a procedure or another workflow, menu choices can be:
  - Edit - opens the State Definition panel to make modifications. This is the same as selecting the Edit link on the State Definition panel.
  - Create Transition - opens the Transition Definition panel.
  - Delete - deletes the state.
  - Copy - makes a copy of the state with all associated transitions preserved.
  - Go to Action Definition - for states calling a procedure, the Procedure Details page is opened. For states calling a workflow, the Workflow Definitions Details page for the "subworkflow" is opened.

- For states with "No action", the choices are the same, except the "Go to Action Definition" option is not available.

- For transitions, menu options include: Rename, Delete, and Copy.

- Right-clicking anywhere on the graph canvas provides two more choices:
  - Create State - allows you to quickly create a new state. This is the same as clicking the Create State button at the top of the graph.
  - Rotate Graph - acts as a "toggle", rotating the graph from a vertical to horizontal view and back again.

Show Legend

The following screen is another example of a workflow graph. Depending on your workflow, your graph could be very simple or much more complex than the example below.

Notice the transition line-endings and different shapes used for states.
The legend is available for reference anytime to help you become familiar with state shapes and line-ending definitions.

List view

This view will be empty until you build a workflow in the Graph view. You can view this page at any time to see a list of states and transitions in your workflow definition.

The following screen is an example of a populated Workflow Definition Details page. A Create State Definition link is available above the Action column, which has the same function as clicking the Create State button in the Graph view.
<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
</table>
| Name        | This column displays state definition and transition definition names currently defined for this workflow definition.  
  - Transition definition names are indented under a state definition name.  
  - Clicking a state definition name displays the State Definition panel (in the Graph view) for that state to see how it was defined or to make modifications.  
  - Clicking a transition definition name displays the Transition Definition panel (in the Graph view) for that transition to see how it was defined or to make modifications. |
| Type        | This is the type of action or trigger currently assigned to the state definition or transition definition.  
  - For states - the type may show calling a subjob, subworkflow, or no action.  
  - For transitions - the trigger type is provided. |
| Action      | This is the action previously defined for the state or transition.  
  - For states - (where the Type is "subjob") the format for actions is `<projectName>:<procedureName>`.  
    Clicking the first link displays the Project Details page for the workflow project.  
    Clicking the second link displays the Procedure Details page for the procedure used by that state.  
  - For states - (where the Type is subworkflow) the format for actions is `<projectName>:<workflowName>`.  
    Clicking the first link displays the Project Details page for the workflow project.  
    Clicking the second link displays the Workflow Definition Details page for the workflow used by that state.  
  - For transitions - clicking the Target action displays the State Definitions panel in the Graph view. |
<p>| Startable   | A &quot;checkmark&quot; in this column shows this state was defined as startable, which means this state is the beginning point for your workflow. |</p>
<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object.</td>
</tr>
<tr>
<td>Actions</td>
<td>You can perform some or all of these actions:</td>
</tr>
<tr>
<td></td>
<td><strong>Create Transition</strong> - Click this link to go to the Transition Definition panel to create a new transition definition for this state.</td>
</tr>
<tr>
<td></td>
<td><strong>Access Control</strong> - Click this link to go to the Access Control page to define access privileges for this transition definition.</td>
</tr>
<tr>
<td></td>
<td><strong>Copy</strong> - Use this link to make a copy of either the state definition or the transition definition. Note: Copying a state also copies its transitions, however, you must have modify privileges on the workflow project to make a copy.</td>
</tr>
<tr>
<td></td>
<td><strong>Move</strong> - Use this link to move a state to another position in the workflow. You will be prompted to choose a state name to move this state to a location before that state. If moving a transition, note that transition can be moved only to another location for the same state—transitions cannot be moved from one state to another state.</td>
</tr>
<tr>
<td></td>
<td><strong>Delete</strong> - Use this link to delete the state definition or transition definition on the same row.</td>
</tr>
</tbody>
</table>

**Properties view**

Select the Properties view button to see the Properties table. If no properties were defined for this workflow definition, no table appears.

The following screen is an example of the Properties table.

![Properties Table Example](image)

The following links and actions are available in the Properties table:

- Links and actions at the top of the table
  - **Create Property** - Click this link to go to the New Property pop-up box to create a new property for this workflow definition.
- **Create Nested Sheet** - Click this link to go the New Nested Property Sheet pop-up box to create a nested property.
- **Access Control** - Click this link to change access control privileges on the property sheet.

**Column descriptions**

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Name</td>
<td>Select a property name to edit that property. You can change its name, value, or add/change its description. If the property name is preceded by a folder icon, this is a property sheet. Click on the property name to open the &quot;folder&quot;.</td>
</tr>
<tr>
<td>Value</td>
<td>The value currently assigned to the property.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object.</td>
</tr>
<tr>
<td>Actions</td>
<td><strong>Delete</strong> - Click this link to delete the property on that row.</td>
</tr>
</tbody>
</table>

**Run Workflow**

Use this page to run a workflow.

- The "star" icon allows you to save this job information to your Home page.
- The "bread crumbs" Project: Upgrade-End to End / Workflow: Upgrade-Linux provide links to a previous web page.
- The name after the Run Workflow page title is the name of the workflow you intend to run.

Starting State - This is the name of the current starting state for this workflow. If this workflow has multiple starting states and this is not the one you want to use, return to the Run Workflow pop-up dialog and select a different starting state.

**Parameters** -

- Any parameters previously specified for this starting start are displayed. If no parameters were defined, this area will be blank.
- If values are supplied, these are the default values specified when the parameter was created. If necessary, you can "type-over" these values to change them before running this workflow.
- You must enter a value for any blank value field labeled "Required".
Click **OK** to run the workflow when your selections are complete.

**Workflow Details**

This page displays workflow details, including the workflow state, project name, workflow definition name, and any properties. The following links are provided for quick access to topic sections you may want to review again.

- **Graph**
- **Show Legend**
- **Using the graph's "quick-access" features**
- **Show History**
- **States**
- **State Details panel**
- **Parameters**
- **Properties**

The name after the Workflow Details page title is the name of the workflow created after running a Workflow Definition. The number at the end of the workflow name is the workflow definition ID number. The ID number is auto-generated by ElectricFlow. Your workflow name will be different, depending on the information you supplied in the workflow definition.

**Links and actions at the top of the table**

Additional links are available if the workflow is running. When the workflow is complete, some links are no longer available.

- **Run Again** - Use this link to run the workflow definition again. When you select the **Run Again** button, you are requesting to re-run the workflow definition with the same parameter values as the original invocation. If you want to change the parameter values, you can select "Run..." from the dropdown menu (small down-arrow) next to the Run Again button.
- **Stop Workflow** - Select this option to stop the workflow. Any unfinished processes will complete, but no new transitions will occur.
- **Delete** - Deletes this workflow.
- **View Log** - Use this link to view the log created by this workflow.
- **Access Control** - Use this link to set privileges for this workflow. For more information, see the Access Control Help topic.
- **Stop Refresh** - This link is available only if a workflow is currently running. Click this link if you do not want the page to refresh the page automatically while the workflow is running.
- The "star" icon allows you to save this workflow information to your Home page.

While the workflow is running, your Workflow Details page will be similar to the following example:
Summary section - at the top of a running workflow page

- Next to the icon, notice that the state name, "Approval needed", is a link. Click this link to open the State Details panel for this state.
- The Manual Transitions section allows you select a manual transition if any were defined. However, if the manual transition contains any parameters whose values were not supplied at definition time, selecting that transition takes you to the Transition Workflow page to enter values.
- The General Information section provides links from the Project name to the corresponding Project Details page and from the Workflow Definition name to its corresponding Workflow Definition Details page.

Links

This page can include a Links section also, which will appear on the far right-side of the Summary section.

To add a link to this section:

- Create a link to any file:
  To add a link, run a command in any job's job step using this format (this works for both local [disconnected] and non-local workspaces):

    ```
    ectool setProperty "/myJobStep/report-urls/<myReportName>" 
    
    
    "commander/jobSteps/<jobStepId>/artifactDirectoryName/<file-path>"
    ```

    Example command:

    ```
    ectool setProperty "/myJobStep/report-urls/Test Report" 
    "commander/jobSteps/$[myJobStep/jobStepId]/testreport/index.html"
    ```

    **Note:** If you are using this format (from ElectricCommander 4.2 and earlier):
ectool setProperty "/myJob/report-urls/<myReportName>" "/commander/jobs/<jobId>/<workspaceName>/<artifactDirectoryName>/[<file-path>]

Example command:

ectool setProperty "/myJob/report-urls/Test Report" "/commander/jobs/${[myJob/jobId]}/${myJobStep/workspaceName}/testreport/index.html"

It will continue to work only for non-local workspaces. We recommend, however, that you change the command to use the newer format.

- **Create a link to any directory:**
  To add a link, run the following style command in any job's job step:

  ectool setProperty "/myJobStep/report-urls/Main Job Workspace" "file:///WinStor2/scratch/chron55build/${[myJob/jobName]}"

  **Note:** Links to a directory automatically work in Internet Explorer, but if using Firefox, local links are disabled unless the default security policy is modified or an extension is used. Refer to http://kb.mozillazine.org/Links_to_local_pages_don%27t_work for more details.

When the workflow is complete...

Your Workflow Details page will be similar to the following example:
When the workflow is complete, fewer links are available at the top of the table and the Manual Transitions section is no longer available.

- The "checkmark" icon indicates the workflow is complete. Click the state shown under Final State ("Success" in our example), to open that state's State Details panel.
- The General Information section is the same as when the workflow was running.

**Graph tab**

The Graph tab displays your workflow in a visual format. This format is the default view. The following screen is an example of a workflow graph. Depending on your workflow, your graph could be very simple or much more complex than the example below.

**Note:** This graph updates in real-time, which means you will see the "active" state highlighted with a color. An icon on the state represents an action.

Use the icons below the Graph tab to rotate the graph for better use of your screen viewing area, and you can re-size the graph using the "%" drop-down menu to choose another size.

**Show Legend tab**

The graph above illustrates all state and transition types. The state and transition names in this graph are labels for the type of state or transition represented. Use the Show Legend tab to see a quick reminder of state shape and transition line-ending definitions.
Using the graph's "quick-access" features

The following screen example is a portion of a workflow graph.

In the graph, states and transitions are links

- Clicking on a state takes you to the State Details panel to that state's transitions, parameters, and properties.
- Clicking on a transition takes you to the Transition Details panel to see details specifically about that transition, including its condition information.
  (Hover your mouse over the transition or transition name and click when the color changes.)

However, if you **right-click** on a state or transition, other link options are available. These options are different for a running or completed workflow versus the options on the Workflow Definition Details page that were available to you while you were defining your workflow.

Available pop-up context-sensitive links include:

- For states, depending on which actions were defined for the state, you may have one or more of the following options:
  - Go to Action - opens the Workflow Details or Job Details page for that state.
  - Go to Action Definition - for states calling a procedure, the Procedure Details page is opened. For states calling a workflow, the Workflow Definitions Details page for the "subworkflow" is opened.
  - Go to State Definition - opens the State Definition panel for that state.

- For transitions, the only link available is: Go to Transition Definition, which opens the Transition Definition panel.

Show History

Selecting Show History allows you to see at-a-glance how your workflow progressed through its states and transitions, or for example, how many times the same state was visited and depending on outcome, which transitions were taken and then the outcome of those target states.
The following example shows a workflow started with the "Check Prerequisites" state and is now at the "Wait For Approvals" state.

So how did the workflow progress through these states?

In the next screen example, with the History panel open, you can clearly see the workflow started and the check failed the first time, so the "retry check" transition was taken. The subworkflow was successful the second time, and the workflow has now transitioned to the "Wait For Approvals" state.
Notice the links displayed in the History panel. You can select links for completed jobs or workflows, which display the Job Details or Workflow Details page, respectively.

States tab

Selecting the States tab provides a table containing all state names and actions for this workflow.

The following links are available in the States table

- State Name - Click any state name in this column to go to that state's State Details panel. (See the next section for more information about the State Details panel).
- Action - Actions are available in this column only if you are using a subjob or a subworkflow. If so, links in this column connect you to the Job Details or Workflow Details page for the subjob or subworkflow, respectively.
- [Show All] link - If the state executed multiple times during a workflow run, only the last subjob or subworkflow is displayed. However, clicking on Show All displays the results for all subjobs or subworkflows executed during a workflow run.
State Details panel

This panel displays state components, including transitions, parameters, and properties.

- Use the Access Control link to set privileges for this state. For more information, see the Access Control Help topic.
- The state name, "Build" (in our example), is shown at the top of the panel.
- Job or Workflow status links to the job or workflow created by the action.
- The Transitions tab is open to display the transition table listing all transitions for this state.

Column descriptions

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>One or more names of transitions currently defined for this state. Click on a transition name to open the Transition Details panel.</td>
</tr>
<tr>
<td>Trigger</td>
<td>The type of trigger currently defined for this transition.</td>
</tr>
<tr>
<td>Target</td>
<td>The target state for this transition. Click on a target state name to open the State Details panel for that state.</td>
</tr>
<tr>
<td>Condition</td>
<td>This condition was specified when the transition was created. A condition specifies under which circumstances the transition is taken. You can edit this condition on the Transition Definition pane, but if you edit the condition during a running workflow, the change will not take effect until you run the workflow again.</td>
</tr>
<tr>
<td>Actions</td>
<td>Access Control - Use this link to set permissions on this transition.</td>
</tr>
</tbody>
</table>
The Parameters tab provides a table listing all defined parameters for this state. You will see any parameters passed to this state the last time this state was entered, but only if parameters were created on the State Definitions Details panel. This table does not allow you to edit the parameter's value.

These parameters are copied automatically to the top-level property sheet and you will see them in the properties table also.

**Column descriptions**

Name - The name of the parameter defined for this state.
Value - The value currently defined for this parameter.

The Properties tab provides a table containing all defined properties for this state. If no properties were defined for this state definition, this table will be blank. All defined parameters are automatically copied to the top-level property sheet. Any custom properties defined for the state will be included in this table also.

### Links at the top of the table
- **Create Property** - Click this link to go to the New Property pop-up box to create a new property for this state.
- **Create Nested Sheet** - Click this link to go the New Nested Property Sheet pop-up box to create a nested property sheet.
- **Access Control** - Click this link to add or decrease access control on the property sheet.

### Column descriptions

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Name</td>
<td>Select a property name to edit that property. You can change its name, value, or add/change its description. If the property name is preceded by a folder icon, this is a property sheet. Click on the property name to open the &quot;folder&quot;.</td>
</tr>
<tr>
<td>Value</td>
<td>The value currently assigned to the property.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object.</td>
</tr>
<tr>
<td>Actions</td>
<td><strong>Delete</strong> - Click this link to delete the property on that row.</td>
</tr>
</tbody>
</table>
Parameters tab

This tab provides a table listing all defined parameters for this workflow’s starting state. You will see any parameters passed to the starting state when this workflow was launched, but only if parameters were created on the State Definitions Details page. This table does not allow you to edit the parameter’s value.

These parameters are copied automatically to the top-level property sheet and you will see them in the properties table also.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>test1</td>
<td>1</td>
</tr>
<tr>
<td>test2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Column descriptions**

- **Name** - The name of the parameter defined for this starting state.
- **Value** - The value currently defined for this parameter.

Properties tab

Select the Properties tab to see the Properties table. If no properties were defined for this workflow definition, this table will be blank.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Value</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>property1</td>
<td>full build</td>
<td></td>
<td>Delete</td>
</tr>
<tr>
<td>property2</td>
<td>test only</td>
<td></td>
<td>Delete</td>
</tr>
<tr>
<td>test1</td>
<td>1</td>
<td></td>
<td>Delete</td>
</tr>
<tr>
<td>test2</td>
<td>2</td>
<td></td>
<td>Delete</td>
</tr>
</tbody>
</table>

**The links at the top of the table**

- **Create Property** - Click this link to go to the New Property pop-up box to create a new property for this state.
- **Create Nested Sheet** - Click this link to go the New Nested Property Sheet pop-up box to create a nested property sheet.
- **Access Control** - Click this link to add or decrease access control on the property sheet.
Column descriptions

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Name</td>
<td>Select a property name to edit that property. You can change its name, value, or add/change its description. If the property name is preceded by a folder icon, this is a property sheet. Click on the property name to open the “folder”.</td>
</tr>
<tr>
<td>Value</td>
<td>The value currently assigned to the property.</td>
</tr>
</tbody>
</table>
| Description | A plain text or HTML description for this object. If using HTML, you must surround your text with `<html> ... </html>` tags. The only HTML tags allowed in the text are: `<a> <b> <br> <div> <dl> <font> <i> <li> <ol> <p> <pre> <span> <style> <table> `<tc>` `<td>` `<th>` `<tr>` `<ul>` |}

Actions | Delete - Click this link to delete the property on that row. |

Workflow Log

This page displays the workflow log.

Notice the name after the page title, “template-1257” — this is the name of the workflow, which includes the workflow name plus the ElectricFlow auto-generated ID number, and it is the object of the workflow log in our example.

Links and actions above the table

- Drop-down menu - Use the down-arrow to select Error, Warn, or Info. The first time you choose a severity level, it will become your default level—the one you always see first when you view this page. Selecting another level changes your default view.
- The "star" icon allows you to save this workflow definition to your Home page.
- The "bread crumbs" Project: SoftwareBuild / Workflow: template-1257 provide links to a previous web page.
Column descriptions

Time - Displays the time when an event occurred that caused the server to generate a message.

Severity - the three severity levels are:

- **ERROR** - An unexpected failure was encountered while entering a state or launching a sub-action. Generally, this error indicates a critical problem with the workflow that requires fixing the workflow definition.
- **WARN** - A non-critical issue was encountered while the workflow was running.
- **INFO** - Provides workflow activity information including the state entered, transitions taken, and so on.

User - The name of the user or project principal that explicitly launched the job. This property is blank when the job is launched by a schedule.

Subject - Objects displayed in this column are the subject of the message. These objects are linked to either the Workflow Details or the State Details page.

Message - A text message generated by the ElectricFlow server while the workflow was running.

Transition Workflow

Use this page to transition your workflow to a different startable state.

Note the name after the page title, "template-99"—this is the name of the workflow in our example.

Links and actions above the table

- The "star" icon allows you to save the Transition Workflow page to your Home page.
- The "bread crumbs" Project: SoftwareBuild / Workflow: template-99 provide links to a previous web pages.
Field descriptions

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition</td>
<td>The name of this transition.</td>
</tr>
<tr>
<td>State</td>
<td>The name of the state that owns the transition—the active state of the workflow.</td>
</tr>
<tr>
<td>Target State</td>
<td>The name of the target state—the state where the workflow will transition.</td>
</tr>
<tr>
<td>Parameters</td>
<td>In the screen example above, &quot;version&quot; is the name of the parameter and you must enter a value for this parameter. This is a required field.</td>
</tr>
</tbody>
</table>

Click **OK** to transition the workflow to the target state.

Workspaces

This page displays all workspaces currently available to ElectricFlow. At a glance, you can see all paths to every workspace.

- To create a new workspace, click the **Create Workspace** link.
- To find a workspace, use the **New Search** link.

Column descriptions

<table>
<thead>
<tr>
<th>Column Name</th>
<th>Description / Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workspace Name</td>
<td>The name created for this workspace. Click on a Workspace Name in this column to edit that workspace.</td>
</tr>
<tr>
<td>Column Name</td>
<td>Description / Actions</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Zone</td>
<td>The name of the zone where this workspace resides.</td>
</tr>
<tr>
<td>Enabled</td>
<td>This workspace is enabled if this box is &quot;checked&quot;.</td>
</tr>
<tr>
<td></td>
<td><strong>Note</strong>: When this box is checked, the workspace is enabled, which means it can be</td>
</tr>
<tr>
<td></td>
<td>accessed. In the case where a job or job step cannot access the workspace, the job</td>
</tr>
<tr>
<td></td>
<td>will &quot;queue&quot;, waiting for the workspace to become available.</td>
</tr>
<tr>
<td>Local</td>
<td>If the box is &quot;checked&quot;, the workspace is &quot;local&quot;, which means files in the local</td>
</tr>
<tr>
<td></td>
<td>workspace are accessible only from the resource that originally created the file.</td>
</tr>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround</td>
</tr>
<tr>
<td></td>
<td>your text with <code>&lt;html&gt;</code> ... <code>&lt;/html&gt;</code> <em>tags</em>. The only HTML tags allowed in the text are:</td>
</tr>
<tr>
<td></td>
<td><code>&lt;a&gt;</code>, <code>&lt;b&gt;</code>, <code>&lt;br&gt;</code>, <code>&lt;div&gt;</code>, <code>&lt;dl&gt;</code>, <code>&lt;font&gt;</code>, <code>&lt;i&gt;</code>, <code>&lt;li&gt;</code>, <code>&lt;ol&gt;</code>, <code>&lt;p&gt;</code>, <code>&lt;pre&gt;</code>, <code>&lt;span&gt;</code>, <code>&lt;style&gt;</code>, <code>&lt;table&gt;</code>, <code>&lt;tc&gt;</code>, <code>&lt;td&gt;</code>, <code>&lt;th&gt;</code>, <code>&lt;tr&gt;</code>, <code>&lt;ul&gt;</code>.</td>
</tr>
<tr>
<td>Drive Path / UNC Path / UNIX Path</td>
<td>The path to the workspace.</td>
</tr>
<tr>
<td>Actions</td>
<td><strong>Copy</strong> - Use this link to make an exact duplicate of an existing workspace, then</td>
</tr>
<tr>
<td></td>
<td>select the copy to go to the Edit Workspace page to change the workspace name.</td>
</tr>
<tr>
<td></td>
<td><strong>Delete</strong> - Use this link to delete the workspace on the same row.</td>
</tr>
</tbody>
</table>

**Note**: Add access control privileges to a workspace on the Edit Workspace page.

**Workspace - create new or modify existing workspace**

To create a new workspace

Enter information in the fields as follows:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Enter a unique name to distinguish this workspace from other workspace names.</td>
</tr>
</tbody>
</table>
Enter three paths to use on resources to access the workspace root directory:

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>A plain text or HTML description for this object. If using HTML, you must surround your text with <code>&lt;html&gt;</code> ... <code>&lt;html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code>, <code>&lt;b&gt;</code>, <code>&lt;br&gt;</code>, <code>&lt;div&gt;</code>, <code>&lt;dl&gt;</code>, <code>&lt;font&gt;</code>, <code>&lt;i&gt;</code>, <code>&lt;li&gt;</code>, <code>&lt;ol&gt;</code>, <code>&lt;p&gt;</code>, <code>&lt;pre&gt;</code>, <code>&lt;span&gt;</code>, <code>&lt;style&gt;</code>, <code>&lt;table&gt;</code>, <code>&lt;tc&gt;</code>, <code>&lt;td&gt;</code>, <code>&lt;th&gt;</code>, <code>&lt;tr&gt;</code>, <code>&lt;ul&gt;</code></td>
</tr>
<tr>
<td>UNC Path</td>
<td>A path in UNC notation (such as <code>//server/ec/a/b/c</code>) to use on Windows machines. The path can use either slashes or backslashes for separators.</td>
</tr>
<tr>
<td>Drive Path</td>
<td>A second path for Windows machines, based on drive notation such as <code>N:\</code> or <code>N:\b\c</code>. If the drive path contains more than just a drive letter, additional directory names must match the trailing directories of the UNC path. For example, if the UNC path is <code>//server/ec/a/b/c</code>, then <code>N:\b\c</code> can be used as the drive path (agents automatically map <code>N:\</code> to <code>//server/ec/a</code>), but <code>N:\x\c</code> is not allowed.</td>
</tr>
<tr>
<td>UNIX Path</td>
<td>The path to use for UNIX machines, typically based on an NFS mount. You must ensure appropriate mounts were created on all machines where the path will be used. <em>ElectricFlow does NOT automatically mount filesystems for UNIX.</em></td>
</tr>
</tbody>
</table>

**Note:** If the workspace will be used only on UNIX machines, you can omit the UNC and drive paths. Conversely, if the workspace will be used only on Windows machines, you can omit the UNIX path. *For more information*, see the Workspaces and Disk Space Management Help topic.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone</td>
<td>Use the drop-down arrow to select a zone for this workspace.</td>
</tr>
<tr>
<td>Local</td>
<td>Select this checkbox if the workspace is &quot;local&quot;, which means files in the local workspace are accessible only from the resource that originally created the file.</td>
</tr>
<tr>
<td>Enabled</td>
<td>&quot;Check&quot; this box to enable this workspace. When this box is checked, the workspace is enabled, which means it can be accessed. In the case where a job or job step cannot access the workspace, the job will &quot;queue&quot;, waiting for the workspace to become available.</td>
</tr>
<tr>
<td>Credential Project and Credential Name</td>
<td>If you need to enter a user name and password to mount the workspace, you must enter the credential project name and then choose the appropriate credential name, which contains the required user name and password. Click the Browse link to select information for these fields.</td>
</tr>
</tbody>
</table>

Click **OK** to save your workspace specification and see it listed on the Workspaces page.
If you need to add properties or privileges to this workspace:

Click OK to create the workspace and return to the Workspaces page, then click on the workspace name to go to the Edit Workspace page.

To edit an existing workspace

All previously supplied workspace information is available on this page and you can modify existing information or add new properties or privileges.

- Click the Access Control link [at the top of the page] to add access privileges to this workspace.
- To assign a new workspace name, highlight the existing name and type-in a new name.
- Re-assign paths if necessary.
- Use the drop-down menu to select a different zone if necessary.
- Add or modify the Credential Project name or the Credential Name if necessary.

Click OK to save your modified information.

If Custom Workspace Properties were already assigned, you may modify these properties or add new ones. If a property name is preceded by a "folder" icon, this denotes a Nested Sheet.

Click the "star" icon at the top of the page to add this page to your Shortcut section on the Home page.

For more workspace information, see the Workspace and Disk Space Management Help topic.

Workspace File

This page displays a file from the workspace for a job, typically the log file for a job step. For log files, this file contains both standard output and standard error from the step.

If you view a file while the job step generating the file is still running, the page refreshes automatically as information is added to the file.

Tip

If the log does not contain the output that you were expecting, check the job step commands. If the step redirects its output to a different location, this information will not appear in the log file.

ElectricFlow Platform Objects and Functionality

All the topics in this section are about a particular object or functionality in the ElectricFlow platform. They are the same as the topics in the Help system on the automation platform UI.

From the automation platform UI, you can access the topics as follows:

- Direct access to these Help topics is from the Help system Table of Contents. Although these topics are not directly linked within the ElectricFlow product, many "page-specific Help topics contain links to one or more of these topics to provide more detailed information quickly.
• To access these Help topics while using ElectricFlow, click the Help link at the top-right corner on any automation platform web page.

Access Control

Privileges

Users and Groups

Special users and groups

Access Control Lists - allow and deny

Inheritance

System Objects

Access Control and Jobs

Examples for Increased Security

Overview

ElectricFlow provides a comprehensive mechanism to control how individuals use the system.

• Users must log in to view information or perform operations.

• After you log in, system access is limited based on:
  ○ username
  ○ the groups to which that user belongs
  ○ permissions specified for various ElectricFlow objects

Access Control is the ElectricFlow functionality that provides security for all system objects. After you are familiar with the following information describing the Access Control system, review the two examples, Basic ACL Setup and Team ACL Setup (at the end of this Help topic), which may provide guidance or insight for how you might setup enhanced ElectricFlow security at your site.

Privileges

ElectricFlow supports four privilege types for each object:

• Read - Allows object contents to be viewed.

• Modify - Allows object contents (but not its permissions) to be changed.

• Execute - If an object is a procedure or it contains procedures (for example, a project), this privilege allows object procedures to be invoked as part of a job. For resource objects, this privilege determines who can use this resource in job steps.

• Change Permissions - Allows object permissions to be modified.
Users and Groups

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository:

- Both user and group information is retrieved from the repository
- Local users and groups can be defined within ElectricFlow

Note: To view user and group information, and to modify local user and group information, click the Administration tab and select either the Users or Groups subtab. External account information cannot be modified from ElectricFlow.

If the same user exists in multiple sources, only the highest priority name is used. A priority order is defined among external repositories, but local names have the highest priority. Thus, if you define a local user with the same name as an LDAP user, you will effectively mask the user in the LDAP account.

For local user accounts, only local groups are considered—group information from external repositories is not used. For accounts from a particular repository, groups from that repository are used along with local groups, but groups in other repositories are not considered.

In other words, you can define local groups in ElectricFlow to supplement groups defined in external repositories. When you view information about users in ElectricFlow, only relevant groups are shown. For example, when you view group information for a local user, only local groups are displayed.

Note: Groups are managed by name only, without regard to source. If a particular group name exists in different repositories, there is no way to distinguish between these groups inside ElectricFlow. Access given to one group is the same for any other group with the same name.

Special Users and Groups

The admin local user has special significance. If you are logged in as "admin," you automatically have all privileges on all objects, regardless of any other system settings. This privilege set is a fallback mechanism in the event too many privileges get removed for an object, leaving it unusable.

The admin account cannot be deleted.

If the admin account is missing, ElectricFlow will recreate the account the next time it starts up with password "changeme."

The Everyone group is predefined by ElectricFlow and cannot be deleted. Every user is automatically a member of the Everyone group.

For each project, ElectricFlow uses the project name and automatically defines a user associated with that project, called the project principal. For example, the project principal for a project named "nightly builds" is "project: nightly builds" (notice that there are two spaces in this name)—this principal is used for jobs running under the project, as described in the "Access control and jobs" section later in this Help topic.

Access Control Lists - allow and deny

Each ElectricFlow object, such as a project, procedure, job, property sheet, workspace, schedule, or resource contains an access control list (ACL). Individual properties do not have their own access control, but instead use
access control lists from their parent containers.

To view the access control list for an object, go to the web page displaying the object and click the Access Control link. An access control list can contain any number of entries—each entry names a particular user or group and indicates allow, deny, or is blank for each of the four privileges.

To determine whether a user can perform an operation on a particular object, ElectricFlow determines which of the four privileges is required for that operation, then searches all access control entries that refer to that user or groups containing that user. To be allowed access, at least one of the matching entries must specify "allow" and none of the entries can be "deny." A "deny" entry overrides an "allow" entry in the same ACL.

**Inheritance**

If an object's access control list does not indicate what to do for the user who is trying to access it, ElectricFlow looks in the access control list for the object containing the target object, then its parent, and so on up to a top-level object covering the entire server. This mechanism is called inheritance.

For example, a nested property sheet on a procedure inherits access control information from its parent property sheet, the procedure, the project containing the procedure, and the server. When you view the object access control list, you also see inherited access control lists so you can trace the object's inheritance chain.

When ElectricFlow performs an access check on an object, it begins with the access control list for that object.

- If a "deny" entry matches an entry in that list, access is denied.
- If there is no "deny" entry, but a matching "allow" entry is found, access is allowed.
- If there is no matching entry that specifies either "allow" or "deny," ElectricFlow moves to the next access control list in the inheritance chain and repeats the process.
- A matching entry in a lower-level access control list takes priority over entries in higher-level access control lists. If no matching entry in any list is found, access is denied.

Inheritance allows you to control access to a collection of objects because you can make changes in just one place. When new objects are created, their access control lists are empty, so all access control for the entire system is determined by the server-level list.

- Typically, when a new project is created, you define an access control list for the project and allow everything in the project to inherit from the project.
- If you do not define additional access control information in project components, all project access is determined by the project's access control list.

In some situations you may want tight control over object access, so changes in parent objects do not affect access to the object or its children. To achieve this, you can "break inheritance," which means a particular object does not inherit from its ancestors. The ElectricFlow web interface allows you to break and restore inheritance for any object on which you can change permissions. However, **if you break an object's inheritance, it affects all children of that object.**

**Additional Information about "deny"**

If a user matches a deny rule, however indirectly, the user is denied access. Even if a specific ACL entry granting (for example) read access by username exists, a less specific deny ACL entry overrides that specific
rule. Therefore, avoid "deny" rules if at all possible (especially to groups), or you may experience some unexpected permissions issues.

You can, however, enforce an implicit "deny" by allowing an object to fall off the end of the inheritance chain. This practice allows denial behavior without the risks associated with an explicit ACL entry to deny access.

**IMPORTANT:** If you break inheritance on an object with an empty access control list, the object will become completely inaccessible. You will not be able to restore inheritance because you no longer have the right to change permissions on that object. If this happens, you must contact your system administrator who can login as admin and restore inheritance.

Consider ElectricFlow principals (actors) from two perspectives:

- A running job or workflow runs using the project as the identity, so if a job requires special permissions you must use the project as the principal in the ACL entry.
- Users and groups come into play when humans manipulate the GUI or execute ectool commands from the command line (or via a shell script) -- basically anywhere that a script or human needs to log in to ElectricFlow. Having logged in, a group and id exist, which can be used in ACL entries.

For example, consider a property that will store a build number. You can set an ACL that breaks inheritance (implicit deny), and then add an ACL entry granting permissions for the project to be able to increment the property value. This prevents humans from manipulating the build number but permits a running job to increment the build number at will.

**Notes:**

- When it is practical, a job will run with multiple identities—the project and the user that launched the job. You cannot, however rely on this behavior for security because jobs run from a schedule (such as CI jobs) and jobs started by a workflow do not have a user principal, just the project principals.
- A job can have multiple project principals because it "accumulates" new project principals when it calls into another project's subprocedure (and then releases the other project's identity when the subprocedure returns). This makes it possible to create trusted libraries.

**System Objects**

A few special *system objects* contain access control lists related to overall ElectricFlow system administration. These access control lists are available from the Administration page. The system objects are:

- **Server** - an ElectricFlow system top-level object. Every other object in the system is contained in the server object and inherits access control information from the server object unless inheritance is broken.
- **Administration** - *Read* permission allows access to the `getStatus`, `getDatabaseConfiguration` [s], `getEmailConfig` [s], and `export(global)` API functions.
  
  *Modify* permission allows access to the `shutdown`, `setDatabaseConfiguration`, `createEmailConfig`, `deleteEmailConfig`, `modifyEmailConfig`, and `import(global)` API functions.

For Change Tracking, the *Read, Modify, and Execute* permissions allow you to revert changes to a tracked object and its tracked contents in the UI (see for more details) or access to the `revert` API function.

- **Artifacts** - *Read* permission allows access to the `getArtifact` API functions.
  
  *Modify* permissions allows access to `createArtifact` and `deleteArtifact` functions.
• Directory - Read permission allows access to the getUsers, getGroups, and getDirectoryProviders API functions. 

Modify permission allows access to the createUser, createGroup, deleteUser, deleteGroup, createDirectoryProvider, modifyDirectoryProvider, deleteDirectoryProvider, and moveDirectoryProvider API functions.

• Email Configurations - Modify permission allows access to the createEmailConfig and deleteEmailConfig API functions.

• Force Abort - Execute permission controls access to the --force flag on abortJob. By default, the ACL is created with Everyone:execute permission in addition to inheriting from the "Server". To force abort a job, the user must have execute permission on the job and execute permission on the forceAbort ACL.

• Logging - Modify permission allows access to the logMessage API function.

• Licensing - Read permission allows access to the getLicense[s] API functions. 

Modify permission allows access to the importLicenseData and deleteLicense API functions. 

Execute permission allows access to the getAdminLicense API function.

• Plugins - Modify permission allows access to the createPlugin, deletePlugin, installPlugin, uninstallPlugin, promotePlugin API functions, and the modifyPlugin API function requires modify permission on the target plugin. For getPlugin, Read permission is required on the target plugin.

• Priority - Execute permission allows the user who launches a procedure (using the runProcedure API function) to raise the priority of the job.

• Projects - Modify permission allows access to the createProject and deleteProject API functions.

• Repositories - Read permission allows access to the getRepository API function. 

Modify permission allows access to the createRepository, deleteRepository, modifyRepository, and moveRepository API functions.

• Resources - Modify permission allows access to the createResource and deleteResource API functions.

• Session - Execute permission allows access to the login API function.

• Workspaces - Modify permission allows access to the createWorkspace and deleteWorkspace API functions.

• ZoneAndGateways - Modify permission allows access to the createZone and deleteZone API functions. Modify permission also allows access to the deleteResource API function when the resource belongs to a Gateway.

Access Control and Jobs

When a job executes, it usually needs to access objects in ElectricFlow. For example, a job step command may refer to a parameter value, which is a property associated with the job object, or a step may invoke ectool to modify properties or any other ElectricFlow state. This process leads to questions:

• Under which username does the job execute?

Procedures always run under the project principal user ID for the project that contains the procedure. If a procedure invokes a subprocedure in another project, that subprocedure will run under its own project’s project principal and the project principal of its calling procedure. When a procedure is running under
multiple project principals, its steps will perform any operations for which any one of its project principals allow.

- **How does ElectricFlow initialize job permissions when the job starts?**

  This question pertains to job object permissions. When a job starts, ElectricFlow sets full access control entries on the job for the project principal and the user who launched the job—assuming the job was launched by a user and not a schedule.

- **What permissions are needed to abort a job?**

  Aborting a job requires execute permission on the job. If a job is launched by a user, that user is given all privileges on the job. If a job is launched by a schedule, the schedule's execute privileges are copied to the job.

The access control system determines whether jobs can be executed or not.

- For a user to run a job without creating a schedule, the user must have execute permission on the top-level procedure being executed.

- To create a schedule to run a procedure, a user must have modify permission for the project containing the schedule. After a schedule is created, no additional permissions are required to start jobs under the auspices of that schedule.

**Examples for Increased Security**

Initially, the *Everyone* group had Read and Execute permission on all ElectricFlow objects by default. The following examples illustrate how you might customize ElectricFlow default Access Control settings for your organization.

**Caution:** Make sure you are familiar with the Access Control system before making changes. Incorrectly setting ACLs can severely impact ElectricFlow behavior.

**Abbreviations used in the examples**

- A = Allow
- I = Inherit (some places referred to as "Don't Care")
- D = Deny
- Change Permission = Change

**Example 1 - Basic ACL Setup**

This example illustrates how you might change Access Control defaults to set up a basic level of security. The easiest way to manage ACLs is by using different ElectricFlow groups that allow users to perform specific roles.

For our example, we will create and use the groups called EC-administrator and EC-designer, and we will modify the default Everyone group. (When setting up your groups, you would choose any group names that suit your organization, but note that the "EC-" prefix is reserved for Electric Cloud use only.) This is how we want to define our groups:
ElectricFlow

- **EC-administrator group**
  This group has most of the power and abilities of the ‘admin’ user login, but allows for more flexibility.

- **EC-designer group**
  This role is more significant. Users in this group can create and modify most ElectricFlow objects.

- **Everyone group**
  This predefined group is used for people who only need to run ElectricFlow procedures, and have no need to create or modify them.

As you begin to modify the Access Control system, note that the system has some project principal ACEs that should remain in place for correct system operation.

**Server ACLs**

The Server is the foundation for almost all ACL checks. Generally, every other object in the system inherits these privileges. For this basic ACL configuration we want to set Server ACLs this way:

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>EC-administrator</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>Everyone</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

**Custom Server Properties ACLs**

An often overlooked ACL setting is Server Property Sheet. Allow the Everyone group Read permission on this object.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
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</thead>
<tbody>
<tr>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

**System Object ACLs**

There are 14 categories of System objects with ACLs.

1 - **Administration** – allow the EC-designer group Read privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
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<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>EC-designers</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

2 - **Artifacts** – allow the EC-designer group Read privileges.
<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
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</tr>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
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</tbody>
</table>

3 - Directory – allow the Everyone group Read privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
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<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

4 - Email Configurations – allow the Everyone group Read and Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

5 - Force Abort - no changes needed for this category.

6 - Logging - no changes needed for this category.

7 - Licensing - no changes needed for this category.

8 - Plugins - allow the Everyone group Read privilege.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
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<td>I</td>
<td>I</td>
<td>I</td>
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</tbody>
</table>

9 - Priority - no changes needed for this category.

10 - Projects - allow the Everyone group Read and Execute privileges, and the EC-designer group everything except Change privilege.

<table>
<thead>
<tr>
<th>Type</th>
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<th>Read</th>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>
11 - **Repositories** - allow the Everyone group Read and Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

12 - **Resources** - allow the Everyone group Read and Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
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</tbody>
</table>

13 - **Session** - allow the Everyone group Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
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<td>Everyone</td>
<td>I</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

14 - **Workspaces** - allow the Everyone group to have Read and Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
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<td>I</td>
</tr>
</tbody>
</table>

**Note:** Sites that want a slightly more open system might consider granting the "EC-designers" group Modify access to Resources and Workspaces.

**Plugin Project ACLs**

Generally, you will want to allow the Everyone group Read privileges on every plugin you expect to use. (Each plugin has its own name, which is the project name also.)

<table>
<thead>
<tr>
<th>Type</th>
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</table>

**Project ACLs**

Next are special Electric Cloud projects, Default, EC-Utilities and EC-Examples.
Projects: Default, EC-Utilities, EC-Examples

Use caution when setting privileges on the EC-Utilities project. These are powerful procedures and some have their own ACL settings. Remember the ‘admin’ user will always be able to use these utilities. Allowing the EC-administrator group full privileges accomplishes the same goal for users in that group. We allow the Everyone group Read only privileges. This is a unique project because it does not inherit ACLs from anywhere else (for example, Server or Projects).

<table>
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<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

Example 2 - Team ACL Setup

Some organizations may want to have two or more different and separate teams use ElectricFlow at the same time. In this example, people on one team have little knowledge about the other team who uses ElectricFlow and no direct access to any objects used by the other team. Our "Team" example describes how to modify default ElectricFlow Access Control settings to create a multi team security configuration using ACLs.

To divide your ElectricFlow system for use by separate teams, you will want to create one or more separate Projects for each team. You may decide to share some projects across teams.

Create your teams (groups). For our example, we will begin with two teams, T1 and T2. Each team has a designer group and a user group. Using groups allows the flexibility to have a designer from one group work as a user in another group.

- Create the EC-administrator group
  This group has most of the power and abilities of the ‘admin’ user login, but allows for more flexibility. Assigning people to the EC-administrator group allows better tracking of ElectricFlow administrative activity.

- Create two designer groups: T1-designer and T2-designer
  Members of the designer groups will have the ability to create and modify procedures and other ElectricFlow objects for their team. A member of the designer group from one team will not be able to view or use the objects of the other team.

- Create two user groups: T1-user and T2-user
  Members of the user groups will have the ability to run procedures that belong to their team. A member of the user group from one team will not be able to view or use objects that belong to the other team who are not in any other group. This setup allows other users to access ElectricFlow without exposing the work of any of the teams. A person not in a group for either team will not be able to see objects of either of the teams.

As you begin to modify the Access Control system, note that the system has some project principal ACEs that should remain in place for correct system operation.
Server ACLs

The Server is the foundation for almost all ACL checks. Almost all objects in the system inherit these privileges. For this basic Team configuration, we will set the Server ACLs this way:

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>EC-administrator</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>Everyone</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

Custom Server Properties ACLs

An often overlooked ACL setting is Server Property Sheet. Allow the Everyone group Read permission on this object.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

System Object ACLs

There are 14 categories of System objects with ACLs.

1 - Administration – allow both designer groups Read privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>T1-designer</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>group</td>
<td>T2-designer</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

2 - Artifacts – allow the Everyone group Read privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

3 - Directory – allow the Everyone group Read privileges.
4 - Email Configurations – allow the Everyone group Read and Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

5 - Force Abort - no changes needed for this category.

6 - Logging - no changes needed for this category.

7 - Licensing - no changes needed for this category.

8 - Plugins - allow the Everyone group Read privilege. Generally, privileges set here will be inherited by all plugins.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
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</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

9 - Priority - no changes needed for this category.

10 - Projects - no changes needed for this category. Privileges for projects are now handled on a case by case basis.

11 - Repositories – allow the Everyone group Read privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
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</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

12 - Resources - allow the Everyone group Read and Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

13 - Session - allow the Everyone group Execute privileges.
<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>I</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

14 - Workspaces - allow the Everyone group Read and Execute privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**Plugin Project ACLs**

Generally, you will want to allow the Everyone group Read privileges on every plugin you expect to use. (Each plugin has its own name, which is also the project name.) Because you may want to use many plugins, you might want to use a script.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
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<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

**ACLs for Existing Projects**

Next are a few Electric Cloud projects, and two sample projects that can be seen and used by their respective team members only.

**Project:** EC-Examples

These are nice examples and we want to grant Everyone the ability to see and run them.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
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</thead>
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<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**Project:** Default

Inherited settings will allow the EC-administrator group full privileges.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
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<th>Execute</th>
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</tr>
</thead>
<tbody>
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<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>
**Project:** EC-Utilities

Use caution when setting privileges on the EC-Utilities project. These are powerful procedures and some have their own ACL settings.

Remember the 'admin' user will always be able to use these utilities. Allowing the EC-administrator group full privileges accomplishes the same goal for users in that group. We allow the Everyone group Read only privileges. This is a unique project because it does not inherit ACLs from anywhere else (for example, Server or Projects).

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>EC-administrator</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

**Project:** Electric Cloud

This project has one procedure and we want to grant everyone the ability to see it.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
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<th>Change</th>
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<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

**ACLs for New Projects**

Now we introduce the concept of ACL settings as they would be in a multiple team environment. For this example, we assume you have five projects being used by two teams in the following way.

- Project-A used by Team1
- Project-B used by Team1
- Project-C used by Team2
- Project-D used by Team2
- Project-E used by Team1 and Team2

**Project-A**

This project is visible and usable only by ElectricFlow users who are members of either the T1-user group or the T1-designer group. Notice that the designer group receives full permissions.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>T1-designer</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>T1-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>
**Project-B**

This project is the same as Project-A.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>T1-designer</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>T1-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**Project-C**

This project is visible and usable only by ElectricFlow users who are members of either the T2-user group or the T2-designer group. Notice that the designer group receives full permissions.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>T2-designer</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>T2-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**Project-D**

This project is the same as Project-C.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>T2-designer</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>T2-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**Project-E**

This project is a superset that includes both teams.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>T1-designer</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>T1-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>
Enabling Same Team Subprocedures

To enable procedures in one project to use procedures in another project, one more step is necessary.

Add the project principals for both T1 projects to the T1-user group.

In this case, these are called: “project: Project-A” and “project: Project-B”.

Add the project principals for both T2 projects to the T2-user group.

In this case, these are called: “project: Project-C” and “project: Project-D”.

Optional: Restricting Resources and Workspaces by Team

Resource ACLs

**Resource**: local

Because each team will have dedicated resources, it is useful to keep one resource available for everyone to use.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**T1-resource**

This resource is visible and usable only by ElectricFlow users who are members of either the T1-user group or the T1-designer group. This resource also needs Execute permission for the project itself to allow it to run from a schedule.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
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</thead>
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<tr>
<td>group</td>
<td>T1-designer</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>group</td>
<td>T1-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**T2-resource**
This resource is visible and usable only by ElectricFlow users who are members of either the T2-user group or the T2-designer group. This resource also needs Execute permission for the project itself to allow it to run from a schedule.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>EC-administrator</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>group</td>
<td>Everyone</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>I</td>
</tr>
</tbody>
</table>

**Workspace ACLs**

**Workspace**: default

Because there will be dedicated workspaces for each team, it is useful to keep one workspace available for Everyone to use.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Everyone</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**T1-workspace**

This workspace is visible and usable only by ElectricFlow users who are members of either the T1-user group or the T1-designer group.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
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</thead>
<tbody>
<tr>
<td>group</td>
<td>T1-designer</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>group</td>
<td>T1-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>

**T2-workspace**

This workspace is visible and usable only by ElectricFlow users who are members of either the T2-user group or the T2-designer group.

<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Read</th>
<th>Modify</th>
<th>Execute</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>T2-designer</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
<tr>
<td>group</td>
<td>T2-user</td>
<td>A</td>
<td>I</td>
<td>A</td>
<td>I</td>
</tr>
</tbody>
</table>
Artifact Management

Artifact Objects
Access Control
Publishing Artifact Versions
Enable Compression
Include and Exclude Patterns
Retrieving Artifact Versions
Entering Filters During a Retrieve Operation
Dependent Artifact Versions
Artifact Cache
Cleaning Up Repositories and Caches

Overview

During the course of the development process, project components or "outputs" are produced for consumption by other projects or the main project to create a whole entity. Ultimately, applications are assembled by combining these various outputs (dependencies) and packaging them together into a single deployable software application.

Outputs can be libraries, scripts, graphics, and so on. This output is an artifact that can be consumed by other projects.

Every stage in the application lifecycle produces and consumes artifacts. Artifacts are critical to the build-test-deploy process.

Using artifacts can:

- improve performance across builds
- provide better reusability of components
- improve cross-team collaboration with greater traceability

For example, instead of each developer repeatedly downloading third-party packages from external sources, these components can be published and versioned as an artifact. A developer then simply retrieves a specific artifact version from a local repository, guaranteeing a consistent package from build to build.

Artifact Objects

ElectricFlow has three objects to support Artifact Management functionality: artifact, artifact version, and repository. Similar to other ElectricFlow objects, each of these objects supports custom properties and access control.
Artifact

An artifact is a top-level object containing artifact versions, a name template for published artifact versions, artifact specific properties, and access control entries to specify privileges.

If an artifact is deleted, all published artifact versions within that artifact will be deleted also.

You can create artifacts in several ways:

- Use the New Artifact web page
- Use the createArtifact API command with the command-line tool (ectool) or an ec-perl script
- An artifact is created when you publish an artifact version if the artifact did not already exist, and the user issuing the publish command has permission to create artifacts. See the "Access Control" and "Publishing Artifact Versions" sections below for more information.

To create an artifact, you enter a Group Id and Artifact Key and together, these create an artifact name in the form groupId:artifactKey. After ElectricFlow creates the artifact name from your supplied Group Id and Artifact Key specifications, you cannot modify the name.

Note: Plan your artifact Group IDs and Artifact Keys carefully to prevent the extra work of deleting a name and beginning your specifications again. The use of a groupId and artifactKey allow two "namespaces" for added flexibility in organizing artifacts within your company or organization.

Examples

- If your development team uses GWT for web development and JUnit for unit testing, you may want to create artifacts "ThirdParty:GWT" and "ThirdParty:JUnit".
- Your organization may have two different development teams (OS and Apps) who want to use artifacts. In building each product, both development groups want to publish and use an "SDK" with their product. But each SDK is different and unique. One solution would be to create one artifact named "os:SDK" and another artifact named "apps:SDK". By using different group Id's, each development team is free to name their artifacts however they choose without worrying about name collisions with artifacts produced by the other team.

To reference an artifact, you can use the groupId and artifactKey combination or simply use the artifactName. The property path /artifacts/<artifactName> allows you to access any properties of a given artifact.

Artifact Version

An artifact version is a collection of 0 to N files that were published to an artifact repository. Artifact version metadata is stored in an artifactVersion object in the ElectricFlow server.

Tips for working with artifact versions:

- To group a collection of files (typically from build output in an ElectricFlow workspace) into an artifact version, specify the "from directory" containing those files.
- If you want to include files from multiple directories in your artifact, you need to specify a common root directory to include these directories when publishing your artifact.
• To restrict which files and subdirectories in the "from directory" to include in the artifact version, you can specify "include" and "exclude" patterns.

• Artifact versions are stored on an artifact repository server in either uncompressed tar archives or compressed tar-gzip archives.

• Artifact versions can be created using the publishArtifactVersion API, which includes creating the object in the ElectricFlow server and publishing the artifact version to the artifact repository.

  Note: Interactively creating an artifact version using the automation platform web UI is not supported at this time.

• When you retrieve an artifact version, the original directory structure of the directory where files were published "from" is preserved.

• When you retrieve/publish artifacts, directories containing symlinks are always resolved; they are not preserved.

Artifact versions are referenced by Group Id, Artifact Key (or artifact name) and a version string.

• The artifact version's name is set based on the name template on the "owning" artifact. By default, the name template is in the form groupId:artifactKey:version.

• Each artifact version name must be unique within an ElectricFlow server installation.

The property path /artifactVersions/<artifactVersionName> allows access to any properties for a particular artifact version. Because you may not know the artifact version name (because of the name template), this path supports the form <groupId>:<artifactKey>:<version> as a substitute for the name of the artifact version.

All ElectricFlow API's that take an artifactVersionName argument also accept this alternate form as a substitute, similar to how other API's that accept a jobId argument accept the job name as a substitute.

Version Strings

A version string must be provided when publishing an artifact version.

For example:

5.8.8-EN-55842 or 5.8.8.55842-EN - In either form, the version string is interpreted as:

  Major version number: 5
  Minor version number: 8
  Patch level number: 8
  Qualifier: EN
  Build number: 55842

You must provide separator punctuation. When interpreting (parsing) the first version string form, ElectricFlow interprets the text after the first hyphen as the build number if this string contains numeric characters only. Otherwise, the string is interpreted as the qualifier.

Version string examples and how ElectricFlow interprets them:
<table>
<thead>
<tr>
<th>Input (version string)</th>
<th>Major</th>
<th>Minor</th>
<th>Patch</th>
<th>Qualifier</th>
<th>Build Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0.3-44834</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>&lt;empty/null&gt;</td>
<td>44834</td>
</tr>
<tr>
<td>3.8.4-RC1</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>RC1</td>
<td>0</td>
</tr>
<tr>
<td>3.8.4-RC1-36</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>RC1</td>
<td>36</td>
</tr>
<tr>
<td>3.8.4.36</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>&lt;empty/null&gt;</td>
<td>36</td>
</tr>
<tr>
<td>1-36</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>&lt;empty/null&gt;</td>
<td>36</td>
</tr>
<tr>
<td>3.8.4.36-RC1</td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>RC1</td>
<td>36</td>
</tr>
</tbody>
</table>

In this table:

- Row 5 shows that you are not required to specify all three of `<major, minor, patch>` when publishing an artifact version if your organization's versioning conventions do not use all three fields. However, there is a caveat with this level of flexibility. You can create two artifact versions in the system with equivalent versions. Version string "1-36" is equivalent to "1.0-36" but they are not the same so you can publish two artifact versions with these version strings successfully. When retrieving an artifact version, in some cases it could be unclear as to exactly which one you will get. For this reason, we recommend that you adopt a convention and abide by it for a particular artifact.

The artifact version object exposes components of the version string by using these intrinsic properties:

- **version** - the version component is the combination of `major.minor.patch-qualifier-buildNumber`. A "version" component does not need to include all of the following intrinsic properties. See the table above.
- **majorMinorPatch** - this is the `major.minor.patch` version component as specified in the version string. For example, if you specified a version string of "1-36", the `majorMinorPatch` component would be "1", not "1.0.0", which makes it possible for you to meet your naming conventions by reconstituting the version string a different way in the artifact version name template.
- **qualifier** - the qualifier component of the version.
- **buildNumber** - the build number component of the version.

