INTEGRIGY

WHITE PAPER

Oracle PeopleSoft

Guide to Auditing and Logging

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GUIDE TO AUDITING AND LOGGING IN ORACLE PEOPLESOFT

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If you have any questions, comments, or suggestions regarding this document, please send them via e-mail to info@integrigy.com.

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Overview

Most clients do not fully take advantage of PeopleSoft's auditing and logging features. These features are sophisticated and are able to satisfy most organization's compliance and security requirements.

The default PeopleSoft installation only provides a basic set of logging functionality. In Integrigy's experience, the implementation of database and application logging seldom exceeds meeting the needs of basic debugging. Most organizations do not know where to start or how to leverage the built-in auditing and logging features to satisfy their compliance and security requirements.

Even organizations already using centralized logging or Security Incident and Event Management (SIEM) solutions, while being more advanced in the Common Maturity Model (CMM), in Integrigy's experience are commonly challenged by PeopleSoft's auditing and logging features and functionality.

This guide presents Integrigy's framework for auditing and logging in PeopleSoft. This framework is a direct result of Integrigy's consulting experience and will be equally useful to both those wanting to improve their capabilities as well as those just starting to implement logging and auditing. Our goal is to provide a clear explanation of the native auditing and logging features available, present an approach and strategy for using these features and a straight-forward configuration steps to implement the approach.

Integrigy's framework is also specifically designed to help clients meet compliance and security standards such as Sarbanes-Oxley (SOX), Payment Card Industry (PCI), FISMA, and HIPAA. The foundation of the framework is PCI DSS requirement 10.2.

To make it easy for clients to implement, the framework has three maturity levels – which level a client starts at depends on the infrastructure and policies already in place.

The three levels are:

- **Level 1** – Enable baseline auditing and logging for application/database and implement security monitoring and auditing alerts
- **Level 2** – Send audit and log data to a centralized logging solution outside the Oracle Database and PeopleSoft
- **Level 3** – Extend logging to include functional logging and more complex alerting and monitoring

Audience and How to Read This Paper

The intended audience are PeopleSoft DBAs, application administrators, IT security staff, and internal audit staff. A working technical knowledge of PeopleSoft and Oracle Databases is recommended.

The section discussing the logging functionality available in PeopleSoft and the Oracle Database may be skipped if the material is already familiar. Internal audit and IT security staff may find it useful to proceed directly to the presentation of Integrigy's Security Monitoring and Audit Framework

Integrigy's Log and Audit Framework for PeopleSoft

The framework is a result of Integrigy's consulting experience and is based on compliance and security standards such as Payment Card Industry (PCI-DSS), Sarbanes-Oxley (SOX), IT Security (ISO 27001), FISMA (NIST 800-53), and HIPAA.

The foundation of the framework is the set of security events and actions that should be audited and logged in all PeopleSoft implementations. These security events and actions are derived from and mapped back to key compliance and security standards most organizations have to comply with. We view these security events and actions as the core set and most organizations will need to expand these events and actions to address specific compliance and security requirements, such as functional or change management requirements.

Table 1 presents the core set of audits that, if implemented, will serve as a foundation for more advanced security analytics. Implementing these audits will go a long way toward meeting logging and auditing requirements for most compliance and security standards like PCI requirement 10.2. The numbering scheme used in Table 1 will be referenced throughout the document.

Table 1 – Foundation Events for Logging and Security Framework

Security Events and Actions	PCI DSS 10.2	SOX (COBIT)	HIPAA (NIST 800-66)	IT Security (ISO 27001)	FISMA (NIST 800-53)
E1 - Login	10.2.5	A12.3 DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E2 - Logoff	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E3 - Unsuccessful login	10.2.4	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1 A.11.5.1	AC-7
E4 - Modify authentication mechanisms	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E5 - Create user account	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E6 - Modify user account	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E7 - Create role	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E8 - Modify role	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2

Table 1 – Foundation Events for Logging and Security Framework

Security Events and Actions	PCI DSS 10.2	SOX (COBIT)	HIPAA (NIST 800-66)	IT Security (ISO 27001)	FISMA (NIST 800-53)
E9 - Grant/revoke user privileges	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E10 - Grant/revoke role privileges	10.2.5	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E11 - Privileged commands	10.2.2	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2
E12 - Modify audit and logging	10.2.6	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2 AU-9
E13 - Objects: Create object Modify object Delete object	10.2.7	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2 AU-14
E14 - Modify configuration settings	10.2.2	DS5.5 DS5.6 DS9.2	164.312(c)(2)	A 10.10.1	AU-2

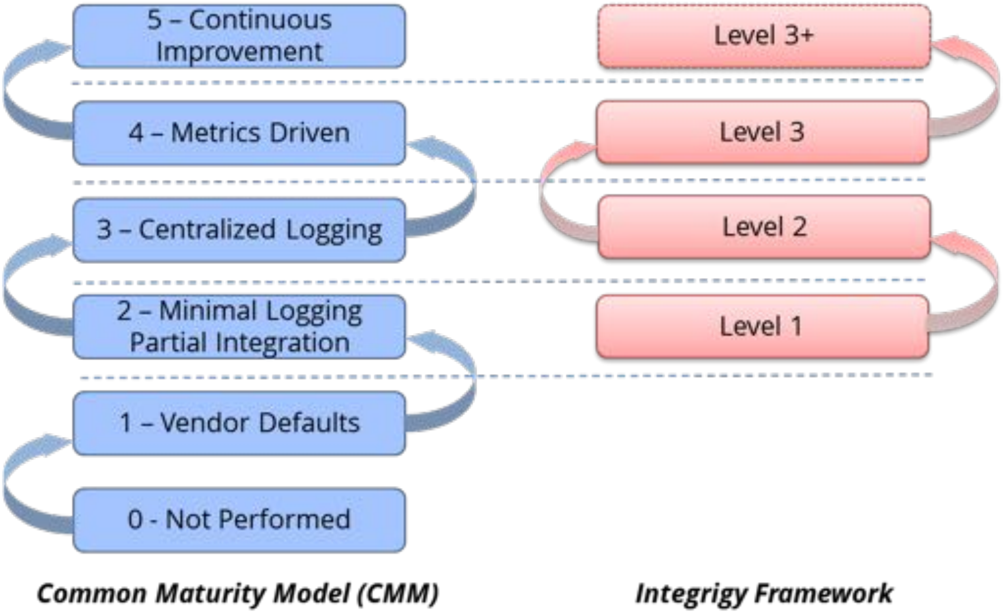
FRAMEWORK APPROACH

Integrigy's framework has three levels of maturity. Not all organizations will start at the same level. Which level a client starts at depends on the infrastructure and policies an organization already has in place. Integrigy's experience is that using this approach will give both specific guidance as well as vision.

The levels are:

- **Level 1** – Enable basic logging for PeopleSoft system administration and implement a best practices checklist for security monitoring and auditing. Implementation focus is on DBAs and application administrators.
- **Level 2** – Send basic log data to a centralized logging solution outside the Oracle Database and PeopleSoft. Implementation focus is on IT security and internal auditors and their meeting the basic requirements.
- **Level 3** – Send PeopleSoft functional and additional database logs to the centralized logging solution. Implementation focus is on IT security and internal auditors to meet advanced requirements for compliance and automation. This is commonly done to meet specific requirements for compliance PCI, SOX, HIPAA and ISO 27001.

Figure 1 - Integrigy Framework Compared to Common Maturity Model



Level 1

The first level focuses on logging and basic monitoring and auditing. Logging, monitoring, and auditing are separate but related disciplines. Logging provides the data for both monitoring and auditing. In the framework's first level optional logging functionality is enabled. This is functionality not enabled by the default PeopleSoft installation and is commonly not used. Once this functionality is in place, the framework then presents a best practice checklist for security monitoring and auditing for PeopleSoft. For those customers considering a security monitoring and auditing program, this should be an ideal starting point.

Level 2

The second level of maturity focuses on integrating with a centralized logging solution. Given the complexity of PeopleSoft and compliance requirements for protection and non-repudiation of log data, a centralized logging solution is required. Once the solution is in place, Level 2 of the framework presents where and how to start passing log and audit data from PeopleSoft and Oracle Database.

Level 3

The third level of maturity is continuous. Once the basic log data is being passed to a centralized logging solution and/or Security Incident and Event Management (SIEM) system, the framework presents additional PeopleSoft configurations that can and should be considered for event correlation. As well, the framework identifies additional database and application server logs to be captured. Level 3 is continuous, as the possibilities of security incident and event correlation rules and filters are only limited by the data within PeopleSoft.

Figure 2 - Integrigy Framework Auditing and Logging Framework

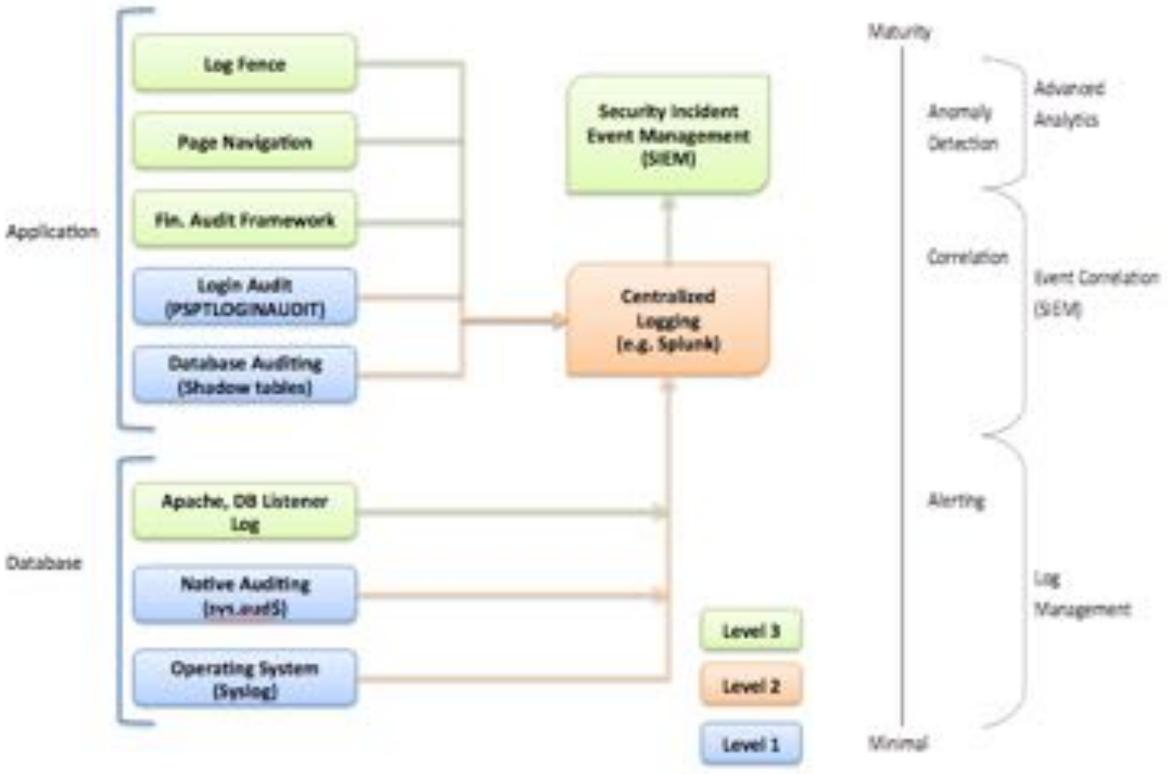
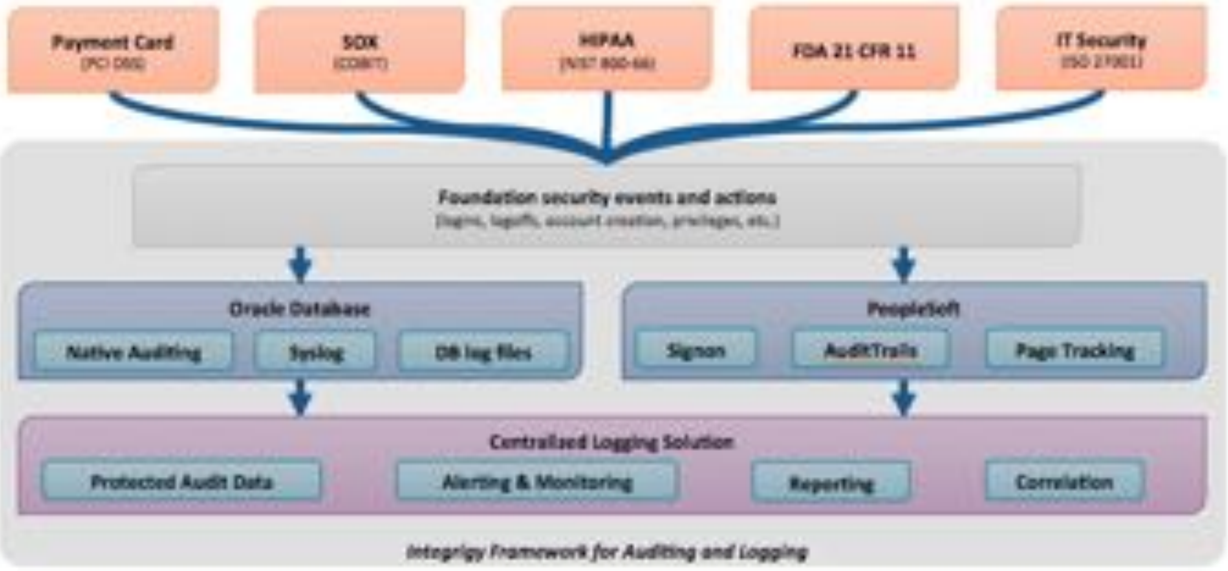


