SROAUG NEWS

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Board of Directors Update

By Uma Mani, Newsletter Director
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The SROAUG Board is proud to say that we had a very successful year in 2007. The 2007 conferences had many presentations on Oracle Applications Rel 12 which was well received by the user community. **SROAUG** was awarded the **OAUG GEO/SIG Certificate of Distinction for 2007!** This is the result of dedicated voluntary efforts and contributions from its members.

SROAUG Conference on February 29th

Our first Conference for 2008 will be on February 29th at Crown Plaza Hotel – LAX. This will be a full day conference with Rel 11i and Rel 12 presentations. Continental breakfast and lunch will be provided at the conference. Drawings for valuable prizes and gifts would be held at the end of the conference. Our conference schedule for this year is

July 25th – Orange County
October 24th – Orange County

Invitation to Share Your Oracle Experience

The SROAUG Board invites you to share your Oracle knowledge and experience. Please consider submitting an article, tip or trick that would be of interest to other Oracle users for publication in a future newsletter. Both technical and functional topics are welcome. Submissions may be sent to:

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Breakthrough on Asset Transfers Across Corporate Books

Brian Bouchard, President and CEO - Chi-Star Technology

Millions of companies rely on Oracle Applications for their financial, supply-chain management, and accounting software. While the Oracle Application is beneficial, the author realized an area of opportunity with the software concerning asset transfers.

The current process to do an asset transfer is very manual and tedious. In order to transfer an asset, a person has to:

1. Determine the asset(s) to be transferred,
2. Document basic asset data for data entry into the receiving book,
3. Manually perform asset retirement(s)
4. Determine the financial & life treatment of the asset(s)
5. Determine if translation rates are required
6. Manually identify the translation rate in Oracle General Ledger
7. Manually calculate the new asset values
8. Manually add the asset(s) to the new depreciation book
9. Manually create inter-company journals

After completion of the process, there is no longer a tie to the original asset, so the audit trail is permanently lost. The trail ends in the book where the asset is retired while a new trail is created in the book where the asset is added.

As a user of Oracle Applications for over fifteen years, the author went to work devising a plan to combat this tedious process. The author soon developed a solution that would automate 6 out of the 9 steps above and turn this process into a decision making process rather than a data entry process. In April 2005, the introduction of AssetCross ™ came to the market as a solution to the manual asset transfer procedure. The AssetCross ™ software will transfer single or multiple assets between corporate depreciation books, transfer full or partial (cost or units) assets, translate transferred amounts to the receiving depreciation book's currency, and maintain an audit trail with the original asset.

A solution like this comes at a time where companies are growing and expanding locally and globally. The induction of this software as an addition to the Oracle Applications provides a better way of managing time that translates into economic savings. Exploring methods to monitor budgets can prove to be critical during the growth and expansion of any business. This solution exemplifies the saying "Time is money, and money is time."

Auditing the DBA: What non-technical managers and auditors should know

Cameron Larner, Absolute Technologies Inc

Introduction

In these days of SOX compliance, functional applications experts are being assigned to develop and maintain proper controls. These individuals are well suited to design and approve business process related controls, but are often ill equipped when it comes to understanding how to audit and control technical professionals, like DBAs and IT Staff, whose methods of access to enterprise data may be confusing or unknown to non-techies.

Nevertheless, steps must be taken to introduce appropriate and effective controls and support these controls by creating and maintaining a secure audit trail. To accomplish this, those managers and auditors tasked with compliance must gain a better understanding of the roles, privileges and capabilities of their DBAs, and how to effectively audit DBA activity in the database. They cannot simply rely on DBAs themselves to develop measures to audit themselves. This would violate basic segregation of duties principles. [For the purposes of brevity, references to the term "DBA" shall include DBAs and other IT Staff with administrative and/or privileged access to the database.]

Intended Audience

As the title of this paper suggests, it is written to benefit those non-technical managers and business analysts who are tasked with securing Oracle E-Business Suite for SOX compliance purposes, but are not familiar with the general details of the Oracle database, nor with the capabilities and privileges of the DBA. Specifically, this paper speaks to those who have or are implementing controls for application end users where the next step is to design and implement a strategy for deploying controls for DBA and IT staff users.

Background

In the context of recent Sarbanes-Oxley legislation (SOX), external auditors have scrutinized DBA access and have required controls and systematic proof of such to attain compliance. After all, the systematic controls you have or will establish for application end users will have little impact on your DBA's ability to overcome them.

Objectives

To facilitate the implementation of such controls, this paper will familiarize the reader with important attributes of the Oracle Database, with the available roles and privileges of an Oracle DBA, and review and discuss approaches and mechanisms to limit or segregate DBA power, audit DBA activity and thus mitigate the risk that a DBA modify or circumvent implemented end user controls without detection; obstruct audit mechanisms; or compromise the audit trail itself.

DBA And Database Basics

If the reader feels that he or she has an adequate understanding of the significant constructs of the Oracle Database and the primary functions and powers of the DBA within, then the reader may wish to skip ahead to the section entitled, "Approaches to Auditing the DBA".

DBA's Primary Functions

The DBA role encompasses many functions, all of which may be performed by one or many individuals in

an organization, utilizing one or many different methods of access to the database. Those smaller organizations which only have one or two DBAs will usually face greater scrutiny by auditors from a segregation of duties point of view because these DBAs typically have unrestricted access to the database, and no peers to validate their work.

Generally speaking, the DBA role consists of the following functions:

- Database Creation, Startup and Shutdown
- Application Implementation/Upgrade
- Migration of Data and Program Changes to Production
- Maintenance, Backup & Recovery
- Performance Optimization
- Security/Database User, and often Application User, Management
  Trouble Shooting

Database Objects
Depending on the privileges granted, the DBA may have access to all data in the database. But, what exactly does "all data" mean? The Oracle database is comprised of "Objects". Some of these objects may be familiar, like tables, some may not, like roles. But, it's important to have a general understanding of them in order to accurately assess the risk of granting access to these objects to the DBA or anyone.

Database Objects may be said to fall into four general categories:

- Those which *contain* data (Business data and Meta data, which is data about data.)
- Those which *refer* to other objects
- Those which programmatically *manipulate* data
- Those which *grant access* to data

Here's a brief description of some of the key objects in each category

Data Containing Objects
Tables
Most E-Business Suite users are familiar with the concept of a table, the database construct that holds records of information segmented by columns. Tables essentially hold all the valuable application (financial and business) content of the database, and thus are the most important object of focus when considering compliance initiatives.

Indexes
An Index contains technical data about a table. They facilitate quick access to an individual record or subset of records in a table. They may also be used to enforce a unique value for a single column or set of columns in the table to prevent duplicate records. The loss or modification of indexes can have a serious impact on system performance.

Sequences
When called, a sequence returns a unique ascending or descending integer from the initial or previously returned integer. It is often used to generate a unique identifier for the primary key column of a table

Object Referencing Objects
Views
A View is a construct that looks like a table to an end user, and has similar column and row properties

containing values, but actually contains no data itself. In contrast, it is merely a logical table based on one or more actual tables or other views. It can provide a user that doesn't have direct access to a table, indirect access to the table via the view. They are often used to de-normalize the relational data of several related tables into a single, end user friendly, logical table.