The **artifactVersionState** property

Artifact versions have an `artifactVersionState` property whose value can be one of the following:

- **publishing** - The artifact version is currently being published and is not available for retrieval.
- **available** - The artifact version is available for retrieval if needed.
- **unavailable** - The artifact version is not available for retrieval while in this state.
You can manipulate the state between available and unavailable on the Edit Artifact Version web page. This action can be useful if an artifact version seems to be corrupt in some way, but you want to investigate before potentially deleting it from the system.

By making the artifact version unavailable, retrievers can acquire an older (potentially more stable) artifact version while you look into the problem. If the artifact version is good, you can simply make it available again.

Repository

The artifact repository is a machine where artifact versions are stored. The repository server is configured to store artifact versions in a directory referred to as the repository backing store.

By default, the backing store is the `<datadir>/repository-data` directory in the repository installation. This default setting can be changed by running `ecconfigure --repositoryStorageDirectory` on the repository server. The repository server listens on port 8200 for HTTPS requests to publish and retrieve artifact versions.

Connection information is stored in the repository object on the ElectricFlow server.

You can create a repository objects in several ways:

- Use the New Repository web page in the ElectricFlow UI
- Use `createRepository` API
- Repository objects can be created automatically during the ElectricFlow installation.

When you are installing a repository server, the installer creates a corresponding repository object on your ElectricFlow server. If you are installing a repository server on the same machine as your ElectricFlow server, a repository object named “default” is automatically created. If you are installing a repository server on a different machine than your ElectricFlow server, the installer will prompt you for information it uses to create the corresponding repository object.

**Note:** When installing a repository server, we recommend installing an agent also to ease maintenance tasks such as clearing out stale artifact versions from the repository backing store.

Click the Artifacts tab, then the Repositories subtab to see your list of created repositories.

![Repositories](image-url)

You can re-order the repository search order (for retrieving artifact versions) by using the mouse to grab and drag the icon in the left column to the row position you prefer, effectively re-ordering the repository list.

For distributed environments, where the preferred repository search order varies depending on which resource is performing the retrieval, you can specify a preference order on the Edit Resource panel. See the illustration below.
To go to the Edit Resource panel; from the Repositories page, select the Cloud tab, which opens to the Resources page, then select a resource name.

Enter one repository name per line in the Repository Names field.

In the following example, a resource in California (A1) uses the "default" repository search order (that is, the order on the Repositories page). A1 searches for artifact versions by first requesting an artifact version from Repository 1. If the artifact version requested is not found, it will then request the artifact version from Repository 2.

The resource in New York (A2) has a specific search order specified where it searches for artifacts from Repository 2, first, then searches Repository 1.
Using multiple repositories

ElectricFlow supports multiple repositories, however you cannot share a repository between multiple ElectricFlow servers. Multiple repository servers may be required in your organization because of business or organizational reasons, government and compliance requirements, or for performance and data protection.

Examples:

Business or Organizational Structure
Within a company, two different development teams want to have artifact repositories containing artifacts and artifact versions specific to their product. A repository server is created for each team. The two teams publish artifact version to their respective repositories.

Performance
A company has multiple development sites. Instead of having a single repository server, which would create significant network performance issues from retrieving artifact versions during the build process, they create a repository at each development location and have artifact versions synchronized between the repository servers. In this way, when artifact versions are retrieved for use by a build process, they are retrieved from a local repository.

Data Protection and disaster recovery
A company has a single ElectricFlow server with two artifact repository server machines. The contents of the repository servers are synchronized and replicated between both machines. In the event repository 1 is unavailable during a retrieve, repository 2 is searched for the requested artifact retrieval.

Configuring the Artifact Repository Server for Amazon S3
You can configure the repository server to use Amazon S3 as the backing store and connect to Amazon S3 using IAM roles. This section describes the changes to make in the 
/opt/electriccloud/electriccommander/conf/repository/server.properties file.
Before starting this procedure, make sure the following have been created and are available on the AWS Management Console (https://aws.amazon.com/console):

- An Amazon S3 bucket for the backing store.
- The IAM role with a policy that grants all the s3:* access to the Amazon S3 bucket you want to use with the repository server.

For example, the IAM role called s3repositoryFullAccess has a policy called s3fullaccessAndAccessToInstallers that grants all the s3:* access to the backing store bucket called ec-test-repository-backingstore.

Follow these steps to set up the artifact repository for Amazon S3:

1. In the /opt/electriccloud/electriccommander/conf/repository/server.properties file, set REPOSITORY_BACKING_STORE to use Amazon S3 by changing

   REPOSITORY_BACKING_STORE=repository-data

to

   REPOSITORY_BACKING_STORE=s3://<name of the backing store bucket>

   You can get the <name of the backing store bucket> by going to IAM > Roles > <name of the IAM role> page on the AWS Management Console. Then click Show Policy to open the Show Policy window to view the name of the backing store bucket.

   **Example:**

   In this example, <name of the backing store bucket> is ec-test-repository-backingstore.

   ![Show Policy](image)

2. Restart the artifact repository server using a command like this:

   ubuntu@ip-10-101-214-28:$ sudo /etc/init.d/commanderRepository restart
3. To test the REPOSITORY_BACKING_STORE, create two files in a /tmp/<your username> directory, publish the directory, and verify that it is published using commands like this:

   ubuntu@ip-10-101-214-28:~$ cd /tmp
   ubuntu@ip-10-101-214-28:/tmp$ mkdir <your username>
   ubuntu@ip-10-101-214-28:/tmp$ cd <your username>
   ubuntu@ip-10-101-214-28:/tmp/<your username>$ touch abc
   ubuntu@ip-10-101-214-28:/tmp/<your username>$ ectool --server localhost login admin changeme
   ubuntu@ip-10-101-214-28:/tmp/<your username>$ ectool publishArtifactVersion --version 1.0 --artifactName hello:world

4. Verify that the /tmp/<your username> is published to the Amazon S3 backing store.

   Example:

   ![Image of repository](image.png)

   **The repositoryDisabled intrinsic property**

   The repository object has a repositoryDisabled property that dictates whether or not artifacts can be published or retrieved from a particular repository. If you take a repository offline for maintenance, you can disable the repository in the ElectricFlow server rather than shutting down the repository machine or the service. Steps that attempt to publish to this repository will fail, and steps that attempt to retrieve artifact versions will skip this repository during the search for available repositories.

   **Access Control**

   You can apply access control permissions to artifacts and artifact versions to control who can create an artifact versus who can publish an artifact version versus who can read or retrieve an artifact version.

<table>
<thead>
<tr>
<th>Action</th>
<th>Required permission</th>
<th>Object</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create an artifact</td>
<td>Modify</td>
<td>artifacts system object</td>
</tr>
<tr>
<td>Read artifact metadata</td>
<td>Read</td>
<td>the relevant artifact</td>
</tr>
<tr>
<td>Modify an artifact</td>
<td>Modify</td>
<td>the relevant artifact</td>
</tr>
<tr>
<td>Action</td>
<td>Required permission</td>
<td>Object</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>---------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Delete an artifact, which deletes all artifact versions within the artifact</td>
<td>Modify</td>
<td>artifacts system object</td>
</tr>
<tr>
<td>Publish an artifact version</td>
<td>Modify</td>
<td>the artifact into which a new version is being published</td>
</tr>
<tr>
<td>Read artifact version metadata (required for retrieval)</td>
<td>Read</td>
<td>the relevant artifact version</td>
</tr>
<tr>
<td>Modify an artifact version</td>
<td>Modify</td>
<td>the relevant artifact version</td>
</tr>
<tr>
<td>Delete an artifact version</td>
<td>Modify</td>
<td>the artifact that owns the artifact version</td>
</tr>
</tbody>
</table>

**Note:** The Execute privilege does not take part in artifact or artifact version access control.

"Out-of-the-box," an `<Everyone, modify>` access control entry is available that allows anyone to publish an artifact version to any artifact, and allows anyone to create an artifact. You might consider removing this access control entry and setting up tighter control for individual artifacts. See the EC-Security plugin for help with this effort.

For more information about access control for artifact management, see the Access Control Help topic.

The following scenarios provide ideas for how you might set up access control for artifact management.

**Control who can create new artifacts and publish artifact versions**

ElectricFlow administrator, Adam, received communication from development manager, Max, requesting that only he should be able to create artifacts in ElectricFlow — developers of ElectricFlow procedures under him should only be able to create steps to publish artifact versions under pre-defined artifacts.

His reasoning is that it is too easy for a developer to introduce a typo during publish (which does auto-create the artifact if the user has the appropriate privilege and the artifact doesn't exist).
Adam accommodates the request by giving Max the modify privilege on the artifacts system object and removing the <Everyone, modify> access control entry. Max then creates artifacts and assigns modify privileges to those artifacts for his development group, effectively allowing them to publish artifact versions.

At run-time, a step belonging to some project actually performs the publish, so Max adds project principal access control entries for the relevant projects as well, providing modify privileges.

**Control which projects can retrieve artifact versions at run-time**

Acme Corporation’s router product has a software stack consisting of OS, PlatformLibraries, and Apps. Each of these has an ElectricFlow project with several procedures that work together to build the relevant component. PlatformLibraries builds against some of the C header files and libraries produced by the OS build. Similarly, Apps builds against libraries produced by PlatformLibraries.

The lead developer for the OS component, creates a Router:OSLib artifact and gives the PlatformLibraries project principal read privileges so that project can retrieve any OSLib artifact version it needs to build PlatformLibraries. Similarly, Paul from the PlatformLibraries team creates a Router:PlatformLib artifact and gives the Apps project principal read privileges.

**Group 1 publishes an artifact version and wants only Group 2 to be able to retrieve it**

An organization wants to create artifacts for each of the third-party packages used by developers. Among the tools shared is the GWT package. The build manager chooses to create an artifact called 3rd-party-PKGS:GWT. Because of licensing concerns, the build team must control or regulate who has access to the GWT and who can publish artifact versions used within the company’s product.

In this case, the build team will publish a GWT artifact version and test it. During the test and approval cycles, only the build team has access to read and modify the artifact or publish new artifact versions. After a version has passed internal testing and approvals, the build team then grants read access to each of the developer groups.

**Publishing Artifact Versions**

An artifact version is published by using a procedure step or the `ectool / ec-perl` command-line interface. In most cases, using the Publish Artifact Version step is sufficient.

The following screen illustrates the parameters section for creating the Publish Artifact Version step:
Enable Compression

When publishing an artifact, consider whether or not to enable compression. Using compression reduces transfer time during publish. However, compression also adds overhead when computing the compressed data. If files included in the artifact version are primarily text files or are another highly compressible file format, the benefit of reduced transfer time outweighs the cost of computing compressed data.

Artifact versions that contain installers, jars, audio, and video are almost certainly not compressible because these file types are already compressed, so the cost of compressing outweighs the (near zero) benefit of reducing transfer time. Another consideration: Artifact versions are stored in the same format as they are transferred, so highly compressible artifact versions use less space in the repository backing store.

Include and Exclude Patterns

When publishing an artifact, you can choose which files to include by using include and exclude patterns. File patterns are expressed as relative paths under the From Directory. Pattern syntax and behavior is the same as Ant and uses the following wildcard characters:

- ? - matches a single character
- * - matches any number of characters, but only at a single directory level
- ** - matches any number of directory levels

Examples:

Use *.jar to match any .jar file in the top-level directory.

Use */*.jar to match any .jar file in any child directory.

Use **/*.jar to match any .jar file at any level.
Retrieving Artifact Versions

An artifact version is retrieved using a procedure step, or the retrieveArtifactVersion API call, used by the ectool/ec-perl command-line tools. This API call returns the most current artifact version that meets your criteria, per the algorithm described below.

Typically, you specify a version number range. Artifact version ranges are specified using interval notation. Brackets [ ] indicate versions to include and parentheses ( ) indicate versions to exclude.

For example, the following artifact versions are published:

- foobar:test:3.0.1-3645
- foobar:test:1.2.3-2139
- foobar:test:2.0.0-4000
- foobar:test:2.0.0-DE-3395
- foobar:test:2.0.0-DE-2445
- foobar:test:2.0.0-DE
- foobar:test:3.0.0-3539
- foobar:test:4.0.0-5584

You want to retrieve the most current artifact version for the foobar:test artifact. To do this, you do not need to provide a version or version range, but instead enter retrieve parameters in the Retrieve Artifact Version step page as follows:

The equivalent command using ectool is:

```bash
ectool retrieveArtifactVersions --artifactName foobar:test
```

and with ec-perl, the syntax is:

```perl
my $cmdr = newElectricCommander();
```
$cmdr->retrieveArtifactVersions({artifactName => "foobar:test"});

Version numbers for two artifact versions (Artifact Version 1 and Artifact Version 2) are compared in the server as follows:

1. Compare major.minor.patch.
2. If they are equal, compare qualifiers.
3. If they are equal, compare buildNumbers.

Note: This comparison algorithm does not take the time of publish into account. "Current" means the artifact version with the greatest version per the above algorithm.

So the above list of artifact versions would be sorted (most current to least) as follows:

- foobar:test:4.0.0-5584
- foobar:test:3.0.1-3645
- foobar:test:3.0.0-3539
- foobar:test:2.0.0-DE-3395
- foobar:test:2.0.0-DE-2445
- foobar:test:2.0.0-DE
- foobar:test:2.0.0-4000
- foobar:test:1.2.3-2139

If you want to retrieve the latest 3.0.0 artifact version, set maximum version to 3.0.1 "exclusive".

The parameters entered in the retrieve step would look like this:

![Parameters](image)

Setting this constraint ensures the entire "version string" is properly evaluated. In other words, you want to ensure all artifact versions with 3.0.0, including qualifiers and build numbers, are included in the evaluation.

The equivalent command using ectool is:
ectool retrieveArtifactVersions --artifactName foobar:test
   --versionRange "(,3.0.1)"

And with ec-perl the syntax is:

```perl
my $cmdr = newElectricCommander();
$cmdr->retrieveArtifactVersions({artifactName => "foobar:test",
   versionRange => "(,3.0.1)"});
```

Note the use of parentheses to exclude version "3.0.1".

Generally, while in development, you will want to specify a minimum artifact version and take the latest version published, then when an artifact has reached a "released" state, indicate a specific version.

**Parameters and Environment Variables for Artifact Retrieval Retry Attempts**

The following parameters for artifact retrieval retry attempts are available in the Automation Platform server settings:

- **Number of retries for Retrieve Artifact**
- **Initial delay between retries for Retrieve Artifact**
- **Maximum delay between retries for Retrieve Artifact**

The following environment variables for artifact retrieval retry attempts are available:

```text
COMMANDER_NUMBER_OF_RETRIES_FOR_RETRIEVE_ARTIFACT
COMMANDER_INITIAL_DELAY_BETWEEN_RETRIES_FOR_RETRIEVE_ARTIFACT
COMMANDER_MAXIMUM_DELAY_BETWEEN_RETRIES_FOR_RETRIEVE_ARTIFACT
```

You set these variables on a client machine before doing a manual retrieval from the client via the `ectool retrieveArtifactVersions` command.

**Entering Filters During a Retrieve Operation**

At times, a company might want to distinguish between artifact versions not just by version range but also by some other property of the artifact version.

Examples are:

- Specifying a qualifier in the version string when publishing.

  For example, you might want to publish an artifact version for your product's English or German variants. You could publish the English version as `2.0.4-EN-55497` and the German version as `2.0.4-DE-55497`.

  When the qualifier string is used this way to classify artifact versions, it should be used as a filter to retrieve the latest version. This is described in the following example.
• Setting a custom property on the artifact version.

For example, after your QA team has tested an artifact version, they could show approval by setting a `qaApproval` custom property, including the name of the QA engineer.

For either case, filters can be applied when retrieving an artifact version. To retrieve the latest German version for the artifact, the parameters entered on the retrieve artifact custom step page look like this:

Because `DE` was used as the qualifier, ElectricFlow will retrieve the latest artifact version for the `perl:pkg` artifact where the qualifier equals `DE`.

Only the following filter operators can be applied to the intrinsic property `version`:

- `equals`
- `greater than` (greaterThan, for use in the API)
- `less than` (lessThan, for use in the API)
- `greater than or equals` (greaterOrEqual, for use in the API)
- `less than or equals` (lessOrEqual, for use in the API)

"equals" is special because it does a string comparison on the version string of the artifact version, while the other operators compare the interpretation of the version string as described earlier.

All filter operators can be applied to version string components: `majorMinorPatch`, `qualifier`, or `buildNumber`. To find artifact versions with no qualifier, specify a filter on "qualifier" with operator "is not set" (or isNull in the API).

So for the QA approval case in a previous example, if a procedure is interested in an artifact version that was approved by QA, the retrieve step would specify a filter for "qaApproval is set".

`ectool` does not currently support the filters argument, but you can write a Perl script as follows:

```perl
my $cmdr = new ElectricCommander();
$cmdr->retrieveArtifactVersions({artifactName => "perl:pkg",
    filters => {propertyName => "qaApprover",
        operator => "isNotNull"}});
```
Dependent Artifact Versions

A published artifact version can be dependent on a list of artifact versions. These dependent artifact versions are retrieved when the primary artifact version is retrieved and they are specified with a query syntax when publishing the primary artifact version.

For example:

An artifact version for the ElectricFlow product could include dependent artifact versions for the core product, the SDK, and online Help:

- the latest `commander:Core` artifact version greater than or equal to version 3.5 (including 3.5)
- the most recent version of the `commander:SDK` artifacts
- the `commander:onlineHelp` artifact with a version greater than version 3.10 (excluding 3.10)

Because dependent artifact versions are evaluated during the retrieve process, specify them using the same syntax as you would for retrieving any artifact version, which is by including the group Id, the artifact key, and a specific artifact version or a version range.

Parameters for the "publish" custom step page would be similar to the following:
A published artifact version could have zero files, that is, no files are published as part of the artifact version, but it still could have a list of dependent artifact versions. An empty artifact version might be useful as modular convenience container for retrieving a group of artifact versions in downstream processes.

Artifact Cache

Artifact versions are retrieved to an artifact cache directory before being consumed by a build process. Properly configured, the artifact cache directory can significantly improve efficiency as you work with artifacts.

The artifact cache directory is set in one of these ways:

- Enter information in the Artifact Cache Directory field on the Edit Resource page.
- Use the modifyResource API to set the artifactCacheDirectory intrinsic property.
- Set the artifactCache field in the agent.conf file.

Thus, each resource can have its own artifact cache location (directory). Alternatively, multiple resources and an entire site can share an artifact cache if the cache directory resides on a shared file server.

When an ElectricFlow step retrieves an artifact version, remember that often a version range or no version at all is specified. For example, to retrieve the latest ElectricFlow SDK artifact version, you could issue the following command:

```
ectool retrieveArtifactVersions --artifactName commander:SDK
```

No version is specified because we want the "latest" artifact version published.

In the following example, the step sends a request (1) to the ElectricFlow server.

- The ElectricFlow server replies (2) with a fully qualified artifact version name. In this case, it returns commander:SDK:1.2.0.43552.
- The step then looks in its artifact cache for the artifact version (3).
- If the artifact is not found in the artifact cache, a request is issued (4) to get a list of repositories to search to find the artifact version.
- The ElectricFlow server replies (5) with a list of repositories and the order in which to search them.
- The step requests the artifact version from the first (6) repository in the list.
- If the artifact version is found in the repository, the artifact version is retrieved to the cache (7).
- If the artifact version is not found, the step requests the artifact version from the next repository in the search order (8).
- If the artifact version is found in that repository, the artifact version is retrieved to the cache (9).
- Otherwise, if the artifact version is not found in any repository, an error is displayed.
In this example, if the requested artifact version was found in the artifact cache (step 3), the resource would not have communicated with either of the repository servers. Also, any potential network latencies would have been avoided from retrieving the artifact version from the repository server.

If you have a cache shared by multiple resources and steps that run on those resources need to use the same artifact version, the first step requesting an artifact version retrieves it from the repository to the cache. Subsequent job steps using the artifact version will have immediate access to the artifact version in the cache, eliminating the need for each step to retrieve its own copy of an artifact version.

Cleaning Up Repositories and Caches

**Note:** This method does not work for artifacts in an Amazon Simple Storage Service (Amazon S3) repository.

Deleting an artifact version in the ElectricFlow server does not delete it in the repository backing store, and it does not remove the artifact version from an artifact cache.

`ectool` and the ElectricFlow Perl module include a function for each of these tasks: `cleanupRepository` and `cleanupArtifactCache`. Both of these API calls are intended to be run on the machine containing the cache/backingstore directory that needs to be cleaned up.

The cleanup algorithm is as follows:

1. Review the directory tree looking for directories three-levels deep.
2. For each such directory, interpret the three path components as `<groupId,artifactKey,version>`.
3. Issue a `findObjects` request to the ElectricFlow server to see if an artifact version with that specification exists.
4. Delete all directories identified by `<groupId,artifactKey,version>` and not recognized by the ElectricFlow server.

To operate correctly, using the `cleanupRepository` API requires read access to all artifact version objects stored in ElectricFlow and therefore must be run in an “admin” session. We also recommend running
cleanupArtifactCache in an "admin" session—if not, artifact versions that are simply not readable by the user invoking the cleanup will be deleted from the cache.

In addition, both functions fail if the server does not recognize any of the chosen artifact versions. Thus, if the cleanup function is called on a directory that is not a backingstore directory or and artifact cache, it will not delete anything.

The recommended approach for removing stale artifact versions from a backing store is to use an ElectricFlow maintenance procedure that periodically runs on each repository server (which presumably has an agent install). Similarly, use a procedure with a broadcast step to run on each agent to clean up its cache. Note that the job step session does not necessarily have read privileges on all artifact versions, so it is important to login as a privileged user, then perform cleanup with those credentials.

Authenticating Users for LDAP and Active Directory

ElectricFlow uses account information from multiple sources. In most cases, the primary account information source is an external LDAP or Active Directory repository: both user and group information is retrieved from the repository. Local users and groups are defined within ElectricFlow.

Use the following LDAP information and examples to enter information in your LDAP template. If you are using the Active Directory template, you may still use the LDAP information as reference—the templates are similar with only a slight difference in the Active Directory template.

Configuring LDAP

A number of options need to be customized for any LDAP configuration. The following sample configuration shows how we have our own LDAP configuration set up. After the sample, see a list of properties with a description.

Sample LDAP Configuration

```xml
<bean id="LdapDirectoryProvider"
     class="com.electriccloud.security.ldap.LdapDirectoryProviderImpl">
  <property name="providerName" value="LDAP"/>
  <property name="url" value="ldap://dir.electric-cloud.com/dc=electric-cloud,dc=com"/>
  <property name="managerDn" value="uid=JohnDoe,ou=People,=electric-cloud,dc=com"/>
  <property name="managerPassword" value="****"/>
  <property name="userBase" value="ou=People"/>
  <property name="userSearchFilter" value="uid={0}"/>
  <property name="userNameAttribute" value="uid"/>
  <property name="fullUserNameAttribute" value="gecos"/>
```
<property name="emailAttribute" value="mail"/>
<property name="groupBase" value="ou=Group"/>
<property name="groupMemberFilter" value="(|(member={0})
    (memberUid={1}))"/>
<property name="groupMemberAttributes" value="member,
    memberUid"/>
<property name="groupSearchFilter" value="(|
    (groupOfNames)(objectClass=posixGroup))"/>
<property name="groupNameAttribute" value="cn"/>
</bean>

The following properties configure LDAP mapping:

  emailAttribute - (optional) The attribute in a user record that contains the user's email address. If the 
  attribute is not specified, the account name and domain name are concatenated to form an email address.

  fullUserNameAttribute - (optional) The attribute in a user record that contains the user's full name (first 
  and last) for display in the UI. If this attribute is not specified or the resulting value is empty, the user's 
  account name is used instead.

  managerDn - (optional) The DN of a user who has read-only access to LDAP user and group directories. If 
  this property is not specified, the server attempts to connect as an unauthenticated user. Not all servers 
  allow anonymous read-only access.

    Note: This user does not need to be an admin user with modify privileges.

  managerPassword - (optional) If the managerDn property is set, this password is used to authenticate the 
  manager user.

  providerName - This human readable name will be displayed in the user interface to identify users and 
  groups that come from this provider.

  userBase - This string is prepended to the basedn to construct the directory DN that contains user records.

  userNameAttribute - The attribute in a user record that contains the user's account name.

  userSearchFilter - This LDAP query is performed in the context of the user directory to search for a user 
  by account name. The string \"r;{0}\" is replaced with the user's login ID. Typically, the query compares a 
  user record attribute with the substituted user login ID.

  url - The LDAP server URL is in the form protocol://host:port/basedn. Protocol is either ldap or 
  ldaps for secure LDAP). The port is implied by the protocol, but can be overridden if it is not at the default 
  location (389 for ldap, 636 for ldaps). The basedn is the path to the top level directory that contains users 
  and groups at this site. This is typically the domain name where each part is listed with a dc= and separated 
  by commas.

    Note: Spaces in the basedn must be URL encoded (%20).
In addition to user information, the LDAP server can be queried for group information. This query is optional because the local group mechanism can refer to LDAP users and local users. However, the following elements can be used to tell the server how to map groups in LDAP

- **groupBase** - (optional) This string is prepended to the basedn to construct the directory DN that contains group records.

- **groupMemberAttributes** - (optional) A comma separated attribute names list that identifies a group member. Most LDAP configurations only specify a single value, but if there is a mixture of POSIX and LDAP style groups in the directory, multiple attributes might be required.

- **groupMemberFilter** - (optional) This LDAP query is performed in the groups directory context to identify groups that contain a specific user as a member. There are two common forms of group record in LDAP directories: POSIX style groups where members are identified by account name, and

  - **groupOfNames** or **uniqueGroupOfNames** records where members are identified by the full user DN.

  Both forms are supported, so the query is passed two parameters: "r;{0}" is replaced with the full user record DN, and "r;{1}" is replaced with the user's account name.

- **groupNameAttribute** - (optional) The group record attribute that contains the name of the group.

- **groupSearchFilter** - (optional) This LDAP query is performed in the context of the groups directory to enumerate group records.

### Determining LDAP Mapping

A typical POSIX user record in LDAP looks similar to the example below. To set up a mapping for this record, it is necessary to identify various record components. First, identify the path in the directory that contains user records. In this example, the build user has a distinguished name (dn) of

- **uid=build, ou=People, dc=mycompany, dc=com**. This name uniquely identifies the build user account and this path splits into three parts:

  - **base dn**: dc=mycompany, dc=com
  - **user base**: ou=People
  - **user element**: uid=build

The **baseDn** is the parent of the directory that contains users. This value should be combined with the protocol and server to form the URL. In this case, the URL is `ldaps://dir/dc=mycompany, dc=com`.

Next, the **userBase** is the portion of the path that identifies the directory containing all user account records. This value is used directly as the **userBase** configuration element.

The remaining portion identifies the user without the People directory: **uid=build**. The user name is replaced in this value with the string "r;{0}" to form the **userSearchFilter**: **uid={0}**. This query allows the server to search for a user's account name by looking for a record with a matching **uid** attribute.

The final mapping step is to identify user record attributes that hold the account name, full user name, and (optionally) the user's email address. In this example, the account name is **uid** (identified earlier), the full user name attribute is **gecos**, and there is no email attribute.
At this point, the server is able to authenticate a user, look up a user by name, and determine the user's full name. For many installations this is sufficient.

Sample LDAP User Record

```plaintext
# build, People, electric-cloud.com
dn: uid=jdoe, ou=People, dc=mycompany, dc=com
loginShell: /bin/bash
uidNumber: 508
gidNumber: 508
objectClass: account
objectClass: posixAccount
objectClass: top
objectClass: shadowAccount
uid: jdoe
gecos: John Doe
cn: John
homeDirectory: /net/filer/homes/build
```

Also, you can configure the server to look for LDAP groups that refer to user accounts. A typical group record is shown below. Like a user account, an LDAP group has a distinguished name with a baseDn, a group base, and a group element. In this case, the baseDn is still dc=mycompany, dc=com. The groupBase configuration element is ou=Group, and the group name is cn=build_users.

The server needs to identify records in the directory that correspond to groups—it does this by applying the groupMemberFilter to the records in the groupBase directory. In this case, group records are members of the posixAccount object class, so the filter can be set to objectClass=posixGroup. To display a group by its name, the server needs to know which attribute represents the group name. In this case, set the groupNameAttribute to cn.

Finally, the server needs a filter to determine which accounts belong to the group and the attribute name that represents a single group member. Group membership can be identified in one of two ways. Either the members are listed by account name, or by their LDAP distinguished name. In this case, POSIX group membership is determined by account name, so set the groupMemberAttributes property to memberUid, and set the groupMemberFilter to memberUid={1}.

Sample LDAP Group Record

```plaintext
# build_users, Group, mycompany.com
dn: cn=build_users, ou=Groups, dc=mycompany, dc=com
objectClass: posixGroup
objectClass: top
gidNumber: 100
memberUid: jdoe
    memberUid: mary
cn: build_users
```

Sample Active Directory Configuration File

The following XML file defines parameters needed to connect to an Active Directory server and the query to use for looking up user information.

```xml
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:
```
LDAP Group Hierarchy

The LDAP or Active Directory provider can now be configured to recognize the nested group hierarchy in the LDAP or Active Directory server in the following use cases.

Access Control

When **Recursively Traverse Group Hierarchy** is selected (enabled) for the directory provider and access control is set up for a given LDAP group in ElectricFlow, the users belonging to any nested groups in LDAP will automatically inherit the access control rules defined for the parent groups. For more information about **Recursively Traverse Group Hierarchy**, see the "Membership Options" sections in To create a new Active Directory provider on page 773 and To create a new LDAP directory provider on page 777 for the directory provider configuration details.

In this LDAP hierarchy:

- **Group1**
  - **User11**
  - **Group11**
    - **User111**
    - **User112**
    - **Group111**
  - **Group12**
    - **User121**
    - **User122**

These access control rules have been set up with **Recursively Traverse Group Hierarchy** enabled:

- **Group1**: Project:Default Read->Allow, Modify->Allow, Execute->Deny
- **Group12**: Project:Default Read->Allow, Modify->Deny, Execute->Allow

Because the users in Group111 and Group11 are also considered to be members of Group1, the access control rules defined for Group1 also apply to them:

Project:Default Read->Allow, Modify->Allow, Execute->Deny

Because the users in Group12 are also considered members of both Group1 and Group12, the access control rules defined in both groups may apply to the users in Group 12. However, ElectricFlow does not apply special precedence logic based on the group hierarchy, and the same precedence logic that is currently applied for a user belonging to two or more groups will apply in this situation, giving Deny a higher precedence:

Project:Default Read->Allow, Modify->Deny, Execute->Deny

Manual Task Assignees and Approvers

If **Recursively Traverse Group Hierarchy** and **Include Nested Group Users as Approvers** are both enabled for the directory provider, users in nested LDAP groups are allowed to complete or approve a manual task when
a parent LDAP group is assigned as an assignee or an approver for the task. For more information about these membership options, see the "Membership Options" sections in To create a new Active Directory provider on page 773 and To create a new LDAP directory provider on page 777 for the directory provider configuration details.

In the following LDAP hierarchy with both Recursively Traverse Group Hierarchy and Include Nested Group Users as Approvers enabled:

- Group1
  - User11
  - Group11
    - User111
  - Group12
    - User121

When Group1 is assigned as an approver for a manual task, User11, User111, and User121 can approve the task.

Notifications

If Recursively Traverse Group Hierarchy and Include Nested Group Users in Notifications are both enabled for the directory provider, users in nested LDAP groups will be included when sending notifications to a parent LDAP group. For more information about these membership options, see the "Membership Options" sections in To create a new Active Directory provider on page 773 and To create a new LDAP directory provider on page 777 for the directory provider configuration details.

In the following LDAP hierarchy with both Recursively Traverse Group Hierarchy and Include Nested Group Users in Notifications enabled:

- Group1
  - User11
  - Group11
    - User111
  - Group12
    - User121

When notifications are set up to be sent to Group1, they are sent to User11, User111, and User121.

Change Tracking

Change Tracking is designed to track every change between every state of non-runtime ElectricFlow objects and to allow you to revert to any previous state of these objects. ElectricFlow tracks the changes to tracked objects including applications, procedures, workflows, workspaces, resources, and project-owned components such as library components and records a Change History of the historical states of the system and the changes between them. The change history has a copy of every state in which every non-runtime object has been, the object's current state, and indexing records for searching through the database. The tracked objects are not
affected when ElectricFlow executes an object that is usually created or modified at execution time, such as a workflow or process.

Change tracking allows you to do the following:

- When debugging a failed job or looking for more information about a component in an ElectricFlow, see the Change History for the changes relevant to that object.
- When searching for specific change history records, filter the records by time frame, change type, entity type, or developer.
- Revert changes to an object or to an objects and its children.
- When you want to determine the differences between objects, export them at various levels in the object hierarchy.

In ElectricFlow, you can use Change Tracking in all aspects of the ElectricFlow end-to-end solution:

- In build-test automation, track the Change History of artifacts, resources, and ACLs.
- In deployment automation, track the Change History of components, environment tiers, and process steps (application or component). You also use Change Tracking with snapshots to make it easier to deploy reliable and repeatable software for Continuous Delivery.
- In Releases and Pipelines, track the Change History of stages and tasks.

Configuring Change Tracking

Change Tracking must be enabled when ElectricFlow starts for your system to track changes and record the Change History.

By default, Change Tracking is enabled for projects created in ElectricFlow 5.3 or later. It is disabled for projects created in ElectricFlow versions before ElectricFlow 5.3, but can be enabled manually.

Enabling Change Tracking Globally

When installing ElectricFlow:

1. Add this line to the database.properties file:

   COMMANDER_DB_AUDITING_ENABLED=true

2. Restart the ElectricFlow server.

Enabling Change Tracking on a Per-Project Basis

IMPORTANT: Unless the allowEnablingDisablingChangeTrackingProjectLevel setting has been altered, only admin users are allowed to perform this task. The default setting is adminOnly. If the setting is changed to anyoneWithAccess, any user with access to the project can enable or disable Change Tracking for the project.

You can enable Change Tracking one of the following ways:

In the ElectricFlow Platform UI

Change Tracking is enabled when the Enable Change Tracking check box is selected.
To disable Change Tracking, click the **Enable Change Tracking** check box to clear it, and click OK.

**Using ectool**

- Enter `ectool modifyProject <projectName> --tracked true` to enable Change Tracking.
- Enter `ectool modifyProject <projectName> --tracked false` to disable Change Tracking.

**Using ec-perl:**

- Enter `$cmdr->modifyProject(<projectName>, {tracked => true});` to enable Change Tracking.
- Enter `$cmdr->modifyProject(<projectName>, {tracked => false});` to disable Change Tracking.

For properties that are frequently updated always to be a numerical value, it is possible to suppress Change Tracking of numerical-value updates by using one of these commands:

**ectool:** `ectool modifyProperty <projectName> -- path <propertyPath> -- counter true`

or

**ec-perl:** `$cmdr->modifyProperty (<projectName>, {path => <propertyPath>, counter => true});`

When the counter flag is set for a property, Change Tracking does not track changes to the property if the only change was a change in the property value from one numeric value to another. All other forms of changes to the properties that have this flag set are tracked normally.

**CAUTION:** Reverting an object that owns a counter property to a previous state will revert the value of the counter property to its value at the previous time that a change to this property was tracked—typically this is
when its value is initialized. This may not be the desired behavior, so you may need to manually set a counter property if it is reverted.

Upgrading to ElectricFlow 6.x

Change Tracking is enabled when you upgrade to ElectricFlow 6.x. This can significantly increase the time it takes to complete the upgrade.

If you want to upgrade with Change Tracking disabled, add this line to the database.properties file before starting the upgrade:

```shell
COMMANDER_DB_AUDITING_ENABLED=false
```

Customizing the Change History Page

The performance of the Change Tracking feature is affected by number of records in the Change History as well as the number of entries being tracked. For example, a page showing 5000 entries may be slow to load and update and does not provide much useful information.

This ElectricFlow server uses the lowest of the following limits to determine the maximum amount of records to display in the Change History page:

- Maximum amount of records on the Change History page
  
  To change the maximum number of records in the Change History page:

  1. Set the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file to a new value.
     
     The default value is 1000.

  2. Restart the ElectricFlow server.

- Maximum number of records retrieved
  
  Set the `TrackingMaxRecords` server setting to a new value not exceeding the `CHANGE_TRACKING_HARD_MAX_RECORDS` parameter in the `wrapper.conf` file.

  To set `TrackingMaxRecords`, do one of the following:

  Change the value in the UI. See the Server Settings page in the automation platform UI.

  Use `ectool` to change the value. For example, enter the following command to limit the number of records retrieved to 100:

  ```shell
  ectool setProperty /server/settings/changeTrackingMaxRecords --value 100
  ```

Viewing the Change History for Artifacts, Jobs, Projects, and Workflows

When troubleshooting why a job failed, you can view the Change History for artifacts, jobs, projects, and workflows in the automation platform.

- **Artifacts** on page 864
- **Jobs** on page 864
Artifacts

Starting from the Home page:

1. Go to the Artifacts tab.
2. Choose an artifact.
3. Click the **Track Changes** button.

**Example:**

![Artifacts tab example]

The Change History for the selected artifact opens.

The default time increment is **Past 60 Minutes**.

**Example:**

![Change History example]

Jobs

Starting from the Home page:
1. To go to the Job Details page, do one of the following:
   - Use the Jobs tab.
   - Use the Jobs Quick View list.

2. If you use the Jobs tab, follow these steps:
   a. Click the Jobs tab.
      The Jobs page opens.

      Example:

      ![Jobs tab example]

   b. Click a job name to select a job.
      The Job Details page opens.

      Example:

      ![Job details example]

3. If you use the Jobs Quick View list, click a job name to select a job.
   The Job Details page opens.

4. Choose a job or job step.

5. Click **Track Changes** for the job or job step.
   The Change History for the job or job step opens.

   The default time increment is **Past 60 Minutes**.

**Projects**

Starting from the Home page:
1. Go to the Projects tab.
2. Choose a project.
3. Click the Track Changes button.

The Change History for the project opens.

**Example:**

![Change History Example](image)

**Workflows**

Starting from the Home page:

1. Go to the Workflows tab.
2. Choose a workflow.
3. Click Track Changes.

The Change History for the workflow opens.

**Modifying What You See the Change History**

You can modify the information that appears in the Change History with these settings:

- Time line—Go to Change History Time Line on page 866.
- Filters—Go to Change History Filters on page 872.

**Change History Time Line**

The time line is at the top of the Change History page.

This example shows the Change History for a property called propertyviewer-1.0.1.
1. **Time increment.**

   The default is **Last Changes**.

   Click the down arrow to select another time increment.

2. The system automatically calculates the minutes, hours, and days since the last successful run.

   In the example, the last successful run occurred 24 hours ago. The time line is divided into four 6 hour subdivisions.

3. **Total number of changes in the selected time increment.**

4. **The number of changes that occurred between 6 hours ago and now is 4.**

   When you click the change number, the Change History is updated and shows only those changes.

5. **Drag the start and end time markers to view specific changes.**

**Default Settings**

The default time increment is **Last Change**.

The entire time line is displayed, and all the changes are in the list below the time line.

**Number of Changes**

The time line shows the number of changes throughout the time increment. In the following example:

- There have been 233 changes in the last 24 hours.
- There have been 213 changes in the last 12 hours.
- There have been 20 changes in the last 6 hours.
When you change the time increment, there have been two changes in the previous 60 minutes.

The system automatically determines how the time line is divided for the selected time increment. When the range is changed to **Past 60 Minutes**, the time line changes:

- The start time is 60 minutes from **Now**.
- The end time is when the **Most Recent** change occurred (**Now**).
- The time line has four divisions.

If the increment is **Past 7 Days**, the time line has seven one-day divisions.
Moving the Start and End Times Manually

You can manually move the start and end times on the time line.

When you move the start time to 18:00 and the end time to 6:00, the list of objects in the change history changes.

Setting Custom Time Increments

Example:
1. Select **Between**.
   
   A drop down dialog box opens.
   
   **Example:**
   
   ![Example Image](image)

2. Select the time and date for the start of the time line.
   
   The default settings are 3:30 PM and eight days before the current date.
   
   **Example:**
   
   ![Example Image](image)
3. Click **OK**.

A drop down dialog box opens at the other end of the time line.

**Example:**

![Example](image)

4. Select the time and date for the end of the time line.

The defaults are **3:30 PM** and the current date.

**Example:**

![Example](image)
5. Click **OK**.

The timeline changes to show only the changes from the start and end times and dates that you selected.

**Example:**

![Change History for JPetStore](image)

**Change History Filters**

The Change History has records only for an object and its tracked entities, not all entities belonging to the object. You can use filters to view changes to specific objects, the types of changes, and the users how made those changes if they are are tracked.

In this example, instead of selecting **View All Changes**, you can select specific objects, such as only properties, processes, property sheets, process steps, and process dependencies that have been modified by the Project:Default and Admin users.
When the list of filter criteria is long, not all of the criteria may appear in the filter list. To see all of the criteria, use the up or down arrows to see all the options.

This list does not show all of the users. Use the up and down arrows to see all four of the users.

Click the down arrow to see the other users.

**Searching the Change History**

Follow these steps to start a search in the Change History.

You can start a Change History search from most pages in the ElectricFlow UI.
1. Click the **Search** button or click **Change History**.

**Example:**

![Search button](image.png)

The **Change History - Search** dialog box opens.

**Example:**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time range</strong> field.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Click the down arrow to open the drop-down list of start times.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The end time is the current time.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Objects</strong> field.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Click the down arrow to open the drop-down list of objects to include in the search.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>You can select <strong>All</strong> or specific objects.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>By default, seven of the most commonly tracked objects are selected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Search criteria.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After you type, the system starts searching for objects based on the time range and objects that you selected.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The search results are in the Change History.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. To select a time range for the search:
   a. Click the down arrow in the **Time range** field to open the drop-down list.
   b. Select a time range.
   c. If you want to use a time increment longer than three days, do the following:
      a. Click **Select Date**.
      
      The Date Picker opens.
      
      **Example:**

      ![Date Picker](image)

      b. Select a date.
      
      The Date Picker closes and the date that you selected appears in the Time Increment field.
      
      **Example:**

      ![Date Picker Example](image)

3. To select an objects for the search:
   a. Click the down arrow in the **Object** field to open the drop-down list.
   b. Select the objects for the search.

4. Enter the search criteria.

   As you type, the system starts to search for objects that match your search criteria.

   A list of objects matching your search criteria appears in the results section.
5. Select an object in the list.

**Example:**

![Change History](image)

The change history for the object that you selected appears.

**Example:**

![Change History](image)

**Reverting Changes to a Tracked Object and Its Tracked Contents**

The Change History displays a list of changes in reverse chronological order (from latest to oldest) for tracked entities in objects such as applications, procedures, workflows, workspaces, resources, and project-owned components such as library components. Each row in the Change History or a tracked object is a record of a change made either to the tracked object or to a tracked object owned by the object (directly or indirectly). For example, the Change History of a project would show both changes to the project itself and changes to any tracked object in the project, such as its procedures, the steps for each procedure, or properties belonging to the procedure steps.
Some types of objects (mostly run-time objects such as jobs, because tracking those would be resource-intensive and seldom useful) are not tracked by the Change Tracking feature. For a few types of tracked objects, some of their attributes are not tracked (for example, agents are tracked, but certain attributes of agents that vary frequently in real-time, such as their current status, are not). Changes to untracked objects, or to untracked attributes of tracked objects, are not shown in the Change History and cannot be reverted. In general, objects that are normally created or changed manually are tracked, and objects that are normally created or modified during automated processing are not. However, depending on your specific usage patterns, this behavior may not be recorded in the Change History, such as when you frequently run jobs that use ectool or API commands to automate the creation of new procedures or steps.

**Note:** You must have the Read, Modify, and Execute permissions to revert changes in the UI or to access to the revert API function.

Follow these steps to select a tracked object and its tracked entities that you want to revert:

1. Go to the Change History for the object that you want to revert using one of these methods:
   - Click the **Track Changes** button ( ) for the object.
   - From the ElectricFlow Home page, click the **Search** button ( ) to go to the "Change History - Search" page and search for the object.

2. Locate the time period in which you are interested.
   A list of changes for the tracked object appears.

3. If you decide to revert the changes for an object owned by the tracked object or for an object that owns the tracked object, use one of the methods to view the list of changes for this object:
   - Close the current Change History and navigate to the Change History for the object.
   - Click the **View Path** button ( ) on the top of the current Change History, copy the path, go to the "Change History - Search" page, and search for a suitable addition to or truncation of that path.
4. Select a row (record) in the Change History corresponding to the earliest of the changes that you want to undo.

You will be reverting the object and all its tracked contents to their state directly before the selected change was made.

a. If the Revert button becomes enabled, ElectricFlow is capable of reverting the selected changes to the object. is tracking the changes to this object.

Go to Step 5.

b. If the Revert button is still disabled, ElectricFlow is not currently capable of reverting changes to the selected object. This could be due to tracking of this object being disabled and re-enabled, or the Change History feature being disabled and re-enabled. Also, not all types of tracked objects can currently be reverted (and due to mutual consistency requirements in the database format, certain types of objects cannot be reverted).

If you are unable to revert the selected object, you may still be able to achieve what you need to do one of these ways:

- Revert the parent object that owns the object you want to revert.
- Separately revert the individual objects owned by the selected object or even nested partial-reversions-of-reversions, possibly combined with manually reversion (undoing) certain changes.

Go to Step 3 to search for an owned or owning tracked object.
5. Before clicking the **Revert** button, make certain that you know all the changes that will be reverted, and have confirmed that this is what you want to do. (While it is possible to re-revert the changes caused by a mistaken reversion operation, doing so leaves a lot of activity in the Change History.)

**IMPORTANT:** All of the changes for tracked entities will be reverted, even the ones that you do not see in the Change History because of the timeline and filter settings.

a. You may need to modify the timeline and filter settings to display all records in the Change History before you verify that all of the records are changes you want to revert.

b. Make sure that the end of the timeline is set to **Now** and that the filters are set to **View All Changes**.

c. Look through the entire list of changes from the most recent to the one you have selected, expanding them to see the details if needed, and confirm that you really want to revert all of them.

**IMPORTANT:** Tip on how to further refine what changes will be reverted

If you want to revert some of the changes shown but not others, you may be able to achieve what you want to do with some combination of the following methods:
- Reverting just certain objects owned by the object that you want to revert.
- Using nested or overlapping sets of reverts of owned objects.
- Undoing individual changes manually using the ElectricFlow UI.
- Using nested partial-reverts-of-reverts.

If you fully understand the XML format used for ElectricFlow exports, you can use the export API call to export the past and current states of a part of the object hierarchy, diff and merge them using a suitable tool for diffing and merging XML files, and then re-import the results. Caution is strongly suggested if you are using this approach to revert objects for which ElectricFlow does not currently support reversion, because:
- There are some places in the ElectricFlow XML data hierarchy where peer objects refer to each other in ways that need to be kept consistent (such as by index of current position in a list).
- For some types of objects, re-importing them can change their IDs and break references-by-id.

6. Click the **Revert** button. Depending on the size of the object and every tracked object it owns, this operation could take some time (as long as exporting a past state of them and then re-importing it).

If this operation is successful, the object and its tracked entities are reverted back to the state at the date and time of the record selected in Step 3. A message appears that the Revert operation was successful.

If this operation is not successful, the object and its tracked entities are not reverted, and a message appears about the failed operation.

**Change History Search Form**

**How to get here:** From most pages, click the **Search** button to open the "Change History - Search" form.

**Example:**
The "Change History - Search" form has the following information:

1. **Time range** field.
   - Click the down arrow to open the drop-down list of start times.
   - The end time is the current time.

2. **Objects** field.
   - Click the down arrow to open the drop-down list of objects to include in the search. You can select All or specific objects.
   - By default, seven of the most commonly tracked objects are selected.

3. **Search criteria.**
   - After you type, the system starts searching for objects based on the time range and objects that you selected.
   - The search results are in the Change History.

**Change History Page**

**How to get here:** Click the Change History button for a tracked object.

**Example:**

The Change History has this information about the object called *Proc:*
1. **Time line**

You can modify the start and end times.

**Default:**

- The entire time line is selected. All changes appear in the Change History list.
- The time increment is from the Last Successful Run to the most current change.
- The start time is based when the last successful run occurred.
- The end time is when the most recent changed occurred.

2. **Path to the tracked object.**

Example:

```
Change History for JPetStore
```

3. **Click to revert the selected changes.**
Time line.
The start time is based on the time range that you selected.
The end time is the current time.
You can manually change the start and end times after you run the search and get the search results.

Filters for the change history.
You can view all changes or view only selected changes.
The objects in the list are the objects in the change history search results.

Change history for the selected object.
- **When**—the date and time that the object changed.
- **What**—The type of object.
- **Name**—The name of the object.
- **By**—The "user" that changed the object, which can be a project or a user.
- **Change**—The type of change.
- **Path**—Click the **View Path** button to see the path to the object.

Click the **View** button to view more information about a specific change in the change history.

### Paths to Objects

Click the **View Path** button next to the "Change History for JPetStore" title to see the path to the application.

Click the **View Path** button to see the change in the path to the object before and after the change.
Detailed Object Changes

Click the View button to see the change in the property called emailNotifier.

Click the Expand button to all the changes to the property,

Example:

When you click the Expand button in a cell, you can see more details in the current change in the cell.

If you click the Select All button, all the changes about the object appear.

To select an object to revert or import the changes to an XML file, select the row of the object in the expanded view.

Credentials and User Impersonation

What is a Credential? on page 884
What is a Credential?

In ElectricFlow, a "credential" is an object that stores a user name and password for later use. Two credential types are available, stored or dynamic:

- **stored** credentials – These credentials are given a name and stored in encrypted form in the database. Each Project has a list of stored credentials it owns. These credentials are managed from the Project Details page.
- **dynamic** credentials – These credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.

Defining a Credential

After a credential is created, no one can view the password for the credential's account. This means one person can define a credential and enter the password, and other people can use the credential (and its account) without needing to know the password.

To create a new credential in the automation platform UI:

1. Click the Projects tab.
2. Select a project (first column) to see the Project Details page.
3. Select the Credentials tab and then click **Create Credential**.

   Click the **Help** link on the New Credential page if you need more information about what to enter in the fields.

Why Use Credentials?

Use ElectricFlow credentials for:

- User impersonation
- Saving passwords for use inside steps

When a step needs to run as a particular user, ElectricFlow can retrieve the user name and password from a stored credential. The credential is passed to the agent over an encrypted channel so the agent can authenticate itself to the operating system and set up a security context where the step runs with the user permissions in the credential.
In some cases, a step needs to enter credentials directly to an application.

- The credential may be a fixed application credential that needs to be presented every time the step runs. In this case, a stored credential provides a place to put this information without needing to embed the password in a script.
- Other times, the password is not known in advance. In this case, a dynamic credential created when a job is launched can prompt a user for information and then pass the credential to the step in a secure manner.

**Credential Access Control**

Because ElectricFlow stores passwords in a recoverable manner, it is important that credentials are accessible only under carefully controlled circumstances. To protect credentials, ElectricFlow uses two mechanisms: access control lists (ACL) and *attached* credentials.

To use a credential for any purpose, a user who attempts to reference the credential must have execute permission on the credential object—this allows you to explicitly control which users are allowed to use a credential anywhere in the system.

In addition to the user-based access control check, ElectricFlow requires a credential be explicitly *attached* to the object that is going to use it. After an object has a credential attached, object modifications are restricted to users who have both execute permission on the credential and modify permission on that object. This safeguard helps prevent credentials from accidentally being used by unauthorized users.

Attach a credential to an object in the automation platform UI one of these ways:

- Set the impersonation credential for a step, procedure, project, or schedule.

  You can also set the impersonation credential for an application process, component process, or a process step.

  Impersonation credentials are inherited, so attaching a credential to a container object like a procedure or a project implicitly attaches it to every object inside the container, such as all steps in a procedure.

- Explicitly attach the credential to a step or schedule using the UI or the `attachCredential` API.

  To access credentials from a step, the credential must be attached directly to the step, or the credential must be passed as a parameter to the containing procedure and have the parameter attached instead.

**Using Credentials for Impersonation at the Platform Level**

This information addresses the question, "When a job step is running on a resource, under which account is it running and how can I control that?" By default, a job step runs under the account used by the ElectricFlow agent that runs the step, which was chosen when the agent was installed. This approach works well in environments where it makes sense to run all jobs under a single user such as a "build" user. You install all agents to run as the desired user, and you do not have to worry about anything else—every step of every job runs as that user.

However, in other environments you may prefer to run different jobs, or even different job steps, under different accounts.

For example:
• If independent groups are sharing an ElectricFlow system, you may want each group to use a different account for its jobs.
• You may need to run jobs as particular users to access ClearCase views for those users.
• There may be certain steps that require special privileges.

For example, as part of your builds you may need to run a step that generates a certificate using privileged corporate information; that step must run under a special high-privileged account, but you want the remainder of the steps in the build to use a less-privileged account.

ElectricFlow allows you to select accounts on a per-job or per-job-step basis. This mechanism is called impersonation, where the ElectricFlow agent impersonates a particular user for the duration of a job step, and this impersonation is implemented using credentials. The use of credentials creates special security challenges.

Note: It is important to ensure privileged accounts can be used only for the purposes you intend and cannot be "hijacked" for other purposes. The ElectricFlow access control mechanism contains special facilities to ensure proper credential use.

Setting the Impersonation Credential in the Automation Platform

Attaching Impersonation Credentials to Steps, Procedures, and Projects

You can attach impersonation credentials to procedure steps, procedures, and projects before executing a job step.

ElectricFlow searches for a credential in the following order and uses the first credential it finds:

1. Procedure step
2. Procedure to which the step belongs
3. Project to which the project belongs

If the step is in a nested procedure, and no credential is found on the step, its procedure, or its project, ElectricFlow checks the calling step (and its procedure and project), its caller, and so on until it has worked up through the topmost procedure in the job. If no credential is found, the job step runs under the ElectricFlow agent account on its resource.

