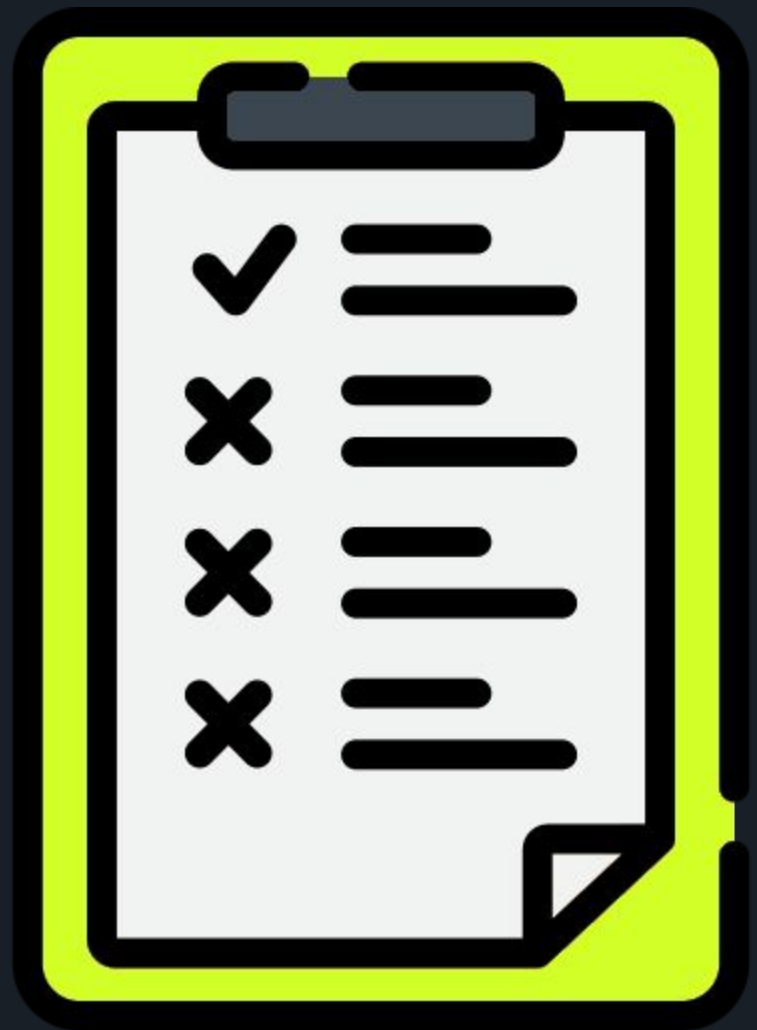KANSAS CITY
N91
2024

SET YOUR EXCHANGE
TO fullauto

A full ctl JOINT

Agenda

- Introductions
- Definitions
- Philosophies
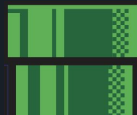- Principles
- Examples

Chris Grundemann

- 20+ years in networking
- Co-founder of IX-Denver
- OIX Chair
- 8 patents in NetTech
- Co-founder and CEO at FullCtl

Matt "Grizz" Griswold

- 20+ years in software development
- Co-founder of UIX / ChIX
- PeeringDB Director
- PeeringDB Maintainer
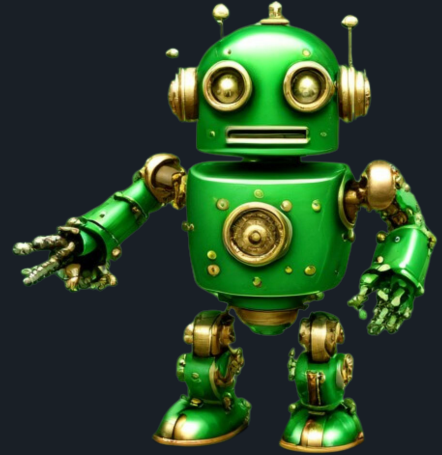- Co-Founder and CTO at FullCtl

What does "fullauto" even mean?

FullAuto == fully automated

Maybe a bit cheeky

Still - why wouldn't you want to fully automate your internet exchange?

But what does "fully automated" mean?

"Fully" not very concrete…

Automation vs Orchestration…

Observability???

What we mean…

SoT synchronization

Route server management

Switch port management

Member management

Traffic graphs

Self-serve

Cool story - but why?

Automation sounds like a lot of work…

If it ain't broke…

CLI: '*Never gonna give you up*'

Hey, CLI,

I just wanna tell you how I'm feeling

Gotta make you understand

Never gonna give you up

Never gonna let you down

Never gonna run around and desert you

Never gonna make you cry

Never gonna say goodbyyyyyyyyyyyyyyyyeeee…

Full Auto Philosophy

Machines > Humans

Humans > Machines

I'm convinced; full auto, let's go!

So… How?