Synonyms
A Synonym is an alias or alternative name for another database object. Typically, it is used to alias an object owned by another user such that the current user need not specify the schema owner of the non-owned object whenever referenced.

Schemas
A Schema is a collection of all the database objects owned by a single user. The Schema name is the same as the user name

Data Manipulating Objects
Procedures
A Procedure is a stored block of PL/SQL which can be executed by name. PL/SQL is Oracle's programming language which can be used to insert, update and/or delete records from tables, and/or create, alter or drop database objects.

Functions
A Function is similar to a procedure, except that a function returns a single value when executed, and thus may be used in SQL select statements to generate a selected value or a where clause operand value.

Packages
A Package is a collection of related procedures and functions encapsulated in a single object, where each procedure or function is executable as an individual object.

Triggers
A Trigger is a stored block of PL/SQL which is associated with a table or a system level event. Oracle automatically executes the trigger when a specified SQL statement is issued against the table, or when a specified system event occurs. System events include database startup and shutdown, user login and logoff, server error, DDL execution, etc…

Users
A User is an account through which an authorized individual can directly connect to the database, and upon which database privileges can be assigned. A User which owns database objects may be referred to as a Schema. Thus, there are really three general categories of Users: those which connect to the database to browse and/or make transactions, those which are established to contain the database objects of an application, and those which do both.

It is worth noting that the database user defined above, is distinct from an application end user. For example, Oracle E-Business Suite provides for the creation of an *application user* account by which the end user logs onto the application. This application user does not correspond to a database user, and does not provide direct database access, but rather is used by the application to validate access to the application at the application level. Once validated by the application, the application automatically connects to a master database user account, called APPS in this case, giving the application user indirect access to the database via their secure application connection.

Roles
A Role is a set of privileges that can be granted to users and/or other roles.

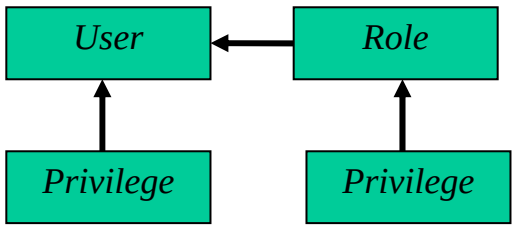
Database Links
A Database Link is an object in the local database, which allows one to connect as a specified user, without the password, to a remote database to access objects in that remote database.

Database Access

The only way to gain access to the database is to connect as a User. However, even if one has a valid user account, the user cannot access individual objects or execute SQL commands without first been given privileges to do so.

Oracle comes packaged with a wide selection of *privileges*. These privileges are typically granted to the user by a DBA or System Administrator. The ability to grant a privilege to a user is a privilege in and of itself, thus any user with such privilege could administer privileges. The Oracle database comes packaged with several default users, some of which, SYS and SYSTEM for example, have been seeded with such administrative privileges.

Although privileges cannot be created, modified or deleted as independent entities, they can be bundled as Roles, and granted to or revoked from users as Roles to ease the burden of privilege administration.



Database Operations

When it come to developing controls for access to and use of the database, it's essential that one understands the basic types of operations (transactions) that may be performed by a DBA or any user.

Here's a review of the general database operations in Oracle:

Select
A user can query and view rows and column values from tables and views.

Although the selection of data cannot materially change it, this type of operation may be of concern if your organization maintains legally defined sensitive or private information that must be restricted to authorized personnel only, which may exclude you DBA and/or IT Staff.

DML [Data Manipulation Language]
A user can insert, update and/or delete table records.

DDL [Data Definition Language]
A user can create, alter and/or drop database objects; Grant and/or Revoke Privileges to/from users and/or roles.

Using DDL, a user can alter programs stored in the database that are used in the calculation and creation of financial transactions. In fact, a knowledgeable user could introduce "Trojan horse" stored programs which could create fraudulent transactions to the benefit of the user, and which could subsequently remove themselves from the database, leaving no trace of their existence. Additionally, a user could create another temporary user, grant powerful privileges to the user, execute fraudulent or unauthorized transactions as the user, then drop the user.

Startup and Shutdown Database

Database shutdown can be executed in different modes, which if executed inappropriately, could lead to a loss of pending transactions, and interfere with the normal course of business operations.

DBA Access in 9i / E-Business Suite

There are many ways a DBA can gain access to the Oracle database of which the reader should be aware. Individuals vested with implementing controls for the DBA and IT staff should be keenly aware of each and every entry point and privilege to which these technical individuals may have access. This is the only way to design preventive controls to attain a reasonable assurance of security.

Default Database Users/Schemas

The Oracle Database comes equipped with several default users/schemas, which are initialized with standard, published passwords. It is imperative to security that these passwords are changed immediately after install, and it is highly recommended that they be changed periodically. [Note: For E-Business Suite R11i, both the APPS and APPLSYS users must have identical passwords. These database passwords, along with those from each application module, must be reset at the Application level *and* the database level.]

User Name	Default Password	Description
Oracle Database Administrative Users (Granted DBA Role)		
SYS	CHANGE_ON_INSTALL	Oracle Master Administrator
SYSTEM	MANAGER	Oracle System Administrator
CTXSYS	CTXSYS	Oracle InterMedia Text Administrator
E-Business Suite 11i Database Users		
APPS	APPS	E-Business Suite Master Account
APPLSYSPUB	PUB	Application User Login Validation
APPLSYS	APPS	Application Object Library
GL	GL	General Ledger
AP	AP	Payables
AR	AR	Receivables
PO	PO	Purchasing
INV	INV	Inventory
CE	CE	Cash Management

Partial Table of Default Database Users for Oracle and Oracle E-Business Suite 11i

The most important of these default users is called **SYS**. SYS is the Oracle Database's master account. It owns the data dictionary, in which all details about all database objects are stored. It is endowed with all privileges, and thus any user who has access to SYS can perform any transaction or operation in the database against any object no matter who owns it.

The second most important of the default users is **SYSTEM**. The SYSTEM user has been granted all database privileges, owns a few objects of its own, can view SYS owned objects, but can not alter them.