This approach makes it easy to manage your account usage. For example, if you want all jobs in one project to use a particular account, define a credential in that project for the account, and then attach the credential to the project. If you want all jobs in a project to use a particular account, except for one step that should use a different account, create two credentials in the project. Attach the first credential to the project and attach the second credential to the particular step.

Attaching Impersonation Credentials to Schedules

You can also attach a credential to a schedule. The credential in the schedule is used for steps where no other credential is available.

The schedule’s credential receives the lowest priority.

Attaching Impersonation Credentials to Jobs

You can specify a credential when you launch a job manually one of these ways:
- Provide the name of an existing credential
- Enter an account and password.

If you choose the second approach, the account and password are stored only in ElectricFlow for the duration of the job.

For either way, the credential you specified when you launched the job is used as a last resort for steps only with no other credential.

**Attaching a New Impersonation Credential**

To attach a new impersonation credential for a procedure, step, or schedule:

1. Click the Projects tab.
2. Select a project.
3. Go to the Project Details page for the project you selected.
4. Do one of the following:
   a. For a **procedure**:
      i. Click **Create Procedure** to go to the New Procedure page.
      ii. On this page, select the Impersonation Credential drop-down box to select a credential to use for impersonation.
   b. For a **step**:
      i. Select a procedure to go to the Procedure Details page.
      ii. Select a step name to go to the Edit Step page.
      iii. On the Edit Step page, scroll down to the Impersonation section.
   c. For a **schedule**:
      i. Select the Schedules subtab.
      ii. Select a schedule to go to the Edit Schedule page.
      iii. Scroll down to Impersonation Credential section.

For more information in the platform GUI, each of these web pages contains a **Help** link in the upper-right corner.

**Accessing Credentials From a Step at the Platform Level**

The ElectricFlow server supports an operation called **getFullCredential** that can return a password when called from inside a step. The ectool interface for this operation is:

```
getFullCredential <credential name>
[--value <password|user>]
```

Without the `--value` option, the response is the same as that returned by **getCredential**, with the addition of a "password" element.

With `--value`, the simple text password or user name value is returned on **stdout** so it can be used directly without XML parsing.
The getFullCredential API is allowed only inside a running step, and is allowed to use credentials that were explicitly attached to the step only.

Attaching a Credential to a Procedure Step, Procedure, or Schedule

A credential must be explicitly attached to the object using it so the server can perform an access control (ACL) check at definition time and limit the visibility of the password. To support accessing credentials other than the one being used for impersonation, steps, procedures, and schedules contain a list of credential names.

In the platform GUI, to attach a credential (other than an impersonation credential) to a step, procedure, or schedule:
1. Go to an "Edit" page.
   For example, to create a credential for a step, a step must already exist.
2. Select a step that needs a credential. The Edit Step page opens.
3. Scroll to the lower section of the page and click Attach Credential.

If you are an ectool command-line user, use the attachCredential API command. For more information on the command-line interface, go to the ectool Help topics within the online Help system.

Passing Credentials as Parameters

Sometimes you may not know which credential you need to use when you define a procedure step. In this situation, you can leave the credential choice up to the caller of the procedure.

The following example describes the procedure for passing credentials as parameters:

1. Create a project named InnerProj.
2. Within that project create a procedure named InnerProc with a parameter 'cred' of the type credential.
3. Within that procedure create a step named InnerStep with:
   ○ Command: ectool getFullCredential cred
   ○ Attached Parameter Credential: cred

4. Create a project named OuterProj with two credentials: cred1 and cred2.
5. Within that project create a procedure named OuterProc with two parameters, cred1 and cred2, of the type credential.
6. Within that procedure create two subprocedure steps that both call InnerStep from the InnerProj project:
   ○ OuterStep1 with Attached Parameter Credential cred1, and cred1 in the Parameters section
   ○ OuterStep2 with Attached Parameter Credential cred2, and cred2 in the Parameters section

If you are an ectool command-line user, you can use the createFormalParameter and attachParameter API commands. For more information on the command-line interface, go to the ectool Help topics within the online Help system.

Credential References

For schedules, the value for any actual parameter passed to a credential-type formal parameter is interpreted as a reference to a previously attached credential on the schedule.
For procedure steps, the value for any actual parameter passed to a credential type formal parameter is interpreted as a reference to a previously attached credential or credential parameter on the calling step.

When a job step is created, all credential references are resolved and the content is copied into transient credentials on the job step. Credential parameter references are resolved by looking for a credential in the calling job step’s transient credential map—looking for a credential with the name specified as the actual parameter value.

Credential references in the API can be specified as a relative or an absolute credential path.

- A *relative* path is similar to "rootCred" and is interpreted as referring to a credential in the current project.
- An *absolute* path includes a project name like "/projects/MyProject/credentials/rootCred" and can refer to a credential in any project.

Anywhere a credential reference is accepted (for example, setting an impersonation credential or attaching a credential to a step), either form can be used.

**Best Practices for Retrieving Credentials**

The ElectricFlow impersonation mechanism provides powerful mechanisms for using different accounts in job steps, and it can be used to handle a variety of challenges. However, if misused, impersonation can open up dangerous security loopholes. This section discusses these risks and how to avoid them.

Use of credentials and impersonation tend to fall into two classes.

**First Class**

In the first class, your goal is to open up access to accounts, you want to make some accounts generally available, and you trust large groups of users (such as everyone who can access a particular project) to use the accounts appropriately. This usage type is simplest and relatively safe.

1. Define an ElectricFlow group containing all trusted users.
2. Set permissions on the Project so only trusted users can access the project.
3. Define credentials for accounts in the Project and grant execute permission to everyone in the group.

After completing this task, everyone in the group can use the accounts for arbitrary purposes. No one outside the group will be able to access the project or the credentials.

**Second Class**

In the second class, you want to provide tightly-controlled access to a highly privileged function such as generating a certificate or accessing sensitive information. This kind of usage requires careful thought to avoid allowing unintended access to the credential. The best way to implement a solution for this scenario is to restrict access to the credential and use it on individual steps only after careful analysis of issues such as the following:

**Does the step's command use properties?**

If so, someone could potentially change the property value to change the step behavior.

For example, suppose the step's command is defined like this:

```
echo ${/myProject/x}
```
Anyone with write access to property x can hijack the step by placing the value "nothing; myCommand" in the property.

After property substitution, the final command will be:

```
echo nothing; myCommand
```

that will cause "myCommand" to execute in the step.

Either restrict access to the property sheet or avoid substitutions.

**Does the step execute code or commands that can be modified?**

In most jobs that execute build and test sequences, the job extracts various files from a source code control system and some of those files contain code executed during the build. In this case, anyone with access to the source code control system can affect the executed code.

For example, suppose a step runs a Make or Ant command using a configuration file extracted from the source code control system. Anyone with access to the source code control system can modify the configuration file to introduce new commands executed during the Make or Ant step. In this situation, it is virtually impossible to control what happens during the step, so you should never attach a credential for a privileged account to such a step.

The higher you attach a credential, the greater the risk of uncontrolled access to the credential's account.

For example, if you attach a credential to a project, there is a good chance anyone with write access to the project, or even the ability to execute the project's procedures, can hijack the credential using one of the loopholes described above. If you attach a credential to a step that invokes a subprocedure, you effectively give anyone with write access to the subprocedure complete access to the credential's account. If you care about access to an account, you should use its credential in the narrowest possible fashion, such as attaching it to a single job step.

**Avoid passing passwords on the command line**

When using credentials, avoid passing the password on the command line because [on most platforms] those passwords will be visible to all users logged into the system. The secure way to pass a credential to an application is to use a secured file in the file system or to pipe the value into the application via stdin.

**Defect Tracking**

The Defect Tracking plugin enables linking existing defects to an ElectricFlow job. "Existing defects" are those defects previously created in the defect tracking system and already associated with the ElectricFlow job in some way.

For example, a defect is associated with a ElectricFlow job if the fix for the defect is part of the source code snapshot being built and tested in the job.

ElectricFlow pre-installs numerous defect tracking plugins including Bugzilla, ClearQuest, Fortress, JIRA, Quality Center, Ration Team Concert, Rally, Team Foundation Server, TeamForge, TestTrack, and more, using plugin integrations.
The following examples and instructions are for a JIRA integration. The steps for other defect tracking systems are similar to those for JIRA.

Scenario example

A developer fixes a defect in the "ABC" project and checks in the fix to the source control system, along with a comment that includes the fixed defect ID, for example:

ABC-123: fixed EFG bug

When the next ElectricFlow job is triggered for the ABC project, ElectricFlow checks out a source code snapshot from the source control system and queries the source control system for a log containing check-in details. This log, which should contain the above comment, will be stored in a property on the job.

The JIRA plugin will then do the following:

- Parse the property containing the source control system log to identify defect IDs.
- Query the configured JIRA server with identified defect IDs, including "ABC=123".
- Construct a descriptive URL to point to the JIRA defect on the JIRA server.
- Include the URL in the JIRA Report.
- Link to this JIRA Report from the Job Details page.

Example: Enabling the JIRA integration in your procedure

To ensure ElectricFlow links existing defects to a job, create a step to link the defects.

Go to Projects > select a Project > select a Procedure. To create a New Step, select the Plugin link.

- In the Choose Step panel, select Defect Tracking from the left pane, then select the defect tracking system you configured.
- The right-pane now shows the types of steps available for your configuration. Select the step you need and automatically go to the New Step page.
- On the New Step page, notice the Subprocedure section now contains the defect tracking integration you configured and the step you chose.

On the New Step page, enter information in the following fields:

General section:

Name–Enter a unique name for your subprocedure step (any name of your choice).

Description - (optional) A plain text or HTML description for this object. If using HTML, you must surround your text with <html> ... </html> tags. The only HTML tags allowed in the text are: <a> <b> <br> <div> <dl> <font> <i> <li> <ol> <p> <pre> <span> <style> <table> <tc> <td> <th> <tr> <ul>

Subprocedure section:

Resource–(optional) You do not need to change the resource you previously chose to run the procedure.
Parameters section:

config–(required) This is the name of the Defect Tracking configuration you created on the New Defect Tracking Configuration page.

Note: If you did not previously create a Defect Tracking configuration, you must do that now before you proceed. Go to Administration > Defect Tracking > click the Create Configuration link to see the New Defect Tracking Configuration page. Access the Help link on that page for more information.

prefix–(optional) This is the key used by JIRA as the prefix for defects within a project. If the "prefix" field is blank, a regular expression is used to try and match defect IDs.

propertyToParse - (optional) This is the property or property sheet to search for defect IDs. If the "propertyToParse" field is blank, the default property/myJob/ecscm_changeLogs is used.

Advanced section:

You do not need to enter any information in these fields.

The following screen is an example of the New Step page where you will create your Defect Tracking subprocedure step.

ElectricSentry

ElectricSentry is the ElectricFlow engine for continuous integration, integrating with Source Control Management (SCM) systems. ElectricSentry is installed automatically with ElectricFlow and is contained in an ElectricFlow plugin named ECSCM. When ElectricSentry detects a new or modified source file check-in, it
launches a user-defined procedure to build and test the latest version of source files. Using a few simple properties, the entire process is controlled by the user who determines when ElectricSentry is active and which projects and branches are monitored and built.

While you can interact with ElectricSentry directly, you may want to use the Continuous Integration Dashboard, the front-end user interface for ElectricSentry, which provides a visual display of your builds, and automates the configuration process for your branch, project, or procedure so you can start using continuous integration schedules quickly.

This Help topic describes using ElectricSentry directly, and NOT the Continuous Integration Dashboard, which has its own Help topic for dashboard use. To get started with the "dashboard", select the Home > Continuous Integration tabs.

**How ElectricSentry works**

ElectricSentry finds procedures the user wants to monitor by scanning for a special type of ElectricFlow schedule. From the schedule, ElectricSentry retrieves the name of the procedure to run, along with values to use as actual parameters when the procedure runs.

ElectricSentry can run at a regular interval you determine. When it runs, ElectricSentry scans all ElectricFlow projects, looking for schedules configured for use with ElectricSentry. When it finds one, ElectricSentry checks to see if there is already a job running based on that schedule and will not start a second job for the same schedule until the previous job completes.

Next, ElectricSentry queries the SCM system to see if new check-ins have occurred since the last attempted build. If the most recent check-in is different from the last attempted build, ElectricSentry then checks a "quiet period" by comparing the current time to the check-in time. If the user-configured time interval has elapsed since the most recent check-in, ElectricSentry runs the procedure to start a new job.

Finally, ElectricSentry deletes previous runs of itself, so only the most recent run appears in the jobs list. If using the Continuous Integration Dashboard, this is slightly different—you will see the previous 10 builds that ran.

**Configuring ElectricSentry**

ElectricSentry does not require any specific configuration, but it does allow fine tuning for some key settings. To change any setting, you must be logged into ElectricFlow and then navigate to the Electric Cloud project.

**Quiet time**

When setting up a continuous integration system, it is common to require an inactivity period before starting a build. This time period allows developers to make multiple, coordinated check-ins to ensure a build does not start with only some of the changes—assuming all changes are checked-in within the specified inactivity time period. This time period also gives developers an opportunity to "back-out" a change if they realize it is not correct.

With ElectricSentry, the inactivity time period can be configured globally for all projects or individually for a single project. The global setup is stored in the ECSCM-SentryMonitor schedule in the Electric Cloud project, using a property named ElectricSentrySettings/ QuietTimeMinutes. You can set this property to the number of minutes you prefer for the quiet time prior to starting a build. If you remove this property, ElectricSentry will use a five-minute default time.
Resource

The ECSCM plugin contains a procedure named ElectricSentry. This procedure has a parameter named `sentryResource` that determines where ElectricSentry will run. The parameter defaults to a resource named `local`, which is created by the ElectricFlow installer. The local resource is configured to run on the machine named `localhost`, which refers to the machine where the ElectricFlow server is running.

You may need to change the resource where ElectricSentry runs, if for example, the server machine is not configured to run your SCM tools. You can change this configuration by modifying the ECSCM-SentryMonitor schedule to specify a different resource in the `sentryResource` parameter.

To do this:

1. Go to the Projects page.
2. Select the Electric Cloud project name to go to the Project Details page.
3. Click the Schedules subtab.
4. Select the ECSCM-SentryMonitor schedule.
5. Change the `sentryResource` field to the name of the resource (or the resource pool name) where you want ElectricSentry to run.
6. Click OK to save your new information.

Polling frequency

ElectricSentry is set to look for new check-ins every five minutes. If you want ElectricSentry to check more or less often, open the ECSCM-SentryMonitor schedule in the Electric Cloud project. Change the number of minutes to speed up or slow down the ElectricSentry polling frequency entry.

Time-of-day and day-of-week

The initial setting allows ElectricSentry to run between 7 am and 11 pm every day of the week, but you can change this time period to monitor check-ins at different hours. The time period should cover the most likely hours developers would be checking-in changes, then frees the resources (after the last job started by ElectricSentry finishes) to run overnight builds. You can modify the ECSCM-SentryMonitor schedule to change the hours or days ElectricSentry monitors check-ins.

Configuring a build for continuous integration

You can control which projects and branches ElectricSentry monitors for continuous integration by creating a schedule that runs a procedure and by adding ElectricSentry settings. These tasks are made easier using the Continuous Integration Dashboard.

Source Control Management (SCM) configurations

ElectricFlow bundles and supports a number of source control types. After creating a source control configuration, your entry will appear in the table on the Source Control Configurations web page—to see this web page, select the Administration > Source Control tabs.

**IMPORTANT:** Click the **Create Configuration** link to configure your source control system.
**Note:** Electric Cloud has tested numerous SCM versions and where possible, all SCM integrations were created in a generic manner to avoid SCM release-specific differences. In most cases, Electric Cloud supports any version of Perforce, ClearCase, Subversion, AccuRev, CM Synergy, Borland's StarTeam, and many others.

Select the Administration > Plugins tabs to go to the Plugin Manager page to see the current list of available SCM plugins. If you do not see the SCM you need, it might be available in the Plugin Catalog—select the View Catalog tab. For a complete list of SCM plugins that are bundled with ElectricFlow, see **Plugins That are Bundled with ElectricFlow** on page 1138.

**Create a procedure**

Navigate to your project and create a procedure that checks out sources from your SCM system and then runs your build process. We recommend having the procedure take a "branch name" parameter, then use this single procedure to build multiple branches of the same project.

**Create a schedule**

In your project, create a schedule that calls the procedure and specifies parameters to call the procedure. On the Project Details web page, select the Schedules tab and click the **CI Configuration** link to go to the New CI Configuration page. Enter a name for the new schedule and choose the SCM Configuration you want to use. For more information on this page, click the **Help** link in the upper-right corner of the screen. If you set up your procedure with a parameter for a branch, create one schedule for each branch you want to monitor.

**Optional - running ElectricSentry on multiple resources**

ElectricSentry normally runs as a single procedure executing queries against all SCM systems configured by ElectricSentry "trigger schedules." Because all queries are executed in a single step, these queries are executed by the same ElectricFlow resource. This process works very well for many companies, but for some large enterprise companies this process is not adequate.

You can benefit from using ElectricSentry on multiple resources if any of the following items apply to your organization:

- **Connectivity** - No one single resource has access to all SCM systems in your organization.
- **Security/Authentication** - Specific resources may contain Authentication tickets required for access to certain parts of your SCM depots, and no single resource contains all of these tickets.
- **Scalability** - You may need too many trigger schedules to monitor in a single execution interval, which can cause unnecessarily long execution times for ElectricSentry jobs.
- **Scheduling** - ElectricSentry is most useful during the work day when developers are adding new code check-ins. At night, it is common to redeploy resources to do nightly builds. If ElectricSentry runs on a central resource that serves development teams in multiple time zones, there is no way to schedule independent Sentry operation for different time zones.

**Overview**

The solution to all of these issues [above] is to run multiple ElectricSentry instances concurrently.

- Each Sentry instance can choose its own resource and its own operation schedule.
- Each instance can be restricted to monitoring schedules for one or more ElectricFlow projects.
- Also, you can create a global instance to monitor all projects not monitored by a restricted instance.

Each ElectricSentry instance is implemented by reusing the ElectricSentry procedure in the ECSCM plugin. This procedure has two parameters, `sentryResource` and `projectList`, that allow you to specify the configuration for different instances.

Each instance will have its own copy of the SentryMonitor schedule—one for each resource where you want ElectricSentry to run.

The default configuration has no projects specified in the "projectList" parameter—this is called the global instance. The global instance monitors all projects not explicitly monitored by any other instance. If a global instance is your only instance, it will monitor all projects.

**Configuring ElectricSentry to use multiple resources**

When ElectricFlow is installed, it creates a project called Electric Cloud that contains ElectricSentry's Sentry Monitor schedules. By default, all steps will run on the resource named local and all projects will be monitored.

To use multiple resources, you need to create new schedules in the Electric Cloud project, creating new ElectricSentry instances.

1. Navigate to the Electric Cloud project and select it.
2. Select the Schedules tab.
3. Disable the schedule named ECSCM-SentryMonitor.
4. Click the Copy link next to the ECSCM-SentryMonitor schedule - repeat for each new ElectricSentry instance you want to create.
5. Re-enable the schedule named ECSCM-SentryMonitor.
6. Navigate to one of the new schedules you created and select it to edit it - change the name from ECSCM-SentryMonitor copy n to something more meaningful, for example, "ECSCM-SentryMonitor for ABC team".
7. In the Parameters section:
   - `projectList` box - enter the project names you need to monitor - one project name per line.
   - `sentryResource` box - enter the resource or pool name where you want this ElectricSentry instance to run.
8. In the Frequency section:
   - Adjust the "time of day" and "days of the week" settings to schedule this ElectricSentry instance to run.

   **Note:** If you are setting up ElectricSentry to run in a different time zone, make sure you set the Time Zone field for the location where ElectricSentry will run.
   a. In the Advanced section, click the Enabled check box.
   b. Click the Save button.

   **Note:** For each new schedule you create, repeat steps 6-10 above.

**The Job Step Execution Environment**
Terms and definitions

Various factors influence job step execution. Both a job step and its postprocessor (if any) run in the same environment, except shell. The shell used to run a command comes from what is specified in the step. If a shell is not specified on the step, the shell specified on the resource is used—this is also the same shell used for running the postprocessor.

Machine

The machine where a job step is executed is determined by the resource specified in the corresponding procedure step. If a pool is specified in the procedure step, ElectricFlow picks a specific resource from that pool. A job step can determine its actual resource by querying the property `/myResource/resourceName` or `assigned resourceName` property on the job step. The host where a step is expected is `/myResource/hostName`. If the resource is a proxy agent, this property contains the name of the proxy target. **The agent host name is in `/myResource/proxyHostName`.**

OS-level access control

For its resource, a job step executes under the same account as the ElectricFlow agent. You may want to contact Electric Cloud technical support for help configuring ElectricFlow agents. Basically, the agent needs to know what account it will run as, and Windows agents require additional setup if impersonation is used. If using impersonation, the job step runs under the credential effectively attached to the step.

Environment variables

For its resource, a job step inherits environment variables from the ElectricFlow agent. The agent's environment variables can be configured as part of the agent configuration. In particular, the `PATH` environment variable typically includes the ElectricFlow installation directory for easy access to applications such as `ectool` and `postp` (the ElectricFlow postprocessor).

Working directory

The default job step working directory is the top-level directory in the job's workspace. However, you can configure the working directory with a property on the procedure step. When you run on a proxy agent, the step actually runs on the proxy target, in the working directory specified in the step. If the working directory is not specified, the step runs in the UNIX path to the workspace.

Standard I/O

Standard job step output and errors are both redirected to the step log file.

ElectricFlow access

For easy access to ElectricFlow, the following environment variables are set automatically for a job step:

- **COMMANDER_HOME**
  A variable whose value is the base installation directory for an agent. On Windows, this directory is typically `C:\Program Files\Electric Cloud\ElectricCommander`. On UNIX platform, this directory is typically `/opt/electriccloud/electriccommander`.

- **COMMANDER_SERVER**
  IP address for the ElectricFlow server machine.
COMMANDER_PORT
Port number for normal communication with the ElectricFlow server.

COMMANDER_PLUGINS
(configurable) The directory where installed plugins live (for example, C:\Documents and Settings\All Users\Application Data\Electric Cloud\ElectricCommander\Plugins)

COMMANDER_HTTPS_PORT
Port number for secure communication with the ElectricFlow server.

COMMANDER_JOBID
Unique identifier for the job containing the current job step.

COMMANDER_JOBSTEPSID
Unique identifier for this job step.

COMMANDER_SESSIONID
ElectricFlow session identifier for the current job, which allows ectool to access ElectricFlow with job associated privileges, without an additional login.

COMMANDER_WORKSPACE_UNIX
Absolute path to the workspace directory for this job, in a form suitable for use on UNIX machines.

COMMANDER_WORKSPACE_WINDRIVE
Absolute path to the workspace directory for this job, in a form suitable for use on Windows, and starting with a drive letter.

COMMANDER_WORKSPACE_WINUNC
Absolute path to the workspace directory for this job, in a form suitable for use on Windows, specified using UNC notation.

COMMANDER_WORKSPACE
Absolute path suitable for accessing the top-level workspace directory for this job on this machine. On a UNIX machine, this has the same value as COMMANDER_WORKSPACE_UNIX. For Windows, it is the same as COMMANDER_WORKSPACE_WINUNC.
COMMANDER_WORKSPACE_NAME
This is the name of the workspace on the ElectricFlow server.

These environment variables allow you to invoke ectool without specifying a --server argument. They also provide a context for accessing properties in ectool. For example, "ectool getProperty foo" looks for the property named "foo" on the current job step. Environment variables provide ectool with a session including all user privileges associated with the job.

Also, if the resource is a proxy agent, these environment variables are available in the step's environment on the proxy target.

Preflight Builds

Preflight Build Solution
Preflights with ElectricFlow
Samples
Default SCMs
Troubleshooting

Why use Preflight Builds?

When developers make changes, they generally build and test their code locally and commit their changes if the code ran successfully. Unfortunately, this process is not sufficient.

Code changes may break the production build because of environment differences, platform-specific issues, or incomplete commits. These issues leave the product in a broken state until the changes are backed-out of the product or the developer commits a fix, which often affects the entire development team. It is a time-consuming process to find the problem when multiple developers commit their changes simultaneously and the build breaks.

Preflight Build Solution

A Preflight Build is used to build and test a developer's changes before those changes are committed. A "post-commit" source tree is simulated by creating a clean source snapshot and overlaying the developer's changes on top of it. These sources are then passed through the production build procedure to validate the changes work successfully.

Developers are allowed to commit their changes only if the preflight build is successful. Because developer changes are built and tested in isolation, many common reasons for broken production builds are eliminated.
Preflights with ElectricFlow

Workflow

After a preflight build is configured, the general flow of interaction between the server, agent, and client is:

- A developer invokes the client preflight program either through an IDE or via the command-line. The following arguments are specified in the XML configuration file or on the command-line:
  - Define which ElectricFlow server to use (hostname, ports, and so on).
  - Define the project, procedure, and parameters to use to start the preflight build, and
  - SCM-specific information to use (ports, changelists, and so on).
- Next, the client preflight program connects to the ElectricFlow server and launches the specified procedure.
  - The job is started and the developer's changes are uploaded.
  - If auto-commit was turned on, the client program waits for the job to complete. Otherwise, the client program exits immediately.
- The job progresses until it gets to the special step added to the procedure to extract sources and overlay changes.
  - The agent-side driver creates a clean source snapshot based on configuration information passed to it from the client-side.
  - The step overlays changes [uploaded by the client] on top of the snapshot to simulate the developer's check-in.
- The build continues as usual, using the modified sources.
- If the developer chose to auto-commit changes, the preflight program was waiting for the job to complete. If the job is successful, the changes are committed if:
  - No files were added or removed from the change sets.
  - No files were modified since the preflight build started.
  - All conditions set in the driver script were met.

Components

Three components are required for an ElectricFlow preflight build:

- **Server** - This is the main ElectricFlow server that will run the preflight builds.
- **Agent** - This is any ElectricFlow agent machine that is setup as a resource for the server. This machine must be able to communicate with the source control system because it is responsible for creating a clean source snapshot on which the developer's changes are overlayed.
- **Client** - This is the machine where a developer has active code changes to submit for a preflight build. Like the agent, this machine must be able to communicate with the source control system because it is responsible for determining which files were modified so it can transmit these files to the agent.

Installation

Preflight is automatically installed with SCM plugins. ElectricFlow pre-installs numerous source code management (SCM) plugins including Accurev, Bazaar, CVS, ClearCase, Git, Mercurial, Perforce, SVN,
StarTeam, Team Foundation Server, and Vault. Before you can use your preferred SCM, you will need it to communicate with the ElectricFlow server. For a complete list of bundled plugins, see Plugins That are Bundled with ElectricFlow on page 1138.

**Configuration**

This section provides details for setting up and running Preflight builds in a typical build environment.

**Server**

**Adding the preflight snapshot step**

A typical production build procedure has a step that extracts a clean source code snapshot before the actual build starts. For preflight builds, a special step needs to run in place of this snapshot step. This special step is responsible for creating the base snapshot and then overlaying the developer's changes.

- On the Procedure Details page, to create a new step click the Plugin link.
- On the Choose Step panel, select Source Code Management.
- Choose the ECSCM plugin for your SCM or from the right-pane, select the "Preflight" step for your SCM.
- On the New Step page, notice that your SCM is displayed in the Subprocedure section.
  - Set the Resource name for the step to an agent that can communicate with the SCM system, so it can create the source snapshot.
- The Parameter section also displays appropriate fields to enter information for your SCM. The following two fields are common to most SCMs:
  - Configuration–Enter the name you created for your SCM configuration.
  - Destination Directory–This is a path relative to the job's workspace, where the source tree will be created.
- Enter all other information required for your new step.
- Click OK.

**Choosing between snapshot steps**

Only one snapshot step should run depending on whether a production or preflight build is invoked. To enable the appropriate step, add a checkbox-style parameter to the build procedure to determine whether or not the build is a preflight. Now, use that parameter in the Run Condition field on the two snapshot steps. In the following example, the parameter is named "preflight", with an unchecked value of "false" and a checked value of "true".

- For the preflight snapshot step, set the run condition to $[preflight]
- For the production snapshot step, set the run condition to $[/javascript getProperty("preflight") == "false"]

**Choosing how files are uploaded**

By default, when developers run preflight builds, their changes are uploaded to the job workspace via the server. However, if the job workspace is on a network share, accessible to the developer's machine, a useful optimization is for files to be copied directly into the job workspace. To use the network share approach, set a
flag on the top-level procedure that is invoked when running a preflight build. This property can be created on the Procedure Details web page as follows:

1. Create a nested property sheet on the procedure called ec preflight.
2. Create a property in that procedure called waitForStep with a value of "1". This property can be created from the command-line by calling:

   ectool setProperty ec preflight/waitForStep 1 --projectName <project> --procedureName <procedure>

Agent

The agent machine must be able to communicate with the SCM system to create the source snapshot.

Client

From a developer's machine, there are two ways to start preflight builds:

- From an IDE:
  - Eclipse
    Open a Run dialogue, select Launch Commander Procedure, then select an existing preflight configuration or create a new one.
    For more information, see the ElectricCommander Eclipse Integration Tech Note PDF file or the Eclipse plugin.
  - Visual Studio (See the ElectricCommander Visual Studio Tech Note PDF file or the Visual Studio plugin)

- From the command line:
  The executable program, ecclientpreflight, is used to run a preflight build from the command-line. This program is included in the ElectricFlow "Tools" installation. When you run ecclientpreflight, configuration options can be passed in an XML configuration file or on the command-line.

If the same option is specified in both the configuration file and on the command-line, the value passed on the command-line takes precedence. The XML configuration file can be passed to the program via the --config option. If the XML configuration file is not passed in, current and ancestor directories are searched for a file named ".preflight", using the first one it finds as the configuration file.

Generally, a ".preflight" file is stored at the root of a developer's workspace, containing configuration information specific to that workspace.

Samples

In the following samples, the SCM was set to Perforce.

The following table is output from "ecclientpreflight --help", enumerating the command-line options. Some options may be specified using an abbreviated format (-c, with a single dash) or a more verbose format (--config, with two dashes).
<table>
<thead>
<tr>
<th>General Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-c, --config &lt;file&gt;</td>
<td>Load configuration options from the specified XML file. If &lt;file&gt; is '-', read standard input. If not supplied, the current and ancestor directories will be searched for a .preflight file. The first .preflight found will be used as the preflight configuration.</td>
</tr>
<tr>
<td>--load &lt;file&gt;</td>
<td>Evaluate &lt;file&gt; after option processing. May appear multiple times.</td>
</tr>
<tr>
<td>-d, --debug</td>
<td>Display debugging information.</td>
</tr>
<tr>
<td>-v, --version</td>
<td>Display version information.</td>
</tr>
<tr>
<td>-h, --help</td>
<td>Display this information.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Server Communication Options</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--server &lt;name&gt;</td>
<td>The host name (defaults to localhost).</td>
</tr>
<tr>
<td>--port &lt;port&gt;</td>
<td>The HTTP port (defaults to 8000).</td>
</tr>
<tr>
<td>--securePort &lt;port&gt;</td>
<td>The HTTPS port (defaults to 8443).</td>
</tr>
<tr>
<td>--secure</td>
<td>If set, only secure connections are used. Off, by default.</td>
</tr>
<tr>
<td>--timeout &lt;timeout&gt;</td>
<td>The response timeout in seconds (defaults to 180).</td>
</tr>
<tr>
<td>--userName &lt;name&gt;</td>
<td>The name of the ElectricFlow user to login as.</td>
</tr>
<tr>
<td>--password &lt;password&gt;</td>
<td>The password for the specified user. If blank and the user has no active session, a prompt to enter the password will be provided.</td>
</tr>
<tr>
<td>--driverLocation</td>
<td>Property path to a property sheet containing the driver scripts that will be loaded and run after a connection to the server is established. Defaults to /server/ec_preflight.</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td><code>--mainDriver</code></td>
<td>The name of a property in the sheet specified by <code>driverLocation</code>. This is the main driver script that will be loaded and run after a connection to the server is established.</td>
</tr>
<tr>
<td><strong>Logging Options</strong></td>
<td></td>
</tr>
<tr>
<td><code>-l, --log</code></td>
<td>If specified, debug information is logged. Off, by default.</td>
</tr>
<tr>
<td><code>--logDir</code></td>
<td>Where to store log and other files. Defaults to the user's home directory.</td>
</tr>
<tr>
<td><strong>Procedure Invocation Options</strong></td>
<td></td>
</tr>
<tr>
<td><code>--projectName &lt;name&gt;</code></td>
<td>The name of the ElectricFlow project containing the procedure to invoke.</td>
</tr>
<tr>
<td><code>--procedureName &lt;name&gt;</code></td>
<td>The name of the ElectricFlow procedure to invoke.</td>
</tr>
<tr>
<td><code>-p, --param &lt;name&gt; = &lt;value&gt;</code></td>
<td>Enter additional parameters to the procedure. May appear multiple times. If any parameters were specified in the config file, those supplied on the command-line append to that list, overriding parameters with the same name.</td>
</tr>
<tr>
<td><code>--priority</code></td>
<td>The priority of the job. Possible values are low, normal, high, highest. If left unspecified, defaults to normal.</td>
</tr>
<tr>
<td><code>--jobTimeout &lt;timeout&gt;</code></td>
<td>The number of seconds to wait for the job to complete when auto-committing changes. Defaults to 3600 seconds (1 hour).</td>
</tr>
<tr>
<td><code>--waitForJob</code></td>
<td>Wait for the job to complete and report its outcome. This action does not occur by default unless a set of SCM charges are being committed automatically.</td>
</tr>
<tr>
<td><code>--runOnly</code></td>
<td>Run the procedure and exit immediately. The SCM driver is not downloaded in this case.</td>
</tr>
<tr>
<td><strong>SCM Options</strong></td>
<td></td>
</tr>
</tbody>
</table>
--scmType

The name of the SCM, required, unless the procedure is invoked in 'run only' mode. The driver is downloaded from $driverLocation/clientDrivers/$scmType. Valid values: ECSCM-Accurev, ECSCM-Bazaar, ECSCM-ClearCase, ECSCM-CVS, ECSCM-Git, ECSCM-Mercurial, ECSCM-Perforce, ECSCM-Repo, ECSCM-StarTeam, ECSCM-SVN, ECSCM-TFS, ECSCM-Vault.

--autoCommit <1|0>

Whether or not the changes should be automatically committed if the job completes successfully. Off, by default.

--commitComment <comment>

A comment for the auto-commit.

Perforce Options

--p4port <port>

The value of P4PORT. May also be set in the environment. This is a required value.

--p4user <user>

The value of P4USER. May also be set in the environment. This is a required value.

--p4passwd <password>

The value of P4PASSWD. May also be set in the environment.

--p4client <client>

The value of P4CLIENT. May also be set in the environment. This is a required value.

--p4template <template>

The name of a Perforce client used to create a base snapshot before overlaying local changes. Defaults to the value of --p4client if not specified.

--p4changelist <change>

The changelist number (or default) whose changes are being tested. May be specified multiple times. If no changelists are specified, all client changelists will be used.

The following is a sample XML configuration file with all options specified:

```xml
<?xml version="1.0" encoding="utf-8"?>
<data>
  <server>
    <userName>myUser</userName>
    <password>myPass</password>
    <hostName>ElectricFlowServer</hostName>
  </server>
</data>
```
<port>1234</port>
<securePort>2345</securePort>
<stompPort>3456</stompPort>
<secure>0</secure>
<timeout>3456</timeout>
   <driverLocation>/server/ec_preflight/alternateDrivers</driverLocation>
   <mainDriver>myMainClientDriver</mainDriver>
</server>

<procedure>
   <projectName>myProject</projectName>
   <procedureName>myProcedure</procedureName>
   <parameter>
      <name>branch</name>
      <value>main</value>
   </parameter>
   <parameter>
      <name>preflight</name>
      <value>true</value>
   </parameter>
   <priority>high</priority>
   <waitForJob>1</waitForJob>
   <jobTimeout>3600</jobTimeout>
</procedure>

<scm>
   <type>perforce</type>
   <port>perf:1234</port>
   <user>myUser</user>
   <password>myPass</password>
   <client>myUser-main-client</client>
   <template>myUser-main-template</template>
   <changelist>default</changelist>
   <changelist>67382</changelist>
   <autoCommit>1</autoCommit>
   <commitComment>Fixing bug 38582.</commitComment>
</scm>
</data>
In most cases, a developer does not need to override all default values, and will probably want to specify passwords and some SCM-specific options on the command-line.

**The following is a more typical XML configuration:**

```xml
<?xml version="1.0" encoding="utf-8"?>
<data>
  <server>
    <userName>myUser</userName>
    <hostName>commanderServer</hostName>
  </server>
  <procedure>
    <projectName>myProject</projectName>
    <procedureName>myProcedure</procedureName>
    <parameter>
      <name>branch</name>
      <value>main</value>
    </parameter>
    <parameter>
      <name>preflight</name>
      <value>true</value>
    </parameter>
    <jobTimeout>3600</jobTimeout>
  </procedure>
  <scm>
    <type>perforce</type>
    <port>perf1234</port>
    <user>myUser</user>
    <client>myUser-main-client</client>
  </scm>
</data>
```

If this file is stored in a .preflight file at the top-level of a source tree, the command to start the preflight would look something like this:

`ecclientpreflight --p4changelist 56793 --autoCommit 1 --commitComment "Fixing bug 38582."`

**Default SCMs**

ElectricFlow includes preflight support for some of the most common Source Control (SCM) systems. For an SCM plugin you installed, look for a Help link for that plugin (on the Plugins page). Command-line options are
included in this Help topic for the following SCMs:

<table>
<thead>
<tr>
<th>SCM</th>
<th>Git</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>AccuRev</td>
<td>Subversion</td>
<td>Star Team</td>
</tr>
<tr>
<td>Bazaar</td>
<td>Mercurial</td>
<td>Star Team</td>
</tr>
<tr>
<td>ClearCae</td>
<td>Perforce</td>
<td>TFS</td>
</tr>
<tr>
<td>CVS</td>
<td>Vault</td>
<td>TFS</td>
</tr>
</tbody>
</table>

**Perforce**

The command-line options for the Perforce driver for `ecclientpreflight` are:

<table>
<thead>
<tr>
<th>Perforce Options / Descriptions</th>
<th>Required: The value of P4PORT may be set in the environment also.</th>
</tr>
</thead>
<tbody>
<tr>
<td>--p4port &lt;port&gt;</td>
<td>Required: The value of P4PORT may be set in the environment also.</td>
</tr>
<tr>
<td>--p4user &lt;user&gt;</td>
<td>The value of P4PORT may be set in the environment also.</td>
</tr>
<tr>
<td>--p4passwd &lt;password&gt;</td>
<td>Required: The value of P4PORT may be set in the environment also.</td>
</tr>
<tr>
<td>--p4client &lt;client&gt;</td>
<td>Required: The value of P4PORT may be set in the environment also.</td>
</tr>
</tbody>
</table>
### Perforce Options / Descriptions

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--p4template &lt;template&gt;</code></td>
<td>The name of a Perforce client used to create a base snapshot before overlaying local changes. Defaults to the value of <code>--p4client</code> if not specified.</td>
</tr>
<tr>
<td><code>--p4changelist &lt;change&gt;</code></td>
<td>The changelist number (or default) whose changes are being tested and can be specified multiple times. If no changelists are specified, all client changelists will be used.</td>
</tr>
</tbody>
</table>
| `--p4synctochange <change>` | The changelist number the Preflight Job should use when syncing the source tree. Values are:  
  * `head` - The most recent changelist anywhere in the P4 depot (default).  
  * `have` - The changelist for the most recent file that was synced to 'p4client' changelist. This is a p4changelist number. |

### Subversion

The command-line options for the Subversion driver for `ecclientpreflight` are:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--svnpath &lt;path&gt;</code></td>
<td>The path to the locally accessible source directory in which changes were made.</td>
</tr>
<tr>
<td><code>--svnupdate tohead</code></td>
<td>Use this option to update the agent workspace created during preflight -- updated to HEAD. By default, the agent workspace is updated to the revision found in the client workspace.</td>
</tr>
<tr>
<td><code>--svnignoreexternals</code></td>
<td>Causes the preflight process to ignore svn externals.</td>
</tr>
</tbody>
</table>

### AccuRev

The command-line options for the AccuRev driver for `ecclientpreflight` are:
## AccuRev Options / Descriptions

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--accurevuser &lt;user&gt;</code></td>
<td>The value of ACCUREVUSER may be set in the environment also. If not specified, the default is to the ElectricFlow user.</td>
</tr>
<tr>
<td><code>--accurevpwd &lt;password&gt;</code></td>
<td><strong>Required:</strong> The value of ACCUREVPASSWD may be set in the environment also. This is a required value.</td>
</tr>
<tr>
<td><code>--accurevpending &lt;pending&gt;</code></td>
<td>Use this option to scan the client workspace for all pending elements using the &quot;stat -fn -p&quot; command. By default, the workspace is scanned for all kept elements using the &quot;stat -fn -k&quot; command.</td>
</tr>
<tr>
<td><code>--accurevpath &lt;path&gt;</code></td>
<td><strong>Required:</strong> The value of the ACCUREVPATH. Also may be set in the environment.</td>
</tr>
</tbody>
</table>

## ClearCase

Preflight support for ClearCase is available only for snapshot views. The command-line options for the ClearCase driver for `ecclientpreflight` are:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--ccpath &lt;path&gt;</code></td>
<td>The path to the locally accessible source directory where changes were made.</td>
</tr>
<tr>
<td><code>--ccUnixCSpecPath &lt;unixCSpecPath&gt;</code></td>
<td>The path to the appropriate config spec on a UNIX platform for the current view.</td>
</tr>
<tr>
<td><code>--ccWinCSpecPath &lt;winCSpecPath&gt;</code></td>
<td>The path to the appropriate config spec on a Windows platform for the current view.</td>
</tr>
<tr>
<td><code>--ccUnixRelativePath &lt;unixRelativePath&gt;</code></td>
<td>The relative path for the current view [on a UNIX platform] from the view root to the directory where changes were made.</td>
</tr>
<tr>
<td><code>--ccWinRelativePath &lt;winRelativePath&gt;</code></td>
<td>The relative path for the current view [on a Windows platform] from the view root to the directory where changes were made.</td>
</tr>
</tbody>
</table>
Bazaar

The command-line options for the Bazaar driver for `ecclientpreflight` are:

<table>
<thead>
<tr>
<th>Bazaar Options / Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--workdir &lt;path&gt;</code></td>
</tr>
<tr>
<td><code>--branch &lt;name&gt;</code></td>
</tr>
<tr>
<td>`--method=&lt;local</td>
</tr>
</tbody>
</table>

Git

The command-line options for the Git driver for `ecclientpreflight` are:

<table>
<thead>
<tr>
<th>Git Options / Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--gitdir=dir</code></td>
</tr>
<tr>
<td>`--method=&lt;local_all</td>
</tr>
</tbody>
</table>

CVS

The command-line options for the CVS driver for `ecclientpreflight` are:

<table>
<thead>
<tr>
<th>CVS Options / Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--cvsroot &lt;path&gt;</code></td>
</tr>
<tr>
<td><code>--module &lt;module&gt;</code></td>
</tr>
<tr>
<td><code>--workdir &lt;path&gt;</code></td>
</tr>
</tbody>
</table>
Mercurial

The command-line options for the Mercurial driver for ecclientpreflight are:

<table>
<thead>
<tr>
<th>Mercurial Options / Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--hgpath &lt;path&gt;</code></td>
</tr>
</tbody>
</table>

Repo

The command-line options for the Repo driver for ecclientpreflight are:

<table>
<thead>
<tr>
<th>Repo Options / Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--repoworkdir &lt;path&gt;</code></td>
</tr>
<tr>
<td><code>--agentworkdir &lt;path&gt;</code></td>
</tr>
</tbody>
</table>

StarTeam

The command-line options for the StarTeam driver for ecclientpreflight are:

<table>
<thead>
<tr>
<th>StarTeam Options / Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--STProjectName &lt;project&gt;</code></td>
</tr>
<tr>
<td><code>--workingdir &lt;path&gt;</code></td>
</tr>
</tbody>
</table>

TFS

The command-line options for the Team Foundation Server driver for ecclientpreflight are:
### TFS Options / Descriptions

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--server &lt;url&gt;</td>
<td>The equivalent value to Collection in VS2008 and under. If you use this option, it is assumed you are using TF version VS2008 or under and it will use the option /server in the preflight. This field is required if you have VS2008.</td>
</tr>
<tr>
<td>--collection &lt;url&gt;</td>
<td>The URL that points to /collection. This value is used for VS2010. If you specify this value, the command uses the option /collection when it executes the TF query for preflight. This field is required if you have VS2010.</td>
</tr>
<tr>
<td>--localfolder</td>
<td>The path to the locally accessible source directory in which changes were made. Generally, this is the path to the root of the workspace.</td>
</tr>
<tr>
<td>--workspace &lt;workspace&gt;</td>
<td>The workspace containing the data for the preflight.</td>
</tr>
</tbody>
</table>

### Vault

The command-line options for the Vault driver for ecclientpreflight are:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--workingdir &lt;path&gt;</td>
<td>Working dir for the updated files.</td>
</tr>
</tbody>
</table>

### Troubleshooting

#### Client

The --debug option to ecclientpreflight provides additional information about internal actions taken when starting the preflight build. By modifying the properties containing driver scripts, debug output can be added where needed. If you want to capture debug information to a log file, use the --log option. By default, logs are stored in the user's home directory. To change this location, use the --logDir option.

#### Agent

The step log for the custom preflight step provides information about the snapshot being created and the files being overlayed. Debug output can be added where needed by modifying the properties containing the driver scripts.

#### Properties
Creating or modifying properties

Using property values

Property sheets and intrinsic properties

Property names and paths

Context-relative "shortcuts" to property paths

Property path shortcuts in ElectricFlow 5.0 and later on page 924

Property name substitutions

Expandable properties

The property hierarchy

Special property references

Intrinsic properties listed by object type

ElectricFlow Object / Property tables

Overview

ElectricFlow provides a powerful data model based around the notion of a property.

- A property is a string value with a name.
- Properties can have arbitrary names and values.
- You can attach properties to any object in the ElectricFlow system, such as a project, procedure, or job.
- After a property is created, it is stored in the ElectricFlow database.
- You can retrieve and modify the property value later.
- You can delete properties that you no longer need.

Properties are used extensively throughout the ElectricFlow system and provide a flexible and powerful mechanism to manage data about your builds.

Property Use Case Examples

- When a job starts, it computes a unique identifier for that build and saves it in a property. Later build steps can retrieve the property value to embed the build number in binaries generated during the job.
- When a build executes, it can set a property on the procedure to identify the source code version used for the build (for example, a tag or timestamp from your source code control system). The next time the build executes, it can retrieve the property value from the procedure and use it to extract information from your source code control system about the files that changed since the last run.
• Suppose you have a collection of machines for testing, and some machines have older test hardware and some machines have newer hardware with slightly different characteristics. You can set a property on each test machine resource to indicate which version of test hardware is available on which machine. Later, when a test executes, the test can retrieve the property for the machine where it ran and configure tests appropriately for that hardware. If you upgrade test hardware on a machine, all you need to do is change the property on that resource to reflect the new version.

• You can set job properties to indicate the build status produced by that job. For example, if your QA team finds fatal flaws in a build, it can mark the job accordingly. Builds that need to be preserved (release candidates or builds undergoing beta testing at customer sites) can be marked with properties so those builds are not deleted.

• When a job executes, properties are set for its job steps that hold metrics such as how many files compiled during a build step, how many tests executed during a test step, or how many errors were detected in the step. These property values are included in reports and can be examined later to compute trends over time. You can define additional properties for metrics useful to you.

*ElectricFlow provides Intrinsic properties and allows you to create Custom properties.* This Help topic enumerates properties available within ElectricFlow (Intrinsic properties), distinguishes between relative and absolute property paths, and describes property hierarchies.

**Note:** Intrinsic properties are case-sensitive. Custom properties, like all other object names in the ElectricFlow system, are "case-preserving," but *not case-sensitive.*

• **Intrinsic properties**
  These properties represent attributes that describe the object to which they are attached, and are provided automatically by ElectricFlow for each similar type object. For example, every project has a Description property that can be referenced with a non-local property path such as /projects/Examples/description.

• **Custom properties**
  Custom properties are identical to intrinsic properties and when placed on the same object, are referenced in the same manner, and behave in every way like an intrinsic object-level property with one exception: they are *not* created automatically when the object is created. Instead, custom properties can be added to objects already in the database before a job is started, or created dynamically by procedure steps during step execution.

**Creating or modifying properties**

You can set a property value by using one of the following three methods or applications: the automation platform web interface, the `ectool` command-line application, or the Perl API.

• Using the web interface, you will see a table labeled Custom Properties on the pages that display details for projects, procedures, and so on. Click **Create New Property** to create a new property for that object, or click on an existing property to change its value.

• Using the `ectool` application, set a property value with a command like:

  ```
  ectool setProperty /myJob/installStatus complete
  ```

This command sets the property named `/myJob/installStatus` to the value `complete`, and creates the property if it did not already exist (the meaning of property names like `/myJob/installStatus` is
You can use ectool from within one job step to set properties accessed by later steps in the same job.

- Using the Perl API, you can use an external script or a script in a step with ec-perl as the shell. A Perl code example:

```perl
use ElectricCommander ();
my $ec = new ElectricCommander;
$ec->setProperty (“/myJob/installStatus”, “complete”, {jobStepId => $ENV{COMMANDER_JOBSTEPID})
```

**Note:** Using the Perl API may yield better performance if you are requesting multiple API calls in one step.

For more information, see the "Using the ElectricFlow API" topic in the ElectricFlow API Guide.

### Using property values

A job step can access a property value by two methods. The first method is *substitution*, using the `[]` notation. Suppose you enter the following text as a command for a step:

```sh
make PLATFORM=[$platform]
```

Before running the step, ElectricFlow finds the property named `platform` and substitutes its value in the command string in place of `[$platform]`. For example, if the property contains the value "windows", the actual command executed is:

```sh
make PLATFORM=windows
```

The substitution method can be used for a command in a step and for any step fields, such as the resource or working directory. This method allows you to compute configuration information in an early step of a job, then use that configuration information to control later steps in the job.

Another way for a step to access the property value is with the `ectool getProperty` command. For example, the following command returns the property value named `platform`:

```sh
ectool getProperty platform
```

### Property sheets and intrinsic properties

A property value can be a simple string or a nested *property sheet* containing its own properties. Property sheets can be nested to any depth, which allows you to create hierarchical collections of information.

Most objects have an associated "property sheet" that contains "custom properties" created by user scripts. The property sheet is an intrinsic property of the containing object called "property sheet", so to reference a project's custom property "branchName", you could specify "/projects/aProject/propertySheet/branchName".

As a convenience, ElectricFlow allows the "property sheet" path element to be omitted and the path written as "/projects/aProject/branchName". If there is no intrinsic property with the same name, the path will find the property on the property sheet.
Custom properties in a property sheet can be one of two types: string property or a property sheet property. String properties hold simple text values. Property sheet properties hold nested properties. Nested properties are accessed via the property sheet property of their containing sheet.

For example:

```plaintext
/projects/aProject/propertySheet/topSheet/propertySheet/propB
- or -
/projects/aProject/topSheet/propB
```

All information managed by ElectricFlow exists in the form of properties and property sheets and your own custom-created properties. For example, each project, procedure, and step is represented internally as a property sheet—the command for a step is actually a property associated with the step, and so on. Every value in the ElectricFlow system can be accessed as a property, using the naming facilities described below. These properties are called intrinsic properties. ElectricFlow enforces some restrictions on intrinsic property values, whereas custom properties can have any value you choose.

To learn more about intrinsic properties defined for an object by ElectricFlow, see the "Using the ElectricFlow Perl API" topic in the ElectricFlow API Guide. For example, to learn about intrinsic properties associated with each project, find the documentation for the `getProject` ectool command. The result of running this command is an XML document whose field names and values represent the properties for the project.

**Note:** At the end of this Help topic, find the current list of ElectricFlow intrinsic properties sorted by each object and its associated properties [in table format].

**Property names and paths**

Properties are named using multi-level paths such as first/second/third, which refers to a property named "third" in a property sheet named "second" in a property sheet named "first." ElectricFlow also supports an equivalent notation using brackets instead of slashes. In this format, slashes are not considered separators when they appear between brackets.

For example, `first[second]/third` and `first[second][third]` both refer to the same property as `first/second/third`. The bracket `[ ]` notation is based on matching brackets. For example, `steps[build[1]]` refers to a property named "build[1]" inside a property sheet named "steps" (it does not treat "build" as a property sheet containing a property named "1").

Property names/paths have two forms: absolute and relative.

**Absolute property paths**

Absolute property paths are referenced by a fully-qualified path syntax that begins with a slash character ("/") followed by a top-level name. This path syntax is similar to a file system path specification. The first component after the "/" must be one of several reserved words that select a starting location to look up the property name. For example, consider the property name `/server/Electric Cloud/installDirectory./server means "lookup" starts in the topmost property sheet associated with the ElectricFlow server. This property name refers to the "installDirectory" property inside the server property sheet.

The system defines the following top-level names (absolute property names):

```plaintext
/applications/...
```
Start in the property sheet containing all applications. For example, /applications[deploy] refers to an application named "deploy" and /applications[deploy]/processes[install] refers to a process named "install" in that application.

/artifacts/...

Start in the property sheet containing all artifacts. For example, /artifacts/myGrp:myKey/prop1 refers to the prop1 property on the artifact whose name is "myGrp:myKey".

/artifactVersions/...

Start in the property sheet containing all artifact versions. For example, /artifactVersions/myGrp:myKey:1.0-36/prop1 refers to the prop1 property on the artifact version whose name is "myGrp:myKey:1.0-36".

Note: Throughout the API, you can substitute "groupId:artifactKey:version" wherever an artifactVersionName argument can be specified. This is the same if the artifactVersionNameTemplate specified in the artifact is in the form "groupId:artifactKey:version". When the template is different, it is convenient to be able to specify this tuple if you do not know the artifactVersionName.

/components/...

Start in the property sheet containing all components. For example, /components[warmile] refers to a component named "warmile" and /component[warmile]/processes[backup] refers to a component process named "backup" in that component.

/environments/...

Start in the property sheet containing all components. For example, /environments[qeserver] refers to an environment named "qeserver".

/groups/...

Start in the property sheet containing all groups. For example, /groups[dev] refers to the group named "dev".