Principles

KISS
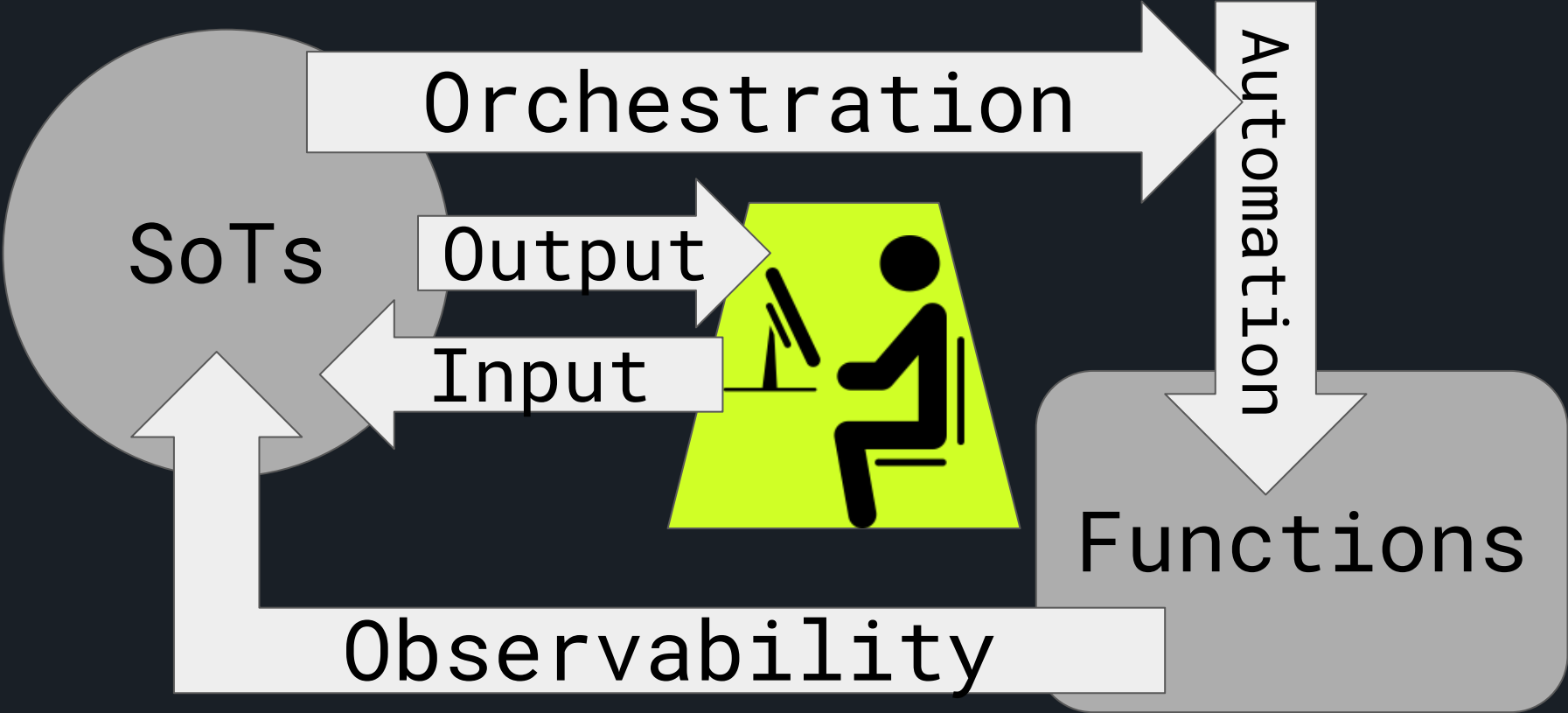
Leverage existing OSS

Do not reinvent the wheel

Modular

Redundant

Basic Architecture

Zoom in: Sources of Truth

SoTs

Zoom in: Sources of Truth

Zoom in: Sources of Truth

SoTs

- IPAM
- DCIM
- NMS
- AAA
- PeeringDB
- IX Operator Portal
- IX User Portal
- Time Series DBs

NetBox   vs   IXPManager

- General Purpose
- Extensible w/ plugins/apps
- 93% Python
- 288 Contributors
- 14,800 "stars"
- 405 watching
- 2,400 forks

- Specialized Use-Case
- "Full stack web application"
- 94% PHP
- 24 Contributors
- 351 "stars"
- 41 watching
- 155 forks

Data Schema

General Purpose has downsides

So, we're working on an IX specific data schema for NetBox / Nautobot…

● Coming Soon: BCOP

Time Series DB(s)