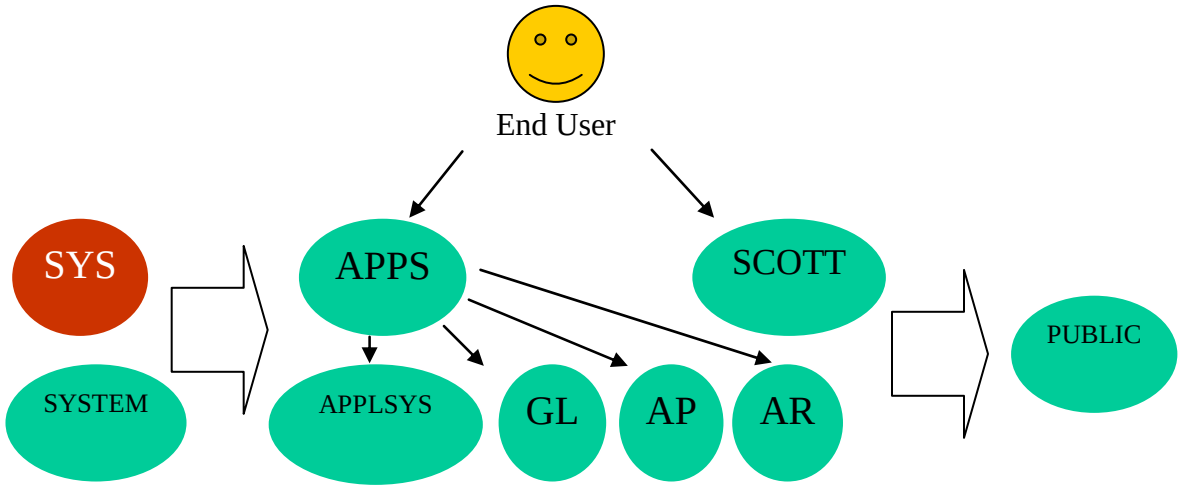
Another important default user is **PUBLIC**. Actually, PUBLIC is really more of a schema than a user. For instance, one cannot connect to the database as "PUBLIC". There is no PUBLIC password. The PUBLIC user acts as a schema repository for particular database objects that are to be granted to all database users. For example, a database user may create a PUBLIC database link or a PUBLIC synonym that is available to all users.

For organizations that have installed Oracle E-Business Suite (EBS), the master application database user account is called **APPS**. Although the different modules of EBS each install their associated database objects into a module specific schema, like GL, AP or AR, the APPS user has been granted privileges to the objects in each of these modules. Thus, using this architecture a single application end user need only connect to the APPS user to gain access to any module in the application. [When an application end user logs on to EBS, the user is connected to the database as APPS.] Once connected to EBS as APPS, EBS uses application level responsibilities, roles, menus, functions and forms to determine what data the application end user can access.

However, any user with the APPS password can connect to APPS directly using a SQL utility like SQL*Plus or Toad, and thus gain unrestricted access to all the database objects within EBS.

Another important default user account for EBS installations is **APPLSYS**. This is the user/schema which owns all the Application Objects Library (AOL) tables and Objects. The AOL module is responsible for, among many other things, the allocation and management of application end user access to the EBS application. Thus, an individual who can connect to the APPLSYS user can create, delete and/or modify application users and their responsibility assignments, possibly infringing upon Segregation of Duties rules and controls.

It should be noted that most EBS implementations also have database user accounts which have not been defaulted by Oracle or EBS, but rather created for use by third party software or customer initiatives to support custom modules or interfaces. These database accounts should be scrutinized for privileges that grant access to financial or sensitive data in EBS, and may contain such data themselves. Therefore, any security measures mentioned within this paper should also be applied to these types of accounts.



E-Business Suite Partial Schema Map

Administrative Privileges

Although we've discussed a few important default database users, when it comes to the SYS user in an Oracle 9i or greater environment, we must also discuss the newer concept of administrative privileges. Prior to 9i, a user would connect to SYS directly. Now, as an enhanced security measure, a user must specify under which administrative privilege to connect, as SYSDBA or as SYSOPER.

For example, from the SQL prompt:

```
SQL> connect sys as sysdba
```

A user connecting as **SYSDBA** is connected as the SYS user, and essentially has full reign of the database. SYSDBA can create the database, start and shutdown the database, perform archive and recovery tasks and can *access and alter any user's data*.

A user connecting as **SYSOPER**, by contrast, is connected as the PUBLIC user, and has most of the same database management privileges as SYSDBA, but it *can't view or alter* any other user's data. Thus, the SYSOPER administrative privilege may be an important tool in facilitating required DBA activities while significantly reducing the risk of fraud or controls breach.

Administrative Roles

Distinct from Administrative Privileges are Administrative Roles. These are pre-defined Roles that have been created specifically for administrative/DBA use, without SYS access, which provide further flexibility in achieving security initiatives without tying the hands of the DBA.

Here's a partial list of Admin Roles:

DBA
This Role provides all system privileges with the admin option. The admin option enables the assigned user to grant the same privilege to other users. The SYS and SYSTEM user, by default, have been granted this role.

SELECT_CATALOG_ROLE
This Role provides select access to the Data Dictionary (SYS) views.

EXECUTE_CATALOG_ROLE
This Role provides execute privileges on Data Dictionary (SYS) packages and procedures.

DELETE_CATALOG_ROLE
This Role provides delete access to the SYS owned AUD$ table, which is designed to contain database audit trail records. Oracle comes equipped with a standard audit trail feature which may be activated by setting a database "initialization parameter", and configured using SQL based audit commands to audit certain database transactions. This Role essentially enables the user to purge the audit table. The reader will learn more about this subsequently

Connection Authentication for Administrators

The functional reader of this paper may find it surprising that an administrator can actually log into the database with admin privileges without a database password. In fact, in most cases you will find that DBA's today rarely use a database password to connect to the database. They rely on operating system (OS) level authentication to connect verses database level authentication via a password file.

As the terms imply, OS authentication enables an administrator with access to the OS of the database server to connect directly to the local database from the server without a password. In contrast, database authentication requires the administrator to provide a valid database password, but the administrator may connect locally or remotely.

Fortunately, OS connection authentication in Oracle is restricted to OS users who belong to one of two account groups called OSDBA ("dba" in Unix) and OSOPER ("oper" in Unix). If an OS user has been assigned the OSDBA group, that user can connect to Oracle as SYSDBA without providing a database password. Alternatively, an OS user assigned to the OSOPER group can connect to Oracle as SYSOPER without providing a database password.

Furthermore, the Oracle database is installed on the OS server using an OS user account called oracle, referred to as the "oracle binary" account. This means that the OS oracle account owns all the files that comprise the Oracle database, and as such, it is assigned the OSDBA group, which, in turn, gives any individual with password access to the oracle account direct access to the Oracle database as SYSDBA.

Unfortunately, it is all too common that DBA's are provided with the oracle OS user password. From a security perspective, the problem is twofold: 1) the DBA gains direct access to SYSDBA, and 2) there is no way to uniquely identify the individual since they are only known to the sever as "oracle" and to the database as "SYS".

Therefore, it is very important to not only restrict and tightly manage database access to SYS, but also to do the same for OS access to the oracle OS account. Whenever possible, it is preferable to create what are called "named accounts" both at the OS and database levels, and assign privileges to them accordingly. Named Accounts are those that are created for use by a single individual, often made up of the individual's actual name. For instance, name the user "clarner" or "camlarner" for Cam Larner. As we will later show, this will greatly increase visibility to user connection and transaction activity, as well as discourage fraudulent or unauthorized activity.

Connection authentication to the SYS user can be configured using the database Initialization Parameter called "REMOTE_LOGIN_PASSWORDFILE". This parameter takes one of three arguments:

1. None
   This is the default, which disables the admin database password file, thus forcing OS level authentication, and therefore only supporting connections to the database as SYS via the local server.

2. Exclusive
   With this option, the admin password file can be used with the local database only. The password file can contain the names of users other than SYS, supporting named account DBA access by not sharing the SYS password. This option allows SYSDBA and SYSOPER administrative privileges to be granted to individual users and have them connect as themselves from the local server or from a remote server or client. However, from an audit trail perspective, any transactions performed using this connection method will not contain the named account of the user, but rather SYS, which makes identification by user name impossible. [The Oracle 9i Administrator's Guide recommends this option to attain the highest level of security.]