/jobs/...

Start in the property sheet containing all jobs. For example, /jobs[ecloud.4096] refers to the job named "ecloud.4096." You can name a job using either its name (as in the preceding example) or using the unique identifier assigned to it by ElectricFlow.

/plugins/...

Start in the property sheet containing all plugins. For example, /plugins[EC-AgentManagement] refers to the currently promoted plugin named "EC-AgentManagement" and /plugins[EC-AgentManagement]/project/procedures[scpCopyFile] refers to a procedure named "scpCopyFile" in that plugin.

Note: There is a subtle difference between

```
ectool setProperty /plugins/EC-AgentManagement/project/foo 'bar'
```

and

```
ectool setProperty /plugins/EC-AgentManagement/foo 'bar'
```
The former places the property on the plugin’s project and can be referenced by
$[/myProject/foo]$ while the latter places the property on the plugin object and will not be
found via $[/myPlugin/foo]$.

Start in the property sheet containing all projects. For example, /projects[nightly] refers to the
project named “nightly,” and /projects[nightly]/procedures[main] refers to a procedure
named “main” in that project.

Start in the property sheet containing all artifact repositories. For example,
/repositories/repo1/propl refers to the propl property on the repository whose name is
“repo1”.

Start in the property sheet containing all resource pools. For example, /resourcePools[linuxA]
refers to the resource pool named “linuxA”.

Start in the property sheet containing all resources. For example, /resources[linux1] refers to the resource named “linux1”.

Start in the top-level server property sheet. For example, /server/a refers to the server property
named “a”.

Start in the property sheet containing all users. For example, /users[Bob] refers to the user named
“Bob”.

Start in the property sheet containing all workspaces. For example, /workspaces[default] refers
to the workspace named “default.”

Relative property paths

Property names that do not begin with “/” are relative and looked up starting in the current context. For
example, when executing a job step, the current context includes properties defined for the job step, parameters
for the current procedure, and global properties on the current job.

Relative property paths are distinguished from absolute property paths because they do not begin with one of
the top-level names. To avoid having to construct full property paths, ElectricFlow supports the concept of a
relative property path.

In use, the relative property path value is resolved by its context and a defined search order, which results in
accessing the value of an absolute fully-specified property value. Contexts and search orders are as follows:
1. In a job step context, ElectricFlow searches for relative property paths in the following order:
   - a property on the job step object
   - a property of the parent job step object, which includes parameters of the procedure on which the step is defined
   - a property on the job object

Notes:
- The search can be enabled or disabled by using the --extendedContextSearch option on the ectool getProperty or setProperty commands. When searching for a property value, disable the search by setting the --extendedContextSearch switch to "false", requiring the property to exist on the job step object or return false. When writing a new value to a property, enable the search by setting the --extendedContextSearch switch to "true", allowing the search for a property within the search order before creating a new one. New properties are created on the job step object.
- Parameters for subprocedure calls from job steps are searched for in a job step context.
- For procedure parameters for nested subprocedures, properties referenced by parameters are looked up as described [above] for job steps.

2. When expanding schedule parameters, ElectricFlow searches the relative property path in the following order:
   - a property on the procedure being called
   - a property on the project on which the procedure being called is defined
   - a property on the server

3. In a job name template context, ElectricFlow searches for the relative property path as a property on the job.

4. In any other context, ElectricFlow searches for the relative property path as a property on the context object.

jobSteps Paths

Some properties can be specified by using the property name and a globally unique identifier for the property, such as jobSteps. The format of the property path is similar to an absolute property path even though the property is not a top-level (absolute) property. For example, you can specify a job step as /jobSteps/<jobStepID>/.

You can also specify a property on a job step as /jobSteps/parent/propertyNamewhere:
- parent is the root parent of the job step that is not visible on the ElectricFlow UI.
- propertyName is the name of the property.

Context-relative "shortcuts" to property paths

A shortcut can be used to reference a property without knowing the exact name of the object that contains the property. You might think of a shortcut as another part of the property hierarchy. Shortcuts resolve to the correct property path even though its path elements may have changed because a project or procedure was renamed. Shortcuts are particularly useful if you do not know your exact location in the property hierarchical tree.

Shortcuts to property paths that provide convenient run-time access include:
/myApplication/...  
Start in the property sheet for the application associated with the current job or job step.

/myApplicationTier/...  
Start in the property sheet for the applicationTier associated with the current job step.

/myArtifactVersion/...  
Start in the property sheet for the artifactVersion associated with the current context. The only context where this property has any value is in the artifactVersionNameTemplate field for the artifact.

/myComponent/...  
Start in the property sheet for the component associated with the current context.

/myCredential/...  
Start in the property sheet for the credential associated with the current job step. This form produces an error if the current job step does not have a credential.

/myEvent/...  
This is a special property used only within an "email notifier." /myEvent/ allows you to refer to fields associated with the notifier itself. You can include these properties, for example, in the text of the email you send out for notification:

/myEvent/notifier - This property contains the name of the notifier that created the notifier event. You created this name when you created the notifier.

/myEvent/entity - This property contains the object where the notifier is attached. Two possible values are "job" or "jobStep," depending on where the notifier is attached.

/myEvent/source - This property contains the name of either the job or the jobStep where the notifier is attached.

/myEvent/type - This property defines whether the notifier is an "On Start" or an "On Completion" notifier. Two possible values are "STARTED" or "COMPLETED".

/myEvent/time - This property contains the time when the notifier occurred. The time is always specified in GMT and uses a formatted string, for example, 2009-06-11T21:00:56.502Z

/myEvent/timeMillis - This property contains the "timestamp" in milliseconds when the notifier occurred. This value is the number of milliseconds since January 1, 1970 GMT. The timeMillis corresponding to the time in the previous example is: 1244754056502

/myEnvironment/...  
Start in the property sheet for the environment associated with the current job or job step.

/myEnvironmentTier/...  
Start in the property sheet for the environmentTier associated with the current job step.

/myGate/...
/myGate/ is currently limited to myGate.gateType (PRE or POST) or myGate.parentStage. It is useful to include information about the active gate and stage in email notifications templates.

/myJob/...

Start in the global property sheet for the current job. /myJob/ points directly to the job object so you can reference built-in job properties (jobName, createTime, outcome, and so on) and custom properties. This property sheet can also be used to hold working data that needs to be passed from one step to another within the job.

/myJobStep/...

Start in the property sheet for the current job step.

/myParent/...

Start in the global property sheet for the parent job step or job if this is a top-level step. /myParent/ points directly to the job or job step object, so you can reference intrinsic or custom properties. For example, you can reference the parameters that were passed to this procedure.

In addition, you can reference a sibling step by calling /myParent/jobSteps/<sibling step name>. Or, you can create additional properties on /myParent/ to pass information from one step in the procedure to another:

step1 calls setProperty /myParent/results 100
step2 can call getProperty /myParent/results
/myParent/.

/myPipeline/...

Start in the property sheet for the pipeline associated with the current job or job step. This can be used by a plugin, procedure, or process step executed from a stage task to retrieve property information defined in the pipeline.

/myPipelineRuntime/...

Start in the property sheet for the pipelineRuntime associated with the current job or job step. This can be used by a plugin, procedure, or process step executed from a stage task to retrieve property information stored on the pipeline runtime

/myPipelineStageRuntime/...

Start in the property sheet for the pipelineStageRuntime for a pipeline stage where the current job or job step was defined. This can be used by a procedure step executed from a stage task to retrieve information for the summary property of the stage runtime.

/myProcedure/...

Start in the property sheet for the procedure in which the current job step was defined. If the current job step is executing as part of a nested procedure, /myProcedure/ refers to the innermost nested procedure.

/myProcess/...
Start in the property sheet for the application or component process in which the current job or job step was defined.

/myProcessStep/...

Start in the property sheet for the application or component process step in which the current job step was defined.

/myProject/...

Start in the property sheet for the project in which the current job step was defined. If the job step has nested procedure invocations, this is the project associated with the innermost nested procedure, for example, the project associated with /myProcedure/.

/myResource/...

Start in the property sheet for the resource assigned to the current job step.

/myResourcePool/...

Start in the property sheet for the resource pool that provided the resource for the current job step. Returns null if the step did not specify a resource pool.

/myStage/...

Start in the property sheet for the pipeline stage in which the current job or job step was defined.

/myStep/...

Start in the property sheet for the current step. "Step" refers to the (static) definition of a step, which is part of a procedure– this is different from a job step, which represents a step when it executes (dynamically) in a job. Use /myJobStep/ to access the job step.

/myState/...

Start in the property sheet for the state object so you can reference built-in and custom state properties or find parameter values passed to that state. When accessed from a state, /myState/ refers to that state. When accessed from a transition, /myState refers to the transition's owning state. When accessed from a job or job step, /myState/ refers to the state that launched that job as a subjob.

/mySubjob/...

Start in the property sheet for the subjob so you can reference built-in and custom job properties, parameters passed to the job, and properties on steps within that job. When accessed from a transition, /mySubjob/ refers to the subjob started by the state that owns that transition. This property path is particularly useful in conditions for On Completion transitions because the outcome or other information for the subjob can influence which state the workflow transitions to next.

/mySubworkflow/...

Start in the property sheet for the subworkflow so you can reference built-in and custom workflow properties. When accessed from a transition, /mySubworkflow/ refers to the subworkflow started by the state that owns that transition. This property path is particularly useful in conditions for On Completion transitions because the active state and other information for the subworkflow can influence which state the workflow transitions to next. You can access information about states and
transitions belonging to the workflow by using the path /mySubworkflow/states/someState or
/mySubworkflow/states/someState/transitions/someTransition.

/myTask/...

Start in the property sheet for the pipeline task in which the current job or job step was defined.

/myTransition/...

Start in the property sheet for the transition object so you can reference intrinsic and custom
transition properties. /myTransition/ is accessible only from a transition.

/myUser/...

This property can be used only if the current session is associated with: the predefined "admin" user,
a user defined as "local", or a user defined by a Directory Provider (LDAP or ActiveDirectory). This
property cannot be used if the user is a "project principal", which is normally the case when running
inside an ElectricFlow step.

For example, with an interactive login you can use:

ectool getProperty /myUser/userName (to get the username of the logged in user, or...)
ectool getProperty /myUser/email (to get the email address)

/myWorkflow/...

Start in the property sheet for the workflow object so you can reference built-in and custom workflow
properties. When accessed from a state or transition, /myWorkflow/ refers to the "owning" workflow.
When accessed from a job or job step, /myWorkflow/ refers to the workflow whose state launched
that job as a subjob. You can access information about states and transitions belonging to the
workflow by using the path /myWorkflow/states/someState or
/myWorkflow/states/someState/transitions/someTransition.

/myWorkflowDefinition/...

Starts in the property sheet for the workflow definition object so you can reference built-in and
custom workflow properties.

/myWorkspace/...

Start in the property sheet for the workspace associated with the current job step.

Property path shortcuts in ElectricFlow 5.0 and later

The following shortcuts to property paths are available in ElectricFlow 5.0 and later. For more information, go to
Context-relative "shortcuts" to property paths on page 920.

<table>
<thead>
<tr>
<th>Shortcuts</th>
<th>Descriptions</th>
<th>For jobs</th>
<th>For job steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>/myApplication/...</td>
<td>Starts in the property sheet for the application associated with the current job or job step.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Shortcuts</td>
<td>Descriptions</td>
<td>For jobs</td>
<td>For job steps</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>/myApplicationTier/...</td>
<td>Starts in the property sheet for the application tier associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myComponent/...</td>
<td>Starts with the property sheet for the component associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myCredential/...</td>
<td>Starts with the property sheet for the credential associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myEnvironment/...</td>
<td>Starts in the property sheet for the environment associated with the current job or job step.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myEnvironmentTier/...</td>
<td>Starts in the property sheet for the environment tier associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myGate/...</td>
<td>/myGate/ is currently limited to myGate.gateType (PRE or POST) or myGate.parentStage. It is useful to include information about the active gate and stage in email notifications templates.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myInventoryItem/...</td>
<td>Starts in the property sheet for the environment inventory.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myJob/...</td>
<td>Starts in the property sheet for the job associated with the current job or job step.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myJobStep/...</td>
<td>Starts in the property sheet for the job step associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myParent/...</td>
<td>Starts in the global property sheet for the parent job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myPipeline/...</td>
<td>Start in the property sheet for the pipeline associated with the current job or job step.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myPipelineRuntime/...</td>
<td>Start in the property sheet for the pipelineRuntime associated with the current job or job step.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Shortcuts</td>
<td>Descriptions</td>
<td>For jobs</td>
<td>For job steps</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>/myPipelineStageRuntime/...</td>
<td>Start in the property sheet for the pipelineStageRuntime for a <strong>pipeline stage</strong> where the current job or job step was defined. This can be used by a procedure step executed from a stage property to retrieve information for the summary property of the stage runtime.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myPlugin/...</td>
<td>Starts in the property sheet for the plugin associated with the current job.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>/myProcedure/...</td>
<td>Starts in the property sheet for the procedure in which the current job or job step was defined.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myProcess/...</td>
<td>Starts in the property sheet for the process in which the current job or job step was defined.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myProcessStep/...</td>
<td>Starts in the property sheet for the process step in which the current job step was defined.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myProject/...</td>
<td>Starts in the property sheet for the project in which the current job was defined.</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>/myResource/...</td>
<td>Starts in the property sheet for the resource associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myResourcePool/...</td>
<td>Starts in the property sheet for the resource pool associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myResourcePool/...</td>
<td>Starts in the property sheet for the resource pool associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myStage/...</td>
<td>Start in the property sheet for the pipeline stage in which the current job or job step was defined.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myState/...</td>
<td>Starts in the property sheet for the state object so you can reference built-in and custom state properties or find parameter values passed to that state.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Shortcuts

<table>
<thead>
<tr>
<th>Shortcuts</th>
<th>Descriptions</th>
<th>For jobs</th>
<th>For job steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>/myStep/...</td>
<td>Starts in the property sheet for the step associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>/myTask/...</td>
<td>Start in the property sheet for the pipeline task in which the current job or job step was defined.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myWorkflow/...</td>
<td>Starts in the property sheet for the workflow object so you can reference built-in and custom workflow properties.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myWorkflowDefinition/...</td>
<td>Starts in the property sheet for the workflow definition object so you can reference built-in and custom workflow properties.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>/myWorkspace/...</td>
<td>Starts in the property sheet for the workspace associated with the current job step.</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Property name substitutions

Property names can contain references to other properties, which are then substituted into the property name before looking it up. For example, consider the following property name:

/\myStep/\$[\myProcedure/name]

If the value of /\myProcedure/name is "xyz", the property above is equivalent to /\myStep/xyz.

### Expandable properties

Property values can contain property references using the "\$[]" notation.

For example:

1. Create a property named "foo" with a value of hello \$[bar].
2. Create a property named "bar" with a value of world.
3. Reference "foo" (either using \$[foo] or ectool getProperty foo). The value "hello world" is returned.

If you want just the literal value of "foo" (useful in the UI, for example), you can use the expand option in ectool:

ectool getProperty foo --expand false. The value "hello \$[bar]" will be returned.

Properties are expanded by default when you use getProperty or getProperties.

If the value of a property contains "$[]" but you do not want it to be interpreted as a property reference, you can use the expandable option:

ectool setProperty symbols '\$[@]#' --expandable false.
This option can be toggled in the web UI as well. Properties are expandable by default.

Because you cannot control where your expandable property might be referenced (and therefore which context is used during expansion), we recommend using absolute paths when referencing a property from the value of another property.

In the example above, if you define both "foo" and "bar" as properties on a project "proj1", you might assume there is no problem with the value of "foo". However, if you later reference "foo" from a job under "proj1" (for example, ${/myProject/foo}), foo will be referenced with the job step as its context. Therefore, when the value of "foo" is expanded, you will get a PROPERTY_REFERENCE_ERROR because "bar" is not defined in the context of the job step.

Custom property names and values

The following properties are used by the standard ElectricFlow UI, so you should use these property names whenever possible, and avoid using these names in ways that conflict with the definitions below.

- **compiles** - the number of files compiled during the job step
- **diagFile** - the filename in the top-level directory of the job's workspace, containing diagnostics extracted from the step's log file
- **errors** - the number of errors (compilation failures, test failures, application crashes, and so on) that occurred during the job step. When property errors are set by postp, the step outcome is set to error also.
- **tests** - the number of tests executed by the job step, including successes and failures
- **testsSkipped** - the number of tests skipped during the job step
- **warnings** - the number of warnings that occurred during the job step. When property warnings is set by postp, the step outcome is set to warning also.
- **preSummary** - if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears before whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.
- **postSummary** - if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears after whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.
- **summary** - if this property exists, its value is displayed in the "Status" field (in the job reports) for this step, replacing whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.

The property hierarchy

All ElectricFlow properties fall into a hierarchical structure, and you can reference any property using an absolute path from the root of the hierarchy. This includes properties you define and intrinsic properties defined by ElectricFlow.

For example, each step contains a property "resource" that provides the resource name to use for that step. All steps of a procedure exist as property sheets underneath the procedure. All procedures in a project exist as property sheets underneath the project, and so on.
The examples below illustrate some nesting relationships between objects.

For example, the notation "project\procedures[procedureName]" means each project object contains a property sheet named "procedures" holding all procedures defined within that project. Within the procedures property sheet, there is a nested property sheet for each procedure, named after the procedure. Thus, the name "projects[a]\procedures[b]" refers to a procedure named "b" contained in a project named "a."

- Each project contains procedures, schedules, credential definitions, workflow definitions, and workflows:

  
  project\procedures[procedureName]
  project\schedules[scheduleName]
  project\credentials[credentialName]
  project\workflowDefinitions[workflowName]
  project\workflows[workflowName]

- Each procedure contains steps and parameters. The parameters are "formal parameters," meaning they specify parameter names the procedure will accept, whether each parameter is required, and so on:

  procedure\steps[stepName]
  procedure\formalParameters[parameterName]

- Steps that invoke subprocedures contain parameter values for the subprocedure. These are called "actual parameters" because they provide actual values that will be passed into the subprocedure:

  step\actualParameters[parameterName]

- Each job contains a collection of job step objects for steps in the outermost procedure, along with parameter values passed into the job when it was invoked:

  job\jobSteps[stepName]
  job\actualParameters[parameterName]

- If a job step invokes a nested subprocedure, its property sheet contains parameter values that were passed into the nested subprocedure, plus all job steps corresponding to that procedure:

  jobStep\actualParameters[parameterName]
  jobStep\jobSteps[stepName]

- Schedules contain parameter values for the procedures they invoke. These are called "actual parameters" because they provide actual values passed into the procedure:

  schedule\actualParameters[parameterName]

- Workflow definitions contain state definitions:

  workflowDefinition\stateDefinitions[stateDefinitionName]

- Transition definitions contain actual parameters:

  transitionDefinition\actualParameters[parameterName]

- State definitions contain transition definitions, actual parameters, and formal parameters:

  stateDefinition\actualParameters[parameterName]
  stateDefinition\formalParameters[parameterName]
  stateDefinition\transitionDefinitions[transitionDefinitionName]

- Workflows contains states:

  workflow\states[stateName]

- Transitions contain actual parameters:

  transition\actualParameters[parameterName]
- States contain transitions, actual parameters, and formal parameters:
  
  \begin{align*}
  \text{state/actualParameters}[\text{parameterName}] \\
  \text{state/formalParameters}[\text{parameterName}] \\
  \text{state/transitions}[\text{transitionName}]
  \end{align*}

**Special property references**

ElectricFlow also supports several special property reference forms that are described in the following subsections.

**increment**

Use this form to increment the value of an integer property before returning its value. For example, suppose property \text{xyz} has the value 43. The property reference $\{\text{increment \ xyz}\}$ first increments the value of property \text{xyz} to 44, then returns 44.

**timestamp**

Use this form to generate a formatted timestamp value. For example, the property reference $\{\text{timestamp yyyy-MM-dd hh:mm}\}$ returns the current time in a form such as "2007-Jun-19 04:36". The pattern following \text{/timestamp} specifies how to format the time and defaults to "yyyyMMddHHmm". The pattern follows conventions for the Java class SimpleDateFormat, where various letters are substituted with various current time elements. For more information, go to [http://docs.oracle.com/javase/7/docs/api/java/text/SimpleDateFormat.html](http://docs.oracle.com/javase/7/docs/api/java/text/SimpleDateFormat.html) for SimpleDateFormat class documentation.

Here are some of the supported substitutions:

- \text{y} - Year, such as "2007" or "07"
- \text{M} - Month, such as "April", Apr", or "04"
- \text{w} - Week in year, such as "27"
- \text{W} - Week in month, such as "3"
- \text{D} - Day in year, such as "194"
- \text{d} - Day in month, such as "18"
- \text{E} - Day in the week, such as "Tuesday" or "Tue"
- \text{a} - am/pm marker, such as "PM"
- \text{H} - Hour in day (0-23), such as "7"
- \text{h} - Hour in am/pm (1-12), such as "11"
- \text{m} - Minute in hour, such as "30"
- \text{s} - Second in minute, such as "15"
- \text{S} - Millisecond, such as "908"
- \text{z} - Time zone such as "Pacific Standard Time", "PST", or "GMT-08:00"
- \text{Z} - Time zone such as "-0800"
Repeated letters cause longer forms to be substituted. For example, "yy" substitutes the last 2 digits of the current year, whereas "yyyy" substitutes the 4-digit year number. Single quotes can be used to substitute text directly without the above interpretations.

**javascript**

This form executes a Javascript code fragment inside the ElectricFlow server and returns the result computed by that code. For example, `$/javascript 4*2` returns "8.0". Javascript code can be arbitrarily long and include multiple statements. The value of the last statement is returned by the property reference.

Javascript code executes in an interpreter that provides access to ElectricFlow properties:

1. The normal way to access property values is through Javascript objects. Global Javascript objects named "server," "projects," and so on, exist and correspond to all top-level objects in an absolute property path. For example, there is a Javascript object named `server` that corresponds to the path `/server`, and a Javascript object named `myJob` that corresponds to the path `/myJob`. You can use either "." or "[]" notation to access properties within the object. For a more complete list of top-level objects, see the "Absolute property paths" section.

Examples:

`$/javascript myJob.mightExist`  
this is a safe way to refer to an optional parameter

`$/javascript (myJobStep.errors > 0) ? "step failed" : "no errors"`  
test a value and return another string based on the result

`$/javascript server.settings.ipAddress`  
refer to a property in a nested property sheet

`$/javascript server["Electric Cloud"]["installDirectory"]`  
if the property name has a space, use "[]" notation

`$/javascript server["Electric Cloud"]["installDirectory"]`  
do not use the "." in front of the "["
2. You can also call the function, "getProperty". It takes a property name as argument and returns the value of that property. The case where this is most useful is when you want to access another special property reference.

Examples:

\[
\text{javascript getProperty} ("/timestamp yyyy-MM-dd hh:mm")
\]
returns the current time

\[
\text{javascript getProperty} ("/increment /myJob/jsCount")
\]
this is the only way to change a property via javascript

For example, consider the following property reference:

\[
\text{javascript (getProperty("/myJobStep/errors") > 0) ? "step failed" : "no errors"}
\]
This example returns "step failed" if the property "errors" on the current job step had a value greater than zero, and it returns "no errors" otherwise.

3. If calling the "setProperty" function, similar to getProperty, there are two variations on the function:

- A global function variation that uses the current context object.
  The global function takes 2 or 3 arguments. The 3-argument version takes a context object, a path, and a value. The 2-argument version omits the context object and uses the current context object (for example, job step).

  Example:

  ```javascript
  setProperty (myProject, "foo", "bar")
  ```
  would set the value of the "foo" property on the current project to "bar".

- An object function variation that can be called on objects, which uses that object as a context object.
  The object function takes two arguments: a "path" and a "value".

  Example:

  ```javascript
  server.setProperty ("foo", "bar")
  ```
  would set the "foo" property on the server object to the value "var".

**ElectricFlow Intrinsic Properties listed by object type**

This section describes the intrinsic properties for some (but not all) of the ElectricFlow objects. For each object type in the following list, there is a link to a table that includes a list of intrinsic properties applicable to that object and provides the property type and description.

- acl repository
- artifact resource
ElectricFlow Property Type definitions

This table provides Property Type definitions for each property listed in the following tables. (A Property Type precedes each property description in the Description column.)

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>boolean</td>
<td>One of two possible values - either true or false. These values are more frequently represented by the numbers &quot;0&quot; and &quot;1&quot;, where &quot;0&quot; equals false and &quot;1&quot; equals true.</td>
</tr>
<tr>
<td>date</td>
<td>A millisecond precision UTC date in ISO 8601 form: [YYYY]-[MM]-[DD]T[hh]:[mm]:[ss][nn]Z For example, 2007-06-19T04:36:22.000Z</td>
</tr>
<tr>
<td>id</td>
<td>Each time an object is created, ElectricFlow generates a unique ID number for that object.</td>
</tr>
<tr>
<td>Type</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>name</td>
<td>This is a unicode string value with a maximum of 255 characters.</td>
</tr>
<tr>
<td>number</td>
<td>This is a simple integer numeric value.</td>
</tr>
<tr>
<td>reference</td>
<td>This property refers to another object.</td>
</tr>
<tr>
<td>string</td>
<td>This is a unicode string value with a maximum CLOB size of the database, but only the first 450 characters are indexed, which means a defined search will not &quot;see&quot; beyond the first 450 characters.</td>
</tr>
</tbody>
</table>

ElectricFlow Object / Property tables

In the following tables, the Description column displays the property type preceding the property description.

**Object Type: acl**

**Description:** An acl is an Access Control List.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aclId</td>
<td><strong>id:</strong> The unique identifier for this acl object. Other objects can refer to this acl by its ID.</td>
</tr>
<tr>
<td>inheriting</td>
<td><strong>boolean:</strong> If true, the ACL inherits ACEs from the ACL's parent.</td>
</tr>
</tbody>
</table>
Object Type: acl

Description: An acl is an Access Control List.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ownerType</td>
<td>This is any type of object the ACL controls and can be any of the objects listed below.</td>
</tr>
<tr>
<td></td>
<td>ace</td>
</tr>
<tr>
<td></td>
<td>acl</td>
</tr>
<tr>
<td></td>
<td>admin</td>
</tr>
<tr>
<td></td>
<td>artifact</td>
</tr>
<tr>
<td></td>
<td>artifactVersion</td>
</tr>
<tr>
<td></td>
<td>event</td>
</tr>
<tr>
<td></td>
<td>formalParameter</td>
</tr>
<tr>
<td></td>
<td>group</td>
</tr>
<tr>
<td></td>
<td>job</td>
</tr>
<tr>
<td></td>
<td>jobStep</td>
</tr>
<tr>
<td></td>
<td>license</td>
</tr>
<tr>
<td></td>
<td>notifier</td>
</tr>
<tr>
<td></td>
<td>procedure</td>
</tr>
<tr>
<td></td>
<td>procedureStep</td>
</tr>
</tbody>
</table>

parentId

id: The parent ACL.

Object Type: artifact

Description: An artifact is an object that contains zero or more artifact versions.

An artifact has two purposes:

1. To group artifact versions and provide a template for naming the versions
2. To restrict who can publish artifact versions, based on groupId:artifactKey

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference:_acl</td>
</tr>
<tr>
<td>artifactId</td>
<td>id: The artifact's ID number.</td>
</tr>
</tbody>
</table>
**Object Type:** artifact

**Description:** An artifact is an object that contains zero or more artifact versions. An artifact has two purposes:

1. To group artifact versions and provide a template for naming the versions
2. To restrict who can publish artifact versions, based on groupId:artifactKey

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>artifactKey</td>
<td>string: User-specified identifier for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.</td>
</tr>
<tr>
<td>artifactName</td>
<td>name: The name of this artifact.</td>
</tr>
<tr>
<td>artifactVersionNameTemplate</td>
<td>name: The template for artifact version names published to this artifact.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>groupId</td>
<td>id: A user-generated group name for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
</tbody>
</table>

[back to top]
Object Type: **artifactVersion**

**Description:** An artifact version is an object that represents a user-defined unit of related files typically produced by one job and consumed by one or more other jobs.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>artifactKey</td>
<td>string: User-specified identifier for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.</td>
</tr>
<tr>
<td>artifactName</td>
<td>name: The name of the artifact.</td>
</tr>
<tr>
<td>artifactVersionId</td>
<td>id: The ElectricFlow-generated ID number for this artifact version.</td>
</tr>
<tr>
<td>artifactVersionName</td>
<td>name: The name of the artifact version.</td>
</tr>
<tr>
<td>artifactVersionState</td>
<td>string: Possible values are: available</td>
</tr>
<tr>
<td>buildNumber</td>
<td>number: User-defined build number component of the version attribute for the artifact version.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>groupId</td>
<td>id: A user-generated group name for this artifact. This field may consist of alphanumeric characters, spaces, underscores, hyphens, and periods.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>majorMinorPatch</td>
<td>string: major.minor.patch component of the version attribute for the artifact.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
</tbody>
</table>
### Object Type: artifactVersion

**Description:** An artifact version is an object that represents a user-defined unit of related files typically produced by one job and consumed by one or more other jobs.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>publisherJobId</td>
<td>id: The ElectricFlow-generated ID number for the job that published the artifact version.</td>
</tr>
<tr>
<td>publisherJobName</td>
<td>string: The name of the job that published the artifact version.</td>
</tr>
<tr>
<td>publisherJobStepId</td>
<td>id: The ElectricFlow-generated ID number for the job step that published the artifact version.</td>
</tr>
<tr>
<td>qualifier</td>
<td>string: User-defined qualifier component of the version attribute for the artifact.</td>
</tr>
<tr>
<td>repositoryName</td>
<td>name: The name of the artifact repository.</td>
</tr>
<tr>
<td>version</td>
<td>string: An artifact version specification uses the following form: major.minor.patch.qualifier.buildNumber</td>
</tr>
</tbody>
</table>

[back to top]

### Object Type: credential

**Description:** In ElectricFlow, a credential is an object that stores a username and password for later use.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>credentialId</td>
<td>id: The credential's ID number.</td>
</tr>
<tr>
<td>credentialName</td>
<td>name: The name of this credential.</td>
</tr>
</tbody>
</table>
Object Type: **credential**

**Description:** In ElectricFlow, a credential is an object that stores a username and password for later use.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>password</td>
<td>string: The password corresponding to the username and this credential.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this credential.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>userName</td>
<td>name: A saved string that represents the name portion of a credential, typically a user account name.</td>
</tr>
</tbody>
</table>

Object Type: **directoryProvider**

**Description:** A directoryProvider is an object containing information about an external directory service (LDAP or ActiveDirectory).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>commonGroupNameAttribute</td>
<td>string: The attribute in a group record that contains the common group name. If specified, this name is used only when searching for groups from an external provider.</td>
</tr>
</tbody>
</table>
**Object Type:** directoryProvider

**Description:** A directoryProvider is an object containing information about an external directory service (LDAP or ActiveDirectory).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>directoryProviderId</td>
<td>id: The ID of the directory provider.</td>
</tr>
<tr>
<td>domainName</td>
<td>string: The domain name from which Active Directory servers are automatically discovered.</td>
</tr>
<tr>
<td>emailAttribute</td>
<td>string: The attribute in a user record that contains the user's email address. If the attribute was not specified, the account name and domain name are concatenated to form an email address.</td>
</tr>
<tr>
<td>enableGroups</td>
<td>boolean: Determines whether or not external groups are enabled for the directory provider. Defaults to &quot;true&quot;.</td>
</tr>
<tr>
<td>fullUserNameAttribute</td>
<td>name: The attribute in a user record that contains the user's full name (first and last) for display in the UI.</td>
</tr>
<tr>
<td>groupBase</td>
<td>string: This string is prepended to the basedn to construct the directory DN that contains group records.</td>
</tr>
<tr>
<td>groupMemberAttributes</td>
<td>string: A comma-separated attribute name list that identifies a group member.</td>
</tr>
<tr>
<td>groupMemberFilter</td>
<td>string: Two common forms of group record in LDAP directories: POSIX style groups where members are identified by account name, and groupOfNames or uniqueGroupOfNames records where members are identified by the full user DN. Both forms are supported, so the query is passed to parameters: &quot;{0}&quot; is replaced with the full user record DN, and &quot;{1}&quot; is replaced with the user's account name.</td>
</tr>
<tr>
<td>groupNameAttribute</td>
<td>name: The group record that contains the name of the group.</td>
</tr>
</tbody>
</table>
Object Type: **directoryProvider**

**Description:** A directoryProvider is an object containing information about an external directory service (LDAP or ActiveDirectory).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>groupSearchFilter</td>
<td><strong>string:</strong> This LDAP query is performed in the context of the groups directory to enumerate group records.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td><strong>name:</strong> This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>managerDn</td>
<td><strong>name:</strong> The DN of a user who has read-only access to LDAP user and group directories.</td>
</tr>
<tr>
<td>modifyTime</td>
<td><strong>date:</strong> The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td><strong>name:</strong> The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td><strong>reference:</strong> propertySheet</td>
</tr>
<tr>
<td>providerIndex</td>
<td><strong>number:</strong> The index that specifies the search order across multiple directory providers. For example: 2 LDAP providers, one with index &quot;0&quot; and one with index &quot;1&quot; means the providers will be searched in that numerical order.</td>
</tr>
<tr>
<td>providerName</td>
<td><strong>name:</strong> This human-readable name will be displayed in the user interface to identify users and groups that come from this provider.</td>
</tr>
<tr>
<td>providerType</td>
<td><strong>string:</strong> &lt;ldap</td>
</tr>
<tr>
<td>realm</td>
<td><strong>string:</strong> An identifier (string) used for LDAP directory providers so users and groups (within LDAP) can be uniquely identified in &quot;same name&quot; collisions across multiple directory providers. The realm is appended to the user or group name when stored in the ElectricFlow server. For example, &lt;user&gt;@dir (where the realm is set to &quot;dir&quot;).</td>
</tr>
<tr>
<td>url</td>
<td><strong>string:</strong> The server URL is in the form protocol://host:port/basedn. Protocol is either ldap or ldaps (for secure LDAP).</td>
</tr>
</tbody>
</table>
**Object Type: directoryProvider**

**Description:** A directoryProvider is an object containing information about an external directory service (LDAP or ActiveDirectory).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>userBase</td>
<td>string: This string is prepended to the basedn to construct the directory DN that contains user records.</td>
</tr>
<tr>
<td>userNameAttribute</td>
<td>name: The attribute in a user record that contains the user's account name.</td>
</tr>
<tr>
<td>userSearchFilter</td>
<td>string: This LDAP query is performed in the context of the user directory to search for a user by account name. The string &quot;{0}&quot; is replaced with the user's login ID. Typically, the query compares a user record attribute with the substituted user login ID.</td>
</tr>
<tr>
<td>userSearchSubtree</td>
<td>boolean: If true, the subtree below the user base is searched recursively.</td>
</tr>
<tr>
<td>useSSL</td>
<td>boolean: This flag is used to specify SSL to communicate with your Active Directory servers.</td>
</tr>
</tbody>
</table>

**Note:** Transport Layer Security (TLS) has replaced Secure Sockets Layer version 3.0 (SSLv3) on the ElectricFlow web server and the ElectricFlow server.

---

**Object Type: emailConfig**

**Description:** An emailConfig is an object that stores information created and used to communicate with the email server.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>configName</td>
<td>string: The name of the email configuration.</td>
</tr>
</tbody>
</table>
Object Type: **emailConfig**

**Description:** An *emailConfig* is an object that stores information created and used to communicate with the email server.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>createTime</td>
<td><strong>date:</strong> The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td><strong>string:</strong> A user-specfied text description of the object.</td>
</tr>
<tr>
<td>emailConfigId</td>
<td><strong>id:</strong> The ElectricFlow-generated ID for the email configuration.</td>
</tr>
<tr>
<td>emailConfigName</td>
<td><strong>string:</strong> The name of the email configuration.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td><strong>name:</strong> This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>mailFrom</td>
<td><strong>string:</strong> The email address used as the email sender address for notifications.</td>
</tr>
<tr>
<td>mailHost</td>
<td><strong>string:</strong> The name of the email server host.</td>
</tr>
<tr>
<td>mailPort</td>
<td><strong>number:</strong> The port number for the mail server. The protocol software determines the default value (25 for SMTP and 465 for SSMTP).</td>
</tr>
<tr>
<td>mailProtocol</td>
<td><strong>string:</strong> This is either SSMTP or SMTP (not case sensitive). Default is SMTP.</td>
</tr>
<tr>
<td>mailUser</td>
<td><strong>name:</strong> An individual or a generic name like &quot;ElectricFlow&quot; -- the name of the email user on whose behalf ElectricFlow sends email notifications.</td>
</tr>
<tr>
<td>modifyTime</td>
<td><strong>date:</strong> The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td><strong>name:</strong> The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td><strong>reference:</strong> propertySheet</td>
</tr>
</tbody>
</table>
Object Type: **emailNotifier**

**Description:** An emailNotifier is an object that stores information created and used to notify users about various types of information, including status.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>condition</td>
<td>string: Only send mail if the condition evaluates to &quot;true&quot;. The condition is a string subject to property expansion. The notification will NOT be sent if the expanded string is &quot;false&quot; or &quot;0&quot;. If no condition is specified, the notification is ALWAYS sent.</td>
</tr>
<tr>
<td>configName</td>
<td>string: The name of the email configuration.</td>
</tr>
<tr>
<td>container</td>
<td>id: The object ID to which the email notifier is attached (for example: procedure-123).</td>
</tr>
<tr>
<td>containerType</td>
<td>string: The type of object that the notifier is attached to (procedure, step, job, jobstep).</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>destinations</td>
<td>string: A space-separated list of valid email addresses, email aliases, or ElectricFlow usernames, or a string subject to property expansion that expands into such a list.</td>
</tr>
<tr>
<td>emailNotifierId</td>
<td>id: The ElectricFlow-generated ID for the email notifier.</td>
</tr>
</tbody>
</table>
| eventType     | string: <onEnter|onStart|onCompletion>  
onStart triggers an email notification when the job or job step begins.  
onCompletion, default, triggers an email notification when the job finishes, no matter how it finishes. |
| formattingTemplate | string: The email address used as the email sender address for notifications. |
Object Type: **emailNotifier**

**Description:** An *emailNotifier* is an object that stores information created and used to notify users about various types of information, including status.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lastModifiedBy</td>
<td><em>name:</em> This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td><em>date:</em> The time when this object was last modified.</td>
</tr>
<tr>
<td>notifierName</td>
<td><em>name:</em> The name of the email notifier.</td>
</tr>
<tr>
<td>owner</td>
<td><em>name:</em> The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td><em>reference:</em> propertySheet</td>
</tr>
</tbody>
</table>

[back to top]

Object Type: **formalParameter**

**Description:** A *formalParameter* is a parameter expected by a procedure, including its name, a default value, and an indication of whether the parameter is required. Formal parameters are different from "actual parameters"---formal parameters define the type of parameters a procedure is expecting, and actual parameters provide values to use at run-time.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>container</td>
<td><em>string:</em> An object ID for a &quot;container&quot; that contains formal parameters.</td>
</tr>
<tr>
<td>containerType</td>
<td><em>string:</em> The type of object containing the formal parameter.</td>
</tr>
<tr>
<td>createTime</td>
<td><em>date:</em> The time when this object was created.</td>
</tr>
<tr>
<td>defaultValue</td>
<td><em>string:</em> The <em>formalParameter's</em> default value.</td>
</tr>
</tbody>
</table>
**Object Type:** formalParameter

**Description:** A formalParameter is a parameter expected by a procedure, including its name, a default value, and an indication of whether the parameter is required. Formal parameters are different from "actual parameters"—formal parameters define the type of parameters a procedure is expecting, and actual parameters provide values to use at run-time.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td><strong>string:</strong> A user-specified text description of the object.</td>
</tr>
<tr>
<td>expansionDeferred</td>
<td><strong>boolean:</strong> Determines whether or not the property expansion is deferred.</td>
</tr>
<tr>
<td>formalParameterId</td>
<td><strong>id:</strong> This is this formal parameter's ID.</td>
</tr>
<tr>
<td>formalParameterName</td>
<td><strong>name:</strong> This is this formal parameter's name.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td><strong>name:</strong> This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td><strong>date:</strong> The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td><strong>name:</strong> The person (username) who created the object.</td>
</tr>
<tr>
<td>required</td>
<td><strong>boolean:</strong> If true, a value for this parameter must be supplied when the procedure is called.</td>
</tr>
<tr>
<td>type</td>
<td><strong>name:</strong> The custom type of formalParameter.</td>
</tr>
</tbody>
</table>
Object Type: **gateway**

**Description:** To communicate with a resource, workspace, or artifact repository server in another zone, a "gateway" must be created. A gateway object contains two resource (agent) machines, for example, GatewayResource1 and GatewayResource2—each configured to communicate with the other. One gateway resource resides in the *source* zone and the other in the *target* zone. A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>gatewayDisabled</td>
<td>boolean: If set to 1 (true), the gateway is disabled.</td>
</tr>
<tr>
<td>gatewayId</td>
<td>id: The unique ElectricFlow-generated ID for this gateway.</td>
</tr>
<tr>
<td>gatewayName</td>
<td>string: The name of the gateway.</td>
</tr>
<tr>
<td>hostName1</td>
<td>string: The agent host name where Resource1 resides. This host name is used by Resource2 to communicate with Resource1. Do not specify this option is you want to use the host name from Resource1's definition.</td>
</tr>
<tr>
<td>hostName2</td>
<td>string: The agent host name where Resource2 resides. This host name is used by Resource1 to communicate with Resource2. Do not specify this option is you want to use the host name from Resource2’s definition.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>port1</td>
<td>number: The port number used by Resource1 - defaults to the port number used by the resource.</td>
</tr>
</tbody>
</table>
**Object Type: gateway**

**Description:** To communicate with a resource, workspace, or artifact repository server in another zone, a "gateway" must be created. A gateway object contains two resource (agent) machines, for example, GatewayResource1 and GatewayResource2—each configured to communicate with the other. One gateway resource resides in the *source* zone and the other in the *target* zone. A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>port2</td>
<td><strong>number:</strong> The port number used by <em>Resource2</em> - defaults to the port number used by the resource.</td>
</tr>
<tr>
<td>propertySheet</td>
<td><strong>reference:</strong> propertySheet</td>
</tr>
<tr>
<td>resourceName1</td>
<td><strong>string:</strong> The name of your choice for the first of two required gateway resources. Do <strong>not</strong> include &quot;spaces&quot; in a resource name.</td>
</tr>
<tr>
<td>resourceName2</td>
<td><strong>string:</strong> The name of your choice for the second of two required gateway resources. Do <strong>not</strong> include &quot;spaces&quot; in a resource name.</td>
</tr>
</tbody>
</table>

**[back to top]**

**Object Type: group**

**Description:** This is any *group* of users known to the ElectricFlow server, including groups defined locally within the server and those groups defined in external repositories such as LDAP or ActiveDirectory.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td><strong>reference:</strong> acl</td>
</tr>
<tr>
<td>createTime</td>
<td><strong>date:</strong> The time when this object was created.</td>
</tr>
<tr>
<td>groupId</td>
<td><strong>id:</strong> The unique ElectricFlow-generated group ID.</td>
</tr>
<tr>
<td>groupName</td>
<td><strong>name:</strong> This is this group's name.</td>
</tr>
</tbody>
</table>
Object Type: **group**

**Description:** This is any **group** of users known to the ElectricFlow server, including groups defined locally within the server and those groups defined in external repositories such as LDAP or ActiveDirectory.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>mutable</td>
<td>boolean: If true, the member list of this group is editable within ElectricFlow via the web UI or the modifyGroup API.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>providerName</td>
<td>name: The name of the directory provider that controls this group.</td>
</tr>
</tbody>
</table>

[back to top]

Object Type: **job**

**Description:** A **job** is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>abortStatus</td>
<td>string: If set, indicates the step was aborted. Values will be either ABORT or FORCE_ABORT - indicating how the step was aborted.</td>
</tr>
<tr>
<td>abortedBy</td>
<td>name: This is the user who issued the &quot;abort.&quot;</td>
</tr>
</tbody>
</table>
**Object Type: job**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet. An actualParameter is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from &quot;formal parameters&quot; - formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.</td>
</tr>
<tr>
<td>callingState</td>
<td>string: The full property path to the &quot;calling state&quot;, which can appear on subjobs and subworkflows of a workflow.</td>
</tr>
<tr>
<td>callingStateId</td>
<td>id: The ElectricFlow-generated ID number for the calling state.</td>
</tr>
<tr>
<td>combinedStatus</td>
<td>Provides more inclusive step status output - the resulting query output may contain up to three sub-elements: status</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>credentialName</td>
<td>name: The name of the credential being used for impersonation when the job runs commands on a resource.</td>
</tr>
<tr>
<td>deleted</td>
<td>The object was marked for background deletion. Possible values are &quot;0&quot; or &quot;1&quot;. Default is &quot;0&quot; (not set).</td>
</tr>
<tr>
<td>directoryName</td>
<td>name: The name of this job's directory within each workspace for this job.</td>
</tr>
</tbody>
</table>
Object Type: **job**

**Description:** A job is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure’s execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>elapsedTime</td>
<td><strong>number:</strong> The number of milliseconds between the start and end times for the job.</td>
</tr>
<tr>
<td>errorCode</td>
<td><strong>errorCode:</strong> When the outcome is error, this property displays the error code, identifying which error occurred.</td>
</tr>
<tr>
<td>errorMessage</td>
<td><strong>string:</strong> When the outcome is error, this property displays the error description.</td>
</tr>
<tr>
<td>external</td>
<td><strong>boolean:</strong> If “true”, the job is external.</td>
</tr>
<tr>
<td>finish</td>
<td><strong>date:</strong> The time this job completed.</td>
</tr>
<tr>
<td>jobId</td>
<td><strong>id:</strong> This is this job’s ID number, which is a UUID.</td>
</tr>
<tr>
<td>jobName</td>
<td><strong>name:</strong> This is this job’s name.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td><strong>name:</strong> This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>launchedByUser</td>
<td><strong>name:</strong> The name of the user or project principal that explicitly launched the job. This property is blank when the job is launched by a schedule.</td>
</tr>
<tr>
<td>licenseWaitTime</td>
<td>The sum of time all job steps had to wait for a license.</td>
</tr>
<tr>
<td>liveProcedure</td>
<td><strong>name:</strong> The current procedure name from which this job was created – if the procedure was renamed since the job launched, this will be the procedure’s new name, and if the procedure was deleted, this will be null.</td>
</tr>
</tbody>
</table>
Object Type: **job**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure’s execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>liveSchedule</td>
<td>name: The current schedule name that launched this job – if the schedule was renamed since the job was launched, this will be the schedule’s new name, and if the schedule was deleted, this will be null.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>outcome</td>
<td>The overall result of the job: success, warning, error, or skipped.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>priority</td>
<td>Values can be low, normal (default), high, or highest.</td>
</tr>
<tr>
<td>procedureName</td>
<td>name: The name of the procedure that defines the job’s steps.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this job.</td>
</tr>
<tr>
<td>propertySheetId</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>resourceWaitTime</td>
<td>The sum of time all job steps had to wait for a resource. This could indicate that eligible resources for the step have reached their step limit, are in-use but the step requires a resource exclusively, or resources are down.</td>
</tr>
<tr>
<td>runAsUser</td>
<td>name: The name of the user being impersonated in this job.</td>
</tr>
<tr>
<td>scheduleName</td>
<td>name: The schedule name that launched this job – this field differs from liveSchedule in that it is written at job creation time only, and not changed, even if the schedule is renamed or deleted.</td>
</tr>
<tr>
<td>start</td>
<td>date: The time when this job began executing.</td>
</tr>
</tbody>
</table>
Object Type: **job**

**Description:** A *job* is an ElectricFlow structure associated with invoking a procedure. A new job is created each time a procedure begins to execute. The job keeps track of all data associated with the procedure's execution, such as the running time of each step and any errors that may occur during the step. ElectricFlow retains job information after the job completes so you can examine what occurred.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| status        | Possible values are:  
  pending - the job was created, but it is waiting for prerequisite steps to complete  
  runnable - the job step is waiting for a resource  
  scheduled - the job was assigned a resource, but the command has not started running  
  running - the job/job step is running a command on the assigned resource  
  completed - the job/job step has completed |
| totalWaitTime | The total sum of license, resource, a precondition, and workspace wait times job steps were restricted and had to wait to process. |
| workspaceWaitTime | The sum of time all job steps had to wait for a workspace. |

Object Type: **jobStep**

**Description:** A *jobStep* is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>abortStatus</td>
<td>string: If set, indicates the step was aborted. Values will be either ABORT or FORCE_ABORT - indicating how the step was aborted.</td>
</tr>
<tr>
<td>abortedBy</td>
<td>name: The user who issued the &quot;abort.&quot;</td>
</tr>
</tbody>
</table>
**Object Type:** jobStep

**Description:** A jobStep is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet An actualParameter is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from &quot;formal parameters&quot; - formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.</td>
</tr>
<tr>
<td>alwaysRun</td>
<td>boolean: If true, this step runs even if the job is aborted before the step completes. Note that a &quot;force abort&quot; will abort an alwaysRun step.</td>
</tr>
<tr>
<td>assignedResourceName</td>
<td>name: The name of the resource assigned to this step by the step scheduler.</td>
</tr>
<tr>
<td>broadcast</td>
<td>boolean: If true, this step runs on all resources in a pool.</td>
</tr>
<tr>
<td>combinedStatus</td>
<td>Provides more inclusive step status output - the resulting query output may contain up to three sub-elements: status</td>
</tr>
<tr>
<td>command</td>
<td>string: This property specifies the command this step runs.</td>
</tr>
<tr>
<td>condition</td>
<td>string: If this element is not present, the event is ALWAYS triggered. If specified, the event is triggered only if the value of the condition argument is TRUE; if not true, a boolean value of &quot;false&quot; or &quot;0&quot; was used. Condition arguments can be a literal, a fixed value string, or a string subject to property expansion.</td>
</tr>
<tr>
<td>conditionExpanded</td>
<td>boolean: The result of the expansion on the step condition.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
</tbody>
</table>
## Object Type: **jobStep**

**Description:** A jobStep is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>delayUntil</td>
<td>For a step that was rescheduled due to a resource or workspace problem, this is the next time the step will be eligible to run.</td>
</tr>
<tr>
<td>elapsedTime</td>
<td><strong>number:</strong> The number of milliseconds between the start and end times for the jobStep.</td>
</tr>
<tr>
<td>errorCode</td>
<td><strong>errorCode:</strong> This property appears when the outcome is error and displays the error code, identifying which error occurred.</td>
</tr>
<tr>
<td>errorHandling</td>
<td>This is the error handling policy copied from the procedure step and indicates how the step responds to errors:</td>
</tr>
<tr>
<td></td>
<td><strong>failProcedure:</strong> The current procedure continues, but the overall status is error (default).</td>
</tr>
<tr>
<td></td>
<td><strong>abortProcedure:</strong> Aborts the current procedure, but allows already-running steps in the current procedure to complete.</td>
</tr>
<tr>
<td></td>
<td><strong>abortProcedureNow:</strong> Aborts the current procedure and terminates running steps in the current procedure.</td>
</tr>
<tr>
<td></td>
<td><strong>abortJob:</strong> Aborts the entire job, terminates running steps, but allows alwaysRun steps to run.</td>
</tr>
<tr>
<td></td>
<td><strong>abortJobNow:</strong> Aborts the entire job and terminates all running steps, including alwaysRun steps.</td>
</tr>
<tr>
<td></td>
<td><strong>failProcedure:</strong> The current procedure continues, but the overall status is error (default).</td>
</tr>
<tr>
<td></td>
<td><strong>ignore:</strong> Continues as if the step succeeded.</td>
</tr>
<tr>
<td>errorMessage</td>
<td><strong>string:</strong> When the outcome is error, this property displays an error message description.</td>
</tr>
<tr>
<td>exclusive</td>
<td><strong>boolean:</strong> If true, this step acquires and retains its resource exclusively.</td>
</tr>
</tbody>
</table>
**Object Type:** jobStep

**Description:** A jobStep is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>exclusiveMode</td>
<td>string: Possible values are: none, job, step, call</td>
</tr>
<tr>
<td>exitCode</td>
<td>number: This is this step’s exit code.</td>
</tr>
<tr>
<td>external</td>
<td>boolean: If &quot;true&quot;, the job is external.</td>
</tr>
<tr>
<td>finish</td>
<td>date: The time when this job step completed.</td>
</tr>
<tr>
<td>hostName</td>
<td>name: The name of the host where this step was invoked (copied from the resource)</td>
</tr>
<tr>
<td>job</td>
<td>id: This is the ID number of the job that owns the job step. The string representation of the job is its name, so $[job] evaluates to the job name, but $[job/foo] is also legal and refers to the foo property of the job.</td>
</tr>
<tr>
<td>jobId</td>
<td>id: This is this job’s ID number, which is a UUID.</td>
</tr>
<tr>
<td>jobName</td>
<td>name: This is the name of this step’s job.</td>
</tr>
<tr>
<td>jobStepId</td>
<td>id: This is this step’s ID number.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>licenseWaitTime</td>
<td>The length of time this job step had to wait to process because the license limit was reached or exceeded.</td>
</tr>
<tr>
<td>liveProcedure</td>
<td>string: The current procedure name for the procedure step from which the job or job step was created – if the procedure step was renamed since the job or job step was launched, this is the procedure step’s new name, and if the procedure step was deleted, this will be null.</td>
</tr>
</tbody>
</table>
**Object Type:** jobStep

**Description:** A jobStep is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>liveProcedureStep</td>
<td>name: This property shows the current procedure name for the procedure step from which this job step was created – if the procedure step was renamed since the job was launched, this will be the procedure step’s new name, and if the procedure step was deleted, this will be null.</td>
</tr>
<tr>
<td>logFileName</td>
<td>name: The name of the log file produced by this step, relative to the job's workspace directory.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>outcome</td>
<td>string: The overall result of the job - possible values are: success, warning, error, or skipped</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>parallel</td>
<td>boolean: If true, this step runs in parallel with other adjacent steps also marked to run in parallel.</td>
</tr>
<tr>
<td>postExitCode</td>
<td>number: This is this step’s post processor exit code.</td>
</tr>
<tr>
<td>postLogFileName</td>
<td>name: The log file name produced by this step’s post processor.</td>
</tr>
<tr>
<td>postProcessor</td>
<td>string: The post processor name used to gather information about this step.</td>
</tr>
<tr>
<td>precondition</td>
<td>string: By default, if a step has no precondition, it will run when scheduled. Set this property to make a step wait until one or more dependent conditions are met. When a job step is eligible to transition from pending to runnable, a precondition is evaluated. A precondition is a fixed text or text embedding property reference that is evaluated to TRUE or FALSE. An empty string, a &quot;0&quot; or &quot;false&quot; is interpreted as FALSE. Any other result string is interpreted as TRUE. The step will block until the precondition is TRUE.</td>
</tr>
</tbody>
</table>
**Object Type:** jobStep

**Description:** A jobStep is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>procedureName</td>
<td>name: The name of the procedure that contains this jobStep.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this jobStep.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>releaseExclusive</td>
<td>boolean: A Boolean value indicating whether this step should release its resource upon completion.</td>
</tr>
<tr>
<td>releaseMode</td>
<td>string: Possible values are: none, release, releaseToJob</td>
</tr>
<tr>
<td>resourceName</td>
<td>name: The name of the resource or pool this step should use to run on.</td>
</tr>
<tr>
<td>resourceSource</td>
<td>This property indicates whether the resource for the job step is explicitly specified by the step or was defaulted from the procedure: procedure or procedureStep.</td>
</tr>
<tr>
<td>resourceWaitTime</td>
<td>The length of time this job step stalled because it could not get a resource. This could indicate that eligible resources for the step have reached their step limit, are in-use but the step requires a resource exclusively, or resources are down.</td>
</tr>
<tr>
<td>retries</td>
<td>number: This is a number - the number of retries before the request times out.</td>
</tr>
<tr>
<td>runAsUser</td>
<td>name: The name of the user being impersonated in this job step.</td>
</tr>
<tr>
<td>runnable</td>
<td>date: The time when the step became runnable.</td>
</tr>
<tr>
<td>runTime</td>
<td>number: The number of milliseconds the step command spent running on a resource.</td>
</tr>
</tbody>
</table>
Object Type: **jobStep**

**Description:** A jobStep is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>shell name</td>
<td>The shell used to execute the step’s commands on a resource. The script name is inserted into the command at the position of a &quot;{0}&quot; marker in the command, or appended as a final argument if no marker is present. A filename suffix adjacent to the marker will be appended to the script name. For more information on shells, see the Shell definition in the Step Help topic.</td>
</tr>
<tr>
<td>start date</td>
<td>The time when this job step began executing.</td>
</tr>
<tr>
<td>status</td>
<td>Possible values are: pending - the job step was created, but it is waiting for prerequisite steps to complete. runnable - the job step is waiting for a resource. scheduled - the job step was assigned a resource, but the command has not started running. running - the job/job step is running a command on the assigned resource. completed - the job/job step has completed.</td>
</tr>
<tr>
<td>stepName name</td>
<td>This is this step’s name.</td>
</tr>
<tr>
<td>subprocedure name</td>
<td>The nested procedure name to call when this step executes.</td>
</tr>
<tr>
<td>subproject name</td>
<td>This property appears if the subprocedure element is present and specifies the project to which the subprocedure belongs (by default, the current project is used.)</td>
</tr>
<tr>
<td>timeLimit number</td>
<td>The maximum length of time this step is allowed to run.</td>
</tr>
<tr>
<td>timeout date</td>
<td>The time when this job step will be automatically aborted if it has not yet completed.</td>
</tr>
</tbody>
</table>
**Object Type:** jobStep

**Description:** A jobStep is an instance of a step that ran - a single invocation of a command on a resource or a single call to a subprocedure within the context of a job.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>totalWaitTime</td>
<td>The sum of resource, workspace, and license wait times for this job step.</td>
</tr>
<tr>
<td>waitTime</td>
<td>number: The number of milliseconds the step spent between runnable and running (for example, waiting for a resource).</td>
</tr>
<tr>
<td>workingDirectory</td>
<td>name: The name of this step’s working directory.</td>
</tr>
<tr>
<td>workspaceName</td>
<td>name: The workspace name used by the jobStep object.</td>
</tr>
<tr>
<td>workspaceWaitTime</td>
<td>The time this job step had to wait because no workspace was found or available.</td>
</tr>
</tbody>
</table>
Object Type: logEntry

Description: A logEntry is an object containing various types of information available in a log file generated from anywhere in the ElectricFlow system.