Figure 3 - Integrigy Framework for Auditing and Logging in PeopleSoft



Log and Audit Functionality

This section reviews the basic log and audit functionality available in PeopleSoft and the Oracle Database. Some of this functionality is enabled by default – some of it is optional and needs to be configured. It should also be noted that more audit and monitoring functionality exists than what is discussed here. The scope of this discussion is limited to what is required to implement Integrigy's framework.

NOTE: This section may be optional if the reader is already familiar with the core auditing and logging functionality in PeopleSoft. The purpose is to provide an overview of the key auditing and logging features used to implement Integrigy's framework.

What Is a Log?

A "log" is a collection of messages that "paints a picture" of an event or occurrence. The following are general categories of log messages, all of which are important to Integrigy's framework:

- **Informational –** benign event occurrence, for example, a system reboot
- **Debug –** information to aid developers and administrators
- **Warning –** events affecting systems and applications
- **Error –** application or system fault
- **Alert –** something interesting has occurred

A log message has three parts:

1. **Timestamp** – when did the event occur
2. **Source** – server, application or person
3. **Data** – system message, SQL statement, debug code, etc.

Operating system Logging

Most, if not all, PeopleSoft implementations running on UNIX or Linux will have Syslog enabled by the system administrators and/or hosting provider. Syslog is a standard for UNIX and Linux message logging and supports a wide variety of devices, from printers and network routers to database servers. Syslog messages generated by applications or services are sent to a message store on the system or can be delivered to a centralized server built for the specific purpose of log storage and analysis.

The following basic operating system events are assumed to be collected and available:

- System startup/shutdown
- Logons and attempted logons – IP address, port, time
- Process history and statics

Oracle Database

Oracle Databases offer a rich set of logging and auditing functionality. For Integrigy's Framework, standard Oracle Database auditing and the capability to send database audit logs to Syslog will be leveraged.

Standard Oracle Auditing

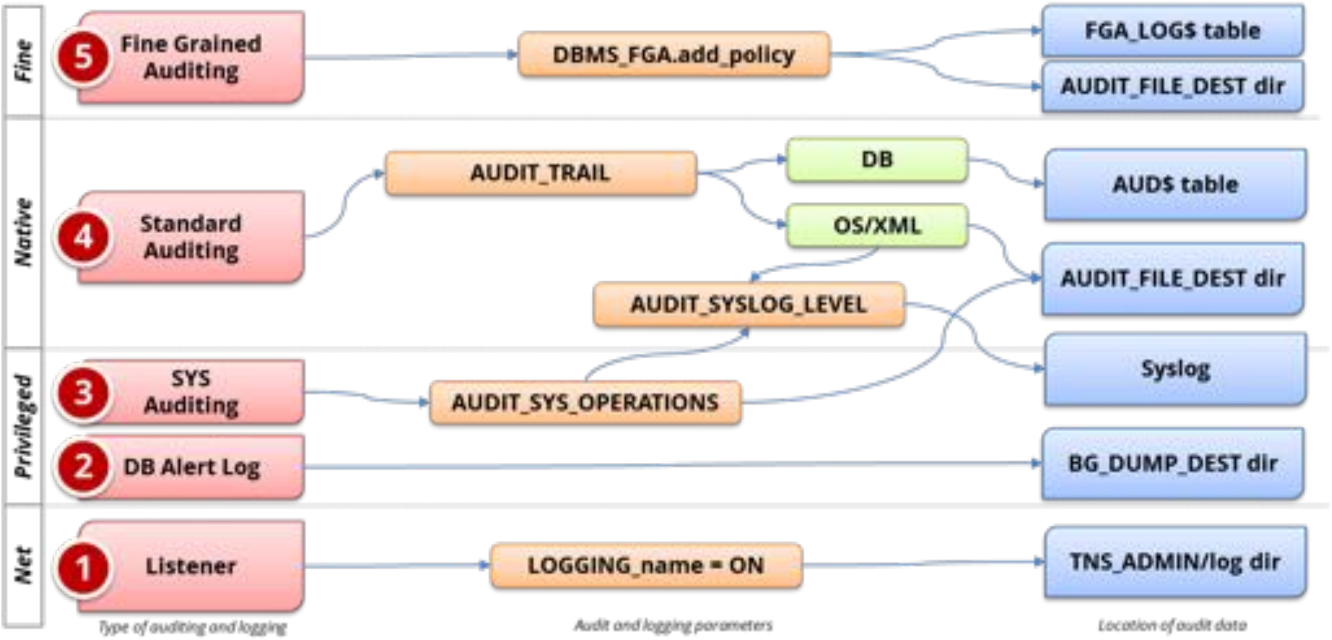
Standard auditing is available in all editions of the Oracle RDBMS. It can be used to audit SQL statements, privileges, schemas, objects and network and multitier activity. Standard auditing must be enabled, and once enabled, a regular program for purging data needs to be implemented.

The variety and volume of data collected by standard auditing can be large and the output can be directed either to the database itself or to files in the operating system outside the database. Moving logs outside the reach of DBAs, either into the operating system or sent to a centralized log server, offers many security benefits. For more information on standard auditing refer to the reference section of this document.

Database Syslog

As noted earlier, Syslog is a standard for UNIX and Linux logging. Oracle Syslog option is a standard database feature that sends Oracle log data to the native operating system Syslog facility, which in turn can be forwarded directly to a centralized syslog server or collector. The native Oracle Syslog auditing has minimal performance overhead and provides immediate protection of the audit trail. However, it is possible for the DBA to disable auditing and mitigating controls must be established around possible deactivation of the auditing. For more information on Syslog refer to the reference section of this document.

Figure 4 - Database Auditing and Logging



PeopleSoft

PeopleSoft provides a robust set of default and optional audit functionality. This includes the following:

- Login Auditing (successful/unsuccessful)
- Navigation (Page Level) Auditing – who went where and looked at what?
- Field Auditing – who created or last updated what?
- Database Auditing – who created or last updated what?

For those familiar with PeopleSoft's auditing functionality, this section can be skipped. For those not familiar this section will give an overview. Refer to the PeopleSoft documentation for a detailed review and explanation.

Login Auditing

PeopleSoft login auditing is sent to the table PSPTLOGINAUDIT for both successful and unsuccessful attempts. To enable Login Audit option. Use PSADMIN (psSYSADMrv.cfg) ensure the following domain parameters are set for auditing. On the application server configuration file look in *PS_CFG_HOME*\SYSADMerv*domain_name* for the file PSSYSADMRV.CFG. Locate the parameter 'Enable Login Audit' and Set Enable Login Audit option = Y

Table PSLOGINAUDIT	
Column	**Description**
PT_AUTH_TYPE	0 = Authentication token used 1 = Database authentication 2 = PeopleCode authentication
OPRID	Profile (User Account) in table PSOPRDEFN
PTSIGNONID	User ID used in attempt. May differ is LDAP is being used.
PT_SIGNON_STATUS	0 = Success 1 = Failure
LASTSIGNONDTTM	Date time of event

Navigation (Page Level) Auditing

PeopleSoft navigation auditing can be enabled. It is not enabled by default. It is enabled by using PeopleTools to add code to the open event of pages such that information is written out to audit logs to log the page name and data records viewed. To enable this functionality refer to the following Oracle support whitepaper: PeopleSoft Security Auditing (Doc ID 1963774.1).

Field Auditing

Field level auditing is delivered by default with PeopleSoft. It is optional in that that functionality is provided but must be enabled on a field-by-field basis. Regardless of what fields are enabled for auditing, all audit records are written to the centralized audit table PSAUDIT.

One important caveat about field level auditing is that only logs activity that occurs within the PeopleSoft user interface. Direct database activity from DBAs and developers using SQL-Plus and/or SQL-Developer will not be detected by field level auditing, nor will field level auditing secure activity occurring within SQR and PeopleSoft's

COBOL programs. Most importantly, however, field level auditing does not support auditing of PeopleTools tables (PT 8.1.x, 8.4.x and PT 8.5.x)[1].

Field level auditing logs:

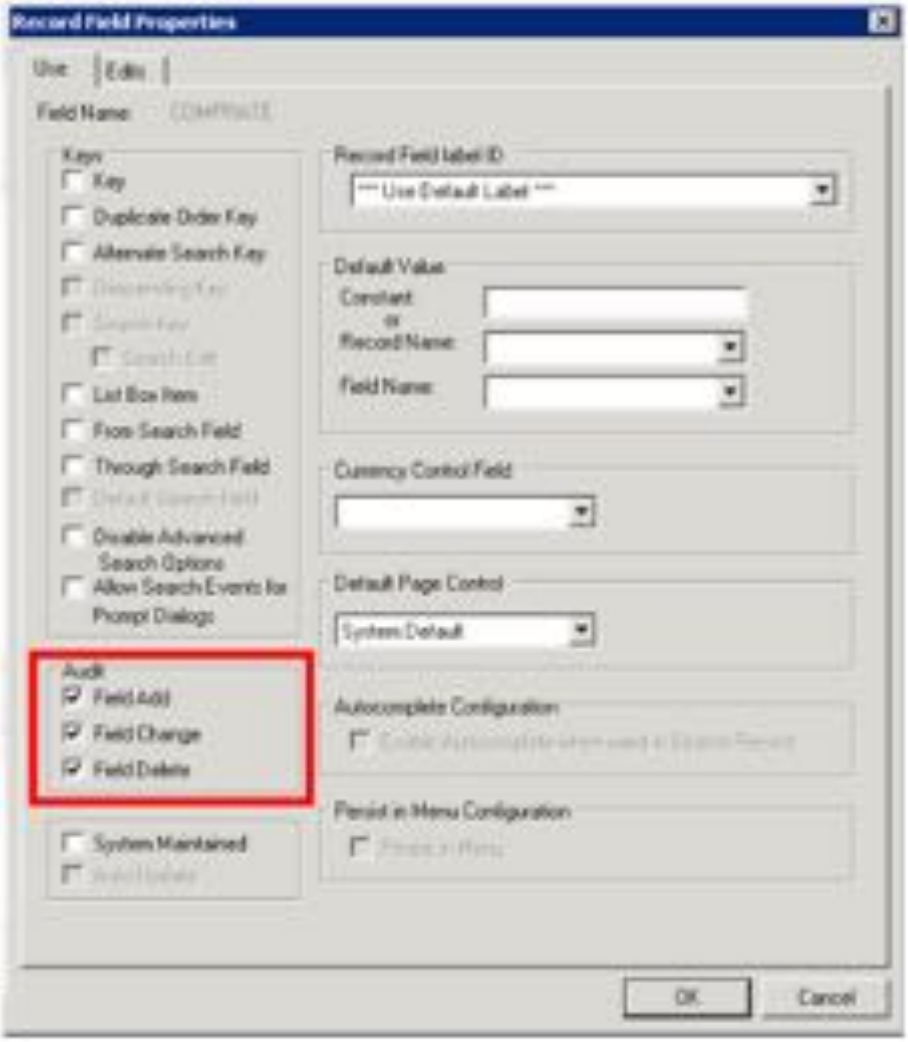
- Who made the change (OPRID)
- Date and Time Stamp of the change
- Type of change: ‘A’dd o ‘C’hange o ‘D’elete
- Record Name (table):
- Field Name in the Record
- The before value
- The after value
- Primary Key of the Record

```
The following SQL identifies fields on records that have field level auditing:

SELECT
F.RECNAME,
F.FIELDNUM,
F.FIELDNAME,
F.USEEDIT,
CASE WHEN BITAND(F.USEEDIT,8) > 0 THEN 'Y' ELSE 'N' END AUDIT_FIELD_ADD, CASE WHEN
BITAND(F.USEEDIT,128) > 0 THEN 'Y' ELSE 'N' END AUDIT_FIELD_CHANGE, CASE WHEN
BITAND(F.USEEDIT,1024) > 0 THEN 'Y' ELSE 'N' END AUDIT_FIELD_DELETE
FROM
SYSADM.PSRECFIELD F
WHERE
F.FIELDNAME = (
SELECT
CASE WHEN (
BITAND(USEEDIT,8) > 0 OR BITAND(USEEDIT,128) > 0 OR BITAND(USEEDIT,1024) > 0
) THEN FIELDNAME ELSE '' END AS FIELD_AUDITED FROM SYSADM.PSRECFIELD
WHERE RECNAME = F.RECNAME
AND FIELDNAME = F.FIELDNAME )
ORDER BY F.RECNAME, F.FIELDNUM;


Audit records will be written to PSAUDIT.
-- Records being audited
SELECT
DECODE(TRIM(AUDITRECNAME),NULL,'NOT ENABLED','ENABLED') AUDIT_STATUS,
PSRECDEFN.RECNAME ,  NVL(TRIM(PSRECDEFN.SQLTABLENAME),'PS_'||PSRECDEFN.RECNAME)
THETABLE ,
TRIM(AUDITRECNAME) AUDITRECNAME,
CASE WHEN BITAND(RECUSE,1) > 0 THEN 'Y' ELSE 'N' END AUDIT_ADD,
CASE WHEN BITAND(RECUSE,2) > 0 THEN 'Y' ELSE 'N' END AUDIT_CHANGE,
CASE WHEN BITAND(RECUSE,4) > 0 THEN 'Y' ELSE 'N' END AUDIT_DELETE,
CASE WHEN BITAND(RECUSE,8) > 0 THEN 'Y' ELSE 'N' END AUDIT_SELECTIVE,
PSRECDEFN.OBJECTOWNERID,
PSRECDEFN.RECDESCR,
PSRECDEFN.DESCRLONG
FROM SYSADM.PSRECDEFN
WHERE  PSRECDEFN.RECTYPE = 0
ORDER BY 1, 2;
```

[1] Can PeopleTools Tables Such As Security Tables Be Audited? (Doc ID 611582.1)



Field Name: COMPRATE

Keys
- □ Key
- □ Duplicate Order Key
- □ Alternate Search Key
- □ Descending Key
- □ Search Key
- □ Search Edit
- □ List Box Item
- □ From Search Field
- □ Through Search Field
- □ Default Search Field
- □ Disable Advanced Search Options
- □ Allow Search Events for Prompt Dialogs

Audit
- ☑ Field Add
- ☑ Field Change
- ☑ Field Delete

- □ System Maintained
- □ Auto Update

Record Field label ID: *** Use Default Label ***

Default Value
Constant
or
Record Name:
Field Name:

Currency Control Field

Default Page Control: System Default

Autocomplete Configuration
- □ Enable Autocomplete when used in Search Record

Persist in Menu Configuration
- □ Persist in Menu

Figure 5 - Example of Field Level Auditing

Database Auditing

Database auditing an alternative to Field Level Auditing. Database triggers are used to copy information from PeopleSoft base tables into "shadow" audit tables. To enable this functionality, the parameter Enable DB Monitoring must be enabled in PSADMIN. Other steps are also required and are detailed in a forthcoming section of this document.

Whereas PeopleSoft field level auditing logs only activity that occurs within the PeopleSoft user interface, database auditing logs ALL activity regardless if coming from the end-user interface, SQR, COBOL and/or direct database activity from DBAs and developers using SQL-Plus and/or SQL-Developer. Most importantly, however, database auditing will log activity in PeopleTools tables (PT 8.1.x, 8.4.x and PT 8.5.x)[2].

[2] Can PeopleTools Tables Such As Security Tables Be Audited? (Doc ID 611582.1)

The graphic below depicts how PeopleSoft database auditing works -

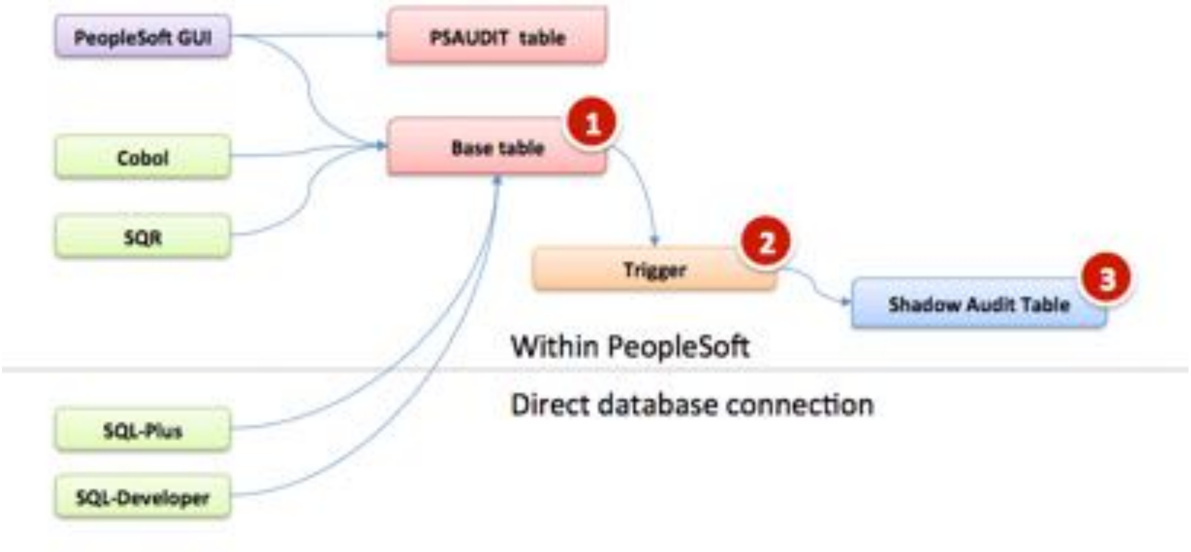


Figure 6 - PeopleSoft Database Auditing

INTEGRIGY FRAMEWORK – LEVEL 1

Level 1 focuses on the basic logging that Integrigy recommends for all PeopleSoft implementations. This logging needs to be in place before proceeding to Levels 2 and 3 of the Framework, but assumes a centralized logging solution is not available yet. Level 1 auditing will be in addition to the standard default functionality such as the created / last updated "Who Columns" on each record.

The following summarizes the steps to implement Level 1:

1. Oracle Database logging
   a. Enable standard database auditing to the database (AUD$) per Integrigy's recommendations
   b. Enable AUDIT_SYS_OPERATIONS
2. PeopleSoft logging
   a. Enable Signon auditing
   b. Enable shadow table auditing on key tables per Integrigy's recommendation
3. Set up policies and procedures for security monitoring and auditing

DATABASE AUDITING

Database auditing is vital to application logging and security monitoring as direct database access can be used to circumvent all application controls.

Level 1 assumes there is no centralized logging solution implemented and the database audit data should be written to the database (SYS.AUD$) for monitoring and reporting. Saving audit data to the database is not ideal as the DBA can manipulate the audit data, but provides for much simplified monitoring and reporting. If a centralized logging solution is implemented, then the database audit data should be written to Syslog per the instructions in Level 2.

Steps for Level 1 database auditing:

1. Enable native database auditing and store audit data to the database. In the init.ora file for the instance, set the database initialization parameter **AUDIT_TRAIL** to **DB**. This will write out all logs to the SYS.AUD$ table except for SYS Operations, which are always written to the operating system audit trail.
2. As the SYS user, configure database auditing per *Table 2 – Recommended PeopleSoft Database Auditing*.
3. The SYS.AUD$ table needs to be purged on a periodic basis per your organization's policy requirement. All rows should be backed up prior to being purged. Purging is configured through the use **DBMS_AUDIT_MGMT**.
4. In the init.ora file for the database instance, enable auditing of the SYS user by setting the database initialization parameter **AUDIT_SYS_OPERATIONS** to **TRUE**. Logs are written to the operating system's native audit trail.

Table 2 – Recommended PeopleSoft Database Auditing

Framework Event	Database Object	Oracle Audit Statement (audit {};)	Resulting Audited SQL Statements	Notes
E1, E2, E3	Session	session	Database logons and failed logons	▪ All database logons and failed logons ▪ This is highly dependent on database usage and application. With application connection pooling, the number of database session is minimized. However, some frequent interface programs may result in large numbers of sessions.
E5, E6	Users	user	create user alter user drop user	▪ All changes to users ▪ Includes all password changes by users – actual password is not captured
E7, E8	Roles	role	create role alter role drop role	▪ All changes to roles ▪ SET ROLE is excluded which is frequently used and would be included if AUDIT ROLE was used
E13	Database Links Public Database Links	database link public database link	create database link drop database link create public database link drop public database link	▪ Creation and deletion of database links
E11, E14	System	alter system	alter system	▪ Changes to the database configuration ▪ Audits killing of sessions, open/closing wallet, and setting of initialization parameters
	Database	alter database	alter database	▪ Change to database and instance state
E9, E10	Grants (system privileges and roles)	system grant	grant revoke	▪ Captures only grants to system privileges and roles ▪ Grants/revokes on database objects will be captured as part of the object creation
E4	Profiles	profile	create profile alter profile drop profile	▪ All changes to password and resource profiles ▪ Assigning profiles to users will be captured as part of ALTER USER
E9, E10	Directories	grant directory	grant directory revoke directory	▪ Granting of directories

Table 2 – Recommended PeopleSoft Database Auditing

Framework Event	Database Object	Oracle Audit Statement (audit {};)	Resulting Audited SQL Statements	Notes
E9, E10	Procedures Packages Functions Libraries Java Objects	grant procedure	grant <procedural type> revoke <procedural type>	- Granting and revoking of procedural objects
E9, E10	Object Grants	grant sequence grant table grant type	grant sequence grant table/view grant type revoke sequence revoke table/view revoke type	- Granting on sequence, tables, types, and views - Grant table will also audit grant view
E12	Auditing	system audit	audit noaudit	- Changes to database auditing
E11, E14	SYSDBA and SYSOPER	sysdba sysoper	All SQL executed with sysdba and sysoper privileges	- Actions taken by DBAs – mostly occurs during weekly maintenance window

As part of the Framework Level 1, we do not recommend enabling extensive auditing of database object (e.g., tables, indexes, procedures, etc.) creation, modification, or deletion since in an PeopleSoft environment this will generate a significant amount of audit data. The application itself is creating temporary objects and there are frequent changes due to patching. The SYSADM user is the account used during these activities and mostly originates from the application or database servers, thus the audit trail becomes fairly meaningless.