3. Shared
   With this option, the password file may be shared across multiple databases, but will only recognize the SYS user entry, so individual named accounts are not supported. This may be an appropriate option if SYS access is restricted to a single DBA who must manage multiple databases. Otherwise it is not recommended from a security point of view.

Regardless of the option configured, it's very important to note that "Operating system authentication takes precedence over password file authentication. Specifically, if you are a member of the OSDBA or OSOPER group for the operating system, and you connect as SYSDBA or SYSOPER, you will be connected with associated administrative privileges regardless of the *username/password* that you specify." - Excerpt from the Oracle9*i* Database Administrator's Guide.

Another important initialization parameter impacting connection authentication is "O7_DICTIONARY_ACCESSIBILITY". This parameter is designed to provide backward compatibility to version 7 for Oracle database versions 8 and above with respect to SYS and Data Dictionary accessibility. In other words, release 7 of Oracle had lower security standards for Administrative access and setting this parameter to "TRUE" re-enables those lower standards. For example, when set to "TRUE", any database user may be granted full access to SYS objects. If "FALSE", only view access may be granted to other users. Additionally, when set to "TRUE", an administrator can logon to SYS remotely or locally without OS authentication.

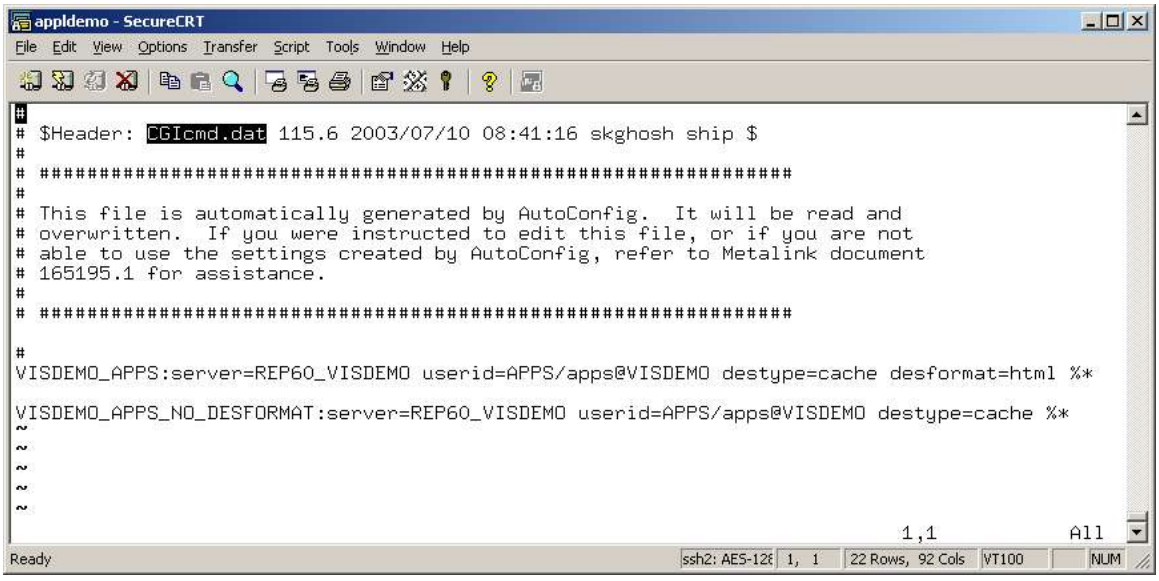
Although in some Oracle E-Business Suite documentation, Administrators are instructed to set this parameter to "TRUE" during installation and/or patches, it is recommended that it be re-set to "FALSE" once the activity is complete to ensure maximum security.

Application Files with Database Passwords

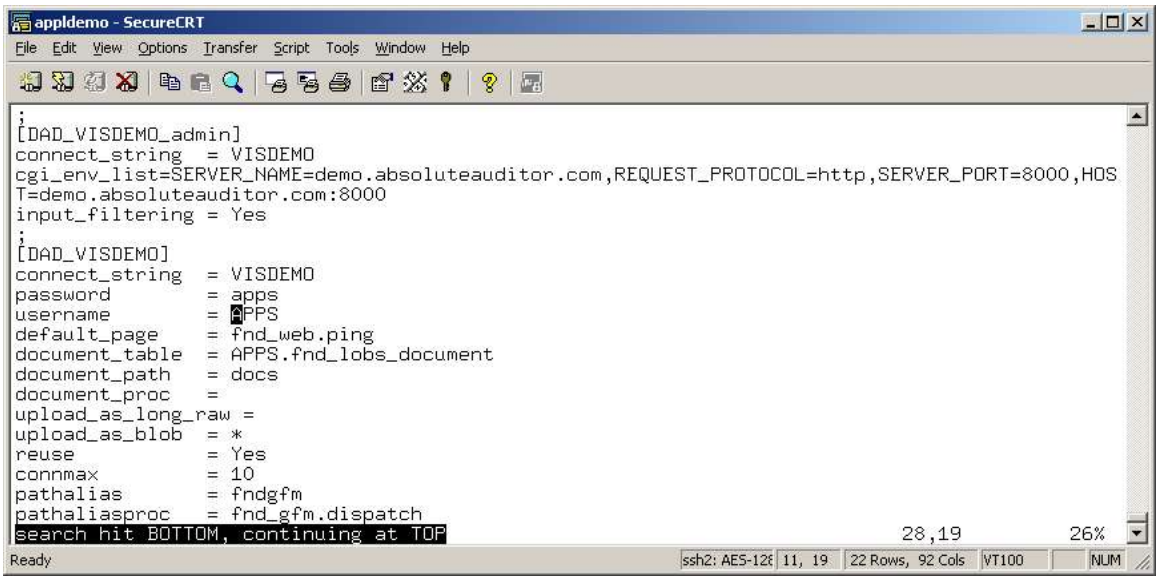
DBA's and IT staff usually have OS account access to the server upon which the Oracle database is installed. On a Unix server, all the E-Business Suite source files are typically stored under a single OS user account named "appl" or "appl" concatenated with the instance name, like "appldev", "appltest" or "applprod". In order to manage files required for patches, updates and customizations, DBAs and IT staff will typically have access to the default appl OS user account.

Unfortunately, providing shared access to this default account provides unrestricted access to some directories and files which contain sensitive information or capabilities that should be secured.

For example, the file $ORACLE_HOME/reports60/server/CGIcmd.dat is used by the application to run reports. It contains a non encrypted reference to the APPS password, as seen in the example below.



Another example is the file $IAS_ORACLE_HOME/Apache/modplsql/cfg/wdbsvr.app, which is used by the application web server to store database connection descriptors, including various user and password entries including the APPS password.



Since DBA's are the folks who administer the application, it's understandable that they would have password access to the APPS user. But, is it necessary? Perhaps a named account with privileges similar to or the same as APPS would be worthwhile. This would help increase visibility to the individual user and help distinguish those transactions performed by the application as APPS verses a DBA connected as APPS.

Nevertheless, it may be prudent to also secure the appl OS user account from shared usage. Named accounts can also be created at the OS level, and discriminately given access to necessary files and directories using OS groups.