The Event Log can be configured for auto-deletion. By default, Event Log retention is 30 days. The ElectricFlow server automatically marks old log entries for deletion and the background deleter cleans out old log entries.

To change the default settings, go to Administration > Server > Settings and modify the Event log retain time and the Maximum background delete delay fields.

Note: Setting the "retain" period to "0" disables the automatic deletion mechanism, allowing you to use an external cleanup script to implement a custom cleanup policy.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>category</td>
<td>(currently not used)</td>
</tr>
<tr>
<td>container</td>
<td>string: Typically, this is the type and name of the workflow or job with a corresponding ID.</td>
</tr>
<tr>
<td>containerName</td>
<td>name: The name of the container.</td>
</tr>
<tr>
<td>containerType</td>
<td>string: The type of object the log entry pertains to (for example, procedure, job step, step).</td>
</tr>
<tr>
<td>deleted</td>
<td>byte: The object was marked for background deletion. Possible values are &quot;0&quot; or &quot;1&quot;. Default is &quot;0&quot; (which means &quot;deleted&quot; is not set).</td>
</tr>
<tr>
<td>logEntryId</td>
<td>id: The log entry ElectricFlow-generated ID.</td>
</tr>
<tr>
<td>message</td>
<td>string: The message text will either be informational or display the warning or error message. The message may contain important information about a resource or workspace issue.</td>
</tr>
<tr>
<td>principal</td>
<td>string: The user or project principal from the session that was active when the event occurred.</td>
</tr>
</tbody>
</table>
**Object Type:** logEntry

**Description:** A logEntry is an object containing various types of information available in a log file generated from anywhere in the ElectricFlow system.

The Event Log can be configured for auto-deletion. By default, Event Log retention is 30 days. The ElectricFlow server automatically marks old log entries for deletion and the background deleter cleans out old log entries.

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<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>severity</td>
<td><strong>string:</strong> Severity can be either TRACE, DEBUG, INFO, WARN, ERROR</td>
</tr>
<tr>
<td>subject</td>
<td><strong>string:</strong> The object associated with the message.</td>
</tr>
<tr>
<td>subjectName</td>
<td><strong>name:</strong> The name of the object associated with the message.</td>
</tr>
<tr>
<td>subjectType</td>
<td><strong>string:</strong> (similar to container) Refers to the object the event concerns. This may be the same as the container, or it may be a different object that is related to the event in some manner.</td>
</tr>
<tr>
<td>time</td>
<td><strong>string:</strong> The time the event was logged.</td>
</tr>
</tbody>
</table>
**Object Type:** procedure

**Description:** A procedure describes a series of actions to be performed on one or more resources. A procedure contains steps and properties and can define formal parameters.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>credentialName</td>
<td>name: The name of the credential assigned to this job step.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>jobNameTemplate</td>
<td>name: The template used to name jobs created from this procedure.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>procedureId</td>
<td>id: This is this procedure's ID number.</td>
</tr>
<tr>
<td>procedureName</td>
<td>name: This is this procedure's name.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this procedure.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>resourceName</td>
<td>name: The name of the resource or pool this procedure should use to run on.</td>
</tr>
<tr>
<td>workspaceName</td>
<td>name: The workspace name used by the procedure object.</td>
</tr>
</tbody>
</table>
**Object Type:** project

**Description:** A project is an object used in ElectricFlow to organize information. A project contains procedures, schedules, credentials, and properties.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>credentialName</td>
<td>name: The name of the credential assigned to this project.</td>
</tr>
<tr>
<td>deleted</td>
<td>The object was marked for background deletion. Possible values are &quot;0&quot; or &quot;1&quot;. Default is &quot;0&quot; (not set).</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>pluginName</td>
<td>name: The name of the plugin associated with this project.</td>
</tr>
<tr>
<td>projectId</td>
<td>id: This is this project’s ID.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>resourceName</td>
<td>name: The name of the resource.</td>
</tr>
<tr>
<td>workspaceName</td>
<td>name: This is the workspace name used by the project.</td>
</tr>
</tbody>
</table>
Object Type: *property*

**Description:** A *property* is a string value with a name. Properties can have arbitrary names and values. You can attach properties to any object in the ElectricFlow system, such as a project, procedure, or job. After a property is created, it is stored in the ElectricFlow database. You can retrieve and/or modify the value later, and you can delete properties you no longer need. Properties provide a flexible and powerful mechanism to manage data about your builds.

**IMPORTANT: Note:** The names "properties" and "project" are not valid property names.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>createTime</td>
<td><em>date:</em> The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td><em>string:</em> A user-specified text description of the object.</td>
</tr>
<tr>
<td>expandable</td>
<td><em>boolean:</em> If set to true, the property value will undergo string expansion when it is retrieved.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td><em>name:</em> This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td><em>date:</em> The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td><em>name:</em> The person (username) who created the object.</td>
</tr>
<tr>
<td>canonicalPath</td>
<td><em>string:</em> The path that specifies the property object.</td>
</tr>
<tr>
<td>propertyId</td>
<td><em>id:</em> This property’s ID number.</td>
</tr>
<tr>
<td>propertyName</td>
<td><em>name:</em> This property’s name.</td>
</tr>
<tr>
<td>propertySheetId</td>
<td><em>reference: propertySheet</em> – If the property is a nested property sheet, the propertySheet refers to the nested sheet.</td>
</tr>
<tr>
<td>value</td>
<td><em>string:</em> The property or actual parameter’s value - if this property is a string property.</td>
</tr>
</tbody>
</table>

[back to top]
**Object Type:** propertySheet

**Description:** A property value can be a simple string or a nested propertySheet containing its own properties. Property sheets can be nested to any depth, which allows you to create hierarchical collections of information.

Most objects have an associated property sheet that contains "custom properties" created by user scripts.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheetId</td>
<td>id: This property sheet’s ID.</td>
</tr>
</tbody>
</table>

[back to top]

**Object Type:** repository

**Description:** A repository is an object that stores artifact versions. This object primarily contains information on how to connect to a particular artifact repository. Similar to steps in a procedure, repository objects are in a user-specified order. When retrieving artifact versions, repositories are queried in this order until one containing the desired artifact version is found.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description for this object.</td>
</tr>
</tbody>
</table>
Object Type: repository

Description: A repository is an object that stores artifact versions. This object primarily contains information on how to connect to a particular artifact repository. Similar to steps in a procedure, repository objects are in a user-specified order. When retrieving artifact versions, repositories are queried in this order until one containing the desired artifact version is found.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>repositoryDisabled</td>
<td>boolean: Determines whether the repository is disabled. Default is &quot;false&quot;.</td>
</tr>
<tr>
<td>repositoryId</td>
<td>id: The ElectricFlow-generated ID number of the repository.</td>
</tr>
<tr>
<td>repositoryIndex</td>
<td>number: The order of the repository, within a list of repositories.</td>
</tr>
<tr>
<td>repositoryName</td>
<td>name: The name of the repository.</td>
</tr>
<tr>
<td>url</td>
<td>string: The server URL is in the form protocol://host:port/. Typically, the repository server is configured to listen on port 8200 for https requests, so a typical URL looks like <a href="https://host:8200/">https://host:8200/</a>.</td>
</tr>
<tr>
<td>zoneName</td>
<td>name: The name of the zone where this repository is or will reside.</td>
</tr>
</tbody>
</table>

[back to top]
Object Type: **resource**

**Description:** A resource is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server though an ElectricFlow agent proxy machine.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td><strong>reference:</strong> acl</td>
</tr>
<tr>
<td>agentState</td>
<td><strong>string:</strong> Specific information about an agent, including the state of the agent. Possible values are: unknown</td>
</tr>
<tr>
<td>artifactCacheDirectory</td>
<td><strong>string:</strong> The directory on the agent host where retrieved artifacts are stored.</td>
</tr>
<tr>
<td>createTime</td>
<td><strong>date:</strong> The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td><strong>string:</strong> A user-specified text description of the object.</td>
</tr>
<tr>
<td>exclusiveJobId</td>
<td><strong>id:</strong> The ID number of the job that owns this resource, which occurs when one of the job’s steps requests exclusive use of the resource for the duration of the job.</td>
</tr>
<tr>
<td>exclusiveJobName</td>
<td><strong>name:</strong> The name of the job that owns this resource, which occurs when one of the job’s steps requests exclusive use of the resource for the duration of the job.</td>
</tr>
<tr>
<td>exclusiveJobStepId</td>
<td><strong>id:</strong> The ID number of the job step that owns this resource, which occurs when one of the steps request exclusive use of the resource for the duration of the job.</td>
</tr>
<tr>
<td>exclusiveJobStepName</td>
<td><strong>name:</strong> The name of the job step that owns this resource, which occurs when one of the steps request exclusive use of the resource for the duration of the job.</td>
</tr>
<tr>
<td>gateways</td>
<td>The gateway names associated with this resource.</td>
</tr>
</tbody>
</table>
Object Type: **resource**

**Description:** A resource is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server though an ElectricFlow agent proxy machine.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>hostName</td>
<td>name: The computer name or IP address for the machine containing the ElectricFlow agent for this resource.</td>
</tr>
<tr>
<td>hostOS</td>
<td>string: The full name of the host operating system, plus its version. However, if this host is a proxy, &quot;proxied&quot; appears as the host description/name.</td>
</tr>
<tr>
<td>hostPlatform</td>
<td>string: Examples for &quot;platform&quot; are: Windows, Linux, HPUX, and so on. However, if this host is a proxy, &quot;proxied&quot; appears as the hostPlatform name.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>lastRunTime</td>
<td>date: The most recent time a job step ran on the resource.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>pools</td>
<td>string: A space-separated list of one or more pool names where this resource is a member. Steps defined to run on a resource pool will run on any available member (resource) in the pool.</td>
</tr>
<tr>
<td>port</td>
<td>number: The port number for this resource.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>proxyCustomization</td>
<td>string: This property displays the customization of the ElectricFlow proxy agent.</td>
</tr>
</tbody>
</table>
**Object Type:** resource

**Description:** A resource is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server through an ElectricFlow agent proxy machine.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>proxyHostName</td>
<td><strong>name:</strong> The name of the ElectricFlow agent being used to proxy to another agent, the proxy target.</td>
</tr>
<tr>
<td>proxyPort</td>
<td><strong>number:</strong> The port number of the ElectricFlow agent being used to proxy to another agent, the proxy target.</td>
</tr>
<tr>
<td>proxyProtocol</td>
<td><strong>name:</strong> The name of the proxy agent protocol used for communication from the ElectricFlow proxy agent to the proxy target - default is SSH.</td>
</tr>
<tr>
<td>repositoryNames</td>
<td>A &quot;new line&quot; separated list of repository names.</td>
</tr>
<tr>
<td>resourceDisabled</td>
<td><strong>boolean:</strong> A Boolean value indicating whether this resource was disabled.</td>
</tr>
<tr>
<td>resourceId</td>
<td><strong>id:</strong> This is this resource’s ID.</td>
</tr>
<tr>
<td>resourceName</td>
<td><strong>name:</strong> The name of the resource or pool.</td>
</tr>
<tr>
<td>shell</td>
<td><strong>name:</strong> The shell used to execute the step’s commands on a resource. If no shell was defined on a step, the shell defined on the resource is used, or if no shell was defined on the resource, a default shell is used. For shells: The script name is inserted into the command at the position of a &quot;'[0]'&quot; marker in the command, or appended as a final argument if no marker is present. A filename suffix adjacent to the marker will be appended to the script name. For more information on shells, see the Shell definition in the Step Help topic.</td>
</tr>
<tr>
<td>stepCount</td>
<td><strong>number:</strong> The current number of executing steps on this resource.</td>
</tr>
<tr>
<td>stepLimit</td>
<td><strong>number:</strong> This property specifies the maximum number of steps that can run on this resource at one time.</td>
</tr>
</tbody>
</table>
Object Type: **resource**

**Description:** A resource is associated with a server machine available to ElectricFlow for running steps. A resource has a logical name in addition to a host name. A resource can be associated with one or more pools. The resource may be a "proxy target" machine that communicates with the ElectricFlow server though an ElectricFlow agent proxy machine.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>trusted</td>
<td>boolean: If &quot;true&quot;, this agent is trusted.</td>
</tr>
<tr>
<td>useSSL</td>
<td>boolean: A Boolean value indicating whether this resource uses SSL for communication.</td>
</tr>
<tr>
<td>workspaceName</td>
<td>name: The workspace name used by this resource.</td>
</tr>
<tr>
<td>zoneName</td>
<td>string: The name of the zone where this resource resides.</td>
</tr>
</tbody>
</table>

[back to top]

Object Type: **resourcePool**

**Description:** A resource pool is a container for a group of resources.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>autoDelete</td>
<td>boolean: If &quot;true&quot;, the resource pool is deleted when the last resource is removed or deleted.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
</tbody>
</table>
Object Type: **resourcePool**

**Description**: A *resource pool* is a container for a group of resources.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>lastResourceUsed</td>
<td>name: The name of the most recently used resource from the pool.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>orderingFilter</td>
<td>string: A Javascript block invoked when scheduling resources for a pool. <strong>Note</strong>: A Javascript block is not required unless you need to override the default resource ordering behavior.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>resourcePoolDisabled</td>
<td>boolean: A Boolean value indicating whether this resource pool was disabled.</td>
</tr>
<tr>
<td>resourcePoolId</td>
<td>id: This resource pool's ID number.</td>
</tr>
<tr>
<td>resourcePoolName</td>
<td>name: The name of the resource pool.</td>
</tr>
</tbody>
</table>

[back to top]

Object Type: **resourceUsage**

**Description**: Provides usage information for all resources in the system. For any job step running on a resource, there is a resource usage record that contains the ID and name of the job, job step, and resource.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>jobId</td>
<td>id: This is this job’s ID number, which is a UUID.</td>
</tr>
</tbody>
</table>
Object Type: **resourceUsage**

**Description:** Provides usage information for all resources in the system. For any job step running on a resource, there is a resource usage record that contains the ID and name of the job, job step, and resource.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>jobName</td>
<td>name: The name of the job.</td>
</tr>
<tr>
<td>jobStepId</td>
<td>id: The ID number of the job step.</td>
</tr>
<tr>
<td>jobStepName</td>
<td>name: The name of the job step.</td>
</tr>
<tr>
<td>licenseWaitTime</td>
<td>The time this job step had to wait because no license was found or available.</td>
</tr>
<tr>
<td>resourceId</td>
<td>id: The ElectricFlow-generated resource ID number.</td>
</tr>
<tr>
<td>resourceName</td>
<td>name: The name (or names) of the resource.</td>
</tr>
<tr>
<td>resourcePoolId</td>
<td>id: The ElectricFlow-generated resource pool’s ID number.</td>
</tr>
<tr>
<td>resourcePoolName</td>
<td>name: The name of the resource pool.</td>
</tr>
<tr>
<td>resourceUsageId</td>
<td>id: The unique ID of the resource usage record.</td>
</tr>
<tr>
<td>resourceWaitTime</td>
<td>The time this job step had to wait because no resource was found or available.</td>
</tr>
<tr>
<td>waitReason</td>
<td>Possible values are: license, resource, or workspace.</td>
</tr>
<tr>
<td>workspaceWaitTime</td>
<td>The time this job step had to wait because no workspace was found or available.</td>
</tr>
</tbody>
</table>

[back to top]
**Object Type:** schedule

**Description:** Schedules are used to execute procedures and determine when specific procedures run.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet An actualParameter is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from &quot;formal parameters&quot;- formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.</td>
</tr>
<tr>
<td>beginDate</td>
<td>string: The first day on which the schedule is active, in the form YYYY-MM-dd. For example, &quot;2009-06-25&quot;</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>credentialName</td>
<td>name: The name of the credential being used for impersonation when the schedule launches a job.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>endDate</td>
<td>string: The end of the range of dates the schedule is active, in the form: YYYY-MM-dd. The actual end date is not included in the range. For example, &quot;2009-06-25&quot;</td>
</tr>
<tr>
<td>interval</td>
<td>string: A floating point number that represents the time to wait between invocations of the schedule.</td>
</tr>
<tr>
<td>intervalUnits</td>
<td>string: These are the units to use when interpreting the interval value. The units can be hours, minutes, seconds, or continuous.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>lastRunTime</td>
<td>date: The last time a job was launched by a schedule.</td>
</tr>
</tbody>
</table>
**Object Type:** schedule

**Description:** Schedules are used to execute procedures and determine when specific procedures run.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>misfirePolicy</td>
<td>string: The policy the schedule uses when it is unable to launch a job at the scheduled time: ignore - wait until the next scheduled time to run runOnce - run immediately, then resume normal scheduling</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>monthDays</td>
<td>string: This property specifies which days of the month this schedule should run - shown as a space-separated list of numbers (1-31).</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>priority</td>
<td>string: Values can be low, normal (default), high, or highest</td>
</tr>
<tr>
<td>procedureName</td>
<td>name: The name of the procedure that contains this schedule.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this schedule.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>scheduleDisabled</td>
<td>boolean: A Boolean value indicating whether this schedule was disabled.</td>
</tr>
<tr>
<td>scheduleId</td>
<td>id: This schedule's ID number.</td>
</tr>
<tr>
<td>scheduleName</td>
<td>name: This property displays this schedule's name and differs from the liveSchedule property found under a job in that the liveSchedule property is written at job creation time only, and not changed, even if the schedule is renamed or deleted.</td>
</tr>
<tr>
<td>startTime</td>
<td>string: The time of day when this schedule should start running, in the form: HH:mm:ss</td>
</tr>
</tbody>
</table>
Object Type: **schedule**

**Description:** Schedules are used to execute procedures and determine when specific procedures run.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>stopTime</td>
<td><strong>string:</strong> The time of day when this schedule should stop running, in the form: HH:mm:ss</td>
</tr>
<tr>
<td>timeZone</td>
<td><strong>string:</strong> A Java-compatible time zone string.</td>
</tr>
<tr>
<td>weekDays</td>
<td><strong>string:</strong> This property specifies which days of the week this schedule should run. This is a space-separated list of MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY SUNDAY. (Note: These are not localized strings.)</td>
</tr>
</tbody>
</table>

Object Type: **server**

**Description:** This is the ElectricFlow server. There is only one such object in your database.

**Read-only server properties**

Two read-only server properties are available for use in a step, a script, or an email notifier, which can be used to identify the ElectricFlow server location.

- `/server/hostName` - returns the ElectricFlow server name
- `/server/hostIP` - returns the ElectricFlow server IP address

These properties are especially useful for building a URL link to an ElectricFlow web page. For example, a link in an email notifier that links back to a Job Details page.

A sample link: `https://$[/server/hostName]/commander/jobDetails.php?jobId=$[jobId]`

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td><strong>reference:</strong> acl</td>
</tr>
<tr>
<td>createTime</td>
<td><strong>date:</strong> The time when this object was created.</td>
</tr>
<tr>
<td>hostIP</td>
<td><strong>string:</strong> The server's IP address.</td>
</tr>
</tbody>
</table>
Object Type: server

Description: This is the ElectricFlow server. There is only one such object in your database.

Read-only server properties

Two read-only server properties are available for use in a step, a script, or an email notifier, which can be used to identify the ElectricFlow server location.

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/server/hostIP - returns the ElectricFlow server IP address

These properties are especially useful for building a URL link to an ElectricFlow web page. For example, a link in an email notifier that links back to a Job Details page.

A sample link: https://$[/server/hostName]/commander/jobDetails.php?jobId=$[jobId]

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>hostName</td>
<td>name: Generally refers to the computer name or IP address for the machine containing the ElectricFlow server.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>serverId</td>
<td>id: The server’s ID number.</td>
</tr>
<tr>
<td>serverName</td>
<td>string: The ElectricFlow server’s name - defaults to &quot;server&quot;.</td>
</tr>
</tbody>
</table>

[back to top]
Object Type: state

Description: A state object belongs to a workflow and corresponds to the state definition, including a pointer to the workflow, formal parameters (cloned from definition), expanded actual parameters (form the last time a transition was taken to this state), and the "process" which includes the procedure or workflow (cloned from definition), unexpanded actual parameters (cloned from definition, expanded and passed to the process on entry), and the "last run" entity reference.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>active</td>
<td>boolean: If &quot;true&quot;, the state of the workflow is active.</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet An actualParameter is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from &quot;formal parameters&quot;-formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>errorMessage</td>
<td>string: When the outcome is error, this property displays an error message description.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this state.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>stateId</td>
<td>id: The ElectricFlow-generated ID number for the state.</td>
</tr>
</tbody>
</table>
Object Type: state

Description: A state object belongs to a workflow and corresponds to the state definition, including a pointer to the workflow, formal parameters (cloned from definition), expanded actual parameters (form the last time a transition was taken to this state), and the "process" which includes the procedure or workflow (cloned from definition), unexpanded actual parameters (cloned from definition, expanded and passed to the process on entry), and the "last run" entity reference.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>stateName</td>
<td>name: The name of the state.</td>
</tr>
<tr>
<td>subjob</td>
<td>name: The name of the subjob.</td>
</tr>
<tr>
<td>subparameters</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>subprocedure</td>
<td>name: The name of the nested procedure called when a step runs.</td>
</tr>
<tr>
<td>subproject</td>
<td>string: If a subprocedure argument was used, this is the name of the project where that subprocedure is found. By default, the current project is used.</td>
</tr>
<tr>
<td>substartingState</td>
<td>name: Name of the starting state for the workflow launched when the state is entered.</td>
</tr>
<tr>
<td>subworkflow</td>
<td>name: The name of the subworkflow - a workflow called by another workflow.</td>
</tr>
<tr>
<td>subworkflowDefinition</td>
<td>name: The name of the subworkflow definition.</td>
</tr>
<tr>
<td>workflow</td>
<td>name: The name of the workflow.</td>
</tr>
</tbody>
</table>
**Object Type:** stateDefinition

**Description:** A stateDefinition is a named object that belongs to a workflow definition, which includes specifications for whether or not the state is "startable", formal parameters, notifications, and the process. A process includes a procedure or workflow, the starting state (for workflows only), and actual parameters.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet An actualParameter is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from &quot;formal parameters&quot;-formal parameters define the parameters a procedure is expecting, and actual parameters provide values to use at run-time.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this state definition.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>startable</td>
<td>boolean: &quot;True&quot; means this state definition can be the initial state of an instantiated workflow.</td>
</tr>
<tr>
<td>stateDefinitionId</td>
<td>id: The ElectricFlow-generated ID number for the state definition.</td>
</tr>
<tr>
<td>stateDefinitionName</td>
<td>name: The name of the state definition.</td>
</tr>
</tbody>
</table>
Object Type: stateDefinition

Description: A stateDefinition is a named object that belongs to a workflow definition, which includes specifications for whether or not the state is "startable", formal parameters, notifications, and the process. A process includes a procedure or workflow, the starting state (for workflows only), and actual parameters.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>subprocedure name</td>
<td>The name of the nested procedure called when a step runs.</td>
</tr>
<tr>
<td>subproject string</td>
<td>If a subprocedure argument was used, this is the name of the project where that subprocedure is found. By default, the current project is used.</td>
</tr>
<tr>
<td>substartingState name</td>
<td>Name of the starting state for the workflow launched when the state is entered.</td>
</tr>
<tr>
<td>subworkflowDefinition name</td>
<td>The name of the subworkflow definition.</td>
</tr>
<tr>
<td>workflowDefinitionName name</td>
<td>The name of the workflow definition.</td>
</tr>
</tbody>
</table>
Object Type: step

Description: A step includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a pool of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet An actualParameter is an object that provides the</td>
</tr>
<tr>
<td></td>
<td>value for a parameter, which is passed to a procedure when it is invoked.</td>
</tr>
<tr>
<td></td>
<td>Actual parameters can be provided for jobs and nested subprocedures within</td>
</tr>
<tr>
<td></td>
<td>a job.</td>
</tr>
<tr>
<td></td>
<td>Actual parameters are different from &quot;formal parameters&quot;- formal parameters</td>
</tr>
<tr>
<td></td>
<td>define the parameters a procedure is expecting, and actual parameters provide</td>
</tr>
<tr>
<td></td>
<td>values to use at run-time.</td>
</tr>
<tr>
<td>alwaysRun</td>
<td>boolean: If true, this step runs even if the job is aborted before the step</td>
</tr>
<tr>
<td></td>
<td>completes. Note that a force abort will abort an alwaysRun step.</td>
</tr>
<tr>
<td>broadcast</td>
<td>boolean: If true, this step will run on all resources in a pool.</td>
</tr>
<tr>
<td>command</td>
<td>string: This property specifies the command this step runs.</td>
</tr>
<tr>
<td>condition</td>
<td>string: If this element is not present, the event is ALWAYS triggered. If</td>
</tr>
<tr>
<td></td>
<td>specified, the event is triggered only if the value of the condition</td>
</tr>
<tr>
<td></td>
<td>argument is TRUE; if not true, a boolean value of &quot;false&quot; or &quot;0&quot; was used.</td>
</tr>
<tr>
<td></td>
<td>Condition arguments can be a literal, a fixed value string, or a string</td>
</tr>
<tr>
<td></td>
<td>subject to property expansion.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>credentialName</td>
<td>name: The credential name assigned to this step.</td>
</tr>
</tbody>
</table>
Object Type: **step**

**Description:** A step includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a pool of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td><strong>string:</strong> A user-specified text description of the object.</td>
</tr>
<tr>
<td>errorHandling</td>
<td>This is the error handling policy copied from the procedure step and indicates how the step responds to errors:</td>
</tr>
<tr>
<td></td>
<td>failProcedure - The current procedure continues, but the overall status is error (default).</td>
</tr>
<tr>
<td></td>
<td>abortProcedure - Aborts the current procedure, but allows already-running steps in the current procedure to complete.</td>
</tr>
<tr>
<td></td>
<td>abortProcedureNow - Aborts the current procedure and terminates running steps in the current procedure.</td>
</tr>
<tr>
<td></td>
<td>abortJob - Aborts the entire job, terminates running steps, but allows alwaysRun steps to run.</td>
</tr>
<tr>
<td></td>
<td>abortJobNow - Aborts the entire job and terminates all running steps, including alwaysRun steps.</td>
</tr>
<tr>
<td></td>
<td>ignore - Continues as if the step succeeded.</td>
</tr>
<tr>
<td>exclusive</td>
<td><strong>boolean:</strong> If true, this step acquires and retains its resource exclusively.</td>
</tr>
<tr>
<td>exclusiveMode</td>
<td><strong>string:</strong> Possible values are: none, job, step, call</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td><strong>name:</strong> This shows who (generally, a username) last modified this object.</td>
</tr>
</tbody>
</table>
**Object Type:** step

**Description:** A step includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a pool of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>logFileName</td>
<td>name: The name of the log file produced by this step, relative to the job's workspace directory.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>parallel</td>
<td>boolean: If true, this step runs in parallel with other adjacent steps also marked to run in parallel.</td>
</tr>
<tr>
<td>postLogFileName</td>
<td>name: This property displays the log file name produced by this step's post processor.</td>
</tr>
<tr>
<td>postProcessor</td>
<td>string: This property displays the post processor name that is used to gather information about this step. Typically, this is either postp or postp &lt;options&gt;, or an appropriate command or path including options to a postprocessor available on the ElectricFlow server.</td>
</tr>
</tbody>
</table>
Object Type: **step**

**Description:** A step includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a pool of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>precondition</td>
<td>By default, if a step has no precondition, it will run when scheduled. Set this property to make a step wait until one or more dependent conditions are met. When a job step is eligible to transition from pending to runnable, a precondition is evaluated. A precondition is a fixed text or text embedding property reference that is evaluated to TRUE or FALSE. An empty string, a &quot;0&quot; or &quot;false&quot; is interpreted as FALSE. Any other result string is interpreted as TRUE. The step will block until the precondition is TRUE.</td>
</tr>
<tr>
<td>procedureName</td>
<td>The name of the procedure that contains this step.</td>
</tr>
<tr>
<td>projectName</td>
<td>The name of the project that contains this step.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>The project’s name this step should use to run on.</td>
</tr>
<tr>
<td>releaseExclusive</td>
<td>A Boolean value indicating whether this step should release its resource upon completion.</td>
</tr>
<tr>
<td>releaseMode</td>
<td>Possible values are: none, release, releaseToJob</td>
</tr>
<tr>
<td>resourceName</td>
<td>The resource’s name this step should use to run on.</td>
</tr>
</tbody>
</table>
Object Type: step

Description: A step includes a command or script executed on a single resource and is the smallest unit of work ElectricFlow understands. Each step specifies a resource on which it should run (either the name of a specific machine or the name of a pool of equivalent machines, in which case ElectricFlow picks a machine from the pool). A step can be given a time limit and if the step does not complete within the specified time, ElectricFlow automatically aborts it.

Steps are ordered within a procedure and normally execute sequentially. However, it is possible to mark a consecutive range of steps for parallel execution, so all steps in that range run concurrently.

A step in one procedure can invoke another procedure instead of running a command. The invoking step provides parameters needed by the nested procedure.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>shell</td>
<td>name: The shell used to execute the step’s commands on a resource. The script name is inserted into the command at the position of a “{0}” marker in the command, or appended as a final argument if no marker is present. A filename suffix adjacent to the marker will be appended to the script name. For more information on shells, see the Shell definition in the Step Help topic.</td>
</tr>
<tr>
<td>stepId</td>
<td>id: The step’s ID number.</td>
</tr>
<tr>
<td>stepName</td>
<td>name: The step’s name.</td>
</tr>
<tr>
<td>subprocedure</td>
<td>name: The nested procedure name to call when this step executes.</td>
</tr>
<tr>
<td>subproject</td>
<td>name: This property is displayed if the subprocedure element is present and specifies the project to which the subprocedure belongs (by default, the current project is used.)</td>
</tr>
<tr>
<td>timeLimit</td>
<td>number: A floating point number that specifies the maximum length of time this step is allowed to run.</td>
</tr>
<tr>
<td>timeLimitUnits</td>
<td>The units to use when interpreting the time limit. Units can be hours, minutes, or seconds.</td>
</tr>
<tr>
<td>workingDirectory</td>
<td>name: The name of the step’s working directory.</td>
</tr>
<tr>
<td>workspaceName</td>
<td>name: The workspace name used by this step.</td>
</tr>
</tbody>
</table>
**Object Type:** transition

**Description:** A transition object belongs to a state and corresponds to the transition definition, and includes the target state (unexpanded actual parameters cloned from definition, expanded and passed to the target state on entry), the Javascript condition, and the trigger (onEnter|onStart|onCompletion|manual).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet An actualParameter is an object that provides the value for a parameter that is passed to the target state when the transition is taken.</td>
</tr>
<tr>
<td>condition</td>
<td>string: If empty or non-zero, the transition is allowed to trigger. If set to &quot;0&quot;, the transition is ignored.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>index</td>
<td>The numeric index of a transition that indicates the transition order in the state definition's transition list.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the project that contains this transition.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>stateName</td>
<td>name: The name of the state.</td>
</tr>
<tr>
<td>targetState</td>
<td>string: The target state for the transition definition.</td>
</tr>
<tr>
<td>transitionId</td>
<td>id: The ElectricFlow-generated ID for the transition.</td>
</tr>
</tbody>
</table>
Object Type: **transition**

**Description:** A *transition* object belongs to a state and corresponds to the transition definition, and includes the target state (unexpanded actual parameters cloned from definition, expanded and passed to the target state on entry), the Javascript condition, and the trigger (onEnter|onStart|onCompletion|manual).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>transitionName</td>
<td><em>name:</em> The name of the transition.</td>
</tr>
</tbody>
</table>
| trigger | *string:* Possible values are:  
  - `onEnter` - before any actions  
  - `onStart` - after a subjob or workflow is created  
  - `onCompletion` - after a subjob or workflow completes  
  - `manual` - when a user manually requests a transition |
| workflowName | *name:* The name of the workflow. |

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Object Type: **transitionDefinition**

**Description:** A *transitionDefinition* is a named object that belongs to a state definition, which includes the target state definition (with actual parameters to the target state, the Javascript condition, and the trigger (onEnter|onStart|onCompletion|manual).

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td><em>reference:</em> acl</td>
</tr>
<tr>
<td>actualParameter</td>
<td><em>reference:</em> propertySheet An <em>actualParameter</em> is an object that provides the value for a parameter passed to the target state.</td>
</tr>
<tr>
<td>condition</td>
<td><em>string:</em> If empty or non-zero, the transition is allowed to trigger. If set to &quot;0&quot;, the transition is ignored.</td>
</tr>
<tr>
<td>createTime</td>
<td><em>date:</em> The time when this object was created.</td>
</tr>
</tbody>
</table>
Object Type: **transitionDefinition**

**Description:** A *transitionDefinition* is a named object that belongs to a state definition, which includes the target state definition (with actual parameters to the target state, the Javascript condition, and the trigger *(onEnter|onStart|onCompletion|manual)*.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td><strong>string:</strong> A user-specified text description of the object.</td>
</tr>
<tr>
<td>index</td>
<td>The numeric index of a transition that indicates the transition order in the state definition's transition list.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td><strong>name:</strong> This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td><strong>date:</strong> The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td><strong>name:</strong> The person (username) who created the object.</td>
</tr>
<tr>
<td>proyectoName</td>
<td><strong>name:</strong> The name of the project that contains this transition definition.</td>
</tr>
<tr>
<td>propertySheet</td>
<td><strong>reference:</strong> propertySheet</td>
</tr>
<tr>
<td>stateDefinitionName</td>
<td><strong>name:</strong> The name of the state definition.</td>
</tr>
<tr>
<td>targetState</td>
<td><strong>string:</strong> The target state for the transition definition.</td>
</tr>
<tr>
<td>transitionDefinitionId</td>
<td><strong>id:</strong> The ElectricFlow-generated ID for the transition definition.</td>
</tr>
<tr>
<td>transitionDefinitionName</td>
<td><strong>name:</strong> The name of the transition definition.</td>
</tr>
<tr>
<td>trigger</td>
<td><strong>string:</strong> Possible values are:</td>
</tr>
<tr>
<td></td>
<td>onEnter - before any actions</td>
</tr>
<tr>
<td></td>
<td>onStart - after a subjob or workflow is created</td>
</tr>
<tr>
<td></td>
<td>onCompletion - after a subjob or workflow completes</td>
</tr>
<tr>
<td></td>
<td>manual - when a user manually requests a transition</td>
</tr>
<tr>
<td>workflowDefinitionName</td>
<td><strong>name:</strong> The name of the workflow definition.</td>
</tr>
</tbody>
</table>

[back to top]
**Object Type: User**

**Description:** User refers to any user currently logged into the ElectricFlow system or any user who may use ElectricFlow, but may not be currently logged in.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>email</td>
<td>name: Displays this user’s email address.</td>
</tr>
<tr>
<td>fullUserName</td>
<td>name: The user’s real name.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>mutable</td>
<td>boolean: If true, the user is editable within ElectricFlow via the web UI or the modifyUser API.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>providerName</td>
<td>name: The name of the directory provider that controls this user.</td>
</tr>
<tr>
<td>userId</td>
<td>id: A unique ID number for a user object.</td>
</tr>
<tr>
<td>userName</td>
<td>name: Displays this user's name and also appears in a group object and displays the name of a user who belongs to this group.</td>
</tr>
</tbody>
</table>

[back to top]
**Object Type:** workflow

**Description:** A workflow object includes a pointer to the workflow definition, sets of states, the active state, the starting state, parameters to the initial state, "complete" - a boolean value determining whether or not the workflow is complete, and a log containing the transactions taken and user events.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>activeState</td>
<td>string: The name of the active state on the workflow object.</td>
</tr>
<tr>
<td>actualParameter</td>
<td>reference: propertySheet An actualParameter is an object that provides the value for a parameter that is passed to the target state when the transition is taken.</td>
</tr>
<tr>
<td>callingState</td>
<td>string: The full property path to the state that created this workflow.</td>
</tr>
<tr>
<td>callingStateId</td>
<td>id: The ID number for the full property path to the state that created this workflow.</td>
</tr>
<tr>
<td>completed</td>
<td>boolean: If &quot;true&quot;, the workflow is completed and no additional transactions will be evaluated.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>deleted</td>
<td>boolean: The object was marked for background deletion. Possible values are &quot;0&quot; or &quot;1&quot;. Default is &quot;0&quot; (not set).</td>
</tr>
<tr>
<td>elapsedTime</td>
<td>The time this object ran from start to finish.</td>
</tr>
<tr>
<td>finish</td>
<td>date: The date/time when this object finished.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>launchedByUser</td>
<td>string: The name of the user or project principal that explicitly launched the workflow.</td>
</tr>
<tr>
<td>liveWorkflowDefinition</td>
<td>name: The current workflow definition name for the workflow definition from which the workflow was created.</td>
</tr>
</tbody>
</table>
Object Type: **workflow**

**Description:** A workflow object includes a pointer to the workflow definition, sets of states, the active state, the starting state, parameters to the initial state, "complete" - a boolean value determining whether or not the workflow is complete, and a log containing the transactions taken and user events.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>modifyTime</td>
<td><em>date:</em> The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td><em>name:</em> The person (username) who created the object.</td>
</tr>
<tr>
<td>projectName</td>
<td><em>name:</em> The name of the project that contains this workflow.</td>
</tr>
<tr>
<td>propertySheet</td>
<td><em>reference:</em> propertySheet</td>
</tr>
<tr>
<td>start</td>
<td><em>date:</em> The date/time when this workflow began to run.</td>
</tr>
<tr>
<td>startingState</td>
<td><em>string:</em> The initial state of the workflow.</td>
</tr>
<tr>
<td>workflowDefinitionName</td>
<td><em>name:</em> The name of the workflow definition.</td>
</tr>
<tr>
<td>workflowId</td>
<td><em>id:</em> The ElectricFlow-generated ID for the workflow.</td>
</tr>
<tr>
<td>workflowName</td>
<td><em>name:</em> The name of the workflow.</td>
</tr>
</tbody>
</table>

[back to top]

Object Type: **workflowDefinition**

**Description:** A workflowDefinition object contains state and transition definitions, including the workflow name template (analogous to a job name template on a procedure), and ordered sets of state and transition definitions.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td><em>reference:</em> acl</td>
</tr>
<tr>
<td>createTime</td>
<td><em>date:</em> The time when this object was created.</td>
</tr>
</tbody>
</table>
Object Type: **workflowDefinition**

**Description:** A *workflowDefinition* object contains state and transition definitions, including the workflow name template (analogous to a job name template on a procedure), and ordered sets of state and transition definitions.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>projectName</td>
<td>name: The name of the <em>project</em> that contains this workflow definition.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>workflowDefinitionId</td>
<td>id: The ElectricFlow-generated ID for the workflow definition.</td>
</tr>
<tr>
<td>workflowDefinitionName</td>
<td>name: The name of the workflow definition.</td>
</tr>
<tr>
<td>workflowNameTemplate</td>
<td>string: Template used to determine the default names for workflows launched from a workflow definition.</td>
</tr>
</tbody>
</table>

[back to top]
Object Type: **workspace**

**Description:** ElectricFlow provides each job step with an area on the disk it can use for “working files” and results. This disk area is called a job workspace. (The job workspace defaults to a directory under the workspace directory.) A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files such as step logs in the workspace.

Normally, a single workspace is shared by all steps in a job, but different steps within a job could use different workspaces. The location of the job step workspace is displayed on the Job Details page for the job under “Details” for the step.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
<tr>
<td>agentDrivePath</td>
<td>name: The drive-letter based mount point for this workspace on Windows agents.</td>
</tr>
<tr>
<td>agentUncPath</td>
<td>name: The UNC path for this workspace on Windows agents.</td>
</tr>
<tr>
<td>agentUnixPath</td>
<td>name: The UNIX path for this workspace on UNIX agents.</td>
</tr>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>credentialName</td>
<td>name: The name of the credential being used when a resource connects to a network share while setting up the workspace.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description of the object.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This shows who (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>local</td>
<td>boolean: If &quot;true&quot;, this workspace is local.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
</tbody>
</table>
Object Type: **workspace**

**Description:** ElectricFlow provides each job step with an area on the disk it can use for “working files” and results. This disk area is called a job *workspace*. (The job workspace defaults to a directory under the workspace directory.) A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files such as step logs in the workspace.

Normally, a single workspace is shared by all steps in a job, but different steps within a job could use different workspaces. The location of the job step workspace is displayed on the Job Details page for the job under “Details” for the step.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>workspaceDisabled</td>
<td>boolean: A Boolean value that indicates whether this workspace was disabled.</td>
</tr>
<tr>
<td>workspaceId</td>
<td>id: The workspace’s ID number.</td>
</tr>
<tr>
<td>workspaceName</td>
<td>name: The workspace’s name.</td>
</tr>
<tr>
<td>zoneName</td>
<td>name: The name of the zone where this workspace resides.</td>
</tr>
</tbody>
</table>

[back to top]

Object Type: **zone**

**Description:** ElectricFlow provides the ability to create zones—often used to enhance security.

- A zone is a way to partition a collection of agents to secure them from use by other groups. For example, you might choose to create a developers zone, a production zone, and a test zone—agents in one zone cannot directly communicate with agents in another zone.

- A *default* zone is created during ElectricFlow installation. The server implicitly belongs to the default zone, which means all agents in this zone can communicate with the server directly (without the use of a gateway).

- Each zone can have one or more “gateway agents”, which you define. Gateway agents are used for communication from one zone to another zone. For more information, see the Gateways Help topic.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>acl</td>
<td>reference: acl</td>
</tr>
</tbody>
</table>
**Object Type:** zone

**Description:** ElectricFlow provides the ability to create zones—often used to enhance security.

- A zone is a way to partition a collection of agents to secure them from use by other groups. For example, you might choose to create a developers zone, a production zone, and a test zone—agents in one zone cannot directly communicate with agents in another zone.
- A default zone is created during ElectricFlow installation. The server implicitly belongs to the default zone, which means all agents in this zone can communicate with the server directly (without the use of a gateway).
- Each zone can have one or more "gateway agents", which you define. Gateway agents are used for communication from one zone to another zone. For more information, see the Gateways Help topic.

<table>
<thead>
<tr>
<th>Property Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>createTime</td>
<td>date: The time when this object was created.</td>
</tr>
<tr>
<td>description</td>
<td>string: A user-specified text description for the object.</td>
</tr>
<tr>
<td>lastModifiedBy</td>
<td>name: This person (generally, a username) last modified this object.</td>
</tr>
<tr>
<td>modifyTime</td>
<td>date: The time when this object was last modified.</td>
</tr>
<tr>
<td>owner</td>
<td>name: The person (username) who created the object.</td>
</tr>
<tr>
<td>propertySheet</td>
<td>reference: propertySheet</td>
</tr>
<tr>
<td>resources</td>
<td>string: A space-separated list of resources contained in this zone.</td>
</tr>
<tr>
<td>zoneId</td>
<td>id: The ElectricFlow-generated ID for this zone.</td>
</tr>
<tr>
<td>zoneName</td>
<td>string: The name of the zone.</td>
</tr>
</tbody>
</table>

**Property error codes**

The following list provides error codes that may appear as a value within an errorCode property.

- ABORTED
- ACCESS_DENIED
- AGENT_BAD_WORKINGDIR
- AGENT_FAILED_CONNECT_BROKER
AGENT_FAILED_CREATE_FILE
AGENTFAILED_CREATE_WORKSPACE
AGENT_FAILED_IMPERSONATION
AGENT_FAILED_MAP_DRIVE
AGENT_FAILED_PROXYTARGET_PING
AGENT_INCOMPATIBLE_VERSION
AGENT_INTERNAL_ERROR
AGENT_INVALID_CWD
AGENT_INVALID_MESSAGE
AGENT_INVALID_PING_TOKEN
AGENT_INVALID_WORKSPACE
AGENT_IO_CONNECTION_REFUSED
AGENT_IO_CONNECTION_RESET
AGENT_IO_ERROR
AGENT_IO_NO_ROUTE_TO_HOST
AGENT_IO_PORT_UNREACHABLE
AGENT_MALFORMED_XML
AGENT_NONABSOLUTE_PATH
AGENT_NONEXISTENT_DIR
AGENT_NONEXISTENT_FILE
AGENT_PING_FAILED
AGENT_STREAM_STOPPED
AGENT_TIMEOUT
AGENT_UNKNOWN_CMDID
AGENT_UNKNOWN_COMMAND
AGENT_WRONG_FILE_TYPE
BAD_AGENT_RESPONSE
BAD_LOGFILE_PATH
CANCELED
CIRCULAR_PROCEDURE_REFERENCE
CORRUPT_CREDENTIAL
DUPLICATE_JOB_NAME
EMPTY_SUBPROCEDURE
FAILED_JOB_RENAME
FORMAL_PARAMETER_ERROR
INTERNAL_ERROR
INVALID_EMAIL_HEADER
MY_EVENT_EXPANSION_ERROR
NO_EMAIL_HEADERS_SEPARATOR
NONEXISTENT_EMAIL_CONFIG
NONEXISTENT_PROCEDURE
NONEXISTENT_RESOURCE
NONEXISTENT_WORKSPACE
NOTIFIER_EXPANSION_ERROR
POST_PROCESSOR_ERROR
POST_PROCESSOR_OUTPUT_FAILURE
PROPERTY_REFERENCE_ERROR
RESOURCE_WITHOUT_HOSTNAME
SERVER_SHUTDOWN
TIMEOUT
UNKNOWN_HOST

Postprocessors: Collecting Data for Reports

Postp
Extending postp: matchers
Postp functions
Integration with the ElectricFlow user interface
Postp integration with Java Tools

Overview
In ElectricFlow, reporting is divided into two phases.
• The first phase is data collection: interesting information is extracted from job step logs and saved in the ElectricFlow database.

• The second phase is report generation: data collected previously is retrieved and organized into reports.

The report phases are separated so data is gathered once but then available to use in a variety of different reports either immediately or later. For example, one report might summarize errors within a particular job, and another report might display error trends from all jobs over the past month.

ElectricFlow implements data collection with a postprocessor.

• A postprocessor is a command associated with a particular procedure step. If a postprocessor is specified for a step, it executes concurrently with the main step command.

• The postprocessor runs on the same machine as the main command and in the same working directory, and it retrieves the log file from the step as its standard input.

ElectricFlow includes a standard postprocessor called postp that you can use and extend.

postp scans the step's log file looking for interesting output such as error messages and then sets properties on the job step to describe what it found. For example, postp might create a property named "errors" whose value is a count of the number of error messages in the log file, or a property named "tests" that counts the number of tests executed by the step. Also, postp can extract portions of the step log that contain useful diagnostic information and save this information for reporting.

Standard ElectricFlow reports, such as those on the Job Details page, display information collected by postp such as properties named "errors" and diagnostic log extracts. This information is available immediately, even before the step completes execution, so you can view it via ElectricFlow's web interface to monitor step execution. Also, you can create additional report generators of your own, which can use the same information displayed by ElectricFlow and/or any other additional information of your choice.

Postp

ElectricFlow's general-purpose postprocessor, postp, uses regular expression patterns to detect interesting lines in a step log.

• postp is already configured with patterns to handle many common cases such as error messages and warnings from gcc, gmake, cl, junit, and cppunit, or any error message containing the string "error." You can use the empty matcher group named "none" if just want to run a postpEndHook.

• postp is easy to use by simply setting the postprocessor for a step to "postp."

• postp also supports several useful command-line options.

To explore these options, invoke "postp --help" from your command-line.

Extending postp: matchers

If you find useful patterns in your log files undetected by postp, you can extend postp with additional patterns. This feature is easily implemented, but the extension interface currently involves writing simple Perl scripts and you need to look at the Perl source file for postp as you do this. The postp source code is installed during ElectricFlow installation and located in the src/postp.pl file in the distribution directory.
Postp is driven by a collection of *matchers*, which are regular expression patterns that select certain lines from step logs, and by a collection of Perl functions the matchers invoke to handle lines of interest. A matcher is a Perl hash with three values similar to the following example:

```
{
    id        => "error",
    pattern   => qr{ERROR:|[Ee]rror:},
    action    => q{
        incValue("errors"); diagnostic("", "error", -4)
    },
}
```

Explanation of the values in the Perl hash example above:

- **id** - A unique name for the matcher—used to identify the matcher in command-line arguments and a few other places.
- **pattern** - A regular expression tested against each line of the step log file. This particular pattern matches lines containing any of the strings "ERROR:“, “Error:“ or "error:“.
- **action** - A Perl script that executes whenever a log line matches the pattern for this matcher. The script in this example increments a variable named "errors" that is copied automatically to a job step property with the same name. The script also saves a portion of the step log beginning 4 lines prior and extending through the current line and associates those lines with this error so it can be displayed in the web interface. See below for more information on the `incValue` and `diagnostic` functions.

To extend postp with patterns of your own, write a Perl script to add new patterns to the `@::gMatchers` array. Here is a simple example:

```perl
my @newMatchers = {
    { id        => "coreDump",
      pattern   => "core dumped",
      action    => q{
          incValue("coreDumps")
      },
    },
    { id        => "segFault",
      pattern   => "segmentation fault",
      action    => q{
          incValue("segFaults")
      },
    },
};
push @::gMatchers, @newMatchers;
```

These matchers detect lines containing the strings "core dumped" or "segmentation fault" and increment separate variables for each line type.

After writing extension code, you must ask postp to execute the code when it starts up. You can execute extension code in one of two ways:

- Place the code into a file and invoke postp with the `--load` option.
  For example, `postp --load fileName`
- Copy the code into a property in ElectricFlow and use the `--loadProperty` option to postp.
  For example, `postp --loadProperty /myProject/extraMatchers`
Postp extensions can contain arbitrary Perl code, which means you can use this mechanism to define additional functions to invoke in matcher actions if existing functions do not provide what you need.

**Note:** Additional postp matchers are available for your convenience. The matcher sample directory was installed during ElectricFlow installation. Go to `src/samples/postp`.