- MRTG & RRDTool are great, but…
- sFlow
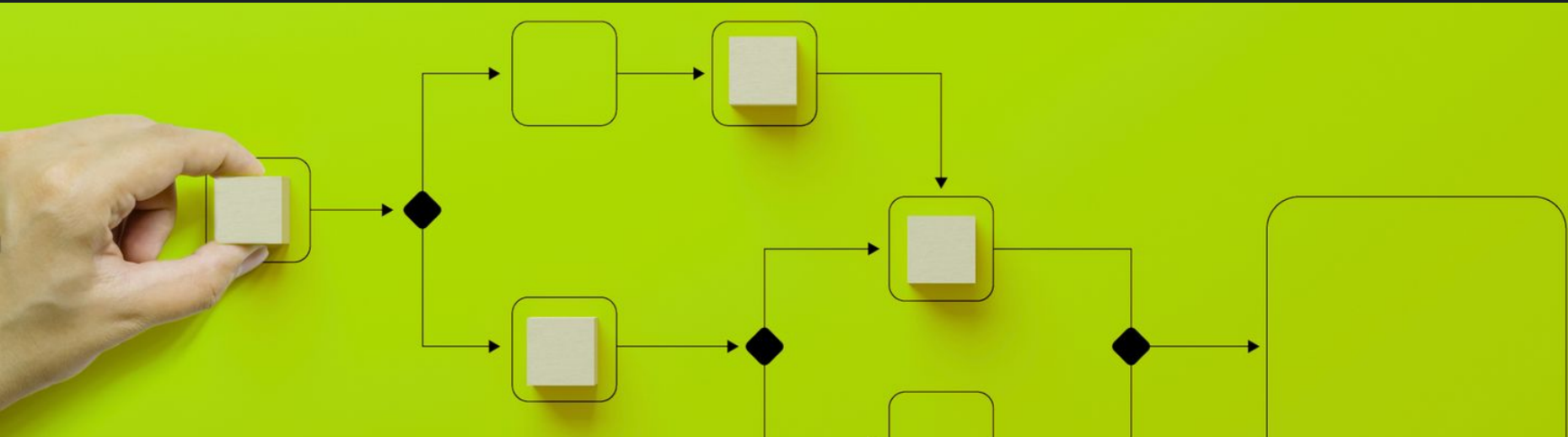- Light levels
- Graphing everything!

Orchestration vs Automation

Change management

Version control

Template integration

Task execution

Zoom in: User experience

Zoom in: User experience

SoTs

Output →

← Input
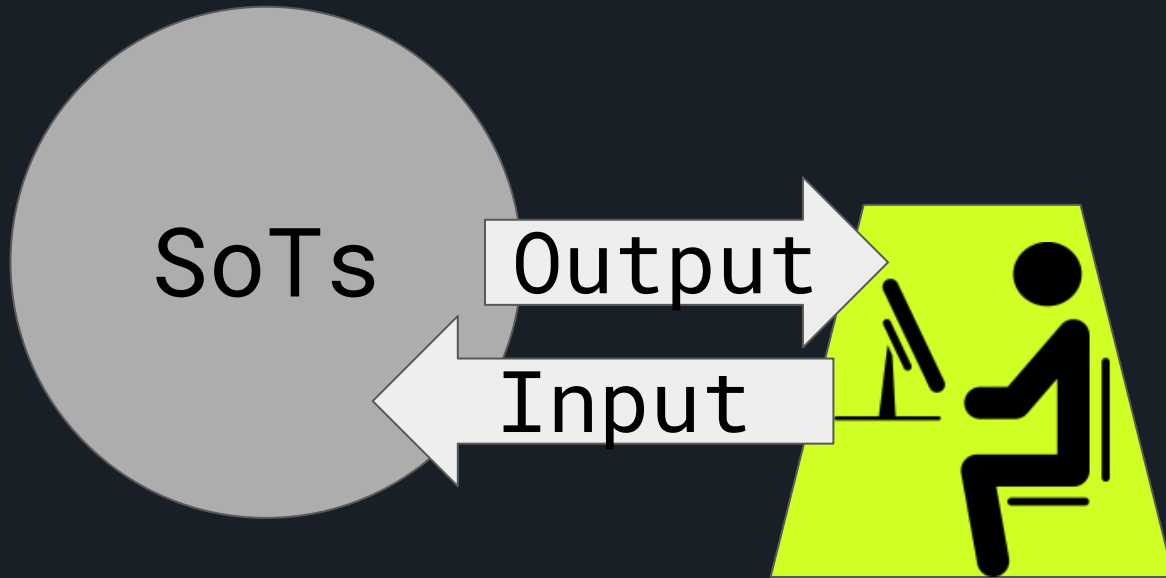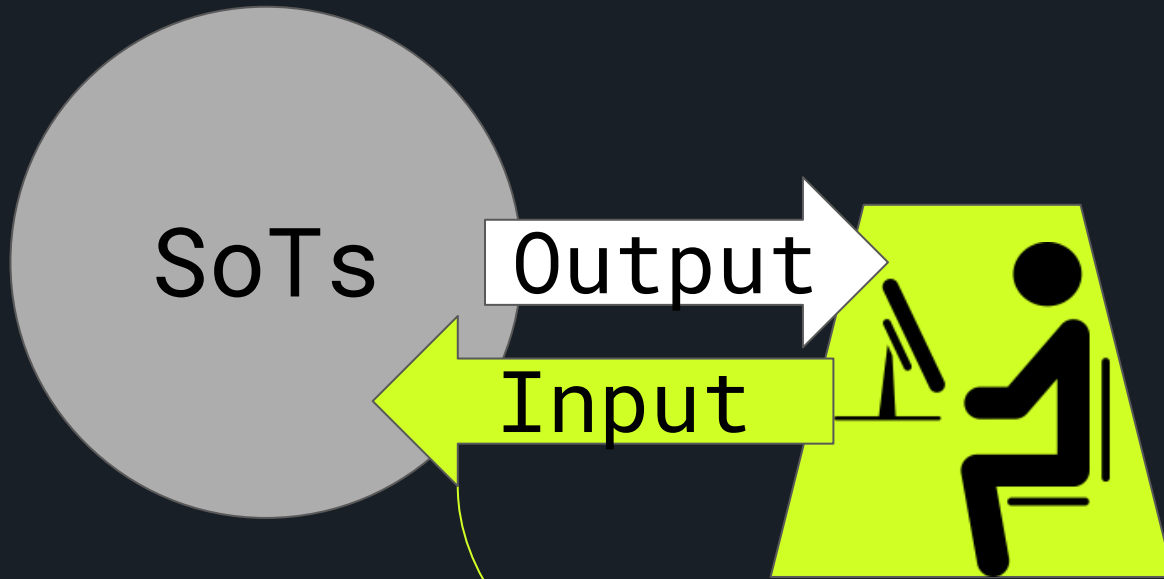
- MAC addr
- as-set
- Max prefix
- Use RS?
- Bounce
- RPKI OV
- Graceful Shutdown