Additionally, in some cases it may be possible to encrypt and/or obfuscate passwords listed in files to prevent them from falling into unauthorized hands. Discuss these approaches with your Oracle support representative and your System Administrator.

Application Access

A DBA or IT staff member that is privy to the APPS password can essentially access, and/or insert, modify or delete any object within the domain of the APPS user, which covers all the application modules within E-Business Suite. The holder of such, can connect directly to the database using a SQL tool like SQL*Plus, could grant himself desired responsibilities, like System Administrator, or create a dummy "unnamed" application user, assign responsibilities to it, and perform transactions that would be very difficult to trace back.

Additionally, if the user also has the SYSTEM password, he could use the $FND_TOP/bin/FNDCPASS executable to change application user passwords and log on as someone else. This executable is usually owned by the appl OS user account, and requires the APPS and SYSTEM passwords.

On a more subtle level, if the application "Examine" utility is enabled, the user can use the APPS password to login to examine and update fields within forms without detection. The Examine utility is managed via the E-Business Suite System Administrator based profile option called "Utilities:Diagnostics".

Another possible unauthorized access point is Oracle Alert, and any other E-Business Suite module with a feature that allows one to enter and execute DML SQL. If a user has been granted the Oracle Alert responsibility, they need not know the APPS password to alter APPS data. When one defines an Oracle Alert, one may enter a SQL statement, which may select, update, insert or delete records from any table under the APPS domain. When Alert executes the statement, it is already connected as APPS. The user could cover the trail of the unauthorized script afterwards by deleting the Alert log and the Alert itself from within Alert. From a database transaction perspective, any changes to tables will have been made by the generic APPS user, and will have no valid application user level identification such as last_updated_by or last_update_date.

It is worth noting that there are several other E-Business Suite forms that allow the execution of user defined SQL. You may find a list of such in the Metalink Note 189367.1.

Approaches to Auditing the DBA

When it comes to auditing the DBA or any database user, there are many standard options available in the Oracle database. Each approach has advantages and disadvantages. However none offer tamper proof mechanisms, in and of themselves, which can secure the audit trail from DBA access and manipulation. Additional custom and/or third party preventive measures and mechanisms are necessary to mitigate the risk that the DBA may violate audit trail security.

SQL Audit

The Oracle database comes equipped with a standard audit trail feature. To activate the feature, the initialization parameter named "AUDIT_TRAIL" must be set to "TRUE" or "DB" to maintain the audit trail records in the database table owned by SYS called AUD$. Alternatively, it may be set "OS" to maintain the audit trail in files located in the OS directory specified by the initialization parameter called "AUDIT_FILE_DEST". These parameters must be set in the init.ora file, and the database must be shutdown and re-started for them to become effective.

Once activated, SQL audit commands must be issued by a user who has been granted the "audit system" privilege to specify what is to be audited. SYS, SYSTEM and users granted the DBA role have this privilege by default.

[Note: SQL Audit is a database level feature, and not the same mechanism as that called "Audit Trail" provided in the System Administrator responsibility of E-Business Suite. The application level Audit Trail feature relies upon Database Trigger technology, as described in the following section.]

There are four basic types of transactions which may be audited.

- **Session Connection**
  Audit when a user logs in or out of the database. [Note: Connections using System Administration privileges, SYSDBA and SYSOPER, are always logged to the OS "AUDIT_FILE_DEST" directory even when the audit trail is disabled.]

  Example: SQL> audit session [by user];

- **Statement**
  Audit when a user executes a specified DML or DDL statement against any object.

  Examples: SQL> audit update table, delete table [by user];

- **Privilege**
  Audit when a user executes any statement using a specified privilege.

Example: SQL> audit delete any table [by user];

- **Object**
  Audit when a user executes any statement on specific object.

  Example: SQL> audit select on hr.employees;

The audit trail record will contain the following information:

- Operating system login user name
- Database User name
- Session identifier
- Terminal identifier
- Name of the schema object accessed
- Operation performed or attempted
- Completion code of the operation
- Date and time stamp

Unfortunately, there are a few issues with SQL Audit that make it undesirable as a compliance audit tool capable of satisfying auditors.

1. The AUD$ audit table is owned by SYS, and readily accessible to database users with DBA grade privileges. This creates a segregation of duties red flag, when the purpose of using such a mechanism is to audit the very DBAs who control it. It's akin to the wolf guarding the hen house.
2. The output of such auditing is often too vague to harvest details that illustrate the impact the audited transaction had on the database. For instance, when an update is transacted against the payroll table, SQL audit does not provide which columns, if any, where changed, not to mention the before and after values of the changed columns. All it provides is that an UPDATE statement was performed against the PAYROLL table on such and such date by such and such user.
3. The ability to narrow the audit scope to detailed data driven conditions is not available, thus creating audit data overload, making it difficult for auditors to sift through all the records and determine which transactions are questionable, unauthorized or fraudulent.
4. Given the lack of scope minimization, SQL Audit has been known to impact system performance.
5. Although SQL Audit does come packaged with database views designed to facilitate reporting, it provides no end user reporting, and the views themselves may not be considered easy to understand by auditor end users.
6. It is based upon SQL command line generated mechanisms which require creation and maintenance by a DBA or equivalently technically minded resource.

Database Triggers

Database Triggers are another mechanism that is standard functionality in an Oracle database, as we have discussed above. They come in two types, table level and system level, and can audit both DML and DDL transactions. They are well suited for auditing and/or financial controls enforcement for the following reasons:

- They provide complete flexibility of audit scope and criteria. One can specify the precise condition upon which to audit a transaction.
- They provide record level and table column details, capturing the before and after impact on data of SQL statements, and any session level details desired.
- They provide a real time mechanism for audit trail creation, email alert transmission and/or transaction prevention.
- They have access to useful session details of the transaction, which can help identify the source of the transaction.
- They can capture data from other associated tables (foreign key references) upon the triggering event, to incorporate context and end user friendly data into the audit record, resulting in data that can be immediately understood by end user auditors.

Unfortunately, they too, have disadvantages, namely:

1. They are SQL command line generated mechanisms which require creation and maintenance by a DBA or equivalently technically minded resource with PL/SQL programming experience.

2. They are not secure from manipulation by a user with SYS access. The triggers themselves can be easily disabled or dropped, or the custom audit trail table may be deleted or updated.

3. DDL type triggers, also called system triggers, are configurable via the "_SYSTEM_TRIG_ENABLED" database initialization parameter. The default for this parameter is TRUE, but it may be disabled by a DBA after database shutdown.

4. Triggers, if not properly optimized and tested, have been known to impact transaction performance on those tables upon which they've been applied.

On the other hand, the trigger approach has been demonstrated to be effective when incorporated into an end user ready, packaged solution by third party software vendors, consulting practices or internal customization project teams, which eliminate any or all of the above mentioned disadvantages.

Log Miner

Log Miner is yet another standard component of functionality in the Oracle Database that may be directed toward audit initiatives. It was designed to provide information necessary for performing recovery operations. Essentially, Log Miner is a SQL command line mechanism which can review both online and archive redo log files of the database to extract the history of all transactions over a period of time for the given log file. It is well suited for auditing for the following reasons:

- Depending on your audit content requirements, it places little to no additional impact on database transactions, though it can require significant system resources and place an indirect load on transactions while a mining session is active.