**Postp functions**

*Postp* contains several built-in functions to invoke in your matchers. The most useful functions are summarized below. Also, you can scan postp code for additional functions.

```plaintext
debugLog(format, arg, arg, ...)
```

Outputs information to the debug log, if the --debugLog command-line switch is set. Format provides a format string similar to printf, and each argument provides a value to substitute into the format string.

```plaintext
backTo(pattern, start)
```

This function searches backward to find the first line in the step log matching "pattern" (a regular expression) and returns the offset of that line relative to the current line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to -1).

```plaintext
backWhile(pattern, start)
```

This function searches backward to find the first line in the step log that does not match "pattern" (a regular expression) and returns the offset relative to the current line of the line just after the first non-matching line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to -1).

```plaintext
currentModule()
```

Returns the name of the current module (as determined by previous calls to pushModule and popModule), or an empty string if there is no current module.

```plaintext
diagnostic(name, type, first, last)
```

This function extracts a group of contiguous lines from the log file and saves them along with additional information for reports such as the log extracts, which appear at the bottom of the Job Details web page. The range of lines to extract is indicated by "first" and "last," each of which is an offset relative to the current line. For example, if "first" is -3 and "last" is 2, then 6 lines will be recorded: 3 lines before the current line, the current line, and 2 lines after the current line. In many cases, the values for "first" and "last" are computed by calling functions such as "forwardTo" or "backWhile." "Name" provides an identifier for this particular diagnostic, such as the name of a test that failed or a file that did not compile. "Type" specifies which kind of information this is, and must be "error," "warning," or "info." In addition to log lines, this function records "name," "type," the current module, if any, and the name of the current matcher.

```plaintext
forwardTo(pattern, start)
```

This function searches forward to find the first line in the step log matching "pattern" (a regular expression) and returns the offset of that line relative to the current line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to 1).
**forwardWhile(pattern, start)**

This function searches forward to find the first line in the step log that does not match "pattern" (a regular expression) and returns the offset relative to the current line of the line just before the first non-matching line. The result is normally used as an argument to the "diagnostic" function. "Start" is optional; it specifies the first line to check and is specified as an offset relative to the current line (it defaults to 1).

**incValue(name, increment)**

Adds "increment" to a value named "name" and arranges for that value to be written eventually to a property by the same name on the current job step. If this is the first call for "name," its value is initialized to 0. "Increment" is optional and defaults to 1.

**Note:** postp does not check the job step for a pre-existing property with the same name; it simply overwrites it.

**logLine(lineNumber)**

Returns the line from the step log given by lineNumber. 1 corresponds to the first line in the step log and the Perl variable $::gCurrentLine holds the number of the current line. This function caches a sliding window of lines in the file, allowing you to go back to retrieve lines preceding the current line (as long as they do not precede it by too many lines). If the requested line is off the end of the file then undef is returned. If the requested line is before the beginning window of cached lines, an empty string is returned.

**popModule()**

 Cancels the effect of the most recent call to pushModule, resetting the current module name to whatever it was before the corresponding call to pushModule.

**postpEndHook()**

If you define a function with this name, it invokes after postp has finished processing the log file, but before it makes its final properties update on the job step. Use this function to perform your own operations such as generating an error if the log file did not contain a particular line you were expecting.

**pushModule(name)**

In some situations it is possible to divide the log file into parts corresponding to different modules. For example, with recursive make invocations, there are typically notifications in the log output before and after each recursive make. This function is invoked to indicate a new module is being entered, where "name" is the name of the module. After this function is called, the "diagnostic" function will include "name" with error or warning messages to provide additional information in job reports. The previous module name, if any, is saved; you can return to it by calling popModule.

**setProperty**

This function sets a property in the ElectricFlow server. If the named parameter is a relative path, like moduleCount, the property is set or created on the current job step. You can use an absolute path, like /myJob/fileLocation also. Calling `setProperty` does not result in an immediate call to the ElectricFlow server. The property is added to an update list for updating at the next "update interval", typically every 30 seconds.

**Integration with the ElectricFlow user interface**

postp interacts with the ElectricFlowUI using two methods. The first method: Create custom properties with special names that are recognized by the UI itself. The second method: Create a file that contains "diagnostics",...
which are used to display errors or warnings, and link them to specific sections in the step’s log file.

Custom property names and values

postp can be used to create properties in ElectricFlow, on the job step or anywhere else in ElectricFlow. However, the following properties are used by the standard ElectricFlow UI, so you should use these property names whenever possible, and avoid using these names in ways that conflict with the definitions below.

- **compiles** - the number of files compiled during the job step
- **diagFile** - the filename in the top-level directory of the job's workspace, containing diagnostics extracted from the step's log file
- **errors** - the number of errors (compilation failures, test failures, application crashes, and so on) that occurred during the job step. When property errors are set by postp, the step outcome is set to error also.
- **tests** - the number of tests executed by the job step, including successes and failures
- **testsSkipped** - the number of tests skipped during the job step
- **warnings** - the number of warnings that occurred during the job step. When property warnings is set by postp, the step outcome is set to warning also.

- **preSummary** - if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears before whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.

- **postSummary** - if this property exists, its value is displayed in the "Status" field (on the Job Details page) for this step. This property appears after whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.

- **summary** - if this property exists, its value is displayed in the "Status" field (in the job reports) for this step, replacing whatever would normally be displayed for status. If the property contains multiple lines separated by newline characters, each line is displayed on a separate line in the status field.

Diagnostic information

The second form of postprocessor generated output contains diagnostic extracts from the step's log file, typically providing additional information about problems. The postprocessor stores diagnostic information in an XML file in the top-level directory of the job workspace, then sets the step's `diagFile` property with the name of the file. Diagnostic files must have a format like the following example:

```xml
<?xml version="1.0" encoding="ISO-8859-1"?>
<diagnostics>
  <diagnostic>
    <matcher>compileError</matcher>
    <name>testa.c</name>
    <type>error</type>
    <module>util/timeLib</module>
    <firstLine>2</firstLine>
    <numLines>7</numLines>
    <message>testa.c: In function 'procl':
               testa.c:12: error: parse error before ';' token
               testa.c:13: error: 'for' loop initial declaration used outside C99 mode
               testa.c:14: error: parse error before ';' token
  </diagnostic>
</diagnostics>
```
testa.c:16: error: too few arguments to function 'exit'
testa.c:18:2: warning: no newline at end of file
testa.c:18: error: parse error at end of input
</message>
</diagnostic>
<diagnostic>
 <name>testa.o</name>
 <type>error</type>
 <module>util/timeLib</module>
 <firstLine>9</firstLine>
 <numLines>1</numLines>
 <message>make: *** [testa.o] Error 1 </message>
</diagnostic>
</diagnostics>

XML elements in the diagnostic file are as follows:

- diagnostics - Overall container; its children consist of all of the diagnostic elements.
- diagnostic - Describes one diagnostic extract; the elements described below are all children of this element.
- matcher - (optional) Identifier for the matcher that triggered this diagnostic; used primarily for debugging.
- name - (optional) Identifier that indicates the problem or situation that resulted in this diagnostic, such as the name of a failed test or the name of a file that did not compile.
- type - Type of message: must be "error," "warning," or "info."
- module - (optional) Name of the module in which the issue occurred, such as the name of a source code module being compiled at the time of a compile error.
- firstLine - Line number in the log file for the first line of the diagnostic extract (1 means the first line of the file). This element is used to provide a link from the diagnostic extract to the full log file.
- numLines - Total number of lines included in the diagnostic extract.
- message - The actual lines from the log file.

**Postp integration with Java Tools**

ElectricFlow integrates with three standard Java tools through postp matchers. These Java tools are:

- **EMMA** - an open source toolkit for measuring and reporting Java code coverage (Emma v2.0)
- **JUnit** - a framework for writing and running automated tests (tested with Ant v1.7)
- **Clover** - Atlassian's Java code coverage (generated by system, functional, or unit tests) analysis tool (Clover v2.4)

**Note:** If one of these Java tools is invoked in an ElectricFlow job step, ElectricFlow automatically detects the invocation [if you are using Postp] and adds any reports generated by these tools to the list of links at the top of the Job Details page.

**The process...**

Postp parses output from the invoked JAVA tool to match paths to reports it has already created. Then, postp copies all files that comprise the report to a unique location in the "Artifacts" Directory. Next, postp generates a
link to the location in the Artifacts Directory to make the report available in the Links section on the Job Details page.

The following example of generated output from Emma illustrates this process:

```
emama:
init:
[mkdir] Created dir: C:\Documents and Settings\ptharani\Desktop\emma-2.0.5312\examples\out

compile:
[javac] Compiling 4 source files to C:\Documents and Settings\ptharani\Desktop\emma-2.0.5312\examples\out

run:
[emmajava] EMMA: processing classpath ...
[emmajava] EMMA: [3 class(es) processed in 47 ms]
[emmajava] main(): running doSearch()...
[emmajava] main(): done
[emmajava] EMMA: writing [txt] report to [C:\Documents and Settings\ptharani\Desktop\emma-2.0.5312\examples\coverage\coverage.txt] ...
[emmajava] EMMA: writing [html] report to [C:\Documents and Settings\ptharani\Desktop\emma-2.0.5312\examples\coverage\coverage.html] ...

all:
BUILD SUCCESSFUL
Total time: 1 second
```

From this output

The actual link may reside here:

```
/home/commanderWorkspace/job_112_200901081732/artifacts/javaTools/238/emmaCoverage/2/coverage.html
```

While the link name may be:

```
Step Id 238 ant-on-the-fly - emma report# 2
```

And the value of the link may be:

```
jobSteps/238//javaTools/238/emmaCoverage/2/coverage.html
```

Java Tool matcher examples

Two examples of postp Emma matchers:

```
{
  id => "emmaReport1",
  pattern => q{{EMMA: writing},
  action => q{emmaExtractReport()},
},
{
  id => "emmaReport2",
  pattern => q{\[report\] writing},
  action => q{emmaValidateOutput()},
},
```
An example of postp JUnit matchers:

```
{
    id => "junitReportCapture",
    pattern => q\({\[junitreport\]} Processing),
    action => q(junitExtractReport()),
},
```

These matchers correspond to the following output:

```
junit.report:
[junitreport] Processing
/net/WinStor2home/ptharani/junitDemol/sample/testreport/TESTS-TestSuites.xml to
/tmp/null1214791178
[junitreport] Loading stylesheet jar:[file:/usr/local/tools/common/apache-ant-1.7.0/lib/ant-junit.jar!/org/apache/tools/ant/taskdefs/optional/junit/xsl/junit-frames.xsl
[junitreport] [file:/usr/local/tools/common/apache-ant-1.7.0/lib/ant-junit.jar!/org/apache/tools/ant/taskdefs/optional/junit/xsl/junit-frames.xsl
[junitreport] [file:/usr/local/tools/common/apache-ant-1.7.0/lib/ant-junit.jar!/org/apache/tools/ant/taskdefs/optional/junit/xsl/junit-frames.xsl
[junitreport]] Transform time: 622ms
[junitreport] Deleting: /tmp/null1214791178
```

An example of postp Clover matchers:

```
{
    id => "cloverHtmlReportAntTask",
    pattern => q\({\[clover-html-report\]} Writing HTML report to),
    action => q(cloverExtractReport()),
},
```

These matchers correspond to the following output:

```
clover.report:
[clover-html-report] Clover Version 2.4.0, built on November 05 2008 (build-747)
[clover-html-report] Loaded from: /home/cloverDemo/clover-ant-2.4.0/lib/clover.jar
[clover-html-report] You have 27 day(s) before your license expires.
[clover-html-report] Loading coverage database from: '/home/cloverDemo/clover-ant-2.4.0/tutorial/.clover/clover2_4_0.db'
[clover-html-report] Writing HTML report to '/home/cloverDemo/clover-ant-2.4.0/tutorial/clover_html'
```

Artifacts directory

The value of the artifacts directory determines the scope of what is visible in the ElectricFlow UI from a job's workspace. By default, the Artifacts Directory is set to "artifacts", so the artifacts directory would have the form:

```
<path to job workspace>/artifacts
```

The value of the artifacts directory can be set in any of the following properties:

```
/myJob/artifactsDirectory
/myProject/artifactsDirectory
/server/settings/artifactsDirectory
```
Postp queries these properties [in the order listed] to determine the location of the Artifacts Directory. If no value is found (because the property was never set), the default "artifacts" is used.

Postp has a feature where it recognizes that data belongs to some standard tool (such as Junit), copies the logs produced by that tool to the artifacts directory, and then creates the report-url properties. These actions are done with the junitReportCapture matcher.

If you want to disable this matcher in your postp invocation in the step that runs junit tests, do the following:

```
postp --dontCheck junitReportCapture
```

It is possible that the artifacts directory will still be created even if nothing is put in it. If that occurs, set the artifactsDirectory property on your job (or the owning project) to empty-string.

**Reports**

ElectricFlow provides multiple reports and custom report capabilities to help you manage your build environment.

- Real-time reports - filtered view of your workload in real-time
- Build reports - summary reports produced at the end of a build and attached to the job
- Batch reports - summaries of your build environment with trends over time, two types:
  - Default Batch reports - automatically installed during ElectricFlow installation and scheduled to run daily
    (Cross Project Summary, Variant Trend, Daily Summary, Resource Summary, Resource Detail)
  - Optional Batch reports - you can configure, rename, and schedule these reports to fit your requirements
    (Category Report, Procedure Usage Report, Count Over Time Report, Multiple Series Reports)
- Custom reports - your choice to create and add at any time

You can use also StatsD and Graphite to generate custom reports. For more information, go to System Health Monitoring on page 1058.

**Note:** Batch and Custom reports must be run on the ElectricFlow server's agent (local agent) only. These reports need the BIRT report engine, which is installed on the ElectricFlow server.

**Run reports on a non-local resource**

If you want to configure reports to run on a non-local resource, do the following:

1. In the web interface, go to Projects > Electric Cloud > runReports > runEcrptdata.
2. Change the Parameter Resource from the default value "local" to the name of a different resource. the resource must have access to the plugins directory.
Real-time reports

Home page

The Home page is a user-customizable dashboard that can be configured to show you just the ElectricFlow jobs you care about.

The Jobs Quick View section (on the right-side of the Home page) shows jobs you define using filters on job properties. You can create multiple categories filtered on specific project names, procedure names, users, or any other job property. Summary details for the job “pop-up” if you hover your mouse over one of the jobs.

Jobs

Unlike the Home page, which allows you to see specific subsets of work, the Jobs page shows all jobs that are running and all jobs that have completed. This is a good report to view when you need to see a list of all jobs run by any user or schedule. System administrators and managers can use this page to monitor overall system throughput.

Job details / Step details

After a job starts, you can get execution details from the Job Details page. To view job details, click on the job from the Home page or the Jobs tab. From within the Job Details page you can drill down to see details for an individual step. This is the finest grain of reporting, showing the detailed results of a specific job.

Resources

The Resources page reports the current state of your defined resources. This page also shows the current state of the agent (connected or not) and any steps currently running on that resource. Use this report to monitor your resources in near real time.

Build reports using ecreport

ElectricFlow includes a utility, ecreport, that summarizes build results and sends that summary through email. This customizable utility allows you to create a simple matrix based on results stored in properties and log files. Details such as SCM change logs and errors can be included.

In addition, you can attach your own reports to any job and have them show up as attachments to the Job Details Report. To attach custom reports, put them in the top-level workspace directory in a file that ends with ".html" and contains the string "report" or "Report." Names of all matching files are displayed in the Summary section in the upper right corner of the page. Click on a report name to view the report.

The following is an example of ecreport output:
ecreport extracts information about a particular job from the ElectricFlow server and writes an HTML report to standard output. The report is organized as a 2-dimensional table summarizing the results of steps in the job. The table layout can be customized by defining its format using the ectool (or ec-perl) --load option. Invoke the program in the top-level directory of the job's workspace so it can access log file extracts in that workspace (or, use the --dir option).

The following options are available for use with the ecreport utility:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--culprit</td>
<td>If specified and the job failed, the report will be emailed to each user mentioned in the updates file. The value of this option provides the subject line for the message (%s will be replaced with the job name).</td>
</tr>
<tr>
<td>--data</td>
<td>Name of file containing job data for the report. If specified, this data is used in place of querying the ElectricFlow server. Used primarily for testing.</td>
</tr>
<tr>
<td>--dir</td>
<td>Change to this working directory before doing anything else.</td>
</tr>
<tr>
<td>--help</td>
<td>Print this message and exit without doing anything.</td>
</tr>
<tr>
<td>Option</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>--jobId</td>
<td>Identifier for the ElectricFlow job to report on (required unless --data is supplied). This is a UUID.</td>
</tr>
<tr>
<td>--load</td>
<td>Name of a file containing Perl code to evaluate after option processing. Used primarily for debugging. There can be multiple --load options.</td>
</tr>
<tr>
<td>--emailConfig</td>
<td>The name of the Email Configuration to use when emailing the report. Defaults to &quot;default&quot;.</td>
</tr>
<tr>
<td>--mailto</td>
<td>Email the report to this addresses.</td>
</tr>
<tr>
<td>--replyto</td>
<td>Value for the &quot;Reply-To&quot; field in emailed reports.</td>
</tr>
<tr>
<td>--server</td>
<td>Location of the ElectricFlow server (hostname or hostname:port), to retrieve job data. Defaults to the COMANDER_SERVER environment variable.</td>
</tr>
<tr>
<td>--subject</td>
<td>Value for the &quot;Subject&quot; field in emailed reports. If the value contains a %s, a string summarizing the job replaces the %s.</td>
</tr>
<tr>
<td>--updates</td>
<td>Name of a file containing information about recent updates reflected in the job. If specified, the contents of this file are included in the report.</td>
</tr>
<tr>
<td>--version</td>
<td>Print ecreport version number.</td>
</tr>
<tr>
<td>--webRoot</td>
<td>Base URL for the ElectricFlow Web server where the job was run, such as <a href="http://myServer/commander">http://myServer/commander</a>. URLs in the report will refer to ElectricFlow Web pages relative to this URL.</td>
</tr>
</tbody>
</table>

Example 1

ecreport --jobId ${/myjob/jobId} --load ./rptformat.pl --updates update.log --webRoot http://myServer/commander > ecreport.html

This example writes a report to the file ecreport.html. Because this file has an .html extension, it will be displayed in the Reports section at the top of the Job Details page. The format of the table for this report is specified in rptformat.pl. An example of the contents from this file would be:

```perl
@::gTableRows = (
    [
        "",
        "Windows",
        "Linux",
        "Solaris"],
    [
        "Extract",
```

---

1010
The “Recent Updates” report section is specified in update.log. The --webRoot argument defines the root for any URL that appears in the report.

Example 2

    ecreport --jobId $[/myJob/jobName] --load ./ecreportConfig.pl --mailto user1@company.com --replyto user2@company.com --subject 'Build Report' --updates updates.log --webRoot http://myServer/commander

This report will be sent as the body of an email message to user1@company.com with subject “Build Report”.

Default Batch Reports (Run Reports)

These reports are installed during the ElectricFlow installation and automatically scheduled to run daily.

To access these reports: Select the Projects tab, then select the Electric Cloud project, then click the Reports subtab. This report collection graphs trends over time, including success/failure, build times, and resource consumption. These reports allow you to customize two levels of grouping into “variants.” These variants may represent products, branches, locations, architectures, or any other descriptors you would like to use to group your workload.

Note: After a Default Batch Report runs, a link for each report appears on the Job Details page in the Links section. When you select a report from the Links section, it will be displayed in full-screen view.

Report types

Cross Project Summary - This report shows the status of multiple variants over the past 30 days. This high-level summary of each of the 30 days shows green, yellow, or red depending on the result of the best build of the day. The summary also shows average times, total invocations, and other data.

Variant Trend - This report shows more details about a particular variant such as build outcome over time, build quantity over time, elapsed build times over time, and a list of actual jobs that ran during the period.
Daily Summary - This report shows the most recent results of each variant, including the last successful build.

Resource Summary - This report shows resource utilization over the last 24 hours. You can see which resources are idle and which resources are busy. ElectricFlow has advanced features that allow you to select resources for your job at runtime, using late binding of property names. This feature provides unparalleled flexibility and control over your environment, but could make it difficult to find out which resources were used. This report provides the visibility you need into resource loading.

Resource Detail - This report shows the utilization of a particular resource over the course of one day.

Wait Time - This report shows cumulative wait time due to license, resource, and workspace waits. It also shows the number of steps that were delayed for any of those reasons.

Default Batch Reports

- Cross Project Summary
  - Variant Trend
- Daily Summary
- Resource Summary
  - Resource Detail

The navigation tree on the left-side of the screen allows you choose the report and date of interest. These reports, which show long term trends over all projects and resources, are run from the runReports procedure in the Electric Cloud project.

The following example shows the Default Batch Reports, the historical reports link, and Optional Batch Reports (described below). Notice that you can expand a selected report to three levels. The third level represents drill-down links available within that report. In addition, if you click on a report name, the most current report is displayed.
Tip

You may change the number of reports displayed under each report type. Locate the propertySheet named `ec_reportConfiguration` on the project or server (project overrides server) and find the "groupings" section. Next, you can create nested property sheets under `ec_reportConfiguration` with the properties `groupingName`, `sortDirection`, and `limit`. If you set this information using `ectool`, you will also see it on ElectricFlow's web interface.

If the `ec_reportConfiguration` propertySheet does not exist, you will need to create it, then copy the example below into the propertySheet.

Example:

```
extool setProperty ec_reportConfiguration/reportDaysLimit --value 90 --projectId foo
```
ectool setProperty ec_reportConfiguration/groupings/1/groupingName --value reportType "--projectName foo
ectool setProperty ec_reportConfiguration/groupings/1/sortDirection --value ascending --projectName foo
ectool setProperty ec_reportConfiguration/groupings/1/limit --value 100 --projectName foo

ectool setProperty ec_reportConfiguration/groupings/2/groupingName --value reportDate "--projectName foo
ectool setProperty ec_reportConfiguration/groupings/2/sortDirection --value descending --projectName foo
ectool setProperty ec_reportConfiguration/groupings/2/limit --value 5 --projectName foo

ectool setProperty ec_reportConfiguration/groupings/3/groupingName --value reportResource --projectName foo
ectool setProperty ec_reportConfiguration/groupings/3/sortDirection --value ascending --projectName foo
ectool setProperty ec_reportConfiguration/groupings/3/limit --value 100 --projectName foo

This example explicitly defines the default behavior for project foo's reports.

The 1, 2 and 3 propertySheets define the order of the groupings. The actual names 1, 2, 3, could be anything as long as they are listed alphanumerically in the order you need.

Additionally, any groupings that do not exist will be skipped during output. For example, if you added a reportRunByUser grouping #4 and added it to some reports that define reportType="User Builds", reportDate, and reportRunByUser properties (but not reportResource), you would get something similar to a resource usage report structure with users rather than resources at the deepest level.

Note: If you choose to display 500 or more reports at one time, you may experience some performance degradation.

Advanced reporting information - ecrptdata

How are default batch reports generated?

Reports are scheduled as part of a special procedure, runReports, in the Electric Cloud project. This procedure has one step, runEcrptdata, that runs the ecrptdata program. This program reads data from ElectricFlow, summarizes it for reports, and generates HTML reports using the BIRT reporting engine. The program takes input parameters. During installation, reporting is configured as follows:

    ecrptdata --end yesterday --grain 300 --debug 2 --reports all

By default, all reports are run every day at 2am. The Cross Project Summary and Variant Trend shows data from the previous 30 days. The Daily Summary, Resource Summary, and Resource Detail reports show data from the last full day (yesterday). You can adjust the schedule to run more often or at different times by altering the "Report Schedule" schedule in the Electric Cloud project.

Changing the report time period

If you would like to alter the report time period, you must change the input parameters to the ecrptdata program within the procedure step "Electric Cloud:runReports:runEcrptdata". Select the Ecptdata step name to go to the Edit Step page. Make the changes you need in the Parameters section. If the --end option
is omitted, the end of the reporting period is the time when the report runs (now). If the keyword "yesterday" is provided, reports will include full data for yesterday. Otherwise, a specific date and time can be given in the format "YYYY-MM-DDTHH:MM:SS".

**Changing the report grouping**

You can tell ElectricFlow how to group the Cross Project Summary and Variant Trend reports. By default, the outer grouping is "Project Name" and the inner grouping is "Procedure Name." To change these groupings, use the following ecrptdata options:

| --group1Name xxxx | Set the column header for the first column of the Cross Project Summary report to "xxxx". |
| --group1Property yyyy | Use property "yyyy" as the name to group on in the first column of the Cross Project Summary report. |

All lookups are done with respect to an individual job and will be converted to absolute property paths. The values `projectName`, `procedureName`, and `jobId` are set in context for the job being examined.

Examples:

- `/myProject/foo` will be converted into the API call "ectool getProperty /projects/projectName/foo"
- `/myProcedure/foo` will be converted into the API call "ectool getProperty /projects/projectName/procedures/procedureName/foo"
- `/myJob/foo` will be converted into the API call "ectool getProperty /jobs/jobId/foo"
- `/myParameter/foo` will be converted into the API call "ectool getActualParameter foo -jobId jobId"

To show the value of the procedure name as the outer grouping and the value of the parameter "branch" as the inner grouping, use the following ecrptdata options:

- `--group1Name Procedure` -- `--group1Property "/myProcedure/procedureName"`
- `--group2Name Branch` -- `--group2Property /myParameter/branch`

**Note:** The `/myParameter"shortcut" to the property path was created specifically for ecrptdata only—it cannot be used as other "/my" property shortcuts are used. For more information on property shortcuts, see the Properties Help topic. In addition, when working with ecrptdata, any /my value is case-insensitive. For example, you can use `/myParameter` or `/myparameter`.

**Filtering**

ecrptdata supports "findObjects" type filters when searching for jobs and job steps.

This feature is implemented with two new command line switches: "--jobFilter <property, operator, operand>" and "--stepFilter <property, operator, operand>". The jobFilter option filters the CrossProjectSummay, DailySummary, and VariantTrend reports. The stepFilter option filters the ResourceSummary and ResourceDetail reports.
Examples:

- `--jobFilter "branch,isNotNull,1"`
- `--jobFilter "jobName,like,my-procedure%"
- `--stepFilter "outcome,notEquals,aborted"

Adding additional data columns to the report

You can add custom data columns to each report. These columns are specified by providing a comma separated list of property references in the following ecrptdata options:

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>--crossProjectProperties</code></td>
<td>sets extra columns for the Cross Project Summary Report</td>
</tr>
<tr>
<td><code>--variantTrendProperties</code></td>
<td>sets extra columns for the Variant Trend Report</td>
</tr>
<tr>
<td><code>--dailySummaryProperties</code></td>
<td>sets extra columns for the Daily Summary Report</td>
</tr>
<tr>
<td><code>--resourceSummaryProperties</code></td>
<td>sets extra columns for the Resource Summary Report</td>
</tr>
<tr>
<td><code>--resourceDetailProperties</code></td>
<td>sets extra columns for the Resource Detail Report</td>
</tr>
</tbody>
</table>

You must choose properties appropriate for the type of report and grouping you have chosen. For example, if you choose Project Name and Procedure Name for your groupings in the Cross Project Summary report, each line of the report will be in the context of a project or procedure. You can add extra columns to show properties on the project or procedure, but it would not make sense to show properties on a resource, job, or job step. For resource reports, the properties must be in the context of a resource.

The column header is the name of the property.

Examples:

- `--crossProjectProperties "/myproject/QA_State,/myprocedure/PartNumber"
- `--resourceSummaryProperties "/myresource/OS,/myresource/Architecture"

Secure login

`ecrptdata` provides options for secure login to the ElectricFlow server.

Currently, there are three ways to login:

1. Use both the `--user <user>` and `--pass <password>` options. This method is not secure… the password will be in plain text and visible to others.
2. If you omit the "--pass <password>" option, the password will be read from stdin. You can then read the password from a secure file or from a stored credential. For example:

```
cat mySafePasswordFile.txt | ecrptdata --user <user> ...
ectool getFullCredential myCred --value password | ecrptdata --user <user> ...
```

3. Another option, "--credential <credentialName>", allows you to specify a credential name. If you use this option, "--user <user>" and "--pass <password>" are ignored. Note that the credential must be attached to the runReports job step. Both the user and password are retrieved from the credential.

Logic:

1. If --credential is used, attempt to lookup credential and extract user and password
2. If user is not set, return error
3. If password is not set, read from stdin
4. Attempt to login to server specified in --server <server> option using user and password

**Optional Batch Reports**

Additional reports are available, but these reports are not scheduled to run by default. You can schedule these reports to suit your purpose.

**Note:** When you run an Optional Batch Report, a link for each report appears on the Job Details page in the Links section. When you select a report from the Links section, it is displayed in full-screen view. The following optional reports are available:

- Category Report
- Procedure Usage Report
- Count Over Time Report
- Multiple Series Report
  (formerly known as the "Value Over Time" report)

These reports are available from the Reports tab on the Project Details page for your Project.

**Note:** For the Category, Count Over Time, and Multiple Series reports, a View Search Results link is available at the bottom of the report if a Saved Filter was used to generate the report.

**Creating a Report Job**

ElectricFlow runs reports as a job, so reports can be managed like any other job.

To create a report for your project:

1. Go to the Project Details page for your selected project.
2. Select the Reports subtab.
3. Click the Create Report link.
After clicking **Create Report**, the next screen is displayed with the default values for the selected tab (Multiple Series) in this example.

Enter information in the fields or select the appropriate values as follows:

- **Report Title** - Your report title. Type over the default report name, choosing any unique name for your report. We supplied Basic Build Report for our report name.

- **Saved Filter**:
  - Project - Click your mouse inside this field to see a list of projects from which to make a selection. We select our FirstNewProject project name.
  - Filter - Use the BasicBuildFilter we created earlier.

- **Time Period** - Use the drop-down menu to select the time period.

- **Create thumbnail?** - Check this box so you can view this report on your Home page. (We will create a “thumbnail” report view on your Home page at the end of this scenario.)

- **Object Type** - Use the drop-down menu to select Job for this example.

- **Table column choices**:
  - Chart Type - Use the drop-down menu to choose the chart type.
  - Function - Use the drop-down menu to choose the function you need.
  - Property Name - Use the default property value or delete the text and click your mouse in the blank field to see a list of possible properties. We chose "outcome" for this example.
  - Display Name - You can choose a different unique Display Name if you prefer to do so.
  - Stacked - Select this check box to see your report results "stacked" versus overlaid.
○ The "X" icon - Click this icon to delete any row you no longer need.

- Select the **Add Series** button if you would like to create additional table entries for additional report information.
- Chart Options - Use the down-arrow to adjust the Time Grouping and see the defaults for the X and Y axis.

Buttons at the bottom of the page:

○ Run Report button - this button takes you to the Job Details page to run the report immediately—one time only.
○ Click the **Create Schedule** button - this button displays a box with a default schedule name you can change.

![Enter Schedule Name](image)

○ Enter a name for the schedule, **Basic Build Report Schedule**—again, we tied the schedule name to the procedure name for which we want the report.

**Viewing the report**

After the report job runs, view the report by selecting the Reports subtab within the project. **Note:** All reports are viewed from within a project context. If you have reports that span multiple projects, run them from the Electric Cloud project or create a project to store summary reports.

After selecting the Reports subtab, see the navigation tree on the left-side of the page. This tree allows you to select the report you want to view. The report tree contains three levels.

- **Report Title** - Click the "+" icon next to the report type to see available report versions.
- **Report Date** - Click this link to see report details.

  **Note:** Click the report type to display the most recent report version.

**Optional Batch report examples**

**Category sample report**

This report shows the distribution of property values in a pie chart.
Creating this report on the Run Procedure page:

Field descriptions:

- **Credential** - these are credentials to be used when collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, the data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.
• Locales - a comma separated list of locales where you would like to render the report. Locale is specified as one or more of the following: en, zh, ja, or ko, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. Note: Currently, ElectricFlow supports four locales only.

• Object Type - the type of object to search (default job)

• Property - the property of interest (default outcome) and must be a valid property for the object type selected

• Report Title - your report title (default Category Report)

• Saved Filter Project - select "Current" or Browse to find the project where you want to save this filter.

• Saved Filter Name - the name of a saved filter to use when filtering collected data.

Use the Search tab to create the filter. After entering your search criteria, click OK.

If the preview displays the data you want, click Save Filter and provide a Project Name and Filter Name to specify where the filter is saved.

On the Run Report parameters page, select the filter. If you leave the Filter Name blank, no filtering is performed.

Note: "Saved filters" can filter on start and end times. Because start and end times are specified in the Time Period parameter, there is a possibility you could select a combination of filter date and time periods that exclude all data. For example, you could select a time period of "Yesterday" and a filter of Start=less than Jan 1, 1900. To avoid this problem, we recommend you do NOT include dates or times in your filter.

• Time Period - these are keywords to define the report start and end times. The range is used to filter collected data. All values are in the local time zone.
  - Today - midnight until now
  - Yesterday - previous full day
  - This week - from the start of the previous Sunday until now
  - Last week - from Sunday to Sunday of the last complete week
  - This month - from the start of the first of this month until now
  - Last month - from the last complete calendar month, which means on January 3rd the last full month is all of December
  - This year - from January 1st until now
  - Last year - all of last year (Jan 1 to December 31)
  - All - all dates until now

Procedure Usage Sample Report

For a specific procedure, this report shows procedures called by the procedure and which procedures it called.
Creating this report on the Run Procedure page:

Field descriptions:

- **Credential** - these are the credentials to use for collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.

- **Locales** - a comma separated list of locales where you would like to render the report. Locale is specified as one or more of the following: en, zh, ja, or ko, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. **Note**: Currently, ElectricFlow supports four locales only.

- **Project** - this is the name of the project where you want to install the report.

- **Project Procedure** - enter a project procedure. "called" and "called by" data is shown for that project/procedure combination. You can use "wildcards." For example, to see data for ALL projects and procedures, enter the % character in each field.

- **Report Title** - this is the title of the report

**Count Over Time Sample Report**

This report shows search results from counting multiple job, job step, or resource objects within the selected time range.
For example, this report counts the number of occurrences for the specified object-type over the selected time range--if a filter exists, it will be applied. This report does not aggregate the value (use ValueOverTime if you want aggregation), each occurrence counts as one.

Use this report when the property contains string values. The ValueOverTime report can be used only for numeric properties.

**Note:** Generating large numbers of datapoints can exceed BIRT's charting capability.

Creating this report on the Run Procedure page.
Field descriptions:

- **Chart Time Grouping**: These are: Auto (default), Minute, Hour, Day, Week, Month, or Year.
- **Chart Type**: These are: Line (default), Bar, Cone, Tube, Triangle, or Area.
- **Chart X-Axis Label**: The text to display on chart x-axis (default: Date).
- **Chart Y-Axis Label**: The text to display on chart y-axis (default: Count).
- **Credential**: Credentials to be used when collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, the data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.
- **Locales**: A comma-separated list of locales where you would like to render the report. Locale is specified as one or more of the following: en, zh, ja, or ko, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. Currently, ElectricFlow supports four locales only.
- **Object Type**: The type of object to search (default: job).
- **Saved Filter Project**: Select "Current" or Browse to find the project where you want to save this filter.
- **Saved Filter Name**: The name of a saved filter to use when filtering collected data. Use the Search tab to create the filter. After entering your search criteria, click OK. If the preview displays the data you want, click **Save Filter** and provide a Project Name and Filter Name to specify where the filter is saved. On the Run Report parameters page, select the filter. If you leave the Filter Name blank, no filtering is performed. **Note**: "Saved filters" can filter on start and end times. Because start and end times are specified in the Time Period parameter, there is a possibility you could select a combination of filter date and time periods that exclude all data. For example, you could select Time Period of "Yesterday" and a filter of Start < less than Jan 1, 1900. To avoid this problem, Electric Cloud recommends you do NOT include dates or times in your filter.
• Table Column Heading Property - the table heading for the right column (default Count)
• Table Column Heading Time - the table heading for the left column (default Date)
• Table Time Grouping - these are: Auto (default), Minute, Hour, Day, Week, Month, Year
• Time Period - these are keywords to define the report start and end times. The range is used to filter collected data. All values are in the local time zone.
  • Today - midnight until now
  • Yesterday - previous full day
  • This week - from the start of the previous Sunday until now
  • Last week - from Sunday to Sunday of the last complete week
  • This month - from the start of the first of this month until now
  • Last month - from the last complete calendar month, which means on January 3rd the last full month is all of December
  • This year - from January 1st until now
  • Last year - all of last year (Jan 1 to December 31)
  • All - all dates until now

Multiple Series Report

This reports shows the cumulative value of a property over time. This report should be run against properties that contain numbers. (Use the Count Over Time report if your property contains string values.) You can specify the function to use for aggregating values (sum, count, average). For example: Assume a property that contains the number of failed unit tests is stored on each job. Using the Multiple Series report, you can see the failure trend over time.
Creating this report on the Run Procedure page:

Field descriptions:

- **Chart Time Grouping** - these are: Auto (default), Minute, Hour, Day, Week, Month, or Year
- **Chart Type** - these are: Line (default), Bar, Cone, Tube, Triangle, or Area
- **Chart X-Axis Label** - the text to display on chart x-axis (default Date)
- **Chart Y-Axis Label** - the text to display on chart y-axis (default Count)
- **Credential** - these are credentials to be used when collecting data. If no credentials are specified (Username/Password remain blank), the report runs with the privileges of the project from where it is run. If credentials are supplied, the data is collected using the ElectricFlow user security access in the credential. Use credentials when you want to access data outside of your project.
- **Locales** - a comma separated list of locales where you would like to render the report. Locale is specified as one or more of the following: en, zh, ja, or ko, which translate respectively to English, Chinese, Japanese, or Korean. If no locale is specified, the default is to use the locale of the ElectricFlow server. For example, a server already set for Chinese will see reports in Chinese with no other changes required. **Note:** Currently, ElectricFlow supports four locales only.
- **Object Type** - the type of object to search (default job)
- **Property** - the property of interest (default outcome) and must be a valid property for the object type selected
- **Property Expression** - an optional mathematical function to apply to your data. For example, elapsed time is recorded in milliseconds. To make a useful report with elapsed times, you may want to show seconds, so this field would be entered as "/1000".
Property Function - the following list contains the aggregation functions to use for data in the chart and table.

<table>
<thead>
<tr>
<th>Function</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>Median</td>
</tr>
<tr>
<td>Count Distinct</td>
<td>Mode</td>
</tr>
<tr>
<td>First</td>
<td>Std Deviation</td>
</tr>
<tr>
<td>Last</td>
<td>Sum</td>
</tr>
<tr>
<td>Min</td>
<td></td>
</tr>
</tbody>
</table>

Report Title - your report title (default Value Over Time Report)

Saved Filter Project - select "Current" or Browse to find the project where you want to save this filter.

Saved Filter Name - the name of a saved filter to use when filtering collected data.

Use the Search tab to create the filter. After entering your search criteria, click OK. If the preview displays the data you want, click Save Filter and provide a Project Name and Filter Name to specify where the filter is saved.

On the Run Report parameters page, select the filter. If you leave the Filter Name no filtering is performed.

**Note:** "Saved filters" can filter on start and end times. Because start and end times are specified in the Time Period parameter, there is a possibility you could select a combination of filter date and time periods that exclude all data. For example, you could select Time Period of "Yesterday" and a filter of Start=less than Jan 1, 1900. To avoid this problem, Electric Cloud recommends you do NOT include dates or times in your filter.

Table Column Heading Property - the table heading for the right column (default Count)

Table Column Heading Time - the table heading for the left column (default Date)

Table Time Grouping - these are: Auto (default), Minute, Hour, Day, Week, Month, Year
• Time Period - these are keywords to define the report start and end times. The range is used to filter collected data. All values are in the local time zone.
  • Today - midnight until now
  • Yesterday - previous full day
  • This week - from the start of the previous Sunday until now
  • Last week - from Sunday to Sunday of the last complete week
  • This month - from the start of the first of this month until now
  • Last month - from the last complete calendar month, which means on January 3rd the last full month is all of December
  • This year - from January 1st until now
  • Last year - all of last year (Jan 1 to December 31)
  • All - all dates until now

Creating Custom reports

The ElectricFlow batch mode reports which, by default, run once each night and are accessed through the Reports tab [in the Electric Cloud project] in the web UI. These reports are built using a combination of the ElectricFlow API and the BIRT Report Designer tool. BIRT is an open source Eclipse-based reporting system you can use to create your own custom reports, or modify existing ElectricFlow reports. This section describes how to write your own custom report and integrate it into ElectricFlow.
There are several steps to using BIRT to create reports:

- Create an XML file with data using the ElectricFlow Perl API
- Design a report using BIRT RCP Report Designer
- Run the report with the BIRT Report Engine
- View the report from within ElectricFlow

Data extraction

To begin creating a custom report, you must first extract report data from ElectricFlow and move it into a standalone XML file. The recommended way to create the XML file is to use the ElectricFlow `ecextract` utility program, which is derived from the Perl API. The benefits of using `ecextract` to create XML files are:

- **Security** - `ecextract` enforces all ElectricFlow security and ACLs. (Direct DB access does not honor ACLs.)
- **Maintainability** - `ecextract` is supported by Electric Cloud, including backward compatibility and insulates you from database schema changes.
- **Simplicity** - `ecextract` provides easy-to-use search and filtering options. Because of the complex nature of our schema, particularly for properties, it may be difficult to create custom SQL statements.
- **Reuse** - You may find that XML files created by built-in reports already contain all the data you need. If you simply want to present data differently or "slice" the data in a different way, you can reuse the XML from the existing built-in reports.

**Note:** If you already use ectool or Perl for data extraction, and have already created the scripts you need for custom reports, you may continue to use those scripts. However, we recommend using `ecextract` if you are new to creating custom reports.

Using `ecextract.pl` for data extraction

A Perl program, `ecextract.pl`, is provided so you do not have to write Perl code—or you can use it as a starter for your own Perl API calls. This script allows you to specify the most common query types on a command line and generates an XML file. The following table lists currently available `ecextract` arguments:

**Usage: ecextract [options]**

<table>
<thead>
<tr>
<th>Data Extract Options:</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>`--type job</td>
<td>jobStep</td>
</tr>
<tr>
<td><code>--property [label=]property</code></td>
<td>Add a property to the output. If label is specified, it is used as the XML tag name instead of the property name.</td>
</tr>
<tr>
<td><code>--filter property, operator, operand1 [,operand2]</code></td>
<td>Add a property filter to the query.</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>--savedfilter filterName</td>
<td>Use a saved filter (ignores --filter)</td>
</tr>
<tr>
<td>--period period</td>
<td>The time period. One of: today, yesterday, thisweek, lastweek, thismonth, lastmonth, thisyear, lastyear, all, window, &lt;number of days&gt;, or range,&lt;start-time&gt;,&lt;end-time&gt;</td>
</tr>
<tr>
<td></td>
<td>Range start, end time is date in ISO 8601 format: YYYY-MM-DDTHH:MM:SS[Z]If the date ends with 'Z', it is considered to be GMT time, otherwise the local timezone is used.</td>
</tr>
<tr>
<td>--sort property, order</td>
<td>Add a sort to the query. Order is either 'ascending' or 'descending'.</td>
</tr>
<tr>
<td>--outputPath</td>
<td>Path and name of output file. Default is out.xml.</td>
</tr>
<tr>
<td>--max</td>
<td>Maximum number of objects to return.</td>
</tr>
</tbody>
</table>

**Server Communication Options:**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--server server</td>
<td>Address for the ElectricFlow server. Defaults to the value of the COMMANDER_SERVER environment variable. If it does not exist, defaults to localhost.</td>
</tr>
<tr>
<td>--port port</td>
<td>HTTP listener port on the server. Defaults to 8000.</td>
</tr>
<tr>
<td>--securePort port</td>
<td>HTTPS listener port on the server. Defaults to 8443.</td>
</tr>
<tr>
<td>--secure 0</td>
<td>1</td>
</tr>
</tbody>
</table>
--timeout seconds  Set the number of seconds for the timeout. Defaults to 280.

Login Options:

--user user  ElectricFlow login user.
--pass password  Password for login user.
--credentialName  Credential name (valid only when running inside a job step).

Global Options:

--help  Print this message and exit without doing anything.
--version  Debug level.
  0 - errors only
  1 - 0 + System progress
  2 - 1 + Property Warnings
  3 and higher give detailed diagnostics

Plugin File Options:

--load loadFile  Plugin perl program to execute
--  Stop processing ecextract options. Allows plugins to process their own options following this option.

teextract.pl is part of the EC-Reports plugin—this script is located in the "agent/bin" directory of the EC-Reports plugin.

Notes:

--property

Properties can be specified as high-level values (--property propertyName), properties in a sheet (--property sheet1/sheet2/propertyName), or as relative paths (--property /myProject/propertyName).
--filter
Each entry consists of a property name to test and an operator to use for comparison. The property can be an intrinsic property defined by ElectricFlow or a custom property added by the user. Each operator takes zero or one operand to compare against the desired property.

The operators are:

contains, equals, greaterOrEqual, greaterThan, in, lessOrEqual, lessThan, like, notEqual, notLike, isNotNull, isNull

Example: --filter jobName,equals,Hello

Examples

The following 3 examples contain the script input and the output.

Example 1: Find properties on job steps for one day in April

ec-perl ecextract.pl ^
--user report ^
--pass report ^
--server localhost ^
--outputPath jobStepOut.xml ^
--type jobStep ^
--max 1000 ^
--property jobId ^
--property finish ^
--property jobStepId ^
--property stepName ^
--property status ^
--property outcome ^
--property runTime ^
--property waitTime ^
--filter jobName,like,commander-2.2%% ^
--filter createTime,greaterOrEqual,2008-04-01T00:00:00.000Z ^
--filter createTime,lessOrEqual,2008-04-02T00:00:00.000Z ^
--sort jobId,descending

Output from example 1

<?xml version="1.0" encoding="utf-8"?>
<response>
  <object objectType="jobStep" objectId="jobStep-3511785">
    <jobId name="jobId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobId>
    <finish name="finish">2009-04-01T23:54:45.424Z</finish>
    <jobStepId name="jobStepId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobStepId>
    <stepName name="stepName">Setup</stepName>
    <status name="status">completed</status>
    <outcome name="outcome">success</outcome>
  </object>
</response>
Example 2: Find all jobs that were created in April 2008

ecc-perl ecextract.pl ^
   --user report ^
   --pass report ^
   --server localhost ^
   --outputPath jobOut.xml ^
   --type job ^
   --max 100 ^
   --property testName ^
   --property testId ^
   --property projectName ^
   --property procedureName ^
   --property branch ^
   --filter createTime,greaterOrEqual,2009-04-01T00:00:00.000Z ^
   --filter createTime,lessOrEqual,2009-04-30T00:00:00.000Z ^
   --sort projectName,ascending ^
   --sort procedureName,ascending ^
   --sort createTime,descending

Output from example 2
<?xml version="1.0" encoding="utf-8"?>
<response>

<object objectType="job" objectId="job-158461">
    <jobName name="jobName">commander-3.2.23916-200904011650</jobName>
    <jobId name="jobId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobId>
    <projectName name="projectName">Commander</projectName>
    <procedureName name="procedureName">Master</procedureName>
    <branch name="branch">3.2</branch>
</object>

<object objectType="job" objectId="job-158455">
    <jobName name="jobName">commander-anders-main-ad.23915-200904011627</jobName>
    <jobId name="jobId">4fa765dd-73f1-11e3-b67e-b0a420524153</jobId>
    <projectName name="projectName">Commander</projectName>
    <procedureName name="procedureName">Master</procedureName>
    <branch name="branch">main</branch>
</object>

Example 3: Find all resources

ec-perl ecextract.pl ^
    --user report ^
    --pass report ^
    --server localhost^
    --outputPath resourceOut.xml ^
    --type resource ^
    --max 100 ^
    --property resourceName ^
    --property stepCount ^
    --property stepLimit ^
    --property hostName ^
    --filter stepCount,greaterThan,0 ^
    --sort resourceName,ascending

Output from example 3

<?xml version="1.0" encoding="utf-8"?>
<response>
Now that you have a dataset, you can create a BIRT report. You need an XML file to use while designing the report. If you did not create an XML data file yet, now is the time to do so. After you have sample data, you are ready to start designing a report.

Report definitions are created with the BIRT Report Designer, currently version 2.5.2. These definitions are then stored in .rptdesign files. You have several options for installing the designer tool:

- Use a BIRT Report Designer bundled and already installed with Eclipse, or
- download BIRT Report Designer to use with your existing Eclipse installation, or
- because Eclipse is not required, you can download only the BIRT Report Designer (this is the easiest and preferred method).

We recommend downloading the BIRT RCP Report Designer only, which is the standalone design tool. The url for downloading the Report Designer is:


The general download page for BIRT 2.5.2 with the other options discussed is

http://download.eclipse.org/birt/downloads/build.php?build=R-R1-2_5_2-201002221500

Using the BIRT Report Designer is beyond the scope of this Help topic. Documentation and tutorials can be found on the BIRT website: http://www.eclipse.org/birt. You may find it helpful to view the report designs for built-in ElectricFlow. These designs can be found in the agent/reports/<report name> directory in the EC-Reports plugin.
Understanding additional report components

In addition to the XML dataset and report design, there are optional report components you may wish to include in your report.

- **External style sheet**
  BIRT supports external style sheets for reports. If you use these style sheets, they need to be located with your report design. For example, built-in ElectricFlow reports use an external style sheet file "styles_birt.css".

- **Externalized string properties**
  String literals (used in your report design) can be externalized into property files to support localization. These property files need to be located with your report design also. The property files for the default locale will have the same name as your report and a ".properties" file extension, for example, CategoryPie.properties. Text for additional locales are stored in files named <report name>_<locale>.properties, for example, CategoryPie_ja.properties contains text localized for the Japanese language.

You may review examples of these additional components for built-in ElectricFlow reports. These files are located in the EC-Reports plugin, in the agent/reports/<report name> directory.

Packaging reports for ElectricFlow

After you have an XML dataset (using `ecextract.pl`), a BIRT report design (using BIRT Report Designer), and any additional optional report components completed, you are ready to integrate your report into ElectricFlow. To do this:

- **Store all the report components in a location accessible to your ElectricFlow agent**—you can use the ElectricFlow plugins directory. For example, for your report files, you could create a directory called "MyReport" in the ElectricFlow plugins directory.

- **Create an ElectricFlow procedure to perform the necessary steps to generate a report**, including: extracting data, running the report design, and registering report output to appear on the Report tab on the Project Details page. You may want to copy one of the procedures from the built-in ElectricFlow reports to use as a template. The following command creates a copy of the RunReport_CategoryPie procedure called RunReport_MyReport in the project of your choice. Substitute your project name for <my-project-name> in the following command.

```
ecctool clone --cloneName/projects/<my-project-name>/procedures/RunReport_MyReport
  --projectName/plugins/EC-Reports/project --procedureName RunReport_CategoryPie
```

**Example: customizing the command body**

The following is an example of customizing the procedure contents for the RunReport_MyReport procedure, cloned from the RunReport_CategoryPie procedure above.

One customization is required and two are optional. The remainder of the command body does not need to be changed.

- **Customizing the location of the BIRT report design file**
  Required: update the location of the BIRT report design file.
• Original value: our $reportDesignFile = "$pluginDir/agent/reports/CategoryPie/CategoryPie.rptdesign";

• Customizing data extraction

To customize data extraction using ecextract.pl, modify the following section of the command body:

```
#-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-
# extractReportData
#
# Extract report data from Commander using ecextract utility
#-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-
sub extractReportData()
{
    # Time property varies based on object type
    my $timeprop = "modifyTime";
    if {
        $timeprop = "finish";
    }

    my $command = "ec-perl \"$pluginDir/agent/bin/ecextract.pl\" "
    . " --debug 3"
    . " --outputPath \"$ecextractXmlFile\""
    . " --credential \"$[Credential]\""
    . " --type \"$[Object Type]\"
    . " --property time=$timeprop"
    . " --property series1="$[Property]"
    if ("$[Saved Filter]" ne "") {
        command = $command . " --savedFilter \"$[Saved Filter]\"
    }

    $command = $command . " --period \"$[Time Period]\"
    print "data extract [$command]n"
    my $result = `$command`;
    print "extract result:\n$result"
    if ($?) {
        exit (1);
    }
}
```
Customizing report parameters
To customize the parameters passed to your report design, modify the following section of the command body:

```
# getReportArgs
sub getReportArgs() {
    # args for creating report
    my $categoryHeading = ucfirst($[Property]);
    my @args = {
        "-f", "$reportFormat",
        "-o", "$reportName",
        "-i", "images/",
        "-p", " xmlfile=../$ecextractXmlFile",
        "-p", "ReportTitle=$reportTitle",
        "-p", "TableColHeadingTime=$categoryHeading",
        "-p", "TableColHeadingSeries1=Count",
        "$reportDesignFile",
    }
    # add locale args
    foreach my $locale (@locales) {
        if ($locale ne "") {
            unshift @args, "-l $locale";
        }
    }
    return @args;

    Helper functions provided in ElectricCommander::ReportUtils.pm
    ecgenReport - runs the BIRT report, using the BIRT Report Designer
```
• **installationDirectory** - this is the directory where ElectricFlow is installed and where you will find JAVA and BIRT

• **artifactDirectory** - this is the directory where reports, images, and other artifacts should be stored. To display using the Reports subtab, these items must be in a directory named "artifacts" at the top of the job's workspace

• **args** - an array of arguments to the BIRT run-time engine, which specifies parameters, design templates, and so on.

**registerReport** - marks the report so it will be displayed when you select the Reports subtab

• **commander** - an `ElectricCommander()` object used to make ElectricFlow calls. If you need to use a specific user context, call the login method before calling `registerReport`

• **jobId** - this is the report job ID, which is used to set properties on the job

• **url** - this is the URL to register and it takes the form workspace name/html file name

• **title** - this is the text string for the report navigation tree

• **treeGroupings** - a hash grouped name/values set as properties to define the report tree groupings—report tree groupings are defined on a propertySheet named `ec_reportConfiguration` on the project or on the server
  - **hash key** - this is a property name that will be created on job's `ec_reportData/$title/property sheet and used for report tree grouping`
  - **hash value** - property value

**registerArtifactsDirectory** - creates the property required to set the artifacts directory

• **commander** - an `ElectricCommander()` object used to make ElectricFlow calls

• **jobId** - this is the report job ID, which is used to set properties on the job

• **artifactsDir** - this is a directory path relative to the workspace where job artifacts will be stored

**extractFile** - this function pulls content from the report definition (stored in properties) and creates files from them

• **commander** - an `ElectricCommander()` object used to make ElectricFlow calls. If you need to use a specific user context, make sure to call the `login` method before calling `registerReport`

• **jobId** - this is the report job ID, which is used to set properties on the job

• **reportType** - this is used to lookup report attributes

• **files** - an array of hashes that specify which properties should be loaded into which files
  - **prop** - the property name from the installed report type
  - **dest** - the destination file name (relative to the current working directory)
  - **expand** - this is "1" if you want ElectricFlow to expand property references in the property, "0" if not

**getReportTimestamp** - return hires timestamp formatted in a specified time zone

• **TimeZone** - (optional) a time zone specifier, default is "local"

• **FormatString** - (optional) a format specifier for the timestamp string
**Custom Report Examples**

This Help topic contains two examples illustrating how you might use the BIRT Report Designer to modify a built-in ElectricFlow report to create a custom report more meaningful for your purposes.