Zoom in: User experience

SoTs

Output →
← **Input**

- Status
- Alerting
- Traffic
- Utilization
- BGP Stats
- Weathermap
- Light Level
- Maintenance
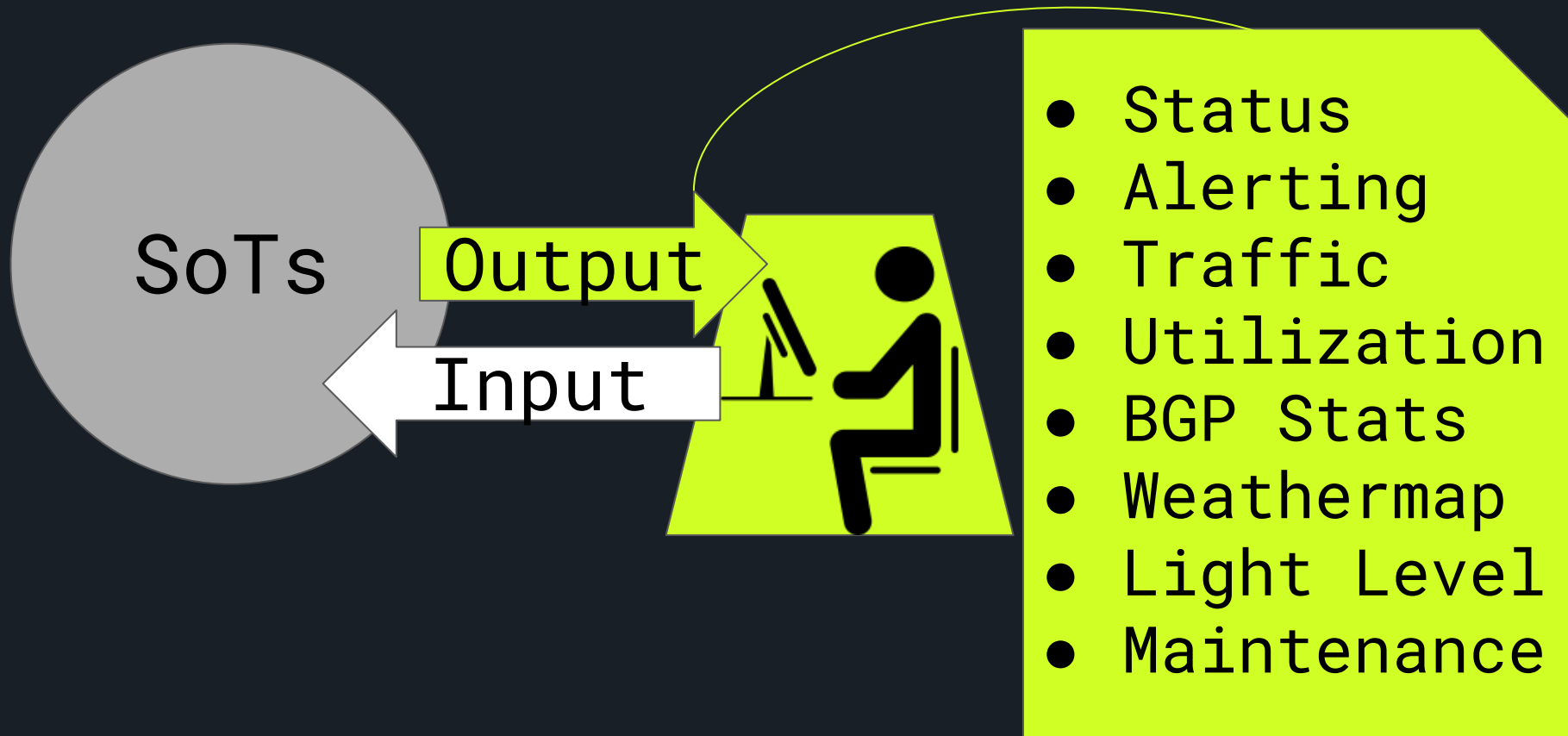
Basic Architecture (Recap)
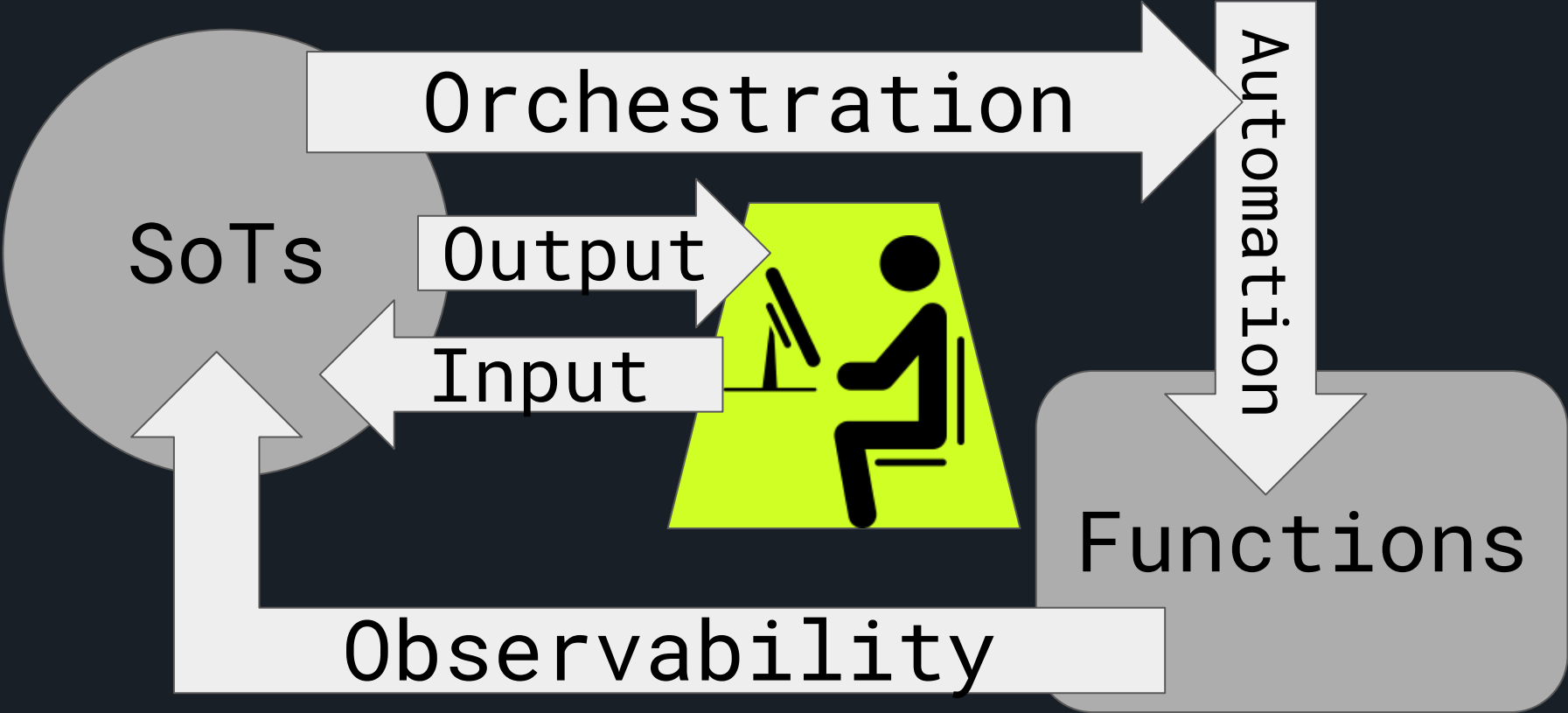
Example: IX-Denver

How we did it

- Identify the moving pieces
- Identify the Sources of Truth
- How do we replace this?
- How do we make this modernized and easily portable?

Pieces

- Customer portal
- Circuit / panel / cross connect DB
  - LOA Generation
- Ansible repo
- Graphs
- Website memberlist
- Route servers

CUSTOMER PORTAL

- IXP-Manager -> ixCtl
- Import data. . .
- IXP-Manager was the only SoT (which makes it nice and easy)

CIRCUITS AND PANELS

- IXP-Manager to NetBox
- Actual representation of how panels are done
- Leverage plugins

CIRCUITS AND PANELS - BEFORE

Patch Panel Port / Cross Connect - PP:303.04:009:C :: 1/2 (Fibre, duplex port: 1)

Current

Description:	PP:314.04:001:B ports 1|2	
Our Reference:	PPP-00663	
Patch Panel:	PP:303.04:009:C	
Patch Panel Port:	1/2 (Fibre, duplex port: 1)	
Member:	Force Broadband	
State:	Connected Change State ▾	
	View logs	
Letter of Authority:	Download View	
Co-location Reference:		
Co-location Billing Reference:		
Created:		
Updated:	2022-03-12 23:37:52	