- It can provide history for both DML and DDL transactions, starting in Oracle 9.2.

- It can provide before and after record level column details.

- Because it uses existing redo logs, it inherently has access to all transactions impacting the database. Therefore, one need not specify audit criteria until actively mining the logs. The audit criteria can be as wide or as narrow as the audit user desires. For example, all transactions made by a given user may be selected at once without specifying which objects were impacted. Alternatively, the audit user may select only those transactions impacting a given table, where a specified column was changed.

- It can be used to analyze historical logs prior to the commencement of one's audit initiatives, if the organization has retained such archived redo logs.

However, the disadvantages are:

1. Log Miner is a SQL command line based mechanism, which requires the expertise of a DBA or like minded individual to maintain.

2. It is not secure from the DBA and/or users with SYS access, the very users, in this case, it is intended to audit.

3. Although Log Miner is equipped with views to access logged data, it provides no end user reporting.

4. To access logged transactions, one must initiate a Log Miner session from the SQL command line, make SQL style inquiries, then terminate the session when finished. The resulting output of the ad hoc inquiries is not saved. Therefore, to maintain an audit trail based upon desired audit criteria, a mechanism must be developed to load the results of such inquiries into a custom audit table to support future end user reporting and audit trail retention requirements.

5. Although Log Miner provides a transaction timestamp, it only ensures that transactions are sequenced in the order in which they were executed, making it an unreliable option to detect exactly when a change occurred.

6. Since redo log files only contain the data necessary to rebuild the database, they contain only a few of the session details available to triggers that could be used to identify the source of the transaction. For instance, values for terminal, module, program, application user and responsibility, to name a few, are not available.

7. Unlike triggers, Log Miner lacks the ability to capture values from foreign key referenced tables at the time of transaction. By the time a Log Miner inquiry is made, the relevant data in the foreign key tables may have changed.

8. Log Miner is somewhat complex and tedious to use, resource intensive to maintain and prone to administrator mistake because each time it is initialized, the admin user must have, and accurately specify, each redo log file required for the given period to audit.

9. Log Miner does not provide real time, upon transaction, auditing, but rather an after the fact view into the redo log files. For this reason, it does not support real time alerts or transaction prevention, though it could be used to "undo" an undesired or unauthorized transaction in certain circumstances.

10. It does not audit database user connections to the database.

The bottom line is that Log Miner is a good choice for ad hoc audit purposes when the database needs to be scrutinized for transactions meeting specific criteria during a specified timeframe. In order for it to be practical as on "always on", continuous mechanism to support compliance and control auditing and reporting requirements, however, it must be incorporated into a larger, more sophisticated, end user application. Fortunately, there are a few third party software vendors who have developed such applications using Log Miner.

Fine Grained Auditing (FGA)

Fine Grained Auditing is a mechanism designed to audit SELECT access to tables at the record and column

level. It is deployed and maintained by a DBA using packaged Oracle procedures from the SQL command line.

This may be an important component of your audit strategy if you must maintain an audit trail of users who actually view sensitive or restricted data. However, it does require DBA level expertise to deploy and maintain, and has a performance impact that must be scrutinized and optimized.

AUDIT_SYS_OPERATIONS

In all of the above approaches to auditing the DBA, we've made it clear that they all embody a conflict of interest in that they generally require a DBA to audit a DBA. This may be less of an issue for organizations that have the resources to assign a distinct individual the segregated role of Security and Audit Administrator, whereby such an individual would be tasked to audit all database users and activity, DBAs included. Yet, even with such segregation of duties by such administrators, the necessity that one or any of the administrators have SYS access continues to present a conflict. It seems there will always be at least one individual with the "master key".

Fortunately, Oracle provides yet another mechanism to add a layer of security and auditability to the database with the initialization parameter called "AUDIT_SYS_OPERATIONS". The parameter enables all SYS activity in the database to be logged to the operating system, indiscriminately and regardless of the setting of the "AUDIT_TRAIL" initialization parameter.

For Unix, the audit files are placed in the $ORACLE_HOME/rdbms/audit by default. However, the "AUDIT_FILE_DEST" initialization parameter may also be used to set an alternative directory based upon your operating system. To change the directory from the Unix default, the oracle binary account must have write privileges to the directory specified, or Oracle will return an error at database startup.

Unfortunately, for Unix, this directory is owned by the oracle binary account user, and thus is often accessible to DBAs. Additionally, given it's flat file structure, audit records generated using this method are not readily accessible or reportable by would be audit end users. Yet, an OS level mechanism owned by root may be deployed to synchronize, copy or move the files to another directory owned by root and not accessible to the oracle binary user, thereby securing them. The utilities called Rsync or Unison may be of use in this effort.

Of course, the mention of the all powerful OS "root" user begs the next security question, who audits root? That topic, however, is thankfully out of the scope of this whitepaper and will thus be left for others to address.

Recommendations

Now that the reader has covered all the basics, options and issues regarding the database, the DBA's role and dominion over it, and the different approaches to control and/or audit the DBA, we can provide a summary of recommendations directed at segregating the power of the DBA and generating a secure and systematic audit trail to prove it.

Segregate DBA Duties and Access

Now that the reader better understands the role of the DBA, it should be clear that a single all-powerful DBA is a security red flag. If at all possible, the easiest way to lower the risk threshold is by creating at least two distinct, non-overlapping DBA positions in your organization. The first, we'll call the "Database and Application Support" DBA, who deals with all the normal database maintenance, trouble shooting, patching, upgrading and performance optimizing tasks and, the second, we'll call the "Security, Access and Auditing" DBA, who deals with granting system access to all users and invoking, maintaining and securing the audit trail mechanisms. In this way, the organization creates a balance of powers across the DBAs.

Although this step sets a good precedent in segregating the documented role of each DBA, there still remains the technical challenge of allocating administration level access between the two roles. As we've pointed out earlier, the SYS user is all powerful, so, at least one individual will retain that power. This opens a nice segway into our next recommendation

Activate AUDIT_SYS_OPERATIONS

This database initialization parameter, when set to "TRUE", audits all activities performed by SYS and writes them to operating system log files in the default or user specified directory. Therefore, this step provides us with a check against the SYS user. But, this measure is only effective if the SYS user has no access to the audit files. This, in turn, brings us to our next step.

Protect the AUDIT_FILE_DEST Log Directory from the DBA

Depending on your operating system, you may be able to specify an audit directory that is inaccessible to the DBA via the oracle binary account or otherwise.

However, for Unix servers, the audit directory must be accessible to Oracle, and thus the oracle binary account. Therefore, the SYS user, without even an OS account, can actually read, alter and delete audit files from a SQL connection, if desired, given that SYS essentially connects to the OS as the oracle binary account. Alternatively, any user with access to the oracle binary account can access the audit files.

Therefore, in Unix, this measure will not be sufficient alone. To protect the audit files, the OS root user must implement some OS level mechanism to copy, move or synchronize the files to a root only accessible directory for safe keeping.