**Example 1: modifying an existing report - adding a "banner" heading**

The easiest way to customize a report is to take an existing report and modify it. ElectricFlow provides a set of built-in reports you can modify.

Process overview for modifying an ElectricFlow built-in report

- Make a copy of an existing report
- Make changes to the report
- Test your new custom report

To copy an existing ElectricFlow report

For this example, we will make a copy of the built-in Value Over Time report. The process to copy a report is:

- Make a copy of the file system report components of the Value Over Time report located in the ElectricFlow plugins directory.

Rename the copied directory to MyReport.

The default location of the ElectricFlow plugins directory is:

- **On Linux:** `/opt/electriccloud/electriccommander/plugins`
- **On Windows:** `C:\Documents and Settings\All Users\Application Data\ElectricCloud\ElectricCommander\plugins`

Linux example - The following commands will make a copy of the Value Over Time report file components and then rename the files:

```
$ cd /opt/electriccloud/electriccommander/plugins
$ cp -r EC-Reports-1.0.0.*/agent/reports/ValueOverTime/ MyReport
$ cd MyReport
$ rename ValueOverTime MyReport ValueOverTime*
```

The contents of the MyReport directory should be:

```
$ ls -l
MyReport_en.properties
MyReport_ja.properties
MyReport_ko.properties
MyReport.properties
MyReport.rptdesign
MyReport_zh.properties
```
styles_birt.css

- Make a copy of the RunReport_ValueOverTime procedure from the EC-Reports plugin that performs the steps to generate a report, including extracting data, running the report design, and registering the report output to appear on the Report tab of the Project Details page. In this example, we will create a Project called “MyReportProject” and the procedure we copy will be called “RunReport_MyReport”.

```bash
$ ectool createProject MyReportProject
      --projectName /plugins/EC-Reports/project --procedureName RunReport_ValueOverTime
response requestId="1"
<cloneName>RunReport_MyReport</cloneName>
</response>
```


- Navigate to project MyReportProject, procedure RunReport_MyReport and select the RunCustomReport step to edit the Command block:

Find the following line:

```bash
our $reportDesignFile = "$pluginDir/agent/reports/ValueOverTime/ValueOverTime.rptdesign";
```

and change this line to:

```bash
our $reportDesignFile = "$ENV{'COMMANDER_PLUGINS'}/MyReport/MyReport.rptdesign";
```

Click **OK** to save the change.

**To modify the copied report design**

Start the BIRT Report Designer and open the report design file (MyReport.rptdesign) located in the MyReport directory previously created in the ElectricFlow plugins directory.

**At this point** You are now ready to begin editing an existing report to create a custom report.
For our example, we are adding a new heading, "Company Confidential," (in large red letters) to the top of the existing report.

1. On the BIRT screen, select the Layout tab.
2. Drag a "Label" from the Palette window into the top of the report and type "Company Confidential" (or whatever text you would like to use for your test report) into the Label box.

See the next BIRT screen example.

3. Now you can change the font size and color to create a banner appearance. Select the Property Editor window to customize your text - see the next screen example.
4. After customizing your text, Save your report.
Congratulations! You have just created a custom report.

Test your new report

Run the report by running the RunReport_MyReport procedure in the MyReportProject project. When the job completes, your new report will be available in the Links section on the Job Details page and from the Reports tab if the MyReportProject project. You will see the new header in the report output.
Example 2: complete end-to-end example

Using BIRT and some scripting expertise, you can create almost any kind of report you can imagine. This example creates a new report that shows the run-time trend of all job steps. Tasks for creating this report can be grouped into the following steps:

- Plan your report
- Create a new BIRT rptdesign file
- Deploy your custom report
- Test your new report

Planning this report example

We decided our report will be a single-series type report that will show job steps runtime. The report will include a line chart at the top of the page whose X and Y axis represent the number of seconds and the job step ID respectively. We also want a table with two columns—column names will be "Job Step Name" and "Run Time".

Next, we need to gather all materials:

Generate sample data to test in the report.

You can use data from a previous run of a Value Over Time report—this file is located in the workspace of a previous reporting job and has the name ecextract.xml.
Also from the copy of an ElectricFlow Value Over Time report, we will "copy and paste" a few values from it to save some typing.

Note: This example briefly describes items we are working with, but for more information about BIRT, you may need to consult BIRT documentation.

Creating a new BIRT rptdesign file

In BIRT Report Designer, create a new rptdesign file. Open the report file you created in "Example 1: modifying an existing report - adding a banner heading" so you can use the previous example report to copy some items into your new report.

Items to copy into the new report:

- From Data Sources, copy ecextract_data
- From Data Sets, copy eceextract
- From Report Parameters, copy xmlfile

See the next screen example to help find these items.

After copying these items, your new report design will look like the following example:
Double-click the Data Sources > ecextract_data file to ensure the XML file is referenced as a parameter. If it is not, type in the value as shown below.
Double-click Data Sources > ecextract_data to ensure the XML Data Source Connection refers to the data file you downloaded earlier. In this example the file is C:\ecextract.xml.

From the Palette window, drag a Chart object into your report. Your view will be similar to the following:

In the New Chart dialog, select Line under Select Chart Type and browse to select PNG for the Output Format.
Click **Next**.

On the next screen:

- Under Select Data, browse to select ecextract.
- Make sure the Use Data From radio button is selected.
- Drag the "series1" header to the Value (Y) Series field.
- Drag the "objectId" header to the Category (X) Series field.
Click **Next** to apply any other formatting changes you choose, then click **Finish**.

On the next screen, after clicking Finish, you have to option to resize the chart as you wish.
You are now ready to drag a Table item from the Palette to the report layout below the chart.
Select "2" columns and the eceextract dataset.

Click OK.
Select the Data Explorer tab and expand Data Sets > extract. See the next screen.
Now you are ready to:

- Drag "objectId" to the left Detail Row.
- Drag "series1" to the right Detail Row.
- Replace the Header Row for "objectId" and "series1" with Job Step Name and Run Time, respectively.

See the next screen example.

Select Preview to see your report.
In the "Enter Parameters" dialog, type the location of your ecextract.xml data file.
Click OK.
Parameters marked with * are required.

XML data file: *

c:\ecextract.xml
At this point, you can continue to make formatting changes to make your custom report look exactly how you want it to look. Our example report, when finished, looked like the following example:
Deploy your custom report

If you have not already done so, save your new report design now. We have named our report design "JobStepRunTime.rptdesign".

The new report design needs to be stored in a location accessible to the ElectricFlow Agent that will run the report. As in the previous example, we will use the ElectricFlow plugins directory for this purpose.

- Save the JobStepRunTime.rptdesign file to a new JobStepRunTimeReport directory in the ElectricFlow plugins directory.

The default location of the ElectricFlow plugins directory is:

On Linux: /opt/electriccloud/electriccommander/plugins

On Windows: C:\Documents and Settings\All Users\Application Data\Electric Cloud\ElectricCommander\plugins

Linux example - The following commands will make a copy of the Value Over Time report file components and then rename the files:

```bash
$ cd /opt/electriccloud/electriccommander/plugins
$ mkdir JobStepRunTimeReport

Now copy the previously saved JobStepRunTime.rptdesign file to the JobStepRunTimeReport directory.

- Make a copy of the RunReport_ValueOverTime procedure from the EC-Reports plugin that performs the steps to generate a report, including extracting data, running the report design, and registering the report output to appear on the Report tab of the Project Details page. In this example, we will create a Project called "JobStepRunTime" and the procedure we copy will be called "RunReport_JobStepRunTime".

```bash
$ ectool createProject JobStepRunTime
$ ectool clone --cloneName /projects/JobStepRunTime/procedures/RunReport_JobStepRunTime
   --projectName /plugins/EC-Reports/project --procedureName RunReport_ValueOverTime
<response requestId="1"
   <cloneName>RunReport_JobStepRunTime</cloneName>
</response>
```

- Edit the "RunReport_JobStepRunTime" procedure in project "JobStepRunTime" to reference the report design file copied earlier.

- Navigate to project JobStepRunTime, procedure RunReport_JobStepRunTime and select the RunCustomReport step to edit the Command block:

![Procedure Details - RunReport_JobStepRunTime](attachment:procedure_details.png)

Find the following line:
our \$reportDesignFile = 
"$pluginDir/agent/reports/ValueOverTime/ValueOverTime.rptdesign";

and change it to:

our \$reportDesignFile = "$ENV{'COMMANDER_PLUGINS'}/
JobStepRunTime/JobStepRunTime.rptdesign";

Click OK to save the change.

Test your new report

Run the report by running the RunReport_JobStepRunTime procedure in the JobStepRunTime project. On the Run Procedure page, change the values of the following parameters:

- Object Type => Job Step
- Property Expression => /1000
- Report Title => Job Step Run Time
Click Run.

When the job completes, your new report will be available in the Links section of the Job Details page and from the Reports tab in the JobStepRunTime project.
System Health Monitoring

You can also use StatsD and Graphite to generate custom reports for system health monitoring in ElectricFlow. After StatsD and Graphite are enabled, reports about a predefined list of items are generated.

This Help topic does not include instructions to set up StatsD and Graphite. Go to the following sites for documentation and tutorials:

- https://github.com/etsy/statsd/

Workflow Overview

Workflow objects
Access Control
Property Search Paths
Parameters
Sending Notifications
Workflow logs
A Workflow Tutorial

Use a Workflow to design and manage processes at a higher level than individual jobs. Workflows allow you to combine procedures into processes to create build-test-deploy lifecycles (for example). A workflow contains states and transitions you define to provide complete control over your workflow process. The ElectricFlow Workflow feature allows you to define an unlimited range of large or small lifecycle combinations to meet your needs.

Some benefits of defining a workflow include

- **Manual intervention** - workflows make it easy to introduce manual decision points into your process. With workflows, you can enable specific users or groups to choose how the workflow should proceed. Using an email notification, you can notify one or more users about the workflow status. If the workflow is waiting for someone to manually intervene, an email (including a screen link) can provide immediate attention and access to choices for how the workflow should proceed.

- **Aggregation** - workflows allow you to collect information from a set of related jobs into a single location. A workflow can act as a central place to monitor the full lifecycle of your build, test, and deploy process.
• **Looping** - workflows provide the native ability to run a job more than once. You have full control over the loop condition—you can re-run the job any number of times, only re-run the job if it did not succeed, or make this decision based on a custom job property.

• **Branching** - workflows allow you to run multiple jobs in parallel and wait for them to complete before moving to the next state in the workflow. If you combine branching with looping, you can re-run these jobs based on a condition you defined (for example, only re-run jobs that failed).

• **Multipathed** - design a workflow to take multiple paths automatically, depending on the outcome of each state’s action, and the pre- and post-triggers you defined for each state.

**Basic workflow concepts**

Workflows contain states—one or more states can be designated as "starting" states to provide multiple entry points into the workflow. When a workflow is launched, a starting state is specified. You may prefer to design a complex or multi-purpose workflow so you can start the workflow at a different state to complete only a portion of the workflow for a particular outcome. For example, you might choose to run only the test suite workflow section.

As each state in a workflow becomes active, it performs an **action**. The state’s action can be to create a job from a procedure or to start a workflow from a workflow definition. When the job or called workflow completes, "On Completion" transitions are evaluated to see if the workflow should change to a different state, possibly based on the outcome of the action.

You can create as many state definitions as you need. For example, you might have a small workflow definition with only 5 states, calling 5 procedures, or you might create 50-100 or more states to process a like-number of procedures from multiple projects.

A state can send email notifications before or after an action to notify interested users about workflow progress or to request manual user intervention to move the workflow to the next state.

Transitions are used to move workflow progress from one state to another state. Four types of transitions are available to move a workflow to the next state:

- **On Enter** – evaluates before sending email notifiers or starting the action
- **On Start** – evaluates immediately after starting the action. These transitions are ignored if no action is specified for the source state.
- **On Completion** – evaluates when the action completes. These transitions are ignored if no action is specified for the source state.

  **Note:** On Completion transitions are taken only if the state is still active when the action completes. These transitions are ignored if the workflow has transitioned to another state.

- **Manual** – evaluates when a user selects the transition in the UI and specifies parameters. The same action can occur using ecctool or the Perl API by calling `transitionWorkflow`. Only users who have "execute" permission on the transition are allowed to use the manual transition.

Similar to other objects in the ElectricFlow system, workflow objects can contain access control privileges, properties, and parameters.
Workflow objects

Workflow objects are split into two types: **Definition** objects and **Instance** objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects.

When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition.

**Note:** We omit the "Instance" qualifier for brevity in the API and the UI.

Workflow Definition

This is the top-level workflow object, which is a container for states, and transitions, and other information defining your workflow. In the same way a procedure defines the behavior of a job, the workflow definition defines the behavior of a workflow.

Create a project to get started:

- Select the Projects tab, then click the **Create Project** link. After creating a project, its name will appear in the table on the Projects page.
- Select your project name to go to its Project Details page, select the Workflow Definitions subtab, then select the **Create Workflow Definition** link.
- On the New Workflow Definition page, name your workflow definition. Access the **Help** link on that page if you need help creating the Workflow Name Template (similar to the Job Name Template). Click **Save**.
- Now, on the Workflow Definition Details page (Graph view), you are ready to create the first state for your workflow.

Click [here](#) to see the Help topic for the Workflow Definition Details page that contains an example of how this page might look as you add states and transitions to your workflow definition. Notice also that you can add properties to the workflow definition at this point.

State Definition

Each workflow can contain one or more states. Defining states for a workflow is analogous to defining steps for a procedure.

You might choose to name your states for their intended purpose (for example: waiting for user, building, testing, or test1, test2, and so on) just as you might name steps for your procedure. You can define multiple states as "startable" so you can choose different starting points when you begin using the workflow. By default, the first defined state is always "startable".

As you create states, they will be displayed in the graph on the Workflow Definition Details page.

Selecting a state in the Graph view opens the State Definition panel to define:

- the action you want this state to perform, along with any parameters required by the action,
- transitions for this state,
- parameters for this state,
• email notifiers for this state,
• and any properties you want to assign to this state.

Transition Definition

Each state can contain one or more transitions. The transition definition requires a name for the transition. This transition name will appear on the Workflow Definition Details graph and the Workflow Definition Details List view.

You can define one or more transitions for each state.

When defining a transition, you can:

• Add a text description for your reference,
• Select the "target" state,
• Select the type of transition trigger you want to use (On Enter, On Start, On Completion, or Manual) See the Workflow Definition Details Help topic for trigger type definitions and other information for defining a transition,
• Select (or enter) a Condition to specify when the transition is allowed to trigger,
• and assign parameters to a transition. These parameters are passed to the target state.

Workflow

While we generically refer to or think of a "workflow" as an automated process to perform multiple tasks, it is actually the end result of running a Workflow Definition. Running a Workflow Definition produces a Workflow, which is analogous to running a Procedure, which produces a Job.

After you start running Workflow Definitions, select the main Workflow tab to see all workflows that ran (or are still running) listed in a table, each linked to its own Workflow Details page. The Workflow Details page main view is a graphical representation of the workflow, and also provides links to stop the workflow process, run the workflow again, see the workflow log, and so on.

A Workflow contains a pointer to:

• its workflow definition,
• sets of states and their transitions,
• the current and initial state,
• parameters to the initial state,
• a "complete" value to specify whether or not the workflow is complete,
• and a log containing transitions taken and user events.

State

The run-time instance of a State Definition is a State. The state is part of a workflow and contains information about actual parameter values specified by the user when the workflow was run or from transitions taken to enter the state.
If the state has an action, then the state contains information about the most recently created job or workflow. Because a state may be entered multiple times, the state contains a copy of the state definition properties needed to launch the action again.

**Note:** After the state is created, it no longer depends on the state definition, so any changes made to the definition will not affect workflows already running. Changes do not take effect until the next time the workflow runs.

**Transition**

The run-time instance of a Transition Definition is a Transition. The transition is part of a state and contains a copy of information from the transition definition. Each transition object corresponds to a transition definition, but once defined, each transition is recognized by its unique name. A transition contains unexpanded actual parameters cloned from definition, expanded and passed to the target state on entry, the Javascript condition, and the trigger type instructing the transition when to occur.

**Note:** After the transition is created, it no longer depends on the transition definition, so any changes made to the definition will not affect workflows already running. Changes do not take effect until the next time the workflow runs.

A transition moves the workflow from its state to a target state.

**Access Control**

Setting access control privileges for those persons who can or cannot run a workflow or execute a manual transition may relate to security policies in your organization.

Specific workflow access control notes:

- All workflow, state, and transition ACLs are copied from the definition object to their corresponding instance when the workflow is run initially.
- To run a workflow, you must have execute permission on the state definition you are using to start the workflow.
- To take a manual transition, you need execute permission on that transition.
- To strictly control who can take a manual transition:
  Grant read and modify privileges to anyone who can view or edit the workflow, but only give execute permission to those users or groups who can take the manual transition.
- You can control who can start each of the startable states by setting ACLs on state definitions accordingly.

**For more information** about access control, including examples you might use, see the Access Control Help topic.

**Property Search Paths**

A workflow serves as a hub of information that can be shared between states, transitions, jobs, and other workflows.
Depending on the context, an implicit search path is used to reference a property by name. Using a simple property name like `${someCustomProperty}` “walks” down the following paths until it finds a property by that name. If the search fails to find a property, an error is produced.

The search path followed to resolve a simple property name depends on where the reference occurs:

**Transition context:**
1. Transition property sheet
2. State property sheet – includes parameter values passed to that state and any custom properties. Because a state can be entered multiple times, parameter values are available for the most recent entry only.
3. Starting state property sheet – used to get to parameter values for the initial entry into the workflow.
4. Workflow property sheet – used to access information shared across the workflow.

**State context:**
1. State property sheet – includes parameter values passed to that state and any custom properties. Because a state can be entered multiple times, parameter values are available only for the most recent entry.
2. Starting state property sheet – used to get to parameter values for the initial entry into the workflow.
3. Workflow property sheet – used to access information shared across the workflow.

For information on context-relative property path shortcuts that allow passing information from one object to another or accessing a property from different parts of the workflow, review the Properties Help topic. The Properties Help topic also includes all intrinsic workflow-related properties.

**Parameters**

States may use formal parameters to determine what information to provide when the workflow enters that state. Parameter values can come from the initial run workflow call or from a subsequent transition into the state.

An automatic transition must specify all values required by the target state. A manual transition may omit some values to be passed to its target state. If a manual transition does not specify all values needed by the target state, then any missing values are collected from the user when the transition is taken.

Parameters to the starting state for the workflow are collected when the workflow is launched. These parameters are accessible throughout the workflow and act like global workflow parameters. See the Property Search Paths section above.

It is important to distinguish between formal parameters on a state and formal parameters on the action the state calls (procedure or workflow starting state). The procedure (or workflow) may have its own parameters, so the state is responsible for entering required actual parameter values. In some cases, values may be static values, in other cases the values may come from the state's parameters or those of the starting state (for example, global workflow parameters).

Parameters on the calling state do not need to be the same as the parameters on the action:

- A state parameter value can be passed as the value for an action's parameter by specifying a property reference in the value field on the Action tab for the state definition.
All parameters on workflow current and starting states are accessible with a simple property reference (for example, '$_{param1}'). Parameters on a workflow starting state act like global workflow parameters because they are available everywhere within the workflow.

Sending Notifications

A state can be defined to send email notifications when it is entered, when it starts its action, and/or when the action completes. Notifiers are created by visiting the Notifications tab on the State Definition panel. See the Email Notifier Help topic for details on defining email notifiers. Sample notifier templates are provided also.

Workflow Logs

Each workflow keeps a log of events that relate to the workflow. The log contains information about the evaluation of transition conditions, transitions taken, actions started, and other information that might prove useful when debugging a workflow. Access the log by clicking the View Log link on the Workflow Details page. For more information, click here to go to the Workflow Log Help topic, which contains a screen example of the Workflow Log page.

Visualizing a Workflow

Two Workflow web pages, Workflow Definition Details and Workflow Details, open to the Graph view.

- Workflow Definition Details page - As you build your workflow, you can see a visual representation of state and transition definitions you define.
- Workflow Details page - displays a graph, updated in real-time, for your running or completed workflow.

Your workflow Graph (on either page) contains context-sensitive links to various options. Options are different depending on whether or not you are building or running your workflow. Workflow Definition Details and Workflow Details Help topics include information about the context-sensitive link options provided within the workflow graph.

The next section, "Building a Workflow - a Tutorial," begins with a "sketched" representation of the workflow the tutorial will create. At the end of the tutorial, see the actual workflow graph created by the ElectricFlow workflow process.

Building a Workflow - a Tutorial

This overview tutorial is an example of how to create a "build-test-approve" workflow, building each state and transition we want the workflow to include, and building the workflow in the order we need to use to achieve our purpose. The diagram below outlines our workflow process.

You can read through the tutorial or actually recreate this example workflow on your machine. If you want to use this tutorial as a real, working example, you must do some initial setup first:

- Create a project named "Sample"
- Create a procedure name "BuildProduct"
- On the "BuildProduct" procedure, add a parameter named "branch"

The following diagram is a visual illustration of the workflow we are going to build.
Reading the diagram:

- the starting state is `Build`, which could transition to the `Test` state or the `Failed` state
- two test states - `Unit Tests` and `System Tests`, which could transition to a `Failed` state or an `Approval needed` state
- the `Approval needed` state could transition to one of two states - `Rejected` or `Approved`
- all transitions are represented by the lines between the states, which include "arrows" to show the possible workflow directions (depending on the outcome of each state's action)

**Best Practice tip**

Designing your workflow on paper or whiteboard, creating your own state and transition diagram, is a great way to organize your thoughts and map your workflow process.

**A summary of the component sections to build our workflow:**

- Calling a job from within a workflow
- Collecting a parameter when a workflow is launched and passing its value to a job
- Retrying a state
- Automatically transitioning to different states based on the outcome of a job
- Invoking another subworkflow
- Running jobs in parallel
- Automatically transitioning to different states based on the outcome of jobs in a workflow
- Waiting for manual intervention
- Restricting who can take a manual transition
- Sending email notifiers
- Adding a global parameter to use later in the workflow
• Setting the name of your workflow
• Workflow list

To begin calling a job from within a workflow

Or, running a job by calling its procedure from a workflow state.

• Select the Projects tab, select the Sample project to go to the Project Details page, then select the Workflow Definitions subtab.
• Click the Create Workflow Definition link to go to the New Workflow Definition page.
• Create a new Workflow Definition named Lifecycle.

Because the workflow definition, Lifecycle, is a new definition and does not have any state or transition definitions, the State Definition panel opens, ready for you to create a new state definition for your workflow.

• Change the system-generated state Name to Build and click OK.
• The State Definition panel is displayed.
Specify the Action for this state, which is Procedure. In this example, the procedure *BuildProduct* already exists with a single parameter named *branch*.

Set the value of this parameter to "3.0".

The *Build* state now has an Action associated with it.

Click **OK**.
Note the shape of this state in the graph. The state shape will be different depending on the state Action selected.

Click **Run** to launch the workflow.

Running the workflow shows a Job was launched by the *Build* state. The workflow job completed successfully, indicated by the "check mark" on the state.

You can get more details about the job by clicking on the *Build* state, which opens the State Details panel, and clicking on the Job link displays the Job Details page.

Alternately, clicking on the Show History button opens the History panel to show what ran and the workflow outcome.

**Collecting a parameter when a workflow is launched and passing its value to a job**

Or, "prompting" for a parameter value when a workflow is launched and passing its value to a procedure.

- Return to the Workflow Definition page for the *Lifecycle* workflow.
- Click the *Build* state (from the graph) to open the State Definition panel, then select the Parameters tab.
- Click the **Create Parameter** link to display the New Parameter page.
- Create a parameter called "branch".
- Add a description and make sure the Required? box is "checked" and click **OK**.
- On the Workflow Definition Details page again, change the value passed to the job from 3.0 to $[branch]$.

Now, when the workflow is launched, you will be prompted for the value of *branch* and you can specify a different value if necessary.

For example, a "3.5" value is now specified in the screen below. The value is passed to the job when the workflow is launched.
Retrying a state

If a State fails (technically, the job started by the workflow state), you may choose to retry it a few times before giving up.

- Create a new transition from the Build state back to itself.
- Right-click on the Build state and select the Create Transition link.
- Create a new On Completion transition named "retry" from the Build state that returns to the same state when the job fails.
- Add a limit of 3 retries by using the following JavaScript condition:

  $\{javascript\ mySubjob.outcome == "error" && myState.getProperty(\'/increment numberOfRetries\') < 3; \}$

- The new transition is displayed on the Workflow Definition Details page.

- When we run the workflow, we see only the last job that was run.
Clicking the States tab and then the **Show All** link displays all jobs that were invoked by the *Build* state.

On this screen, you can see the build was attempted 3 times because that was the limit we specified in the JavaScript condition for the "retry" transition.

Also, you can see the number of times a state was visited and which transitions were taken by clicking the **Show History** button.

**Automatically transitioning to different states based on the outcome of a job**

If the *Build* job fails, we might want to end the workflow. If the job succeeds, we might want to continue to the next stages of the workflow.
- Add new states to transition to, depending on the outcome of the job:
  - Create the *Test* state where the workflow will transition to when the build state succeeds.
  - Create a *Failed* state.

- Create an On Completion transition from *Build* to *Test* when the job succeeds.
- Notice that the Condition dropdown menu provides a template condition called *Job success* that can be used here.

- Create an On Completion transition from *Build* to *Failed* when the job fails.
- Notice that the Condition field remains blank. Because transitions are evaluated in order, if the workflow gets to this transition, we will know that the "success" case will be false.

  Leaving the Condition field "Always" allows us to handle all "non-successful" outcomes (error or warning).
• When you run the workflow, if the build succeeds the workflow will end up in the Test state.

• The workflow will end up in the Failed state if the build fails after trying three times. (In this example, we show the Workflow History panel open.)
Invoking another workflow

Just as a state can invoke a job as its “Action”, it can invoke another workflow, which then becomes its subworkflow.

- From the Workflow Definition Details page for Lifecycle, click on the Test state in the graph.
- Specify the “Action” for the Test state, which is a Workflow.
- In this example, the workflow AutomaticTests already exists and so does a state called UnitTests, which has a single required parameter called buildName.
- We can get the name of the build from the Build state by using the property path $[/myWorkflow/states/Build/subjob/jobName].
- The Test state now has an Action associated with it.
- Because the Test state Action is Workflow, the object shape in the graph has changed.

Running the workflow shows another workflow was launched by the Test state.
- Click on the workflow link in the History panel to see more details about that workflow.

Running jobs in parallel

Run multiple jobs at the same time.
- Look at the AutomaticTests workflow that was invoked (in the previous example) by the Test state in our main Lifecycle workflow. The first state in this workflow runs unit tests, and when the tests complete, the state automatically transitions to the second state that runs system tests.
Now we will change the behavior of the transition to move from the *Unit tests* state to the *System tests* state as soon as the first job is launched.

Edit the existing transition by renaming it to *Kicked off unit tests* and changing it to an On Start trigger type.

Now, when the *AutomaticTests* workflow is launched, both jobs will run in parallel.

The workflow completes automatically when both jobs complete.

Automatically transitioning to different states based on the outcome of jobs in another workflow

If the jobs in the *Test workflow* fail, we will want the workflow to end. If the jobs succeed, we will want to continue to the next stages of a calling workflow.
- Click the **Create State** link.
- Create the *Approval needed* state that the workflow will transition to when tests succeed.
- Create a transition named "Tests succeeded" from *Test* to *Approval needed* when all jobs in the workflow succeed.
  (Right-click on the *Test* state to create the transition.)
- The following JavaScript condition checks the outcome of all subjobs for a subworkflow and evaluates to "true" only if they all succeeded:

```javascript
var success = "1";
for (var stateName in mySubworkflow.states) {
    var subjob = mySubworkflow.states[stateName].subjob;
    if (subjob !== null && subjob.outcome !== "success") {
        success = "0";
        break;
    }
}
success;
```

**Note:** We created the *Approval needed* state first, then we created the *Tests succeeded* transition to connect the two states.
• Create a transition from the Test to the Failed state when either of the jobs in the workflow fails.

• Notice the Condition field remains blank.

• Because transitions are evaluated in order, if the workflow gets to this transition we know the success case was "false".

• When you run the workflow, if the test jobs succeed, the workflow will end up in the Approval needed state.

• In the following example, one of the tests in the Test workflow encountered an error, so the workflow will end up in the Failed state if either of the test jobs fail.
Note: The "blue checkmark" indicates the workflow (or subworkflow) has completed, which means it is no longer running. This icon does NOT indicate the workflow outcome (completed successfully, or with warnings or errors).

To see exactly what happened in the workflow, you can "drill-down" by clicking on the workflow link shown in the History panel.

Waiting for manual intervention

Allow users to choose how to progress the workflow.
- From the Workflow Definition Details page for Lifecycle:
  - Create an Approved state and a Rejected state for the workflow to transition to when a user approves or rejects the build.

- For the Approval needed state, we create a manual transition called Approve that the user can select to progress the workflow to the Approved state.

- Next, we create a manual transition called Reject that the user can select to progress the workflow to the Rejected state.
- At this point, our workflow now looks like the following example.
When you run the workflow and the build and test phases succeed, the new manual transitions are made available to users on the Workflow Details page. **Note:** If a user does not have execute permission for manual transitions, the Manual Transitions section will not be included in the summary section at the top of the Workflow Details page.
- If you choose the Approve transition, the workflow will end up in the Approved state.
• If you choose the Reject transition, the workflow will end up in the Rejected state.

Restricting who can take a manual transition

Only allow certain users to take manual transitions.

• From the Workflow Definition Details page for Lifecycle:
  ◦ When the workflow is created, access control entries from the Transition Definition are copied to the corresponding transition. These are the access control entries for the Approve transition before we edit them (see below).
  ◦ To add access control to a transition, select the transition or transition name.
  ◦ When the Transition Definition panel opens, click the Access Control link,
When the Access Control page is displayed, click the **Add Group** link to add privileges for a group that can take this transition.

**Note**: If you already have groups created, you can use them here or create two groups now: *Lifecycle Approvers* and *Lifecycle Modifiers*.

- Allow read and execute access for a group named *Lifecycle Approvers*. These users can see and take a manual transition in a workflow.
- Allow read, modify, and change permission access for a group named *Lifecycle Modifiers*. These users can edit the Transition Definition, but will not have access to take a manual transition in a workflow.
- "Break the inheritance" so only specified groups have access to this transition.
- Duplicate this access control configuration for the Reject transition.

When a workflow is launched and reaches the Approval needed state, a user who is not a member of the Lifecycle Approvers group will not be allowed to execute any manual transitions.
- A user who is a member of the Lifecycle Approvers group can execute manual transitions.
- The Workflow Details page updates in real-time, which means you will see changes at the top of the page pertaining to the current state in the running workflow, and current changes in the graph also. For example, if the previous state had a manual transition, but the current state now processing does not have a manual transition, the Manual Transition section will not be displayed.
Sending email notifiers

Send email notifications so a user or group knows they need to take an action on a workflow.

- From the Notifications tab for the Approval needed state definition, click the Notifiers tab.
- Click the Create Notifier link.

- We want to create an On Enter email notifier.
- When a workflow enters the Approval needed state, this email notifier will be sent out.
In this example, we want to send an email notification to the "approvers". The email will contain a link to the Workflow Details page and links to all available transitions.

Use this formatting template for the email notifier: [http://docs.electric-cloud.com/commander_doc/5_1/PDF/WorkflowTutorialScript.txt](http://docs.electric-cloud.com/commander_doc/5_1/PDF/WorkflowTutorialScript.txt).

It includes a link to the ElectricFlow workflow, embeds a block of JavaScript that cycles through all the manual transitions from the active state, and has a link to go directly to those transitions. To ensure that the script works properly, use the script as is and make sure there are no white spaces before `<!DOCTYPE...>`, `<html>`, and `</html>`.  

This script is a sample of the type of script you can insert into the Formatting Template field illustrated in the following screen example.
• When a workflow is run and it reaches the Approval needed state, an email similar to the following example can be sent to specified destinations.

Only users who have execute permission on these transitions will be able to approve them by clicking the link.

![Workflow Approval Required](View%20Workflow%20workflow_7_20141212073210)

Adding a global parameter to use later in the workflow

Prompt for a parameter when the workflow is launched, and use its value later in the workflow.

• Currently, there is one parameter for the starting state Build.
• Click on the Build state in the graph and select the Parameters tab.
• Click the Create Parameter link to create a second parameter.

![Workflow Definition Details - Lifecycle](Project%20Details%20-%20Lifecycle)

• Add a checkbox-type parameter named skipTests which, if selected, should skip the test suite after the build is completed.
- Create an On Enter transition from Test to Approval needed if the `skipTests` parameter evaluates to "true". Because this is an On Enter transition, it will be taken before the automated tests workflow is started.

- When the workflow is launched, you will see the `skipTests` checkbox.
If the parameter is checked, and after the Build state is completed, the workflow will immediately transition from Test to Approval needed, without starting the subworkflow.

**Note:** Looking at the workflow History, we see the Test state was entered, but the subworkflow (and subjobs) was not executed.

---

**Setting the name of your workflow**

Choose appropriate names for workflows so they are easy to identify.

- If the Workflow Name Template was not set, workflows are created with a default name (*workflow <jobId> <timestamp>* or *workflow_239_201012091208*, for example). However, because you may have many different workflow definitions, you might want to create a distinguishing name for workflows launched from each definition.

- From the Workflow Definition page for Lifecycle, click the **Edit** link at the top of the page.
• Setting the Workflow Name Template (as shown in the sample below) achieves this goal.

  lifecycle-$[branch$]-workflow-$[/increment /myProject/lifecycle-counter$]

  $[branch$] refers to the value of the branch parameter as specified when the workflow is launched.

  $[/increment /myProject/lifecycle-counter$] creates a property called lifecycle-counter on the project and increments the property every time a new workflow is launched so the names are unique.

• Now, when the workflow is launched, its name is much more descriptive than the default workflow name.
Workflow List

Most of the time, you will want to interact with your workflow from the default Graph view. However, if you want to see your workflow in a list or table view, click the List button. See the Workflow Definition Details Help topic for detailed information about this page.
The transition order is important because transitions are evaluated in order and the first one with a condition that evaluates to 'true' is taken. In the next screen example, the Test state has two On Completion transitions. When the state completes, it evaluates the Tests succeeded transition first. If a third transition was added for the Test state, you could use this List view and Move the transition to the correct order for evaluation.
Another workflow example

An advanced sample Workflow Definition is pre-defined for you in the EC-Examples project. This is a "working" example, also modeling the workflow process, with which you can interact. To navigate to this example: Select the Projects tab > EC-Examples > Workflow Definitions subtab > then select Build Workflow With Approvals.

Workspaces and Disk Space Management

- Defining workspaces
- Using workspaces
  - Workspace directory names
  - Working directories
- Workspace accessibility
  - Local workspaces
- Access control
Impersonation and workspaces

ElectricFlow managed files

Disk space management
ecremotefilecopy

Overview

ElectricFlow provides each job step with an area on the disk it can use for "working files" and results. This disk area is called a **job workspace**. (The job workspace defaults to a directory under the workspace directory.)

- A job step can create whatever files it needs within its workspace, and ElectricFlow automatically places files in the workspace, such as step logs. Normally, a single workspace is shared by all steps in a job, but it is possible for different steps within a job to use different workspaces.
- The location of the job step workspace is displayed on the Job Details page for the job under "Details" for the step.
- Workspaces are grouped together, with workspaces for different jobs allocated as children of the same *workspace root*. When you define procedures, you can specify which workspace roots to use, then ElectricFlow creates a child directory within that workspace root for the job's steps to use.
- The term "workspace" is used at different times to refer to either a job workspace or a workspace root. Depending on the context, it should be easy to discern which "workspace" is being discussed or referenced.

Defining Workspaces

ElectricFlow can handle any number of workspace roots, which are defined by selecting the Cloud > Workspaces tabs on the web interface. To create a workspace root, provide a workspace name and three file paths for jobs to access the workspace:

**Workspace name**

The workspace name must not have trailing spaces.

When two workspaces have similar names, such as "Server1" and "Server1 " (with an extra space at the end), the database records them as two entries, one without trailing spaces and one with trailing spaces.

If you run a job against one of these workspaces, it may hang and not proceed because ElectricFlow is waiting for a resource, an available workspace, or a step to complete.

**UNC path**

A UNC path that Windows machines can use to access the workspace via the network, such as
```
//server/share/x/y/z.
```
You must ensure this path is accessible on any resource where the workspace is used.

**Drive path**

A Windows path, using a drive letter that refers to the same directory as the UNC path. Before running a job step using the workspace, the ElectricFlow agent creates a drive mapping for this path to match the UNC path.
For example, if the UNC path is //server/share/x/y/z and the drive path is N:, the agent will map N: to //server/share/x/y/z. If the drive path is N:/y/z then the agent will map N: to //server/share/x.

The directories in the drive path after the drive letter (y/z in the preceding example) must match the last directories in the UNC path.

UNIX path

A path used on UNIX machines to access the workspace via the network, typically using an NFS mount. You must ensure appropriate mounts exist on all resources where the workspace is used.

If your environment contains Windows machines only, you can omit the UNIX path, and if your environment contains UNIX machines only, you can omit the UNC and Drive paths.

During the ElectricFlow installation, you had the option of defining a workspace. If you defined a workspace, it was named "default" and will be the default workspace for all jobs, as described below.

By default, remote workspaces are accessed with the agent user's credentials. For Windows resources, you can override that user's credential by attaching a credential to the workspace. Using a credential attached to a workspace is useful if the agent machine is not a member of the domain, but the workspace is located on a machine in the domain. An attached credential for a domain user allows the agent to manipulate the workspace as that domain user.

Using Workspaces

The simplest way to use workspaces is to define a single workspace named "default" that is readable and writable on all resources, and never specify any other workspace information. With this approach the default workspace will be used for all steps in all jobs.

However, you can also arrange for different jobs to use different workspaces, or even for different steps within a single job to use different workspaces.

You can specify a workspace name in any of the following ElectricFlow objects:

- If you specify a workspace in the definition of a procedure step, it applies to that step.
- If you specify a workspace in the definition of a procedure, it applies to all steps in the procedure.
- If you specify a workspace in the definition of a project, it applies to all steps in all procedures defined in that project.
- If you specify a workspace in the definition of a resource, it applies to all steps assigned to that resource.

If workspaces are defined in several of these places, the workspace for a particular step is chosen in priority order corresponding to the list above: a workspace specified in a step takes priority over all others, followed by a workspace in the procedure, project, and finally resource. If no workspace is specified in any of these locations, the workspace named "default" is used.

Workspace Directory Names

A job workspace directory name, within its workspace root, is derived from the name of the job.
For example, if a job named "job_63" uses a workspace whose root directory is //ec/workspaces, the job workspace directory will be //ec/workspaces/job_63. Changing the name of a job has no impact on workspace names: the initial name of the job is always used for workspace directory names.

A job is allocated a single job workspace only within a particular workspace root, which will be shared by all steps that specify that root.

For example, suppose a job has 5 steps: 3 steps specify workspace A and 2 steps specify workspace B. The 3 steps that specify A will all share a single directory under A, and the other 2 steps will share a single directory under B.

**Working Directories**

By default, each job step begins execution with its current working directory set to the top-level directory in the job's workspace. A job step can override this location by specifying an explicit working directory. If a job step specifies a relative path for its working directory, the path is relative to the top-level workspace directory.

**Workspace Accessibility**

The simplest way to set up ElectricFlow is to make every workspace root accessible on every resource. This accessibility mode provides the most flexibility and simplifies ElectricFlow system management.

Unfortunately, some environments cannot allow such universal access.

For example, some sites do not provide file sharing between UNIX and Windows machines. In large enterprise environments where ElectricFlow is shared among multiple groups, you may want to partition resources among the groups and limit access by each group to the other groups' resources. In the most extreme case, you may not have network file sharing at all. ElectricFlow can handle all of these cases.

If a workspace root is not accessible on a particular resource, you should not use that workspace in any step that runs on the resource. If you do, the resource will not be able to create the job workspace directory and the step will stall until the issue is resolved. A workspace root (on a resource) must be both readable and writable to be used for job steps.

**Local Workspaces (Disconnected Workspaces)**

Normally, workspaces are shared, which means if the same workspace is used on different resources, they see the same set of files. However, it is possible to define a local workspace (also referred to as a disconnected workspace), which means it will refer to a different local directory on each resource where it is used.

To define a local workspace on Windows, specify a local path such as C:/Windows/Temp/ecworkspace for the drive path.

For UNIX, specify a local UNIX path such as /usr/tmp/ecworkspace. Local workspaces are advantageous because they do not require remote network access and access may be faster in some cases.

However, you cannot share workspace information among job steps running on different resources.

**Note:** Web servers "ask" the relevant agent for access to log files in workspaces. The agent streams the file back to the web server, which then streams the log file to your browser. However, this mechanism works only for Windows and Linux 4.2 (or later) agents. Solaris, MacOS, and HPUX agents must transfer log files to a
workspace proactively so a Linux or Windows agent can access them for the web server—this task can be made easier, using the `ecremotefilecopy` tool. See the `ecremotefilecopy` section in ElectricFlow Installed Tools on page 572 for details.

![Diagram illustrating the architecture](image)

The diagram illustrates the architecture when the web server requests a log file and you have defined a local workspace.

1. The web server asks the local agent to retrieve the file from a workspace.
2. The agent (local to the web server) asks the ElectricFlow server how to find the workspace, and the ElectricFlow server replies with a route to an agent and validates the session ID.
3. The route to the agent that has the file could be: (a) the local agent itself or (b) a different agent that ran the step that produced the file.
   a. The agent (local to the web server) gets the file from its local disk.
   
   or
   
   b. The agent gets the file from some other agent.
4. The agent (local to the web server) sends the file to the web server.

**Access control**

You can restrict access to workspaces using the ElectricFlow access control mechanism. Before a step can use a workspace, it must have the "execute" privilege on the workspace, where "it" means the ElectricFlow user ID under which the step executes (the project principal). You can set permissions on a workspace to enable or disable access as you choose.

**Impersonation and workspaces**

Before a job step can use a particular workspace, three access limitations must be satisfied:

- The job step must have execute access to the workspace object.
If not, ElectricFlow aborts the step with an access control violation. See the Access Control Help topic for details.

The workspace must be accessible on the resource where the step runs.

If not, the ElectricFlow agent is unable to create the step's log file and the step's execution will fail. See Workspace Accessibility (above) for more information.

The Windows or UNIX agent account and/or job step must have read/write access to workspace files.

If not, the step's execution will fail in one of several ways. This issue is the topic of this section.

Potentially, two system accounts can impact each job step execution:

The first account is the one used by the ElectricFlow agent—you selected this account when ElectricFlow was installed. The agent account must have the ability to write the workspace root directory (to create the job workspace directory), and it must have the ability to write the job workspace directory to create log files.

The second account is the one under which the step executes. If the step does not use user impersonation (in other words, no credential has been specified for it), the step runs under the same account as the agent so there are no additional issues. However, if the step is running with credentials, the credentialed account must also have read/write access to the workspace area.

Because of these requirements, you may end up with a configuration where any job step running in a workspace can read or write any file under that workspace root, including files from other jobs that share the same workspace root. In many environments this solution works, but in some situations you may want to prevent one job from accessing files from a different job.

To create job privacy, run all of the job's steps with credentials for a separate account. In addition, run a job step at the beginning of the job that creates a subdirectory within the job workspace and change the protection on that directory to permit access to the credentialed account only. Next, place all private files for the build in the protected subdirectory. These files will not be accessible to other jobs or the agent. The top-level directory in the job workspace still needs to be accessible to the agent so it can read and write log files, but everything in the lower-level directory will be private.

ElectricFlow managed files

ElectricFlow automatically places certain files in the top-level job step workspace directory:

Step logs

When a step's command executes, its standard output is redirected to a log file unique to that step. The log filename is derived from the step name and its unique identifier within ElectricFlow.

For example, a step named "step1" will have a log file with a name like "step1.2770.log", where 2770 is a unique identifier assigned by ElectricFlow. A unique identifier is needed in situations where the same step name occurs multiple times in a job such as multiple invocations of a single nested procedure.

Postprocessor logs
If a step specifies a postprocessor, standard postprocessor output is redirected to a file in the workspace. The postprocessor output file will have a name similar to the step log. For example, "step1.2770-postp.log".

**Diagnostic extracts**

If a postprocessor extracts diagnostic information from a step's log file, it usually places that information in an XML file in the top-level job workspace directory, and then it sets a property that contains the filename. The ElectricFlow postp postprocessor uses filenames like diag-2770.xml, where 2770 is the unique identifier for the step. Other postprocessors may use different filenames.

**Disk space management**

The current ElectricFlow version does not provide a facility for automatically deleting old workspaces. You are responsible for deleting obsolete job workspaces yourself. If you delete a job, ElectricFlow does not automatically delete its workspace. (A future ElectricFlow version may provide automated facilities for identifying and deleting obsolete workspaces—until then, you may wish to create a procedure that runs on a regular schedule and deletes old job workspaces.)

**Tutorials**

The ElectricFlow Help topics in this directory help you learn more about ElectricFlow and specific ElectricFlow tasks.

You can directly access these Help topics from the Help system Table of Contents.

You can also access these Help topics while using the automation platform. Click Help at the top-right corner on any web page in the automation platform.

**Adding a Link to a Job**

ElectricFlow provides an easy method for adding links to the Job Details page to view files and reports for any job where you need to access additional information quickly. Adding direct links eliminates logging into where these files may be stored.

**Note:** The Workflow Details page and several other ElectricFlow web pages also allow adding links.

This tutorial shows how to add links to a job and have them immediately available on the Job Details page.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

**An explanation of what you see:**

- The Procedure Details page for the "Adding a link to a job" procedure contains two steps: Create File and Create Job Link
The Action column displays a code fragment of the script used to create the readme.txt file and a reference for the Create Job Link step. For this example, we want to link to a "readme" file. (You can click on the Create File step name to go to the Edit Step page to see the full ec-perl script shown partially in the Action column.)

Click Run to run this sample procedure and see the resulting job status on the Job Details page, where the new link to the readme.txt file is displayed under the Links heading in the summary section at the top of the page.

Implementation

Use the following instructions if you would like to practice creating a link on the Job Details page now.

Note: Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow. These instructions only coach you through the process you would use to create links on your Job Details pages.

1. In the automation platform UI, click Projects > EC-Tutorials-<version> > Adding a link to a job.
   The Procedure Details page opens.
2. In the Procedure Steps section, click Subprocedure to create a new step based on a subprocedure.
   The Choose Subprocedure Step dialog box opens.
3. To select a project:
   a. Select Project. In the text box, start typing EC-Utilities.
      As you type, possible matches appear in a drop-down list.
   b. When you see EC-Utilities, select it.
4. To select a procedure:
   a. Select Project. In the text box, start typing Create Job Link.
      As you type, possible matches appear in a drop-down list.
   b. When you see Create Job Link, select it.
5. Click OK.
   The New Step page opens.
6. In the General section, Google search in the Name field.
7. In the Parameters section:
   a. In the Link Label field, enter Google Search.
      (This is any name you choose for the name of your link.)
   b. In the Link Location field, enter http://www.google.com
      (This is the URL to your link location, or it can be a relative path to where you want to create a link.)
   c. Click OK to save your entries and return to the Procedure Details page.
8. On the Procedure Details page, click Run.
9. On the Job Details page, as soon as the links are processed you will see the new "Google Search" link in addition to the "readme.txt" link.

Clicking on the new Google Search link will take you to the Google website.
Related Information

**Job Details** - See this Help topic for more detailed information about creating links and complete information on other aspects for using the Job Details page.

**Calling a Subprocedure**

The ability to create *reusable components* is a major ElectricFlow strength. Procedures in any project or plugin can be called as a subprocedure in a step for another procedure. Creating a subprocedure is one way of reusing existing functionality already implemented in ElectricFlow.

This tutorial shows how to use the step configuration process to call an existing procedure to use as a subprocedure.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects > EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see:**

- The Procedure Details page for the Calling a subprocedure procedure contains a step named Execute a procedure from this project. (Clicking on this step takes you to the Edit Step page.)
- The Action column displays a plugin (or project) name, EC-Tutorials, and a procedure name, Working with properties in a stored procedure. (Clicking on the plugin/project name takes you to the Project Details page for that project, and clicking on the procedure name takes you to the Procedure Details page for that procedure.)

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

**Implementation**

Use the following instructions if you would like to practice creating another subprocedure for this "Calling a subprocedure" procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow and cannot be transferred to your procedures. These instructions only provide a clearer explanation for how you can call subprocedures in your projects.

To create a step that executes a subprocedure:

1. On the Procedure Details page, click the **Create Step** link to see the Choose Step Type dialog.
   - Select the Subprocedure tab.
   - Select Plugin and place your cursor in the text field and start typing EC-Tutorials.
   - For Procedure, click inside the text box and select Reserving a Resource for job step duration procedure or whichever procedure you would like to choose.
   - Click **Create** to go to the New Step page to create the step to call an existing procedure to use as a subprocedure.

2. On the New Step page, enter any new step name of your choice. Notice that no parameters are required for this step.
3. Click **OK** to return to the Procedure Details page to see your new step in the table, then click **Run**.

4. When the Job Details page is displayed, you can see your new step and the procedures it is calling.

**Related Information**

Procedure - create new or edit existing procedure - Help topic
Step - create new or edit existing step - Help topic

**Checking the Outcome of Preceding Steps**

ElectricFlow steps can have a *success, warning, error, or skipped* outcome. Sometimes it is useful to execute or skip subsequent steps based on the outcome of a previous step. Used with error handling behavior available at the step level, sophisticated flow control can be achieved easily.

This tutorial demonstrates how to see the outcome of a preceding step and use run conditions to execute steps based on that outcome.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see:**

The Procedure Details page for the procedure, "Checking outcome of preceding step", contains 3 steps:

- **step 1 - force an error** - This step forces an error by attempting to run on a resource that does not exist.
  This action was achieved by hard-coding the step named "step 1 - force an error" to run on a resource called "this-does-not-exist".

- **step 2 - execute if step 1 failed** - This step uses JavaScript to check the outcome of the first step and executes if the first step failed.
  You can view the JavaScript for the run condition by clicking on the step name to take you to the Edit Step page—see the Run Condition field in the Advanced section.
  This statement checks the result of "step 1" for an error. If there is an error, "step 2" will execute.

- **step 3 - execute if step 1 succeeded** - This step also uses embedded JavaScript to check the outcome of the first step and executes if the first step succeeded.
  This is a slight variation of "step 2". Instead of looking at "step 1" for an error, this step checks for success and executes only if "step 1" succeeds.
  You can view the JavaScript for the run condition by clicking on the step name to take you to the Edit Step page—see the Run Condition field in the Advanced section.

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

**Implementation**

Use the following instructions if you would like to practice creating steps to check the outcome of a preceding step.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow and you cannot transfer any steps from this tutorial to your projects. These instruction are provided only to give you a clearer definition for how to recreate this process in your own projects.
• Click the Create Step link.
  ○ In the Choose Step Type dialog, choose Command step to go to the New Step page.
  ○ Enter a Name for your step.
  ○ In the Command(s) text box, you can use the information in the above section. "Copy and paste" the provided JavaScript, changing the step name (between the brackets) to the new step name you supplied.

• Repeat this process to create 3 steps, clicking OK to save each step.

• When your 3 new steps are displayed on the Procedure Details page, click Run to see your steps running on the Job Details page.

Related information

Step - create new or edit existing step - Help topic

Conditional Execution

Process automation frequently contains actions to be executed only if certain conditions are met. Conditional execution can be applied directly to your procedures rather than having to maintain larger scripts to handle these actions. For example, you may need to control whether or not to build on different operating system types.

This tutorial shows you how to implement simple conditional execution in a step.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see:

This procedure defines one parameter and then uses a run condition to check the parameter value to decide whether or not to execute a step.

• The Procedure Details page for the Conditional execution procedure contains a step named step 1.
  (Clicking on this step takes you to the Edit step page.)

• The Action column displays the command to be executed.

• The Parameters section displays a parameter with values.
  The parameter named "Execute step 1" was created as a checkbox.

  If checked, the parameter equates to "true".
  In the run condition for "step 1", the parameter is read using the following property reference notation:
  "[$[Execute step 1]]."

  (Clicking on the Parameter Name takes you to the Edit Parameter page to make modifications you may need.)

Click Run (at the top of the page) to run this sample procedure, which then takes you to the Run Procedure page where you could cause step 1 to execute by selecting the Execute step 1 checkbox.

• Click Run again to go to the Job Details page to see the job created by running this procedure.

Implementation

Review the following instructions if you would like to see how to reproduce a conditional execution step.
Note: Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow. These step-by-step instructions are provided only for more detailed information so you can easily see how to create your own "conditional execution" solutions within your procedures.

- Click the Create Parameter link to go to the New Parameter page.
  - Enter a new parameter name.
  - Click the Type down-arrow and select Checkbox.
  - Select Initially checked?
  - For Default Value, type "true".
  - Select Required?
  - Click OK to save your parameter and return to the Procedure Details page.

- Click the step name to go to the Edit Step page.
  - Change the Run Condition text to check the new parameter name you supplied above.
  - Click OK to return to the Procedure Details page.
  - Click Run to go to the Run Procedure page to see 2 parameters where you can now decide if both are required or not.
  - Click Run to go to the Job Details page.
    - If only 1 parameter was "checked" as required, you will see the "skipped" notation in the Status column.

Related information

More complex run conditions can be implemented using inline JavaScript.
See the tutorial, "Checking outcome of preceding step" for a more complex run condition example.

Custom parameter layouts

By default, parameters for procedures are displayed in alphabetical order based on the parameter name. Using the ec_parameterForm property allows parameters to be displayed in a specified order, different from the default, alphabetized order by name.

This tutorial shows how to create a custom parameter layout for procedures.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see:

- This procedure implements two parameters.
- The Action column contains the command to execute. In this case, the action shows the ec_parameterForm property which was attached to the procedure.
- Notice the checkmarks in the Req? column, which indicates both parameters are "required" each time this procedure runs.
In the Custom Procedure Properties table, notice the "formElement" values supplied to determine the new parameter order.

- If the procedure is run **without** the `ec_parameterForm` property, the parameter input form displays parameters in default, alphabetical order:

  ![Parameter Form](image)

  **Click Run.**

  On the Run Procedure page, notice you are presented with a Parameter section that shows the parameters in reverse order because values supplied for the `ec_parameterForm` property were called to create this new order.

  ![Parameter Form](image)

  The following XML creates the new order for these parameters:

  ```xml
  <editor>
  <formElement>
    <property>second parameter</property>
    <label>this is the label for "second parameter"</label>
    <type>entry</type>
    <required>1</required>
  </formElement>
  <formElement>
    <property>first parameter</property>
    <label>this is the label for first parameter</label>
    <type>entry</type>
    <required>1</required>
  </formElement>
  </editor>
  
  **Click Run** to run this sample procedure and see the resulting job status on the Job Details page.
Implementation

**Note:** This tutorial is intended for viewing, but not modifications within its procedure, and any changes you might make will not be saved when you upgrade ElectricFlow.