PeopleSoft Logging

Integrigy's Log and Audit Framework is designed to secure volume, high security impact fields. PeopleSoft's default auditing send record and field level data to centralized tables (PSAUDIT). Field level auditing has several disadvantages. First, field level auditing secures only activity that occurs within the PeopleSoft user interface. Direct database activity from DBAs and developers using SQL-Plus and/or SQL-Developer will not be detected by field level auditing, nor will field level auditing secure activity occurring within SQR and PeopleSoft's COBOL programs. Most importantly, however, field level auditing does not support auditing of PeopleTools tables (PT 8.1.x, 8.4.x and PT 8.5.x)[3]. Consequently, Integrigy's Log and Audit Framework for PeopleSoft uses the database-auditing alternative.

Implementing database trigger-based auditing will create a performance impact however, the Integrigy Framework for PeopleSoft Logging and Auditing targets high security impact, low volume transactions so as to alleviate any potential security impact.

[3] Can PeopleTools Tables Such As Security Tables Be Audited? (Doc ID 611582.1)

The following steps are detailed below to enable database auditing within PeopleSoft:

1. Enable Login Auditing
2. Enable DB Monitoring
3. Create PS_ORID function
4. Verify Existing Audit Triggers
5. Define Audit records (shadow tables)
6. Define Audit Triggers
7. Deploy Audit Triggers
8. Secure Shadow Audit Tables
9. Setup Rolling Purge of Audit Tables

Enable Login Auditing

This step is not part of database auditing but is good to do before enabling database auditing.

Enable Login Audit option. Use PSADMIN (psSYSADMrv.cfg) ensure the following domain parameters are set for auditing. This will log User logon/off and attempts to the table PSPTLOGINAUDIT

On the application server configuration file look in *PS_CFG_HOME*\SYSADM*domain_name* for the file psappsrv.cfg. Locate the parameter 'Enable Login Audit' and Set Enable Login Audit option = Y

Enable DB Monitoring

First use PSADMIN (psappsrv.cfg) to ensure the domain parameters are set for auditing to allow database triggers to tables with the 'AUDIT_prefix'.

Verification:

1. On the application server configuration file look in *PS_CFG_HOME*\SYSADM*domain_name* for the file psappsrv.cfg (for example in /home/psadm2/psft/pt/8.54/appserv/APPDOM/psappsrv.cfg)
2. Locate the parameter EnableDBMonitoring
3. Make user EnableDBMonitoring = 1

Create PS_OPRID Function

For Oracle audit triggers, in order for the audit triggers to obtain the PS_OPRID, PeopleSoft provides a function. This function must be installed into the Oracle database schema for the PeopleSoft database prior to creating the audit triggers. This function is installed by executing the following SQL as the PeopleSoft database owner ID:

```
$PS_HOME\scripts\getpsoprid.sql
```

For other database platforms refer to the documentation[4].

[4] https://docs.oracle.com/cd/E58500_01/pt854pbh1/eng/pt/tadm/concept_UnderstandingDatabaseLevelAuditing-077a5f.html - topofpage

Verify Existing Audit Triggers

Verify what database trigger based auditing has already been enabled:

Verification:

-- List sensitive tables with database trigger auditing enabled

```
SELECT PSRECDEFN.RECNAME , PSRECDEFN.SQLTABLENAME,
NVL(TRIM(PSRECDEFN.SQLTABLENAME),'PS_'||PSRECDEFN.RECNAME) THETABLE ,
PSRECDEFN.OBJECTOWNERID,
PSRECDEFN.FIELDCOUNT,
PSRECDEFN.RECDESCR,
PSRECDEFN.DESCRLONG,
OPTTRIGFLAG,
SYSTEMIDFIELDNAME,
TIMESTAMPFIELDNAME,
PSTRIGGERDEFN.*
FROM SYSADM.PSTRIGGERDEFN , SYSADM.PSRECDEFN
WHERE PSRECDEFN.RECNAME = PSTRIGGERDEFN.RECNAME
ORDER BY 1,3;
```

Define Audit Records

To create the shadow tables for database auditing you need to the client/server Application Designer Tool. Configure records for database trigger auditing. This process must be done per the documentation. ***Do not manually create the shadow audit tables and/or triggers***. Once created, DataMover can be used to migrate the audit records and triggers among non-production instances and/or to production.

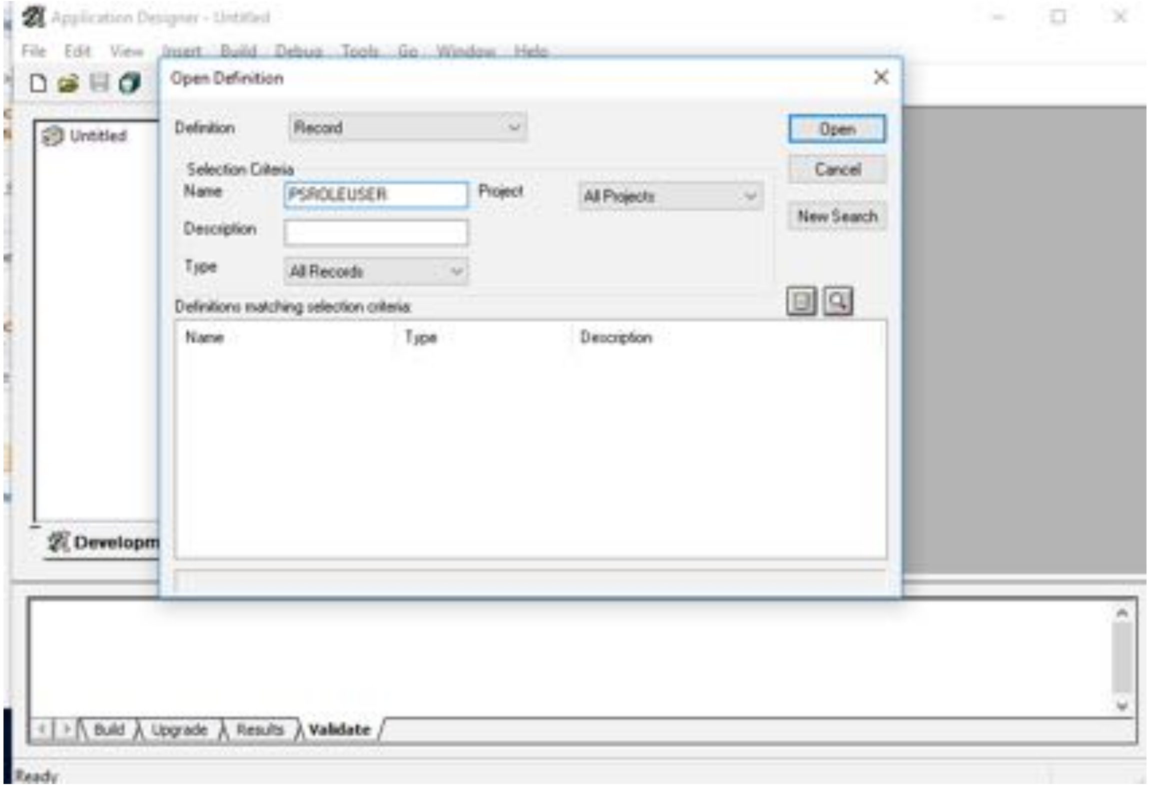
Refer to Appendix A for the full listing. Below is a recommended short list to start with. Use the Status column to record your progress configuring the audit records.

Recommended Level 1 Auditing					
No	**Framework**	**Record**	**DB Table**	**Description**	**Status**
1	E14	PRCSDEFN	PS_PRCSDEFN	Process Definition	
2	E1, E2	PSACCESSLOG	PSACCESSLOG	Login history (only for update or delete)	
3	E14	PSCLASSDEFN	PSCLASSDEFN	Permissions Lists Definition	
4	E14	PSMENUDEFN	PSMENUDEFN	Menu Definition	
5	E13	PSMENUITEM	PSMENUITEM	Menu Item	
6	E4, E5	PSOPRDEFN	PSOPRDEFN	User definition	
7	E1, E3	PSPTLOGINAUDIT	PSPTLOGINAUDIT	Login history (only for update or delete)	
8	E12, E13	PSRECDEFN	PSRECDEFN	Record Definition	
9	E7, E8	PSROLECLASS	PSROLECLASS	Role Classes	
10	E7, E8	PSROLEDEFN	PSROLEDEFN	Role Definition	
11	E9	PSROLEUSER	PSROLEUSER	Role User	
12	E4, E5, E6, E14	PSSECOPTIONS	PSSECOPTIONS	Password controls	
13	E12	PSTRIGGERDEFN	PSTRIGGERDEFN	Defined database triggers	
14	E14	PSWEBPROFILE	PSWEBPROFILE	Web Profile	

Steps to create shadow audit tables:

1. From the client/server Application Designer, open the record definition of the PeopleSoft base table record
2. Create a copy of the base table by saving it as a new record, prefaced with AUDIT_<base table name>.
3. Remove all existing edit and key attributes for the existing columns.
4. Add to the top of the audit record the following three (3) audit-specific fields "columns". These tables must be the first three columns and must be spelled exactly.
5. Each of the three audit columns must be a "Required" field and also must be a "Key" field.
6. Remove base columns not needed to support auditing. Select only the minim number of columns required and/or deemed necessary for auditing.
7. Save to commit all changes to the PeopleSoft metadata dictionary for the new table "record" – click the Save icon in the ribbon
8. New the create table use the Build menu in the ribbon. Select the shadow audit table(s) to create in the database. This step will only generate a file in the local Windows operating system where the Application Designer is running.
9. Open the DDL file by double clicking on the name of the file. This will open the DDL file in Notepad. Copy the DDL.
10. Login to SQL-Plus, TOAD or SQL-Developer as SYSADM and past the DDL to create the shadow audit table.