Limit Use of SYSDBA

In an earlier section, we warned that the above mentioned approach to audit SYS did not provide an end user friendly mechanism for access and reporting. Nevertheless, it may be the only realistic and readily available approach, especially if it is complimented with a strict and enforced policy of limited access to the database as SYSDBA. In other words, if you seldom allow users to log onto the database as SYS, then you'll generate minimal SYS audit transaction upon which to report and review. If such transactions begin to increase or become overwhelming, you know you have an access issue to resolve.

Limit OS User Assignment of the "DBA" Group

Don't fall into the trap of simply focusing on security at the database level. Remember that any OS user assigned to the DBA group has direct access to SYS, no database password needed. Include the restriction of this group in your high priority list of strictly enforced policies.

Utilize Named Accounts with the DBA Role

To improve visibility and accountability to DBA users, avoid providing shared access to the Oracle default accounts, both at the OS and database levels. Each individual connecting to the OS or the database should do so via their own, individually named account. This may add to user access maintenance, but it will greatly reduce the risk of fraud.

Specifically, instead of allowing DBAs to login to SYS as SYSDBA, provide them with a named account granted the DBA role. As a policy, query the database periodically to review and manage which users have been granted the DBA role.

```
SQL> select *
  2  from dba_role_privs
  3  where granted_role = 'DBA'
  4  /
```

```
GRANTEE                        GRANTED_ROLE                   ADM DEF
------------------------------ ------------------------------ --- ---
SYS                            DBA                            YES YES
SCOTT                          DBA                            NO  YES
CTXSYS                         DBA                            NO  YES
SYSTEM                         DBA                            YES YES
```

For database startup and shutdown operations, have the DBA connect as SYSOPER instead of SYSDBA. SYSOPER connects as the PUBLIC user, and has no access to the Data Dictionary or other schema's objects.

Define and Enforce a Password Security Policy

To tighten security across all default and named account users, systematic mechanisms should be deployed to ensure that passwords are changed periodically, are hard to guess, and are not reused with frequency.

Oracle provides user *Profiles* that may be created, assigned to users and maintained by the security DBA to establish systematic password protection in the following areas:

- Account Locking
- Password Aging and Expiration
- Password History
- Password Complexity Verification

Audit DBA Activity on Key Application Objects

Deploy an audit trail mechanism that can provide detailed, record and column level audit records, as well as the ability to define precise audit criteria by which to narrow the generated audit output to only those transactions that have a greater probability of being unauthorized.

Both database triggers and Log Miner, may be effectively used, separately or together, to achieve this. However, in either case, expect a significant development effort to create a maintainable, secure, and end user accessible solution. Alternatively, look to packaged software solutions which have already built a framework around these utilities to deliver a turn key database auditing solution.

For organizations running E-Business Suite, special audit attention may be warranted when transactions are performed using the APPS user via a "backend" connection to the database using a SQL tool like SQL*Plus or Toad verses a "front end" secure connection authenticated by E-Business Suite. As the reader may remember, E-Business Suite connects the application user to the database as APPS. The ability to distinguish between backend and front end connections using APPS can help identify unauthorized backend usage of the APPS user by DBAs or other privileged staff.

In this case, triggers are the better audit mechanism for accurately detecting the difference because they have access to the full range of session details during the transaction. They can more accurately identify if the APPS user is logged on via a front end connection as an application user, and determine the application user's name and responsibility. Log Miner fall short because it only provides limited session information, and does not provide application level user details.

Monitor Key Initialization Parameters

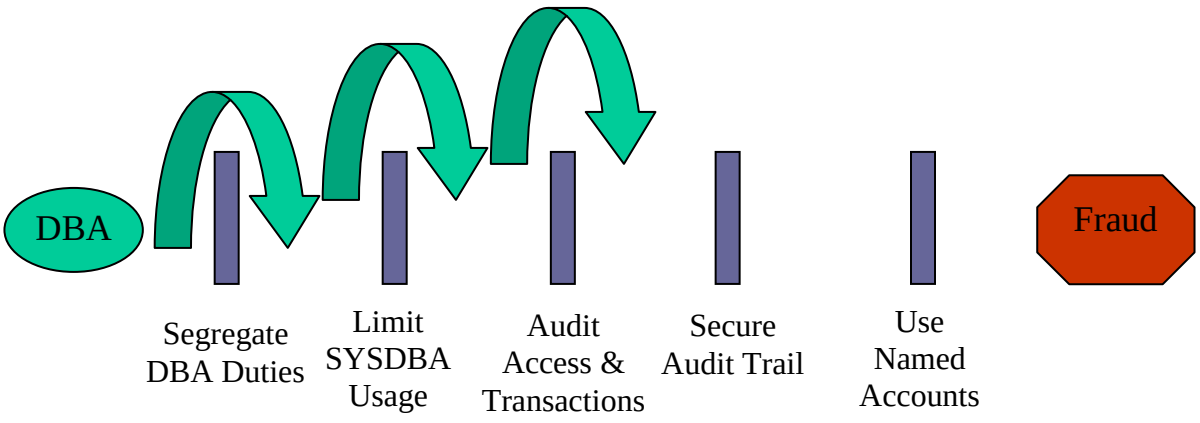
Last but not least, verify the values for key database initialization parameters discussed in this paper periodically and each time the database is restarted. Some parameters require that the database be shutdown and restarted to take effect, others can be modified while the database is up and running. Here's a simple SQL script which will get the job done.

```
select name, decode(type,1,'Yes','No') Require_Restart, value
from v$parameter
where name in (
'audit_sys_operations',
'audit_file_dest',
'audit_trail',
'remote_login_passwordfile',
'07_dictionary_accessibility',
'_system_trig_enabled')
```

Conclusion

It may be said by many that the DBA role is a trusted role, or that a good DBA could overcome almost any restrictions or audit trail deployed for control and compliance purposes, so why try? Whether that is true or not, the reality is that external auditors are starting to scrutinize DBA access and requesting controls and systematic proof of such to attain compliance. Any particular approach may not be "bullet proof", but each hurdle or preventive measure deployed reduces the overall risk as assessed by the auditor.

Hurdles to Mitigate Risk



References

- Oracle9i Database Administrator's Guide Release 2 (9.2)
- Oracle9i Release 2 (9.2) New Features in Oracle9i Database Reference
- Oracle Advanced Security Administrator's Guide Release 2 (9.2)
- Oracle9i SQL Reference Release 2 (9.2)
- Oracle9i Database Reference Release 2 (9.2)
- Oracle9i Application Developer's Guide – Fundamentals Release 2 (9.2)
- Oracle Privacy Security Auditing *by Arup Nanda & Donald K. Burleson*

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Optimizing Service Modules through Integration with Knowledge Base

Raghotham Reddy, Lead- Oracle Practice, HCL America Inc

Summary
In the Wake of companies realizing that their margins are narrowing and costs escalating, many organizations have realized the benefit they would get in effectively managing customers issues, avoiding duplicate of work, reducing the manpower.

Many Originations across have realized that just an addition to the Service module will Help Organization to find solutions for a problem Quickly, accurately and efficiently for the problems faced by the Customers

Millions of companies have gone for Oracle eBusiness suite with Service modules, but now the companies have realized how effective and useful it would be for them to have even Knowledge Base implemented.