Ticket Reference:	
Assigned At:	2021-05-09
Connected At:	2021-05-09
Internal Use:	No
Chargeable:	No
Owned By:	Customer
Rack:	910 MMR
Facility:	910 Telecom

CIRCUITS AND PANELS - AFTER

Cable Trace for Interface xe-0/0/12

den1.sw03
Juniper QFX5130-32C
910 Telecom / RR 314.04

xe-0/0/12

Cable LC-LC
Connected
Singlemode Fiber
3.00 Meters

1|2 (module: SLOT.B)

PP:314.04:001
Generic LC Patch Panel 4U LC Patch Panel
910 Telecom / RR 314.04

1|2 (module: SLOT.B)

Cable LC-SC
Connected
Singlemode Fiber
3.00 Meters

1|2 (module: SLOT.C)

PP:303.04:009
Generic SC Patch Panel 4U SC Patch Panel
910 Telecom / RR 303.04

1|2 (module: SLOT.C)

Download SVG

Trace Completed

Total segments	2
Total length	6 Meters / 19.69 Feet

ANSIBLE REPO

- IXP-Manager inventory plugin ->
  DeviceCtl inventory plugin
- Works with other tooling using
 DeviceCtl

To be continued … (otm referee)

ORCHESTRATION

- Ansible + Referee
- Git = CI/CD, change management
- FullCtl DB is 100% versioned
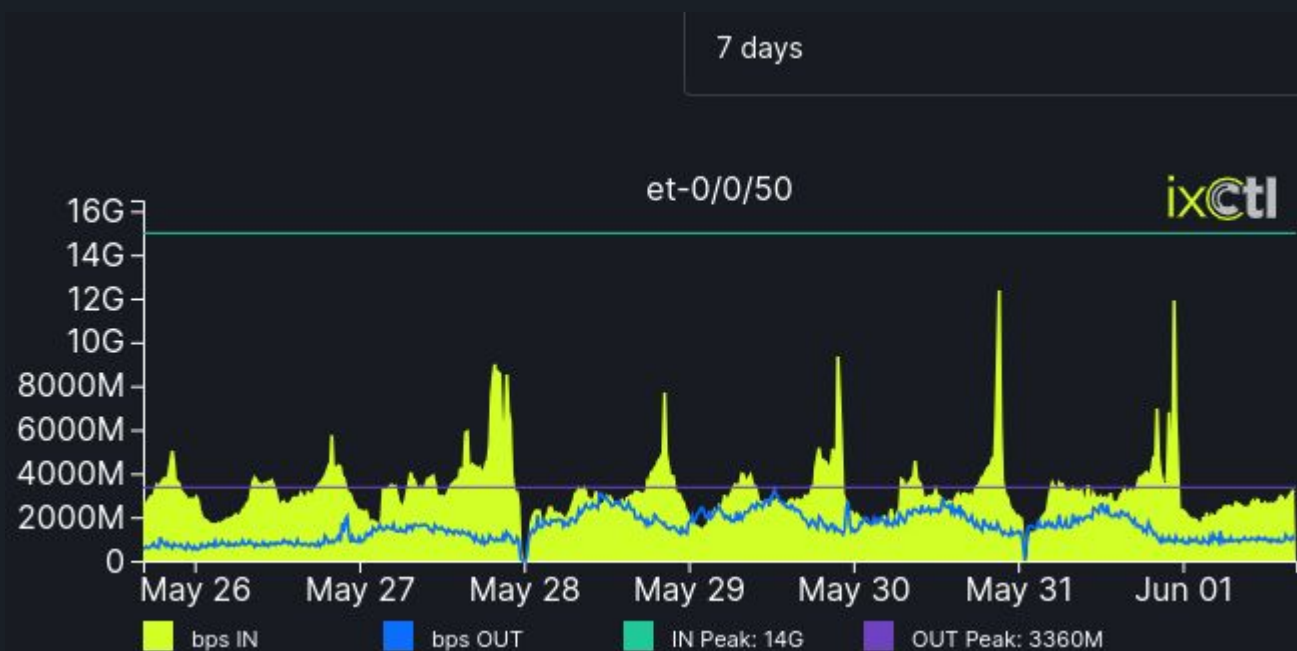 - NetBox, Nautobot not…
  - DeviceCtl abstraction adds it

GRAPHS

- IXP-Manager generated MRTG Config -> DeviceCtl
- Leverage the FullCtl IX Schema to generate MRTG config
- Load all existing graph data from MRTG (takes about 30 seconds to import 15 years)