Audit Field Name	**Purpose**	**Data Type**
AUDIT_OPRID	Identifies the user who causes the system to trigger the audits, either by performing an add, change, or delete to an audited field.	Character
AUDIT_STAMP	Identifies the date and time that the audit is triggered.	Datetime
AUDIT_ACTN	Indicates the type of action the system audited. Possible action values include: • *A* – Row inserted. • *D* – Row deleted. • *K* – Row updated, snapshot before update. • *N* – Row updated, snapshot after update.	Character


Application Designer - Untitled
File Edit View Insert Build Debug Tools Go Window Help
Untitled
Development
Open Definition
Open
Cancel
New Search
Build Upgrade Results Validate
Ready

Definition: Record

Selection Criteria

Name: PSROLEUSER

Project: All Projects

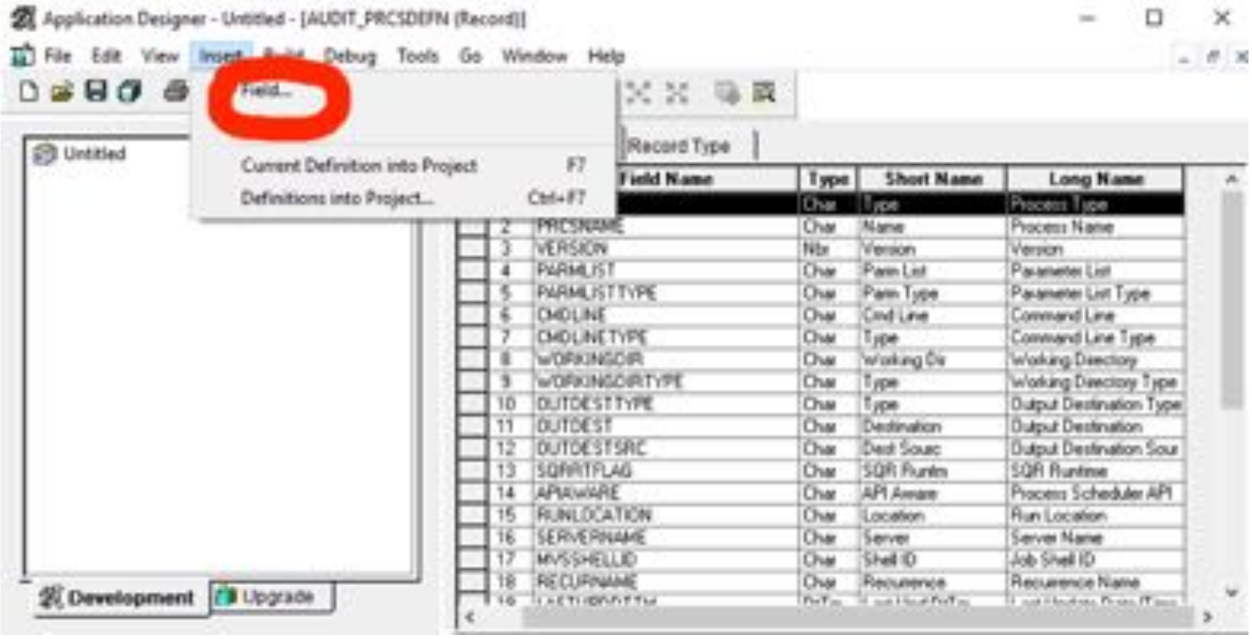
Description:

Type: All Records

Definitions matching selection criteria:

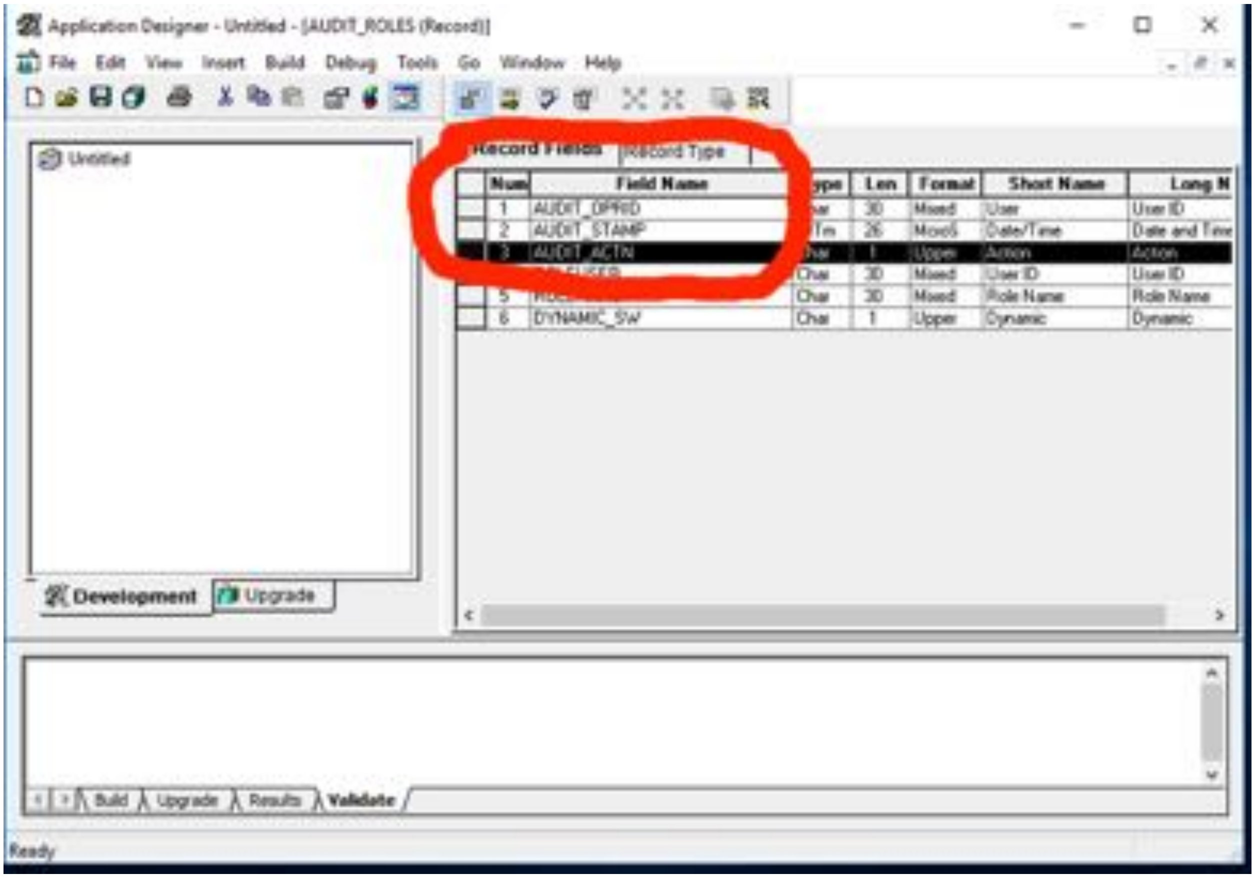
Name	Type	Description

Figure 7 - Locate the base table


Application Designer - Untitled - [AUDIT_PRCSDEFN (Record)]
File Edit View Insert Build Debug Tools Go Window Help
Field...
Current Definition into Project F7
Definitions into Project... Ctrl+F7
Untitled
Development
Upgrade
Record Type

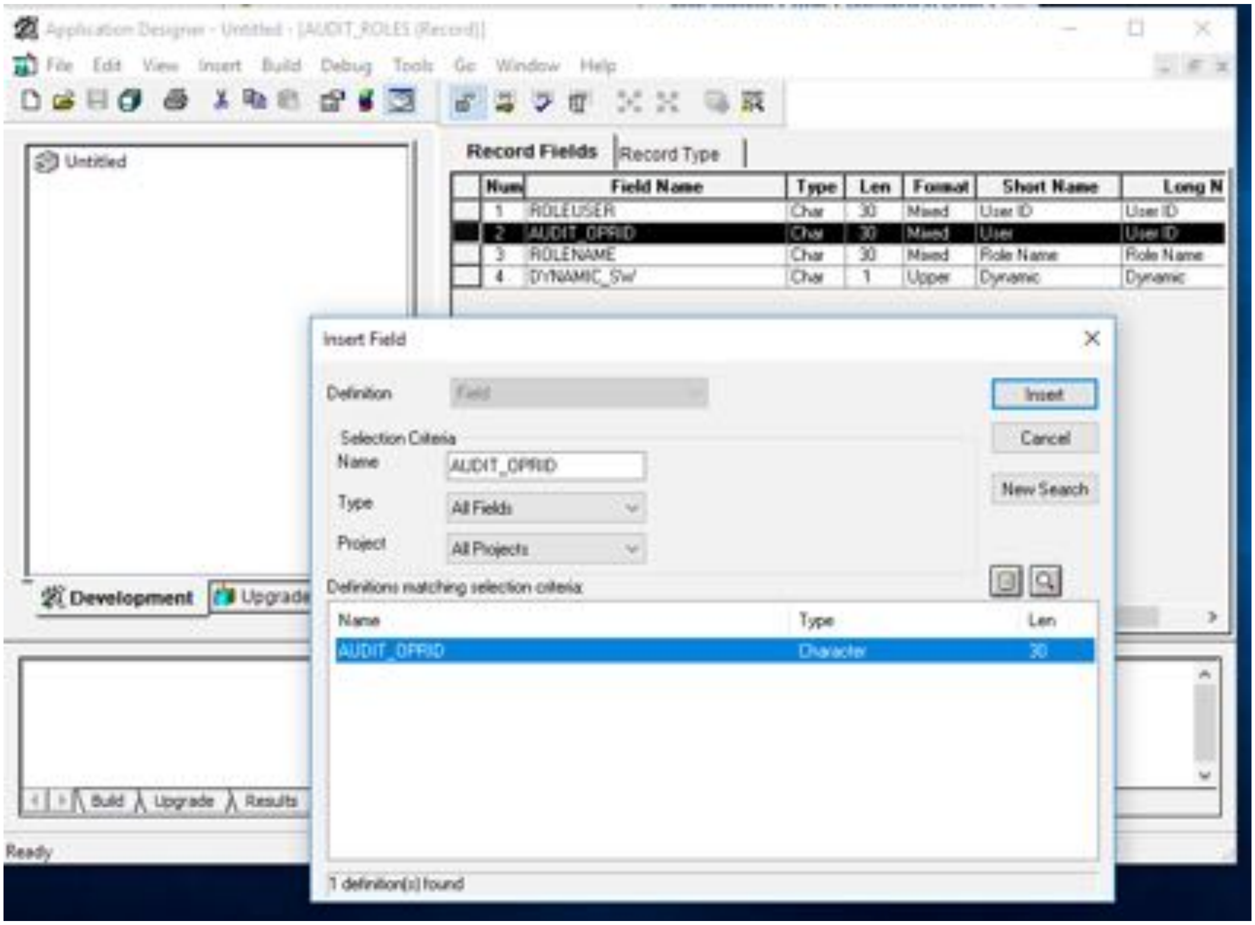
	Field Name	Type	Short Name	Long Name
		Char	Type	Process Type
2	PRCSNAME	Char	Name	Process Name
3	VERSION	Nbr	Version	Version
4	PARMLIST	Char	Parm List	Parameter List
5	PARMLISTTYPE	Char	Parm Type	Parameter List Type
6	CMDLINE	Char	Cmd Line	Command Line
7	CMDLINETYPE	Char	Type	Command Line Type
8	WORKINGDIR	Char	Working Dir	Working Directory
9	WORKINGDIRTYPE	Char	Type	Working Directory Type
10	OUTDESTTYPE	Char	Type	Output Destination Type
11	OUTDEST	Char	Destination	Output Destination
12	OUTDESTSRC	Char	Dest Sourc	Output Destination Sour
13	SQRRTFLAG	Char	SQR Runtm	SQR Runtime
14	APIAWARE	Char	API Aware	Process Scheduler API
15	RUNLOCATION	Char	Location	Run Location
16	SERVERNAME	Char	Server	Server Name
17	MVSSHELLID	Char	Shell ID	Job Shell ID
18	RECURNAME	Char	Recurrence	Recurrence Name

Figure 8 - Insert Field(s)



	Num	Field Name	Type	Len	Format	Short Name	Long N
	1	AUDIT_OPRID	Char	30	Mixed	User	User ID
	2	AUDIT_STAMP	DtTm	26	Mixed	Date/Time	Date and Time
	3	AUDIT_ACTN	Char	1	Upper	Action	Action
	4	ROLEUSER	Char	30	Mixed	User ID	User ID
	5	ROLENAME	Char	30	Mixed	Role Name	Role Name
	6	DYNAMIC_SW	Char	1	Upper	Dynamic	Dynamic