Some of the important facts the customer is considering are –

- Having a central solution knowledge base that is accessible to both agents and customers provides faster, more reliable and more consistent delivery of service.

- 80/20 Rule (Forrester study)

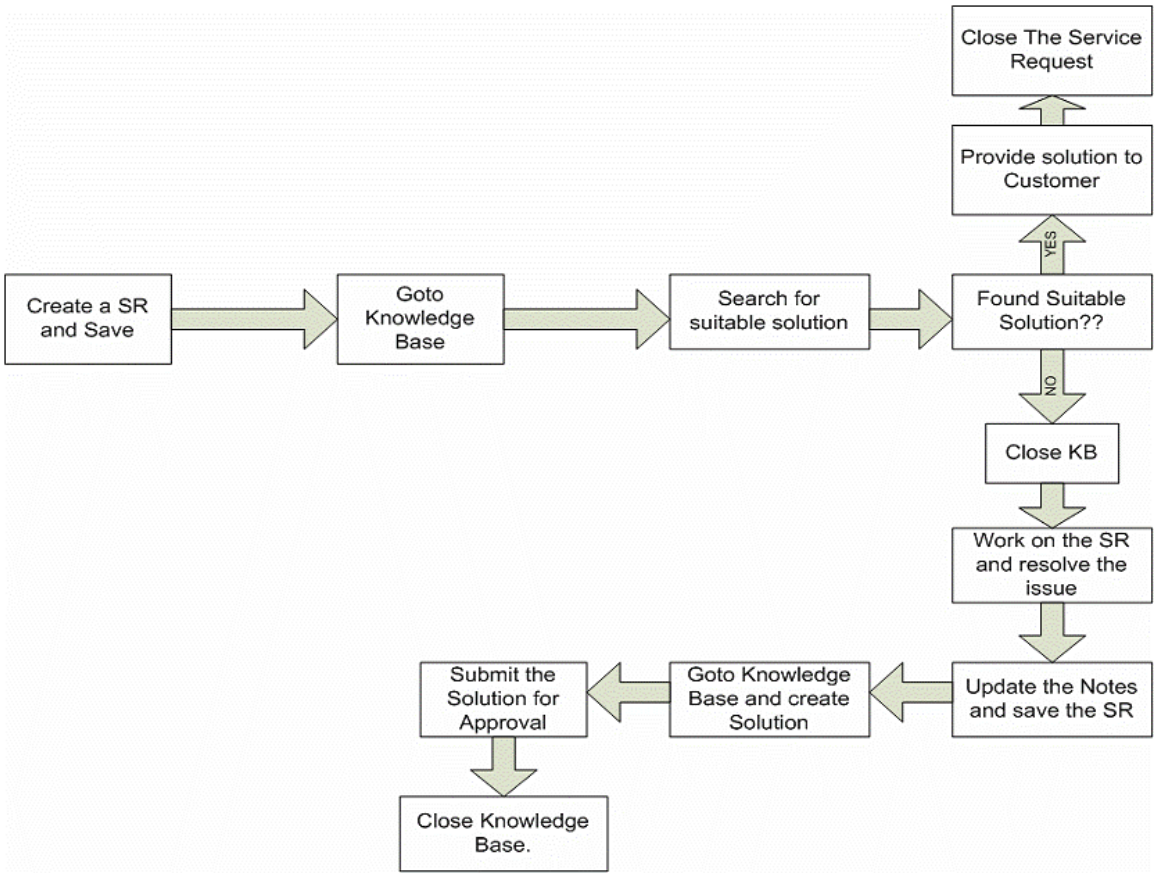
  - 80 percent of calls are about the same 20 percent of issues. Because these issues are the subject of a high call volume, companies are willing to invest in making sure that they have nicely crafted answers available for each of these questions.

- Knowledge Management was designed to address these issues by providing:

- Common access to the same knowledge management system that customer service representatives (CSRs) use
- Full integration to all Oracle Service products
- Quick and easy solution search and entry
- Powerful InterMedia Text and relationship searches for more accurate results
- Access to technical documentation through the Marketing Encyclopedia System

Knowledge Management belongs to the Service application suite within CRM. It is integrated with Support, *i*Support, Field Service, and Depot Repair. It provides a solution management system for these products.

Oracle E-Business Suite CUSTOMER SUPPORT FLOW



Knowledge Management Solution Architecture

Statements (symptom, cause, action, problem, solution, and so on):
- Are building blocks of a solution
- Contain a summary (Varchar2, 2KB) and a detail (CLOB, 2GB)
- Maintain a statement relationship link instead of physically embedding statements within a solution
- Are weighted, based on the number of times they have been used in a solution and have had the Solved button selected

Note: Numbers used in the diagram are arbitrary. In actual use, all statement relationship numbers within a solution would be similar.

- Can be reused with no limit
- Can have any number of statement types
- Can be used in more than one solution type

Solution Sets
- Contain a title and links to several statements
- Can coexist in one knowledge base

Have a seeded solution type of symptom, cause, or action (SCA) but can be defined as the merchant chooses

Knowledge Management Functionality

Natural Language Formatted Text Queries: Queries can be entered in a normal sentence structure. The system ignores common words and uses significant words for the search process. The Boolean operator is "or." There is also a phrase search that can be performed on a combination of significant words.

Keyword Search: Single or multiple words can be entered, separated by spaces. You can perform a Boolean "or" and phrase searches by using significant words.

Flexible Solution Model: Knowledge Management accepts any solution model that a merchant may have.

There is no limit to the number of solution models that can be run simultaneously, although running many models may cause user confusion.

Oracle InterMedia Text 8.1.6: InterMedia Text comes with CRM releases 11.5.1 to 11.5.3.

Solution Scoring: A text match and a relationship match compose the total score for a solution.

Solution overview

1. A comprehensive information management system that enables merchants to manage all internal and external information by using powerful Oracle-developed intelligent knowledge capture, storage, and distribution tools.

2. Implementing Knowledge Management provides easy solution capture and immediate access to new solutions. The relational aspect of knowledge management provides focused results that more directly relate to the issue being researched, thus reducing the cost of providing service while increasing customer satisfaction and gaining an edge over competitors.

3. A traditional support interaction involves a customer calling a support call center, selecting from a series of options until he or she gets to the product area in which they need support, and waiting until an agent is available to provide service.

4. Problem resolution is tied to the skill of the agent as well as to the tools available. If a Knowledge Management system is not available, a frequently posed question must be repeatedly researched by each agent. The customer experience could be different each time.

5. A series of costs both real and in terms of customer satisfaction, are incurred. Real costs are associated to the life cycle of the problem. Customer service representatives must answer the initial customer call, log the problem, request more information, escalate the problem, deal with bugs, find out that a solution already exists, communicate the fix back to the customer, and close the problem. This is costly and contributes to poor customer and employee satisfaction.

Conclusion

The idea behind writing this paper was to easily explain the customers of the enormous advantages and they would get by implementing Knowledge base along with service module.

Some of the key benefits of this Implementation are - Effectively managing customer's issues, avoiding duplicate of work, reducing the manpower Cost, Quick response, and ultimately leading to Customer satisfaction.

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