GRAPHS
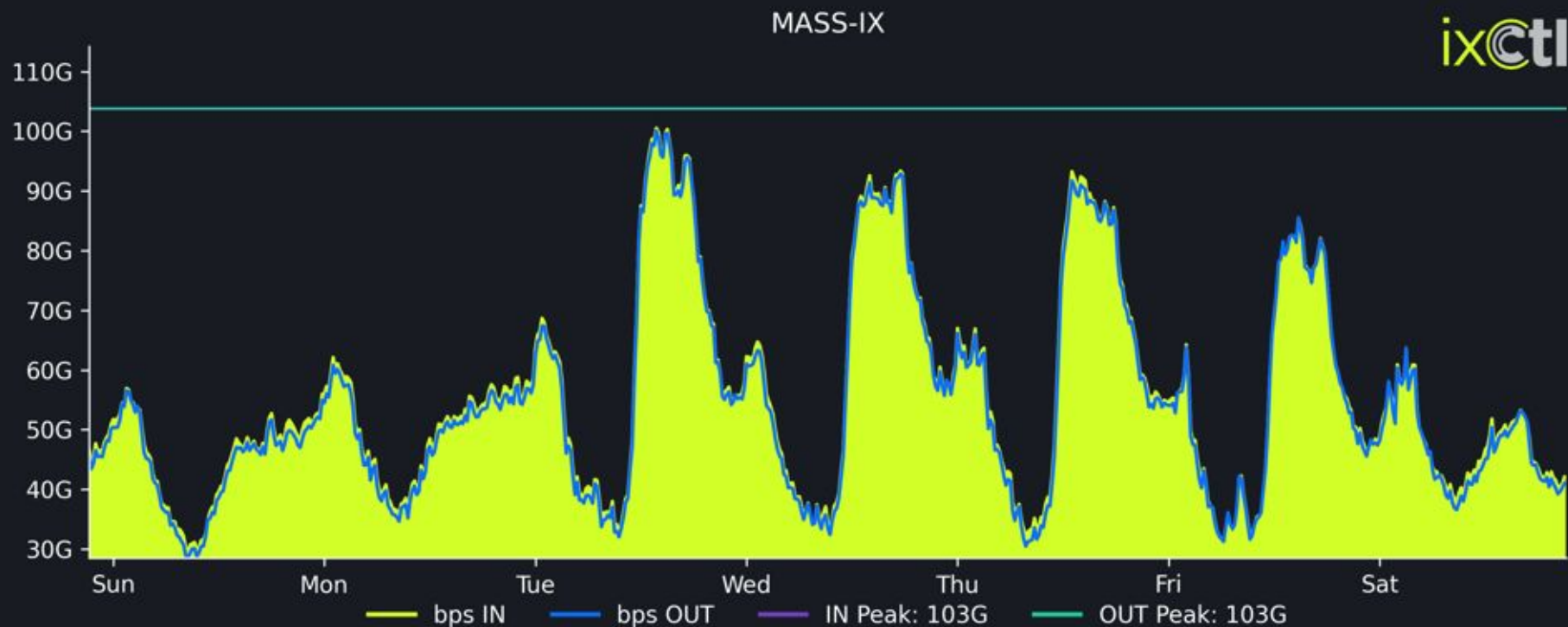
GRAPHS

GRAPHS

- Coming soon — prometheus and grafana

WEATHERMAP

- Php dir, fed by script
- VM with PHP, etc.

=

- Containerize, feed from our universal schema

ROUTE SERVERS

- ARS -> ARS 🎉
- Took base config, dropped into `ixCtl` Management
- Porting from IXP-Manager not much more difficult

Edit RS-B

Name*

RS-B

ASN*

394594

Router ID*

206.53.175.5

ARouteServer configuration

Type*

Bird 2

Max. AS_PATH length*

32

☑ RPKI BGP Origin Validation

☑ Graceful shutdown

No export action*

Pass (Treat as transitive)

It will take a moment for the route server config to be (re)generated
Config last generated at: 2024-03-24 12:05:58

🗑 DELETE

SAVE ✏

ARouteServer extra config (yaml)

```
cfg:
  prepend_rs_as: False
  path_hiding: True
  gtsm: False
  add_path: False
  filtering:
    next_hop:
      policy: "strict"
    ipv4_pref_len:
      min: 8
      max: 24
    ipv6_pref_len:
      min: 12
      max: 48
    global_black_list_pref:
      - prefix: "206.53.175.0"
        length: 24
        comment: "Local network"
      - prefix: "2001:504:58::"
        length: 48
        comment: "Local network"
    max_as_path_len: 32
    reject_invalid_as_in_as_path: True
    transit_free:
      action: "reject"
      asns: >
        174, 209, 286, 701, 1239, 1299, 2828, 2914,
        3257, 3320, 3356, 3549, 5511, 6453, 6461,
        6762, 6830, 7018, 12956
    irrdb:
      enforce_origin_in_as_set: True
      enforce_prefix_in_as_set: True
      allow_longer_prefixes: True
      tag_as_set: True
    max_prefix:
      action: "block"
      peering_db:
        enabled: True
        increment:
          absolute: 200
          relative: 20
```

SOURCES OF TRUTH

- IXP-Manager
- Replacing with: ixCtl, DeviceCtl, PeerCtl, NetBox
- Ansible repo
- ARouteServer git repo

INTERFACING WITH SOT

- Ansible for Automation
- ARS

Mostly replaced with our FullCtl IX Schema

FullCtl IX SCHEMA

- Similar to the IX-F/Euro-IX schema, but with added fields
- More useful for automation
- More stricter
- More better

https://ix.fullctl.com/apidocs/swagger

FullCtl IX SCHEMA

detail   1/1 ∧ ∨

(path)

ix_tag ★ required
string

ix_tag

(path)

Responses

Code	Description	Links
200		*No links*

Media type

application/json ▾

Controls Accept header.