However, in your own projects, you can use the sample XML above to change the parameter order in any of your procedures.

If you copy and paste the code samples we provided, using the `ec_parameterForm` property in one or more of your procedures, make sure you replace our example values with your parameter names, labels, and so on. If you have more than two parameters to reorder, create any number of additional `<formElement>` sections you need.

Related information

- [Customizing the ElectricFlow UI / Customizing Parameters - Help topic](#)
- [Step - create new or edit existing step - Help topic](#)
- [Parameter - create new or edit existing parameter - Help topic](#)

Email Notifications

Use email notifiers to send information to people who need or want ElectricFlow notifications, whether or not they actually use ElectricFlow. For example, you might want to set up an email notifier to send log file error excerpts matched by `postp` to a team or individual responsible for investigating the error.

This tutorial illustrates how email notifiers can be attached to steps to automatically send an email when jobs, steps, or workflows execute.

**Prerequisite:** If you do not have an Email Configuration, you must create one before you can set up an email notification. An Email Configuration tells the ElectricFlow server which host to use for mail delivery. Remember the email configuration name you choose because you will need it later.

To view an example procedure for this tutorial, go to the automation platform UI > **Projects** > **EC-Tutorials-<version>**, and click the procedure name.

**An explanation of what you see:**

- A step named "do something" that puts a short message in the log file
- A parameter that defines the email address for where you want to send the notification. This parameter is used as the destination value for the notifier named "start notifier". This notifier sends an email when the procedure runs.
- An email notifier named "start notifier" with its Type specified as "onStart".
  - Click on the notifier name to view the notifier details.
  - Make sure the value in the Email Configuration field matches the email configuration name from the "Prerequisite" section above.
  - Click **OK** to save any changes and return to the Procedure Details page.

Click **Run**.
On the Run Procedure page, in the Parameters section, enter an email address, an address list, or email group name.

Click **Run** again to run this sample procedure and see the resulting job status on the Job Details page.

**Implementation**

**Note:** Use the following information to create an email notifier in your own project, assuming you have already setup an email configuration. Any changes you might make within this tutorial will not be saved when you upgrade ElectricFlow.

Using the ElectricFlow automation platform UI to add an email notifier:

1. On the Procedure Details page, go to the Email Notifiers section, and click **Create On Start Email Notifier**.

   ![Email Notifiers](image)

2. Enter information in the fields on the New On Start Email Notifier page. See the example below.

   ![New On Start Email Notifier](image)

   **Note:** If the Email Configuration field is left blank, the system uses the email configuration with the name "default".

   Click **OK** to save the notifier.

When the procedure is run, an email notification is sent to the email addresses specified in the Destinations field. In this tutorial example, the Destinations field refers to the parameter value passed in to the procedure when it is run.

The value is referenced using the following notation:

$[/myJob/Send notification email to]
Executing Tasks on All Resources in a Pool

Creating resource pools (grouping resources) means you can reference many resources using one name, the pool name. When configuring a step, you can "broadcast" the step to all resources in a pool. For example, you might want to start an application deployment at the same time on all resources in a pool.

This tutorial shows how to group resources into a resource "pool".

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see:

This procedure implements three steps:

1. The first step, Setup environment, creates a pool for resources.
   
   Clicking on the step name takes you to the Edit Step page to see the full command text supplied to create this step—a partial section is displayed in the Action column.

   Note: Functionality to create this step is beyond the scope of this tutorial. For more information, see the link to "Using ectool and the ElectricFlow API" below.

   The following resources were created and added to a pool named EC-Tutorial-pool:
   EC-Tutorials-resource1
   EC-Tutorials-resource2
   EC-Tutorials-resource3

2. The second step, Execute command on all resources in pool, executes an echo statement on the resource EC-Tutorial-pool and has the "broadcast" option selected, which results in the step executing on all resources in the pool simultaneously.

3. The third step, Cleanup, deletes the resources created in the Setup environment step.

Click Run to run this sample procedure and see the resulting job status on the Job Details page.

Implementation

Note: This tutorial is intended for viewing only and/or clicking on the available links to see more information. Any modifications you might make within this tutorial cannot be transferred to your projects and will not be saved when ElectricFlow is upgraded.

Before you can create the steps illustrated in this tutorial procedure for your own purpose, you must have already defined your resources and created resource pools.

See the following list of related links for more help with creating and using resource pools.
Related information

Resources - Help topic
Resource Pool - create new or edit existing pool - Help topic
Resource Pool Details - Help topic
Step - create new or edit existing step - Help topic

Factory Procedures

Factory procedures allow dynamic behavior in process automation. To implement a factory procedure, you must first create a procedure that other procedures can use as a template. A procedure uses the template to construct new procedures at runtime. Instead of creating steps or complex scripts to account for all possible scenarios, procedures can be created "on the fly" based on user input, resulting in a very dynamic system.

This tutorial shows how to create factory (dynamic) procedures, which are procedures that modify themselves at runtime based on parameters passed into them.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation for what you see and what is actually happening:

This tutorial contains 2 procedures and creates a third procedure "on the fly":

- "Factory procedures" - this procedure uses the procedure template (Utility Procedure - Factory Template).
  This procedure has a parameter called "number of steps". This parameter takes an integer and is used to specify how many new steps should be generated.
  Note: For this tutorial example, only one procedure is constructed to use the template procedure, but you may have multiple procedures that use the factory template procedure.

- "Utility Procedure - Factory Template" - you do not see this procedure on this Procedure Details page, but it is included in the EC-Tutorials project. This is the factory procedure template used when generating new steps in the main procedure. This procedure implements a single step that writes some text to the log file.
  This procedure is designed to do a repetitive task, repeating the task a variable number of times. For example, you might need to run a test framework "n" number of times.
  Note: You can view this procedure in the EC-Tutorials project.

The main procedure, "Factory procedures", implements these steps:

- The first step: "create dynamic procedure" is a Perl script that uses the Perl API to create a new procedure.
  The following script creates a new procedure containing the number of steps specified by the parameter:
  
  ```perl
  my $procedureName = "Dynamically Created Procedure $[jobId]";
  $ec->createProcedure("${[/myProject/projectName]},$procedureName);
  for(my $i=0;$i<[$number of steps];$i++)
  {
  ```
  ```
  ```
```
$ec->createStep("$/myProject/projectName","Generated step $i","Utility Procedure - Factory Template", 
    actualParameter => {actualParameterName => 'text', value => "Executing generated step $i"});
}
$ec->setProperty("/myJob/dynamicProcedure",$procedureName);

1. First, the procedure generates a unique name for the new procedure to be created. The name is created by appending the value of the $[jobId] property string.
2. A new procedure is created in the current project.
3. Based on the number of steps to be created that were passed in as a parameter, a number of subprocedure steps are created in the procedure. The subprocedure steps call the utility procedure associated with this tutorial.
4. The name of the newly created procedure is stored in /myJob/dynamicProcedure.

- The second step: "Run dynamically created procedure" calls the procedure that was created in Step 1. Step 2 appears to call nothing, but in fact it is calling a procedure referred by $[/myJob/dynamicProcedure].

Click Run to run this sample procedure and go to the Job Details page.

Running the procedure and specifying the number of steps to be generated as 3, results in the following job being executed:

![Job Details](image)

Notice the steps that execute in parallel in the dynamically created procedure:
Generated step 0, Generated step 1, and Generated step 2

Implementation

To create a "factory procedure" process in your project:
1. Create a utility procedure - this procedure performs a task.
   - Create the steps you need for your task.

2. Create a second procedure - the “factory procedure,” providing a name of your choice for this procedure.
   - Create a minimum of 3 steps in this procedure.
     - step 1 - create a new procedure that contains steps, each calling the utility template procedure.
     - step 2 - this step executes the procedure created in step 1.
     - step 3 - this step deletes the procedure created in step 1.

Each time you run the “factory procedure,” it creates a temporary procedure to run the utility procedure.

Note: Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

Postp extension

*postp* is a powerful ElectricFlow feature (postprocessor) you can use to monitor step output in real-time and take action. Frequently, the *action* is to extract information from step output, store it in the ElectricFlow database, and set properties for reporting. In addition, postp can be used to execute functionality depending on whether or not a pattern is found. Postp, an essential part of the ElectricFlow toolbox, provides fast feedback to users about job step status.

Note: Postp matchers are written in Perl. Postp extensions are either loaded from a file located on the ElectricFlow server or from a stored property.

This tutorial demonstrates how to construct a simple custom *postp* matcher to extend postp capabilities, and loads the postp extension from a property.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see:

- This procedure implements a single step, "get directory listing", that retrieves a directory listing using a simple Perl script. Perl is used for the example to ensure the same output no matter which operating system is used for this tutorial. Understanding the Perl code used to generate the tutorial listing is not required for this tutorial.
- A property was created. This procedure has a postp extension attached in a property named `matcher` and contains the following Perl code:

```perl
use ElectricCommander;
push (@::gMatchers,
   {
     id => "fileCountMatcher",
     pattern => q{\d+ File\s+},
     action => q{
       setProperty("summary", "Matcher $matcher->id found the following output
       output\n$n$1");
     }
   });
```
The postp matcher has an identifier ("id"), a regular expression ("pattern") that matches text and an "action" to be performed when text matching the regular expression is found. In this case, the regular expression "id" is fileCountMatcher, and an example of the output being matched is "2 File(s)". When the pattern is matched, the action to perform is to set the summary property to the text matched by the regular expression.

The custom postp matcher is loaded using the following command in the Postprocessor field when creating the step:

    postp -loadProperty /myProcedure/matcher

Click on the step name to go to the Edit Step page to see how this step was created—note the text in the Command box and the Postprocessor field.

Click Run to run this sample procedure and see the resulting job on the Job Details page.

See the Status column. The number of files in the file system root where the workspace is located is displayed.

![Job Details](image-url)

### Implementation

To try using postp functionality in your own project:

- Edit an existing procedure or create a new one with a "matcher" as a property.
  For your practice example, you can "copy and paste" the matcher example provided in this tutorial (above).
- Create a new Command step for this procedure - filling in the Postprocessor field on the New Steps page.
  Again, for practice, you can use the postp string provide above in this tutorial.

When you run your new procedure, you will see results similar to those you saw after running the tutorial example procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

### Related information

- [Postprocessors](#) - Help topic
- [Step - create new or edit existing step](#) - Help topic
Publishing and Retrieving an Artifact

To ensure traceability in processes, output needs to be versioned and tracked as it is handed from one process stage to another. With ElectricFlow Artifact Management, implementing your processes is auditable and secure.

This tutorial shows how to produce and consume artifacts as part of an ElectricFlow process.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see - the following concepts are illustrated in this procedure:

- The first five steps are simple ec-perl scripts that create files and directories as use as an artifact.

  The first step, "Create myartifact.txt file", creates a text file in a workspace that can be added as an artifact. Click this step to go to the Edit Step page to see the full "dummy" script used to set up the artifact in the Command(s) field. This script creates a file named myartifact.txt.

  Note: There is no code specific to ElectricFlow in this step, so understanding the Perl code used to generate the text file is not necessary.

  The next four steps create a directory, a subdirectory and the second text file in it.

- The "Publish artifact" step calls the EC-Artifact:Publish procedure. This step is configured to place the file myartifact.txt, created in the Setup step, into an artifact.

  To do this, the EC-Artifact:Publish procedure requires the following information:

  - The artifact where you want to publish. This is in the format Artifact Group:Artifact Key.
    In this case, the name of the artifact (where you want to publish) is EC-Tutorials:MyArtifact.

  - The artifact version being published. The version is in the form of major.minor.patch-qualifier-buildnumber or major.minor.patch.buildnumber-qualifier. For this tutorial, the version is set to 1.0.$[jobId]-tutorial.
    Using the $[jobId] property expansion results in a new artifact being created every time the procedure is run.

  - The repository server from which you need to retrieve the artifact. This tutorial uses a repository named default that was created when ElectricFlow was installed.

  Note: To see how this information is specified in this step, click the "Publish artifact" step name to go to the Edit Step page.
The "Retrieve artifact" step calls the EC-Artifact: Retrieve procedure. This step takes two required parameters and several optional parameters (see the Edit Step page/Parameter section for this step). The required parameters are:

- **Artifact** – EC-Tutorials:MyArtifact (this is the name of the artifact to retrieve).
- **Version** – 1.0.$[jobId]-tutorial (this is the artifact version to be retrieved - either an exact version or a version range). This tutorial uses an exact version.

The optional parameters are:

- **Retrieve to directory** – the location where the artifact files are downloaded when they are retrieved. This is where the retrieved artifact versions are stored.
- **Overwrite** – the default is update where the artifact files are updated when they are retrieved. The other values are true (the files for the retrieved artifact versions are overwritten) or false (the files for the retrieved artifact versions are not overwritten).

The Retained Artifact Location Property parameter is the name or property sheet path that the step uses to create a property sheet. The default value is

/myJob/retrievedArtifactVersions/$[assignedResourceName].

This property sheet has information about the retrieved artifact versions, including their location in the file system. It displays the location from where the artifact is to be retrieved and retrieves the property value in the /myJob/retrievedArtifactVersions/$[assignedResourceName].

For the Filter(s) parameter, enter search filters, one per line, applicable to querying the ElectricFlow database for the artifact version to retrieve.

For more information about these parameters, go to Retrieve Artifact Version Step.

- The "Output location that artifact was retrieved to" step prints the message "Artifact extracted to: <directory where the retrieved artifact will be located>".
- Click Run to run this sample procedure and see the resulting job on the Job Details page.

**Implementation**

To publish and retrieve artifacts, apply these concepts to your artifact projects, creating the steps as required to your procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

**Related information**

- Artifact Management - Help topic
- Artifact Details - Help topic
- Job Details - Help topic
- Publish Artifact Version step - Help topic
- Retrieve Artifact Version step - Help topic

**Reserving a Resource for Job Step Duration**
Sometimes you may want a resource to perform work for only one job at a time. Because a ElectricFlow agent is capable of executing steps for many jobs on a resource, this can produce undesirable performance results. For example, you might want a dedicated resource to stress test an application after you have ElectricFlow initiate a load testing task.

This tutorial shows how to reserve a resource for one job step only while that job step is running.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see:

- This procedure locks the resource for the step and executes the tasks.
- To demonstrate this functionality, two steps are implemented.
  - Notice that both steps are set to run in parallel on the local resource.
  - Both steps request a lock of the resource for the duration of the step execution.

The functionality implemented in each step:

- A simple Perl sleep statement to force a lock over a period of time when the procedure is run
- Select "Step" in the Retain Exclusive field in the Advanced section on the New/Edit Step page

Click a name in the Step Name column (to go to the Edit Step page for that step). You will see the Perl sleep statement added to the Command text box, and "Step" selected on the Retain Exclusive field.

Instead of running the steps in parallel as you may have previously requested, the steps will now execute serially. The second step must wait for the resource to become available because it was reserved by the first step.

Click Run to run this sample procedure and see the resulting job on the Job Details page.

Implementation

Create or edit Command Steps for your procedures if you need this functionality.

- Go to the Procedure Details page for the procedure where you want a step to reserve a resource.
- Add a Command Step to your procedure (use the step creation link at the top of the table), or edit an existing step.
- In the Command text box, enter a script if you want to specify any time constraints.
- On the New/edit Steps page, in the Advanced section, choose "Step" in the Retain Exclusive field.

The next time you run this procedure, your job step will have exclusive use of the resource you specified.

Note: Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

Related information

Step - create new or edit existing step - Help topic

Running Steps in Parallel
The main advantage to running steps in parallel is increased performance. You can set a step to run serially as a synchronization point and then execute more steps in parallel. For example, running steps to execute tests on different platforms concurrently would mean numerous tests could complete in the same time period.

This tutorial demonstrates how to run steps in parallel.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

**An explanation of what you see:**

This procedure contains 5 steps:

- Step 1 and 2 run in parallel.
- The third step (sync) is a sync point where the procedure waits until steps 1 and 2 finish executing.
- Steps 4 and 5 execute in parallel after the sync point.
- Steps 1, 2, 4, and 5 execute simple Perl scripts that print a message and "sleep" for a period of time.
  
  **Note:** Using "sleep" is not required, but used here to make sure each parallel step runs long enough to be visible while running this tutorial.

Click **Run** to run this sample procedure and see the resulting job status on the Job Details page.

**Implementation**

**Note:** Use the following information to create steps to run in parallel in your procedures. Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

Steps will run in parallel if you select the Run in Parallel option in the Advanced section on the Step - create new or edit existing step page.
Step Timeouts and Steps that Always Run

Complex processes can be brittle so ElectricFlow provides a way to account for different errors in your procedures. You can specify timeouts, error handling methods, and steps that always run no matter what errors have occurred in preceding steps in the procedure. These facilities can make sure your build does not "hang" in a situation where you would prefer the build to continue.
This tutorial shows how to construct a procedure so processes are terminated after a set time period and how to implement a step that always runs in the event of an error (to perform cleanup).

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see:

This procedure implements 2 steps:
(Clicking on the step name takes you to the Edit Step page to see how the step was created.)

- The "force timeout" step has a 10-second timeout and is set to abort the procedure and terminate running steps in the event of a timeout or error.

  This step executes a sleep command using ec-perl, which makes the step execute for 15 seconds. Step error handling is set to "Abort procedure and terminate running steps". This step will always fail because the 15-second sleep time is longer than the 10-second timeout.

- The "always run" step set to run no matter what the error handling behavior is for any preceding steps.

  This step uses an echo statement to output some text. The step property, Always Run Step, is set to "true" so this step runs regardless of the result for the preceding step.

Click Run to run this sample procedure and see the resulting job on the Job Details page.

On the Job Details page: Notice that the "always run" step completed with Success while the "force timeout" step completed with a TIMEOUT error.

Implementation

Note: This tutorial is intended for viewing only. Any changes you might make within this tutorial cannot be transferred to your projects will not be saved when you upgrade ElectricFlow.

As you create steps for your projects, you can duplicate these tutorial concepts. On the New Steps page, review the Advanced section. Notice the Error Handling and Always Run Steps options.

- For Error Handling, choose the option that best suits your purpose.
- For the Always Run Step option, select the checkbox to ensure this step will always run.

Storing and Retrieving Properties in a Job

When a job is running, it is often necessary to share data between steps. Because the data being shared is specific to the running procedure instance, the job, the data is more appropriately stored at the job level rather than the procedure level. Use the techniques illustrated in this tutorial to safely pass data between steps in a job.

This tutorial shows you how to create, set, and retrieve properties stored on a job.

To view an example procedure for this tutorial, go to the automation platform UI > Projects > EC-Tutorials-<version>, and click the procedure name.

An explanation of what you see:

This procedure implements two steps.
• Write data to a property attached to the running job:
  "Step 1 - Create a property attached to the job" calls ectool to create a property name property1.
  ○ The path to the property being set is "/jobs/${myJob}/property1.
  ○ ${/myJob} is a shortcut to the running job name and can be used while the job is running. If the
    job number was 1000, the path "/jobs/${myJob}/property1" might expand to
    "/jobs/job-1000/property1".

• Read data from the property created in Step 1:
  "Step 2 - Read the property attached to the job by Step 1" - this step could read step values stored on a
  job, running as part of the job, or could be executed using a simple property expansion.
  ○ In this case, property1 was set in Step 1 and is referenced in Step 2 using the ${property1}
    notation.
  ○ Two other ways to reference a property (shown by example in the Action column):
    • Using ${/myJob/property1}
    • Using inline JavaScript with the notation ${javascript myJob.property1}

Click Run to run this sample procedure and see the resulting job on the Job Details page.

• After the job completes, click the icon in the Log column for Step 2 to view three lines each showing the
  data (the property value) that was stored in the property that was retrieved.

Implementation

If you need to retrieve properties, adapt these step concepts to your procedures.

• For help getting started, click on a step name in the tutorial procedure to go to the corresponding Edit
  Step page.
• You can reuse the text supplied in the Command(s) box, changing the "property1" name and other
  values to those more meaningful to your project/procedure.

Note: Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.

Related information

  Procedure - create new or edit existing procedure - Help topic

  Step - create new or edit existing step - Help topic

Working with Properties Stored in a Procedure

Using ElectricFlow properties is one of the keys to robust yet flexible process automation. Configuration and
historical data persistence are common tasks in process automation.

This tutorial shows common ways to read and write properties on a procedure.

Note: For this tutorial, familiarity with creating procedures and steps is assumed. See the "Related Information"
links below if you would like to review these topics.

To view an example procedure for this tutorial , go to the automation platform UI > Projects > EC-Tutorials-
<version>, and click the procedure name.
An explanation of what you see—this procedure implements the following functionality:

- This procedure implements five steps. Each step name is a description of its action.
  - Click on a step name to go to the corresponding Edit Step page to see how the step was created. This page also contains text in the Description text box to describe what you see in the Action column on the Procedure Details page. The full text of what appears in the Action column is provided in the Command text box.
  - In the Custom Procedure Properties table, notice two properties were created: `property1` and `property2`

- There are numerous ways to work with stored properties. Each of the 5 steps described below illustrates a different method.
  - Read data from `property1` using the property substitution notation (syntax): The property value is read in this step using the property substitution reference ${/myProcedure/property1}.
  - Read data from `property1` using inline JavaScript: The property name `property1` is read from the procedure level using this JavaScript notation: `${javascript myProcedure.property1}`.
  - Perform a calculation using data from `property2` and inline JavaScript: In this example, the value of `property2` is multiplied by 5 using this JavaScript notation: `${javascript myProcedure.property2 * 5}`.
  - Read data from `property1` using the ElectricFlow Perl API: Perl code is used to call the ElectricFlow API to retrieve the value of `property1`. The getProperty API returns an object so the property value must be retrieved after the getPropertyName call, using the findnodes method for the returned object.

    ```perl
    #read the property
    my $property1node = $ec->getProperty("/myProcedure/property1");
    #retrieve the property value from the object returned to $property1node
    my $property1 = $property1node->findnodes("//value")->string_value();
    ```
  - Read data from `property1` using ectool: ectool code is used to retrieve the value of `property1`:

    ```perl
    ectool getProperty "/projects/${[projectName]/procedure/Working
    with properties stored in a procedure/property1"
    ```

Click **Run** to run this sample procedure and see the results on the Job Details page.

On the Job Details page, click the icon in the Log column to see the value read from the property.

**Implementation**

If you need to retrieve properties stored in a procedure, adapt any one of these step concepts to your procedures.

You can reuse the text supplied in the Command(s) box (from any Edit Step page in this tutorial), changing names and other values to those more meaningful to your project/procedure.

**Note:** Any changes you make within this tutorial will not be saved when you upgrade ElectricFlow.
Related Information

- Procedure - create new or edit existing procedure - Help topic
- Step - create new or edit existing step - Help topic
- Properties - Help topic

Glossary

This glossary is a reference topic containing short descriptions for ElectricFlow objects, terms, and concepts.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>access control</td>
<td>An access control list (ACL) determines if a particular user can perform a particular operation on a specified object. The list contains <em>access control entries</em> (ACE), each of which specifies a user or group and indicates whether certain operations are allowed or denied for that user or group. Using access control provides security for ElectricFlow system use. See the <strong>Access Control</strong> topic for more information.</td>
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<td>ACE (Access Control Entry)</td>
<td>An ACL determines if a particular user can perform a particular operation on a specified object. The list contains <em>access control entries</em> (ACE), each of which specifies a user or group and indicates whether certain operations are allowed or denied for that user or group. Using access control provides security for ElectricFlow system use. See the <strong>Access Control</strong> topic for more information.</td>
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<tr>
<td>ACL (Access Control List)</td>
<td>An ACL determines if a particular user can perform a particular operation on a specified object. The list contains <em>access control entries</em> (ACE), each of which specifies a user or group and indicates whether certain operations are allowed or denied for that user or group. Using access control provides security for ElectricFlow system use. See the <strong>Access Control</strong> topic for more information.</td>
</tr>
<tr>
<td>actual parameter</td>
<td>An actual parameter is an object that provides the value for a parameter, which is passed to a procedure when it is invoked. Actual parameters can be provided for jobs and nested subprocedures within a job. Actual parameters are different from &quot;formal parameters&quot;: formal parameters define parameters a procedure is expecting, and actual parameters provide values to use at run-time.</td>
</tr>
<tr>
<td>admin</td>
<td>&quot;admin&quot; is a special built-in user that has universal ElectricFlow access. If you log in as admin, you can perform any operation in the system, regardless of access control limitations.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
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</tr>
<tr>
<td>agent</td>
<td>An agent is an ElectricFlow component that runs on each machine where job steps can execute. The agent works under the ElectricFlow server's control to execute job steps, monitor their progress, and record information about their completion. A single agent process can manage multiple job steps executing concurrently on a single machine. See the Web Interface Help &gt; Resources topic for more information.</td>
</tr>
<tr>
<td>artifact</td>
<td>An artifact is a top-level object containing artifact versions, a name template for published artifact versions, artifact specific properties, and access control entries to specify privileges.</td>
</tr>
<tr>
<td>artifact key</td>
<td>An artifact key is an identifier for an artifact and the &quot;key&quot; component of the artifact name.</td>
</tr>
<tr>
<td>artifact repository</td>
<td>See the Artifact Management &gt; Artifact objects &gt; Repository topic for more information.</td>
</tr>
<tr>
<td>artifact version</td>
<td>An artifact version is a collection of 0 to N files that were published to an artifact repository.</td>
</tr>
<tr>
<td>backing store</td>
<td>The backing store is the directory on the repository server where artifact versions are stored. By default, the backing store is the &lt;datadir&gt;/repository-data directory in the repository installation—this default setting can be changed.</td>
</tr>
<tr>
<td>compression</td>
<td>Compression reduces transfer time when publishing an artifact. However, compression also adds overhead when computing the compressed data. If files included in the artifact version are primarily text files or are another highly compressible file format, the benefit of reduced transfer time outweighs the cost of computing compressed data.</td>
</tr>
<tr>
<td>continuous integration</td>
<td>Using continuous integration means a build is launched every time code changes are checked into a Source Control Management (SCM) system. The ElectricFlow ElectricSentry component is the engine for continuous integration, while the CI Continuous Integration Dashboard is the front-end user interface for ElectricSentry.</td>
</tr>
<tr>
<td>credential</td>
<td>A credential is an object that stores a user name and password for later use. You can use credentials for user impersonation and saving passwords for use inside steps. Two credential types are available: stored or dynamic.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
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</tr>
<tr>
<td>custom property</td>
<td>Custom properties are identical to intrinsic properties and when placed on the same object, are referenced in the same manner and behave in every way like an intrinsic object-level property with one exception: they are not created automatically when the object is created. Instead, custom properties can be added to objects already in the database before a job is started, or created dynamically by procedure steps during step execution. Custom properties in a property sheet can be one of two types: <em>string</em> property or a <em>property sheet</em> property. String properties hold simple text values. Property sheet properties hold nested properties. Nested properties are accessed by way of the property sheet property of their containing sheet.</td>
</tr>
<tr>
<td>description</td>
<td>A description is an optional plain text or HTML description for an object. Description text is for your use, ElectricFlow does not use this information. If using HTML, you must surround your text with <code>&lt;html&gt; ... &lt;/html&gt;</code> tags. The only HTML tags allowed in the text are: <code>&lt;a&gt;</code>, <code>&lt;b&gt;</code>, <code>&lt;br&gt;</code>, <code>&lt;div&gt;</code>, <code>&lt;dl&gt;</code>, <code>&lt;font&gt;</code>, <code>&lt;i&gt;</code>, <code>&lt;li&gt;</code>, <code>&lt;ol&gt;</code>, <code>&lt;p&gt;</code>, <code>&lt;pre&gt;</code>, <code>&lt;span&gt;</code>, <code>&lt;style&gt;</code>, <code>&lt;table&gt;</code>, <code>&lt;tc&gt;</code>, <code>&lt;td&gt;</code>, <code>&lt;th&gt;</code>, <code>&lt;tr&gt;</code>, <code>&lt;ul&gt;</code>.</td>
</tr>
<tr>
<td>diagnostic extract</td>
<td>A diagnostic extract is a log file portion from a job step, typically describing an error or interesting condition, extracted by a postprocessor and saved for reporting. The postprocessor usually places this information in an XML file in the top-level job workspace directory, and then sets a property that contains the filename. The ElectricFlow postp postprocessor uses filenames like <code>diag-2770.xml</code>, where “2770” is the unique identifier for the step. Other postprocessors you may use can have a different filename configuration.</td>
</tr>
<tr>
<td>dynamic credential</td>
<td>Dynamic credentials are captured when a job is created. Dynamic credentials are stored on the server temporarily until the job completes and then discarded.</td>
</tr>
<tr>
<td>ec-perl</td>
<td><em>ec-perl</em> is a small wrapper program installed as part of ElectricFlow. When the ec-perl wrapper runs, it sets up the environment, finds, and calls ElectricFlow's copy of Perl, passing all of its parameters to Perl.</td>
</tr>
<tr>
<td>ectool</td>
<td><em>ectool</em> is the ElectricFlow command-line application that provides control over the ElectricFlow system if you prefer using a command-line interface rather than the ElectricFlow web interface. Most functions that can be invoked through the ElectricFlow web interface can be invoked using ectool.</td>
</tr>
<tr>
<td>Term</td>
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</tr>
<tr>
<td>ElectricAccelerator</td>
<td>ElectricAccelerator is a software build accelerator that dramatically reduces software build times by distributing the build over a large cluster of inexpensive servers. Using a patented dependency management system, ElectricAccelerator identifies and fixes problems in real time that would break traditional parallel builds. ElectricAccelerator plugs into existing Make-based infrastructures seamlessly and includes web-based management and reporting tools.</td>
</tr>
</tbody>
</table>
| ElectricSentry     | ElectricSentry is the ElectricFlow engine for continuous integration, integrating with numerous Source Control Management (SCM) systems. ElectricSentry is installed automatically with ElectricFlow and is contained in a plugin named ECSCM and in the Electric Cloud project.  
  **Note:** The CI Continuous Integration Dashboard is the front-end user interface for ElectricSentry. |
| email configuration| Before you can send an email notifier, you must set up and email configuration, which establishes communication between the ElectricFlow server and your mail server.                                                                                     |
| email notifier     | After setting up the ElectricFlow server and your mail server to communicate, you can send email notifications (notifiers). You can attach email notifiers to procedures, procedure steps, and state definitions.                                               |
| Event log          | See log.                                                                                                                                                                                                      |
| Everyone           | A special intrinsic access control on page 1120 group that includes all users.                                                                                                                                   |
| filter             | Two filter categories:  
  - Intrinsic filters - these filters provide a convenient way to access certain well-defined fields for jobs.  
  - Custom filters - these filters allow you to access a much broader range of values, including custom properties. Any values accessible through an intrinsic filter can be checked using a custom filter also (though not as conveniently). |
<p>| formal parameter   | A formal parameter is an object that defines a parameter expected by a procedure, including its name, a default value, and an indication of whether the parameter is required. Formal parameters are different from &quot;actual parameters&quot;: formal parameters define the kinds of parameters a procedure is expecting, and actual parameters provide values to use at run-time. |</p>
<table>
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<tr>
<td>gateway</td>
<td>To communicate with a resource, workspace, or artifact repository server in another zone, a &quot;gateway&quot; must be created. A gateway object contains two resource (agent) machines. For example, GatewayResource1 and GatewayResource2 are each configured to communicate with the other. One gateway resource resides in the source zone and the other in the target zone. A gateway is bidirectional and informs the ElectricFlow server that each gateway machine is configured to communicate with its other gateway machine (in another zone).</td>
</tr>
<tr>
<td>group</td>
<td>A group defines a collection of users for access control purposes. A group can be defined externally in an LDAP or Active Directory repository, or locally in the ElectricFlow server. See the ElectricFlow Help &gt; Web Interface Help &gt; Users and Groups &gt; Groups topic for more information.</td>
</tr>
<tr>
<td>impersonation</td>
<td>Impersonation is a mechanism that allows a job step to execute under a particular login account (the ElectricFlow agent &quot;impersonates&quot; a particular user during the execution of that step). Impersonation is implemented using credentials. See the ElectricFlow User Guide for more information.</td>
</tr>
<tr>
<td>inheritance</td>
<td>A feature of the ElectricFlow access control mechanism where access to a particular object is determined by the access control list for that object, and also by the access control lists of the object's parent and other ancestors. Each object can be configured to enable or disable inheritance from its ancestors.</td>
</tr>
<tr>
<td>intrinsic property</td>
<td>Intrinsic properties represent attributes that describe the object to which they are attached. ElectricFlow automatically provides intrinsic properties for each similar type object within ElectricFlow. For example: Every project has a description property that can be referenced with a non-local property path such as /projects/Examples/description.</td>
</tr>
<tr>
<td>job</td>
<td>A job is the output associated with invoking an ElectricFlow procedure. A new job is created each time you run (execute) a procedure.</td>
</tr>
<tr>
<td>Term</td>
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</tbody>
</table>
| job configuration| A job configuration is an object containing all parameter and credential information needed to run a procedure. A Job Configuration section is provided as part of the ElectricFlow Home page to make it easy for you to invoke your favorite configurations with a single mouse click. You can create job configurations in three ways:  
  - From the Job Details page for a previously invoked job, click the **Save Configuration** link at the top of the page. Your saved job configuration will be displayed on your Home page.  
  - Create a job configuration from "scratch" by clicking the **Create** link in the Job Configurations section (on the Home page). In the Create Configuration pop-up menu, select the project and procedure you want to use for creating this configuration.  
  - On the page for editing a schedule, click the **Save Configuration** link at the top of the page. Your saved configuration will be displayed on your Home page. |
| job name template | This is the template used to determine the default name for jobs launched from the procedure. You can create a Job Name Template when you create a procedure.  
  For example:  
  In the Job Name Template field, you might enter:  
  
  ```
  ${projectName}_${increment}/myproject/jobCounter_${timestamp}
  ```  
  
  which produces a name like:  
  `projectFoo_1234_20140102130321`  
  You can enter any combination of elements to create procedure names more meaningful to you. For example, you could choose to include the build number and procedure name. |
<p>| jobs quick view   | A Jobs Quick View section is one of the facilities provided on the ElectricFlow Home page. This section allows you to define a category of jobs interesting to you (such as all running jobs or all jobs for a particular product version). Your Home page can display the last several jobs in each category you define. |
| job step         | After a procedure is executed, the resulting job contains one job step for each step in the original procedure. The job step records information about the procedure step execution, such as the command executed, the resource where it executed, execution time, and error information. |</p>
<table>
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<tbody>
<tr>
<td>job workspace</td>
<td>A directory (containing all files and subdirectories) allocated by ElectricFlow for a particular job. Each job workspace is allocated as the child of a workspace root directory. See workspace on page 1137.</td>
</tr>
<tr>
<td>local group</td>
<td>A group defined inside ElectricFlow, as opposed to a group defined in an external repository. A local group can refer to both local and remote users, whereas a group in an external repository refers to users in that repository only. See group.</td>
</tr>
<tr>
<td>local user</td>
<td>A user defined inside ElectricFlow, as opposed to a user defined in an external repository. If a user defined in an external repository has the same name as a local user, the external user is not accessible. Local users are not visible outside ElectricFlow. We recommend using external accounts whenever available, but you may need to create local users if you do not have a shared directory service or if you need special accounts to use for ElectricFlow only. See user.</td>
</tr>
</tbody>
</table>
| log             | ElectricFlow provides a log for events generated anywhere in the system, including jobs and workflows.  

**Note:** From the Administration tab, the default view for the Event Log page is the warning (WARN) level. For workflow and job event logs, the default view from their respective pages is the information (INFO) level.

- To see *only* events for a single workflow, select the Workflows tab, then a workflow Name to go to the Workflow Details page and click the View Log link at the top of the page.
- To see *only* events for a single job, select the Jobs tab, then the Job name to go to the Job Details page and click the View Log link at the top of the page.
- To see *only* events for a specific object, select the Search tab to go to the Define Search page.

For example:  
You can select the Object Type, "Log Entry", then click the **Add Intrinsic Filter** link. Select the down-arrow where you see "Container" auto-populated and select "Container Type. Use the "equals" operator, then select the next down-arrow to choose an object. Click **OK** to start the search.  
See the ElectricFlow Help > Web Interface Help > Event Log topic for more information. |
<table>
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</table>
| matcher          | A *matcher* controls the postp postprocessor. Use *matchers* to extend postp with additional patterns if you find useful patterns in your log files undetected by postp.
A *matcher* contains a pattern that matches lines in a step’s log and actions to carry out if/when the pattern matches. |
| misfire policy   | A misfire policy allows you to manage how a schedule resumes in cases where the normal scheduled time is interrupted.
Available options are:
  - `skip` (all misfires are ignored and the job runs at the next scheduled time) and
  - `run once` (after one or more misfires, the job runs at the soonest time that occurs within an active region).
  See schedule on page 1132. |
| parameter        | A property value passed into a procedure when it is invoked (at *run* time), and used by the procedure to change its behavior. Two types of parameters: *actual* and *formal*. |
| plugin           | A plugin is a collection of one or more features, or a third-party integration or tool that can be added to ElectricFlow. Plugins are delivered as a JAR file containing the functional implementation. When a plugin is installed, the ElectricFlow server extracts the JAR contents to disk into a configurable plugins directory.

  A plugin has an associated project that can contain procedures and properties required by the implementation. A plugin can provide one or more new pages for the web interface and may also provide a configuration page so you can provide additional information that may be necessary to implement the plugin.

  For a complete list of plugins that are bundled with ElectricFlow, see Plugins That are Bundled with ElectricFlow on page 1138. |
<p>| polling frequency| The <em>polling frequency</em> is how often the ElectricSentry continuous integration engine is set to look for new code check-ins. The default is set to every 5 minutes, but this number can be adjusted. |
| pool             | Also known as &quot;resource pool&quot;. A <em>pool</em> is a collection of resources. If a step specifies a pool name as its resource, ElectricFlow can choose any available resource within that pool. |</p>
<table>
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<tr>
<td>postp</td>
<td><em>postp</em> is a postprocessor included with ElectricFlow. <em>postp</em> uses regular expression patterns to detect interesting lines in a step log. <em>postp</em> is already configured with patterns to handle many common cases such as error messages and warnings from <em>gcc</em>, <em>gmake</em>, <em>cl</em>, <em>junit</em>, and <em>cppunit</em>, or any error message containing the string &quot;error.&quot; <em>postp</em> also supports several useful command-line options, and it can be extended using &quot;matchers&quot; to handle environment-specific errors. See <a href="#">matcher</a>.</td>
</tr>
<tr>
<td>postprocessor</td>
<td>A postprocessor is a command associated with a particular procedure step. After a step executes, the postprocessor runs to analyze its results. Typically, a postprocessor scans the step log file to check for errors and warnings. Also, it records useful metrics such as the number of errors in properties on the job step, and extracts step log portions that provide useful information for reporting. ElectricFlow includes a standard postprocessor called <em>postp</em> for your use and you can &quot;extend&quot; <em>postp</em>. See <a href="#">matcher</a>.</td>
</tr>
<tr>
<td>preflight build</td>
<td>A preflight build provides a way to build and test a developer's changes before those changes are committed. A &quot;post-commit&quot; source tree is simulated by creating a clean source snapshot and overlaying the developer's changes on top of it. These sources are then passed through the production build procedure to validate the changes work successfully. Developers are allowed to commit their changes only if the preflight build is successful. Because developer changes are built and tested in isolation, many common reasons for broken production builds are eliminated.</td>
</tr>
</tbody>
</table>
| privileges    | ElectricFlow supports four privilege types (for access control and security) for each object:  
  - Read - Allows object contents to be viewed.  
  - Modify - Allows object contents (but not its permissions) to be changed.  
  - Execute - If an object is a procedure or it contains procedures (for example, a *project*), this privilege allows object procedures to be invoked as part of a job. For resource objects, this privilege determines who can use this resource in job steps.  
  - Change Permissions - Allows object permissions to be modified. |
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<tbody>
<tr>
<td>procedure</td>
<td>A procedure defines a process to automate one or more steps. A procedure is the ElectricFlow unit you execute <em>(run)</em> to carry out a process. A step in one procedure can call another procedure (in the same or different project), and this procedure then becomes known as a &quot;subprocedure&quot; (also known as a &quot;nested&quot; procedure). The step can pass arguments to the subprocedure.</td>
</tr>
</tbody>
</table>
| project            | A project is a top-level container for related procedures, workflows, schedules, jobs, and properties, which is used to isolate different user groups or functions, and also encapsulate shared facilities. Projects have two purposes:  
  - Projects allow you to create separate work areas for different purposes or groups of people so they do not interfere with each other. In a small organization, you might choose to keep all work within a single project, but in a large organization, you may want to use projects to organize information and simplify management.  
  - Projects simplify sharing. You can create library projects containing shared procedures and invoke these procedures from other projects. After creating a library project, you can easily copy it to other ElectricFlow servers to create uniform processes across your organization. |
<p>| project principal  | <em>Project principal</em> is a special user ID associated with each project. If a project name is &quot;xyz,&quot; the project principal for that project is &quot;project: xyz&quot; (with an embedded space). This principal is used when procedures within the project are run, so you can create access control entries for this principal to control runtime behavior. |</p>
<table>
<thead>
<tr>
<th>Term</th>
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</tr>
</thead>
</table>
| property    | A property is a name-value pair associated with ElectricFlow objects to provide additional information beyond what is already built into the system. Built-in data is accessible through the property mechanism also. Two types of properties: intrinsic and custom. ElectricFlow provides intrinsic properties and allows you to create custom properties. Note: Intrinsic properties are case-sensitive. Custom properties, like all other object names in the ElectricFlow system, are case-preserving, but not case-sensitive.  
  - Intrinsic properties  
    These properties represent attributes that describe the object to which they are attached, and are automatically by ElectricFlow for each similar type object. For example, every project has a Description property that can be referenced with a non-local property path such as /projects/Examples/description.  
  - Custom properties  
    Custom properties are identical to intrinsic properties and when placed on the same object, are referenced in the same manner, and behave in every way like an intrinsic object-level property with one exception: they are not created automatically when the object is created. Instead, custom properties can be added to objects already in the database before a job is started, or created dynamically by procedure steps during step execution. |
<p>| property sheet | A property sheet is a collection of properties that can be nested to any depth. The property value can be a string or a nested property sheet. Most objects have an associated &quot;property sheet&quot; that contains custom properties created by user scripts. |
| proxy agent  | A proxy agent is an agent on a supported Linux or Windows platform, used to proxy commands to an otherwise unsupported agent platform. Proxy agents have limitations, such as the inability to work with plugins or communicate with ectool commands. |
| proxy resource | This resource type requires SSH keys for authentication. You can create proxy resources (agents and targets) for ElectricFlow to use on numerous other remote platforms/hosts that exist in your environment. |
| proxy target | A proxy target is an agent machine on an unsupported platform that can run commands via an SSH server. |
| publisher    | A publisher is the job that completes the publish operation for an artifact version. |</p>
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</tr>
</thead>
<tbody>
<tr>
<td>quiet time</td>
<td>An inactivity period before starting a build within a continuous integration system. This time period allows developers to make multiple, coordinated check-ins to ensure a build does not start with some of the changes only—assuming all changes are checked-in within the specified inactivity time period. This time period also gives developers an opportunity to &quot;back-out&quot; a change if they realize it is not correct. Using ElectricSentry, the inactivity time period can be configured globally for all projects or individually for a single project.</td>
</tr>
<tr>
<td>reports</td>
<td>ElectricFlow provides multiple reports and custom report capabilities to help you manage your build environment.</td>
</tr>
<tr>
<td></td>
<td>• Real-time reports - filtered view of your workload in real-time</td>
</tr>
<tr>
<td></td>
<td>• Build reports - summary reports produced at the end of a build and attached to the job</td>
</tr>
<tr>
<td></td>
<td>• Batch reports - summaries of your build environment with trends over time, two types:</td>
</tr>
<tr>
<td></td>
<td>• Default Batch reports - automatically installed during ElectricFlow installation and scheduled to run daily (Cross Project Summary, Variant Trend, Daily Summary, Resource Summary, Resource Detail)</td>
</tr>
<tr>
<td></td>
<td>• Optional Batch reports - you can configure, rename, and schedule these reports to fit your requirements (Category Report, Procedure Usage Report, Count Over Time Report, Multiple Series Reports)</td>
</tr>
<tr>
<td></td>
<td>• Custom reports - your choice to create and add at any time</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
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<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>repository or repository server</td>
<td>The artifact repository is a machine where artifact versions are stored in either uncompressed tar archives or compressed tar-gzip archives. The repository server is configured to store artifact versions in a directory referred to as the repository <strong>backing store</strong>. By default, the backing store is the <code>&lt;datadir&gt;/repository-data</code> directory in the repository installation—this default setting can be changed. A repository is an object that stores artifact versions. This object primarily contains information about how to connect to a particular artifact repository. Similar to steps in a procedure, repository objects are in a user-specified order. When retrieving artifact versions, repositories are queried in this order until one containing the desired artifact version is found. Connection information is stored in the repository object on the ElectricFlow server.</td>
</tr>
</tbody>
</table>
| resource                  | A resource specifies an agent machine where job steps can be executed. Resources can be grouped into a "pool", also know as a "resource pool." ElectricFlow supports two types of resources:  
  - **Standard** - specifies a machine running the ElectricFlow agent on one of the supported agent platforms  
  - **Proxy** - requires SSH keys for authentication. You can create proxy resources (agents and targets) for ElectricFlow to use on numerous other remote platforms/hosts that exist in your environment. |
<p>| schedule                  | A schedule is an object used to execute procedures automatically in response to system events. For example, a schedule can specify executing a procedure at specific times on specific days. Three types of schedules are available: Standard, Continuous Integration, and Custom (custom schedules are typically continuous integration schedules that do not use the ECSCM plugin). |
| Sentry schedule           | A continuous integration schedule created using the ElectricSentry engine for continuous integration or the CI Continuous Integration Dashboard, which is an easy-to-use front-end user interface for the ElectricSentry engine. |</p>
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<tbody>
<tr>
<td>shortcut</td>
<td>One type of shortcut is part of the ElectricFlow Home page facility and records the location of a page you visit frequently (either inside or outside of ElectricFlow), so you can return to that page with a single click from the Home page. Another type of shortcut is a context-relative shortcut to property paths. This shortcut can be used to reference a property without knowing the exact name of the object that contains the property. You might think of a shortcut as another part of the property hierarchy. These shortcuts resolve to the correct property path even though its path elements may have changed because a project or procedure was renamed. Shortcuts are particularly useful if you do not know your exact location in the property hierarchical tree.</td>
</tr>
<tr>
<td>state</td>
<td>Workflows always have a single active state. Each state in a workflow, when it becomes active, can perform an action. A state can run a procedure to create a subjob or run a workflow definition to create a subworkflow—in the same way that procedures can call other procedures. One or more states can be designated as &quot;starting&quot; states to provide multiple entry points into the workflow. See state definition.</td>
</tr>
</tbody>
</table>
| state definition | Workflow objects are split into two types: Definition objects and Instance objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects.  
When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition.  
**Note:** We omit the "Instance" qualifier for brevity in the API and the UI.  
Each workflow can contain one or more state objects. Defining states for a workflow is analogous to defining steps for a procedure. |
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>step</td>
<td>A step is a procedure component. Each step specifies a command to execute on a particular resource or a subprocedure (nested procedure) to invoke. Commonly created steps include:</td>
</tr>
<tr>
<td></td>
<td>- Command - This step invokes a <code>bat, cmd, shell, perl</code> script, or similar.</td>
</tr>
<tr>
<td></td>
<td>- Subprocedure - This step invokes another ElectricFlow procedure.</td>
</tr>
<tr>
<td></td>
<td>- Plugin step - These include task-specific steps. Depending on which step-type you choose, the information you need to enter is somewhat different. Some of the step types bundled with ElectricFlow include:</td>
</tr>
<tr>
<td></td>
<td>- Publish or retrieve artifact version</td>
</tr>
<tr>
<td></td>
<td>- Send Email</td>
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<tr>
<td></td>
<td>- Various SCM step types</td>
</tr>
<tr>
<td></td>
<td>- Build tools</td>
</tr>
<tr>
<td>stored credential</td>
<td>Stored credentials are given a name and stored in encrypted form in the database. Each project contains a list of stored credentials it owns. These credentials are managed from the Project Details page.</td>
</tr>
<tr>
<td>subprocedure</td>
<td>Creating subprocedures is a way of &quot;nesting&quot; procedures. A step (from any procedure) can call a procedure from another project or the same project. The procedure called by the step then becomes a subprocedure.</td>
</tr>
<tr>
<td>substitution</td>
<td>A mechanism used to include property values in step commands and elsewhere. For example, if a step command is specified as &quot;echo $[status]&quot;, and when the step executes there is a property named &quot;status&quot; with value &quot;success&quot;, the actual command executed will be &quot;echo success&quot;.</td>
</tr>
<tr>
<td>system object</td>
<td>This is a special object whose access control lists are used to control access to some ElectricFlow internals. System objects are: admin, artifactVersions, directory, emailConfigs, forceAbort, licensing, log, plugins, priority, projects, repositories, resources, server, session, and workspaces.</td>
</tr>
<tr>
<td>tag</td>
<td>A way to categorize a project to identify its relationship to one or more other projects or groups. You can edit a project to add a tag. Enter a tag if you want to categorize or &quot;mark&quot; a project to identify its relationship to one or more other projects or groups.</td>
</tr>
<tr>
<td></td>
<td>- For example, you might want to tag a group of projects as &quot;production&quot; or &quot;workflow&quot;, or you might want to use your name so you can quickly sort the project list to see only those projects that are useful to you.</td>
</tr>
<tr>
<td>Term</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</table>
| transition      | Transitions are used to move workflow progress from one state to another state. Four types of transitions are available to move a workflow to the next state:  
  - On Enter - transitions before sending notifiers or starting the sub-action  
  - On Start - transitions immediately after starting the sub-action. These transitions are ignored if no sub-action is specified for the source state.  
  - On Completion - transitions when the sub-action completes. These transitions are ignored if no sub-action is specified for the source state. **Note:** On Completion transitions are taken only if the state is still active when the sub-action completes, and are ignored if the workflow has transitioned to another state—this can occur if an On Start or Manual transition occurred before the sub-action completed.  
  - Manual - transitions when a user selects the transition in the UI and specifies parameters. The same action can occur using ecplot or the Perl API by calling transitionWorkflow. Only users who have "execute" permission on the transition are allowed to use the Manual transition. See **transition definition**. |
| transition definition | Workflow objects are split into two types: *Definition* objects and *Instance* objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects.  
  When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition.  
  **Note:** We omit the "Instance" qualifier for brevity in the API and the UI.  
  Each state can contain one or more transition objects. The transition definition object requires a name for the transition. This transition name will appear on the Workflow Definition Details page for quick reference and also on the State Definition Details page when you select the Transition Definitions tab.  
  You can define one or more transitions for each state, depending on which transition options you want to apply to a particular state. |
<p>| user            | A user defines an account used to log into the system and control access to ElectricFlow objects. A user can be defined externally in an LDAP or Active Directory repository, or locally in ElectricFlow. See <strong>local user</strong>. |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>workflow</td>
<td>You can use a workflow to design and manage processes at a higher level than individual jobs. For example, workflows allow you to combine procedures into processes to create build-test-deploy lifecycles. A workflow contains states and transitions you define to provide complete control over your workflow process. The ElectricFlow Workflow feature allows you to define an unlimited range of large or small lifecycle combinations to meet your needs. See workflow definition.</td>
</tr>
<tr>
<td>workflow definition</td>
<td>Workflow objects are split into two types: Definition objects and Instance objects. Definition objects provide the template for a running workflow instance. You create a new workflow by defining a Workflow Definition along with its State Definition and Transition Definition objects. When you run the workflow definition, the system creates a new Workflow object with an equivalent set of State and Transition objects that represent the run-time instances of the workflow definition. Note: We omit the &quot;Instance&quot; qualifier for brevity in the API and the UI.</td>
</tr>
<tr>
<td>workflow name template</td>
<td>This is the template used to determine the default name of jobs launched from the workflow definition. For example: !==$[projectName]$[$[increment /myproject/workflowCounter]$[timestamp]] !== (substitute your values for the names above) Produces a workflow name like: projectName_123_20140102130321</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
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<tr>
<td>-----------------------</td>
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</tr>
<tr>
<td>workspace</td>
<td>A workspace is a subtree of files and directories where job file data is stored. The term &quot;workspace&quot; typically refers to the top-level directory in this subtree.</td>
</tr>
<tr>
<td>workspace root</td>
<td>A workspace root is a directory in which ElectricFlow allocates job workspace directories. Each workspace root has a logical name used to refer to it in steps and procedures.</td>
</tr>
<tr>
<td>zone</td>
<td>A zone is a way to partition a collection of agents to secure them from use by other groups—similar to creating multiple top-level networks. For example, you might choose to create a developers zone, a production zone, and a test zone—agents in one zone cannot directly communicate with agents in another zone. A default zone is created during ElectricFlow installation. The server implicitly belongs to the default zone, which means all agents in this zone can communicate with the server directly (without the use of a gateway).</td>
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# Appendix A: Plugins That are Bundled with ElectricFlow

The following plugins are bundled with this version of ElectricFlow.

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