Figure 9 - Create the three audit columns



Num	Field Name	Type	Len	Format	Short Name	Long N
1	ROLEUSER	Char	30	Mixed	User ID	User ID
2	AUDIT_OPRID	Char	30	Mixed	User	User ID
3	ROLENAME	Char	30	Mixed	Role Name	Role Name
4	DYNAMIC_SW	Char	1	Upper	Dynamic	Dynamic

Insert Field

Definition: Field

Selection Criteria

Name: AUDIT_OPRID

Type: All Fields

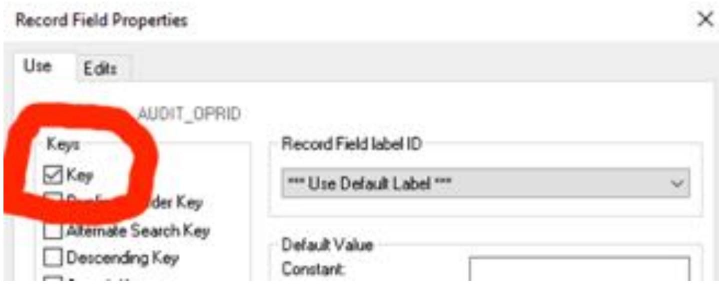
Project: All Projects

Definitions matching selection criteria:

Name	Type	Len
AUDIT_OPRID	Character	30

1 definition(s) found

Figure 10 - Example of creating an audit column



AUDIT_OPRID

Keys

☑ Key

□ D... ...der Key

□ Alternate Search Key

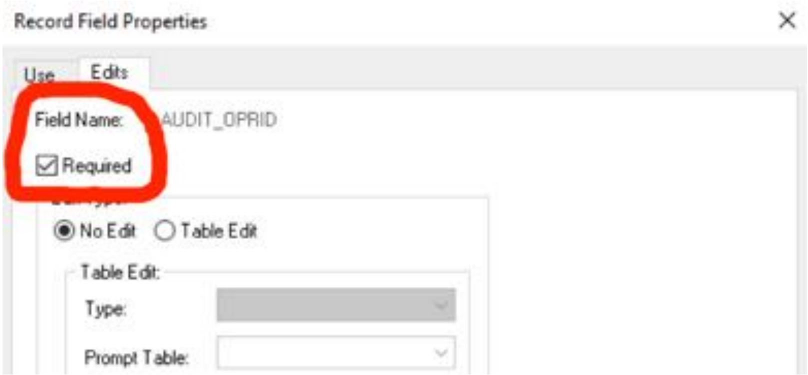
□ Descending Key

Record Field label ID: *** Use Default Label ***

Default Value

Constant:

Figure 11 - Each audit column must be a Key Field



Field Name: AUDIT_OPRID

☑ Required

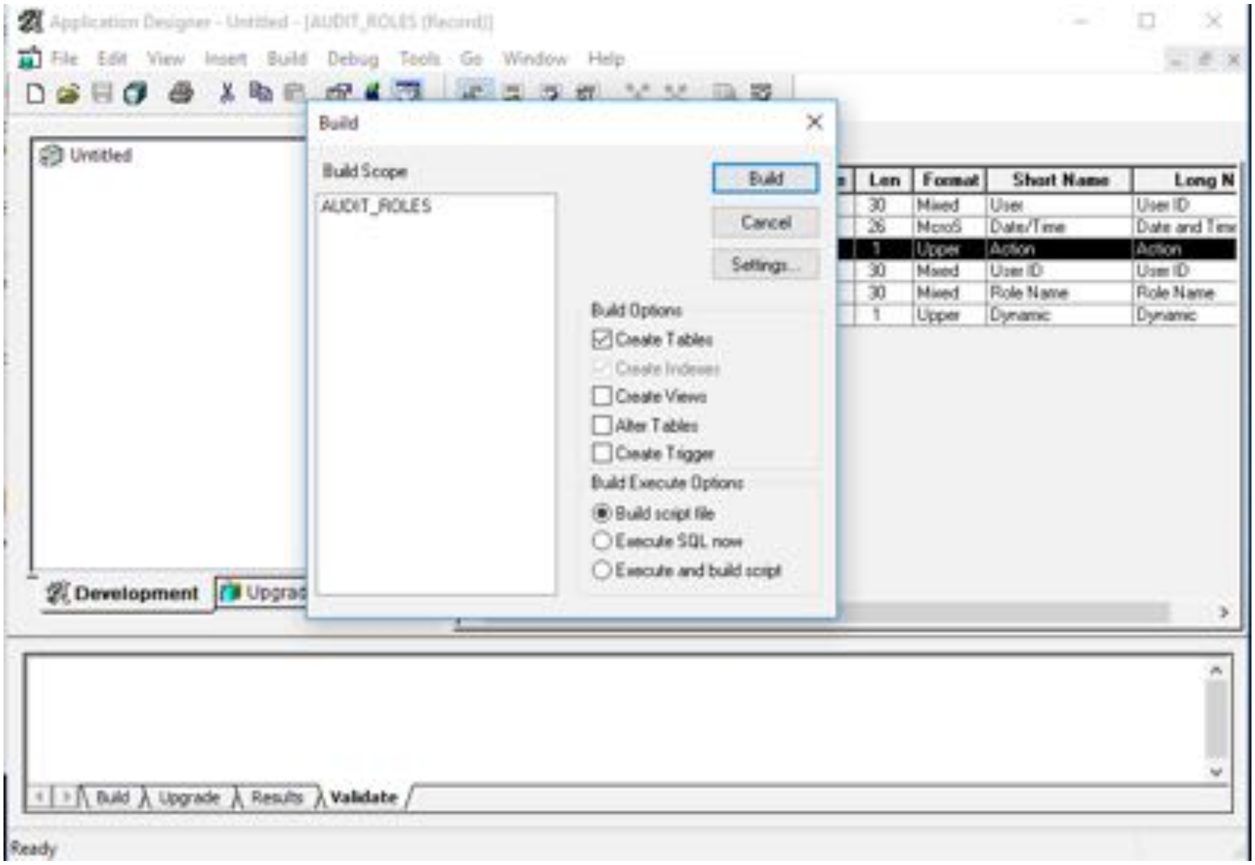
● No Edit ○ Table Edit

Table Edit:

Type:

Prompt Table:

Figure 12 Each audit column must be a required field



Build Scope

AUDIT_ROLES

Build Options

☑ Create Tables

☑ Create Indexes

□ Create Views

□ Alter Tables

□ Create Trigger

Build Execute Options

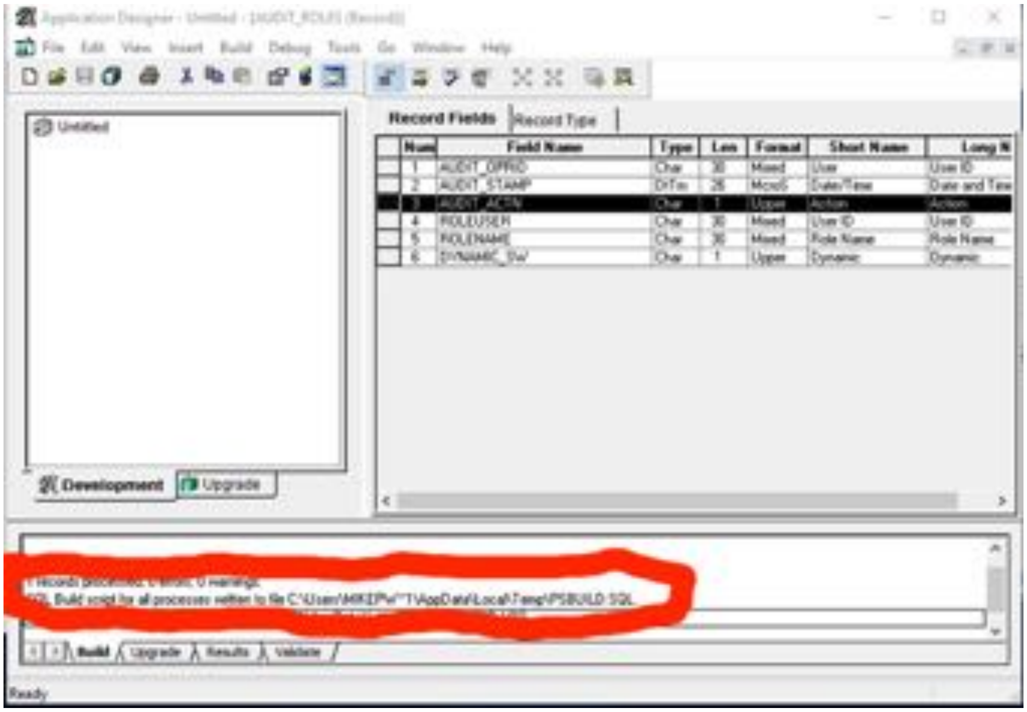
● Build script file

○ Execute SQL now

○ Execute and build script

Len	Format	Short Name	Long N
30	Mixed	User	User ID
26	MicroS	Date/Time	Date and Tim
1	Upper	Action	Action
30	Mixed	User ID	User ID
30	Mixed	Role Name	Role Name
1	Upper	Dynamic	Dynamic

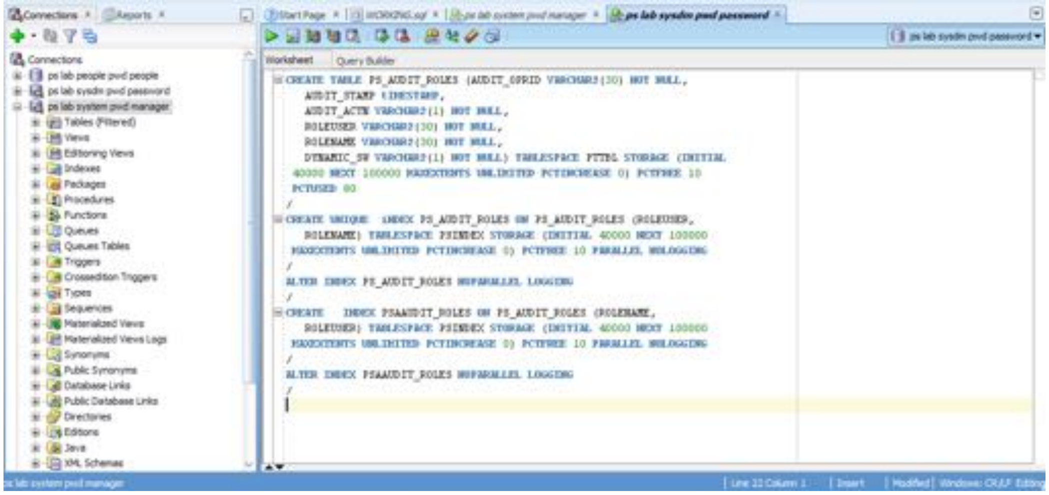
Figure 13 - Generate DDL to build new table


Application Designer - Untitled - [AUDIT_ROLES (Record)]
File Edit View Insert Build Debug Tools Go Window Help
Untitled
Development
Upgrade
Record Fields
Record Type
Build
Upgrade
Results
Validate
Ready

	Num	Field Name	Type	Len	Format	Short Name	Long N
	1	AUDIT_OPRID	Char	30	Mixed	User	User ID
	2	AUDIT_STAMP	DtTm	26	McroS	Date/Time	Date and Tim
	3	AUDIT_ACTN	Char	1	Upper	Action	Action
	4	ROLEUSER	Char	30	Mixed	User ID	User ID
	5	ROLENAME	Char	30	Mixed	Role Name	Role Name
	6	DYNAMIC_SW	Char	1	Upper	Dynamic	Dynamic

```
1 Records processed, 0 errors, 0 warnings.
SQL Build script for all processes written to file C:\Users\MIKIP~1\AppData\Local\Temp\PSBUILD.SQL.
```

Figure 14 - Double Click on the file name to open the DDL table create script and copy it