Example Value | Schema

```
{
    "data": [
        {
            "id": 0,
            "pdb_id": 2147483647,
            "ix": 0,
            "ixf_member_type": "peering",
            "ixf_state": "active",
            "asn": 2147483647,
            "name": "string",
            "display_name": "string",
            "ipaddr4": "string",
            "ipaddr6": "string",
            "macaddr": "string",
            "as_macro": "string",
            "as_macro_override": "string",
            "is_rs_peer": true,
            "speed": 2147483647,
            "md5": "string",
            "prefix4": "string",
            "prefix6": "string",
            "port": 2147483647,
            "grainy": "string",
```

IX-F SCHEMA

- Replaced internally, not externally (PDB)
- IX-F not used in PDB because IXP-Manager didn't match IRL
- Once we switched and it was modeled correctly, we updated PDB with ixCtl IX-F schema

DASHBOARDS

- Speaking of using OSS - grafana dashboards?
- Time series DB…

SELF SERVICE

- MAC, as-set, max-prefix, etc…
- Update PDB
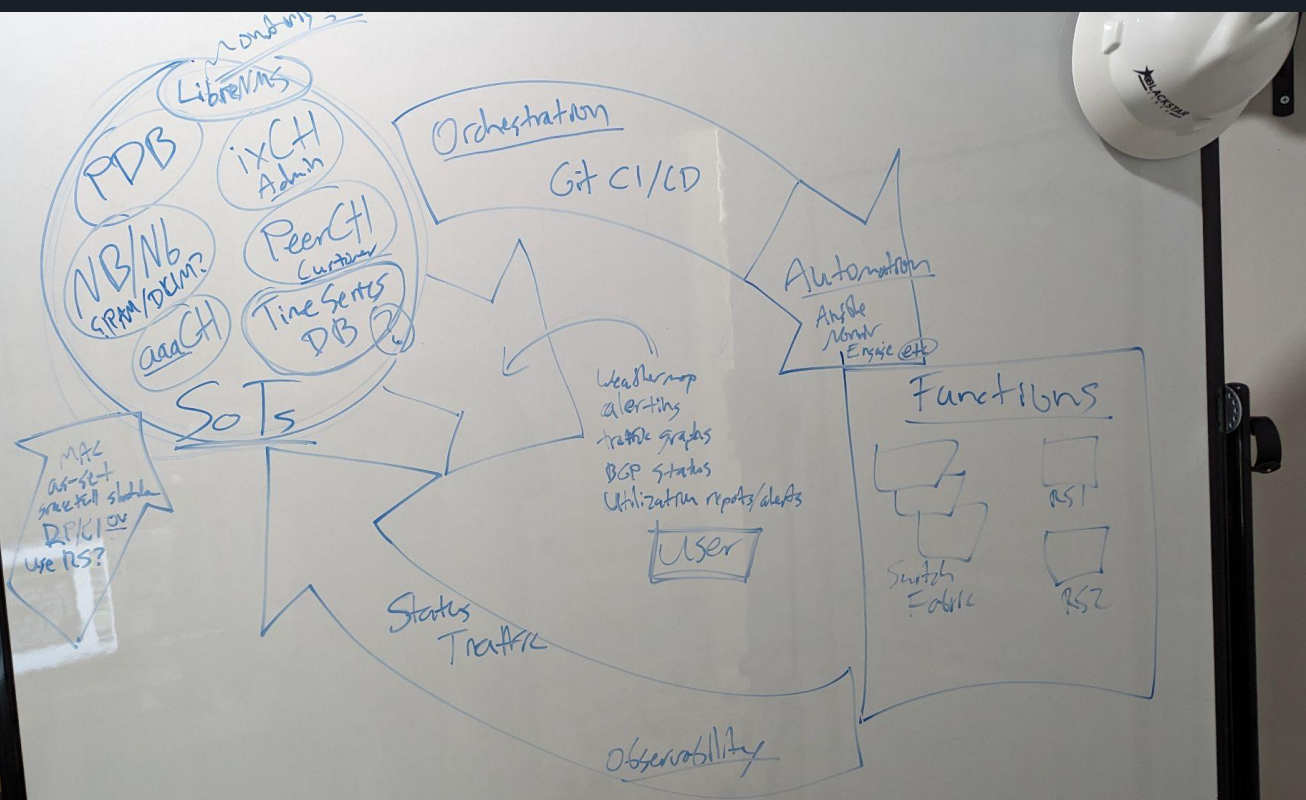- Bounce port
- Light levels
- Traffic
- BGP culling (graceful)

fullauto

https://github.com/fullctl

Extras…

Architecture detail…

More???

TODO: Ensure the end-state is well described…

- NetBox/Nautobot plugins?
- Our tools?