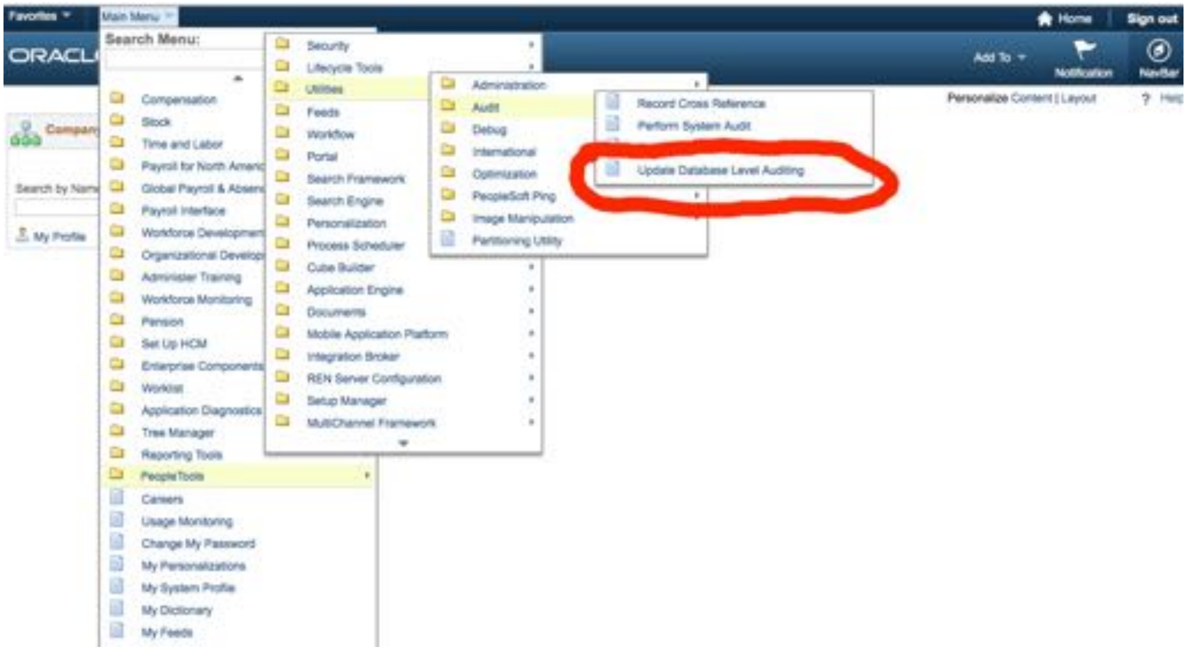
```
CREATE TABLE PS_AUDIT_ROLES (AUDIT_OPRID VARCHAR2(30) NOT NULL,
   AUDIT_STAMP TIMESTAMP,
   AUDIT_ACTN VARCHAR2(1) NOT NULL,
   ROLEUSER VARCHAR2(30) NOT NULL,
   ROLENAME VARCHAR2(30) NOT NULL,
   DYNAMIC_SW VARCHAR2(1) NOT NULL) TABLESPACE PTTBL STORAGE (INITIAL
 40000 NEXT 100000 MAXEXTENTS UNLIMITED PCTINCREASE 0) PCTFREE 10
 PCTUSED 80
/
CREATE UNIQUE  iNDEX PS_AUDIT_ROLES ON PS_AUDIT_ROLES (ROLEUSER,
   ROLENAME) TABLESPACE PSINDEX STORAGE (INITIAL 40000 NEXT 100000
 MAXEXTENTS UNLIMITED PCTINCREASE 0) PCTFREE 10 PARALLEL NOLOGGING
/
ALTER INDEX PS_AUDIT_ROLES NOPARALLEL LOGGING
/
CREATE   INDEX PSAAUDIT_ROLES ON PS_AUDIT_ROLES (ROLENAME,
   ROLEUSER) TABLESPACE PSINDEX STORAGE (INITIAL 40000 NEXT 100000
 MAXEXTENTS UNLIMITED PCTINCREASE 0) PCTFREE 10 PARALLEL NOLOGGING
/
ALTER INDEX PSAAUDIT_ROLES NOPARALLEL LOGGING
/
```

Figure 15 - Past table DDL script and run as SYSADM

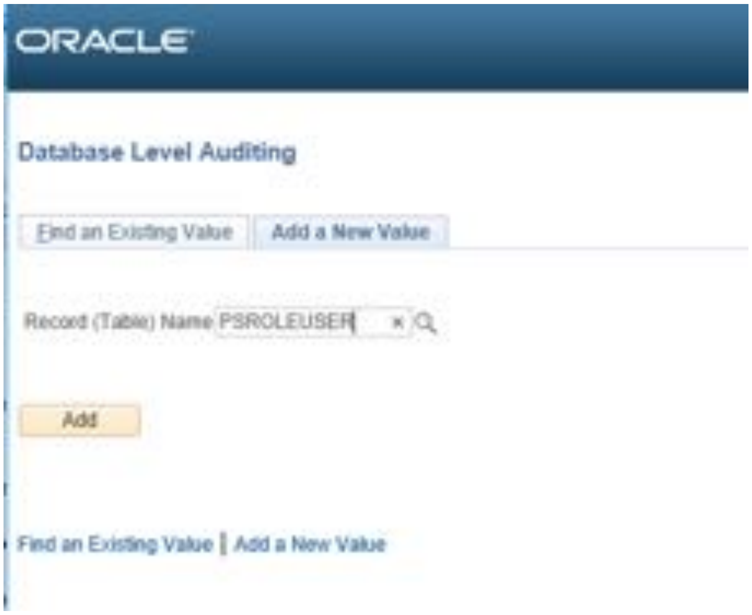
Generate and Deploy Audit Triggers

Once you have created the shadow audit tables both in the PeopleSoft data dictionary and in the database, you need to create the triggers to copy all changes from the base tables to the shadow audit tables.

1. From the PeopleSoft application (not the client/server Application Designer), navigate to PeopleTools -> Utilities -> Audit -> Update Database Level Auditing.



2. Find the shadow audit table “record” and click Add a New Value.



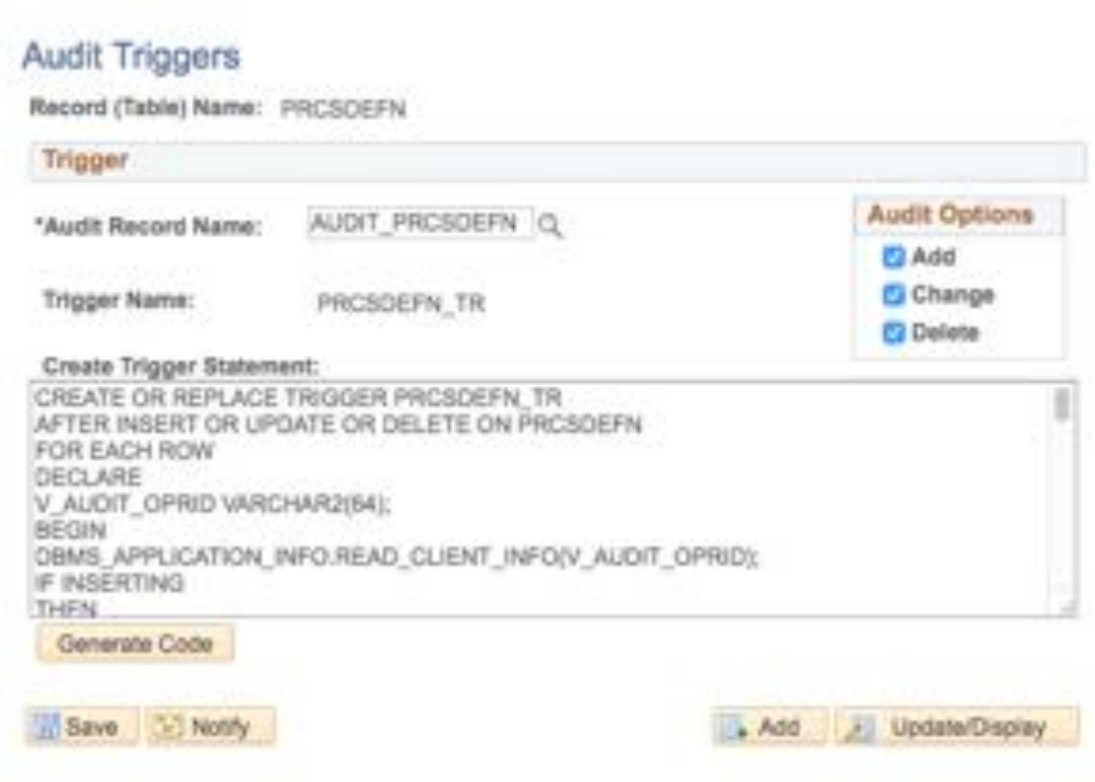
Database Level Auditing

Record (Table) Name PSROLEUSER

3. Create and audit record. This step will generate the DDL for the trigger and associate the trigger with the shadow audit table “record”. Perform the following steps:

    1. Be sure to use the prefix “*AUDIT_*” for the name,
    2. Click the checkboxes for Add, Change and Delete and
    3. Click “Generate Code”
    4. Click Save”.

This step will only generate the SQL DDL to create the trigger, but it will NOT execute the DDL. The ‘generate code’ button will just deposit the DDL into the table PSTRIGGERDEFN. Once all the DDL for all triggers is generated, the last step will be to run a single consolidated DDL script to generate triggers.



Audit Triggers

Record (Table) Name: PRCSDEFN

Trigger

*Audit Record Name: AUDIT_PRCSDEFN

Trigger Name: PRCSDEFN_TR

Audit Options

☑ Add

☑ Change

☑ Delete

Create Trigger Statement:

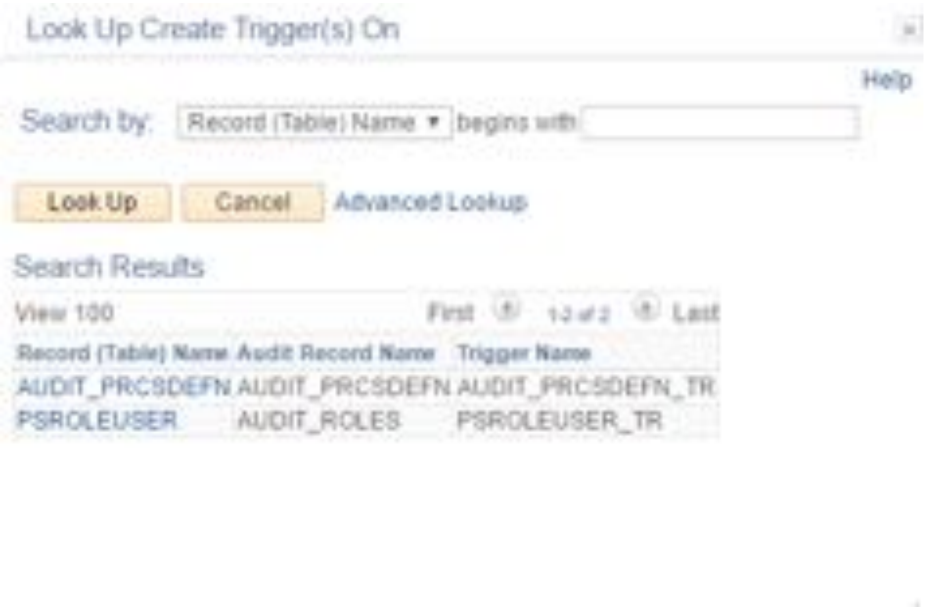
```
CREATE OR REPLACE TRIGGER PRCSDEFN_TR
AFTER INSERT OR UPDATE OR DELETE ON PRCSDEFN
FOR EACH ROW
DECLARE
V_AUDIT_OPRID VARCHAR2(64);
BEGIN
DBMS_APPLICATION_INFO.READ_CLIENT_INFO(V_AUDIT_OPRID);
IF INSERTING
THEN
```

Figure 16 - Example of Trigger Definition - Note AUDIT_ prefix

Deploy Audit Triggers

Once all the base tables “records” have been created the DDL generated to create the triggers, a batch job needs to be run in the Process Scheduler to create a single DDL script to deploy the triggers. Follow the steps below to deploy all the triggers.

1. In the Application , navigate to PeopleTools -> Utilities -> Audit -> Perform Database Level Audit
2. Select the triggers to be included in the DDL deployment script, either select ALL or just those defined in step three above. Then click RUN and note the process ID assigned.



Look Up Create Trigger(s) On

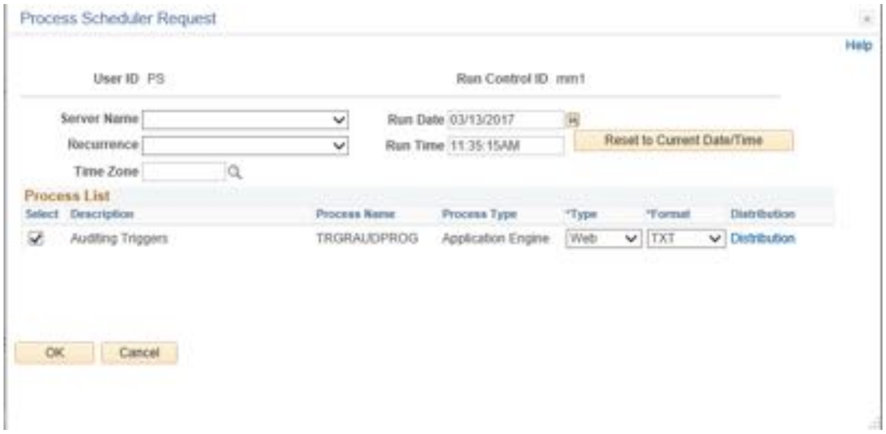
Search by: Record (Table) Name begins with

Search Results

View 100 First 1-2 of 2 Last

Record (Table) Name	Audit Record Name	Trigger Name
AUDIT_PRCSDEFN	AUDIT_PRCSDEFN	AUDIT_PRCSDEFN_TR
PSROLEUSER	AUDIT_ROLES	PSROLEUSER_TR

Figure 17 - Select Triggers and run batch job to create consolidated DDL script



Process Scheduler Request

User ID PS Run Control ID mm1

Server Name
Recurrence
Time Zone
Run Date 03/13/2017
Run Time 11:35:15AM

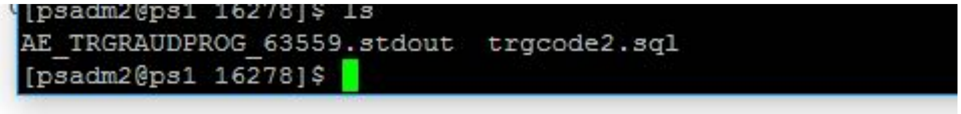
Process List

Select	Description	Process Name	Process Type	*Type	*Format	Distribution
☑	Auditing Triggers	TRGRAUDPROG	Application Engine	Web	TXT	Distribution

Figure 18 - Run the process

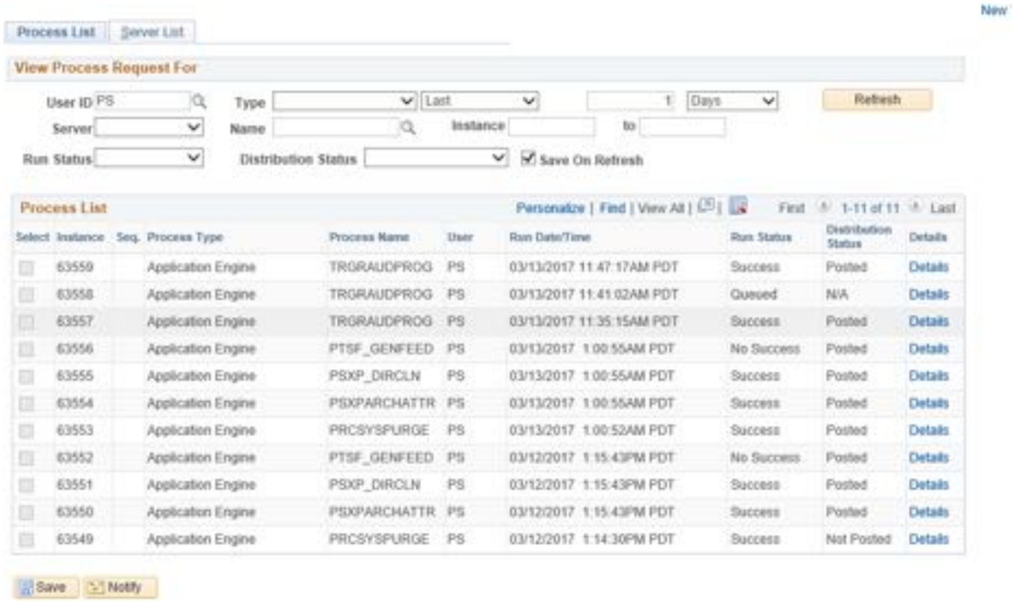
3. Once the SQL script is generated, locate the file in the PS_SRVRDIR directory in the Unix file system where the Process Scheduler is being run. For Windows, the file will be created in the directory the %TEMP% environment variable specifies. The file name will be: TRGCODEX.SQL, where X represents a digit that is determined by the number of files by the same name that already exist in the output directory.

   In the demo environment, an example is below:
   ./home/psadm2/psft/pt/8.54/psreports/PSHCM92/20170313/16278/AE_TRGRAUDPROG_63559.stdout



```
[psadm2@ps1 16278]$ ls
AE_TRGRAUDPROG_63559.stdout  trgcode2.sql
[psadm2@ps1 16278]$
```

Figure 19 - Find the trgcodeX.sql file



View Process Request For

User ID PS
Type
Last
1 Days
Server
Name
Instance
to
Run Status
Distribution Status
☑ Save On Refresh

Process List

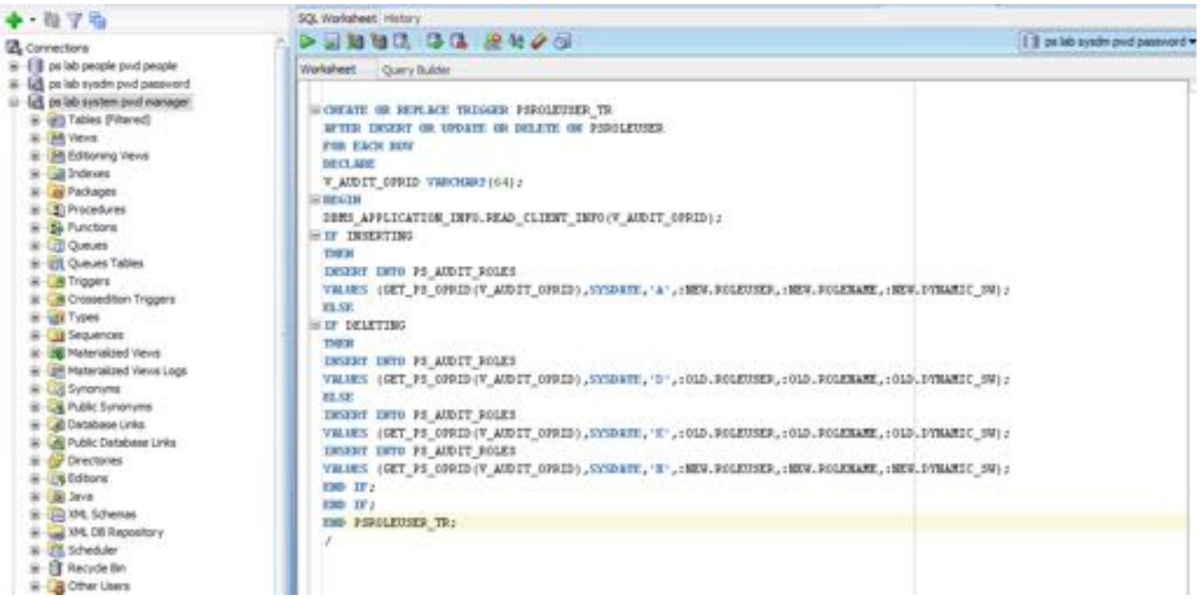
1-11 of 11

Select	Instance	Seq.	Process Type	Process Name	User	Run Date/Time	Run Status	Distribution Status	Details
□	63559		Application Engine	TRGRAUDPROG	PS	03/13/2017 11:47:17AM PDT	Success	Posted	Details
□	63558		Application Engine	TRGRAUDPROG	PS	03/13/2017 11:41:02AM PDT	Queued	N/A	Details
□	63557		Application Engine	TRGRAUDPROG	PS	03/13/2017 11:35:15AM PDT	Success	Posted	Details
□	63556		Application Engine	PTSF_GENFEED	PS	03/13/2017 1:00:55AM PDT	No Success	Posted	Details
□	63555		Application Engine	PSXP_DIRCLN	PS	03/13/2017 1:00:55AM PDT	Success	Posted	Details
□	63554		Application Engine	PSXPARCHATTR	PS	03/13/2017 1:00:55AM PDT	Success	Posted	Details
□	63553		Application Engine	PRCSYSPURGE	PS	03/13/2017 1:00:52AM PDT	Success	Posted	Details
□	63552		Application Engine	PTSF_GENFEED	PS	03/12/2017 1:15:43PM PDT	No Success	Posted	Details
□	63551		Application Engine	PSXP_DIRCLN	PS	03/12/2017 1:15:43PM PDT	Success	Posted	Details
□	63550		Application Engine	PSXPARCHATTR	PS	03/12/2017 1:15:43PM PDT	Success	Posted	Details
□	63549		Application Engine	PRCSYSPURGE	PS	03/12/2017 1:14:30PM PDT	Success	Not Posted	Details

Figure 20 - Monitor Process Manager Job

4. WINSCP and/or copy the file TRGCODEX.sql

5. Open the file TRGCODEX.sql in SQL-Developer using the SYSADM account and run the script.



```
CREATE OR REPLACE TRIGGER PSROLEUSER_TR
AFTER INSERT OR UPDATE OR DELETE ON PSROLEUSER
FOR EACH ROW
DECLARE
V_AUDIT_OPRID VARCHAR2(64);
BEGIN
DBMS_APPLICATION_INFO.READ_CLIENT_INFO(V_AUDIT_OPRID);
IF INSERTING
THEN
INSERT INTO PS_AUDIT_ROLES
VALUES (GET_PS_OPRID(V_AUDIT_OPRID),SYSDATE,'A',:NEW.ROLEUSER,:NEW.ROLENAME,:NEW.DYNAMIC_SW);
ELSE
IF DELETING
THEN
INSERT INTO PS_AUDIT_ROLES
VALUES (GET_PS_OPRID(V_AUDIT_OPRID),SYSDATE,'D',:OLD.ROLEUSER,:OLD.ROLENAME,:OLD.DYNAMIC_SW);
ELSE
INSERT INTO PS_AUDIT_ROLES
VALUES (GET_PS_OPRID(V_AUDIT_OPRID),SYSDATE,'K',:OLD.ROLEUSER,:OLD.ROLENAME,:OLD.DYNAMIC_SW);
INSERT INTO PS_AUDIT_ROLES
VALUES (GET_PS_OPRID(V_AUDIT_OPRID),SYSDATE,'N',:NEW.ROLEUSER,:NEW.ROLENAME,:NEW.DYNAMIC_SW);
END IF;
END IF;
END PSROLEUSER_TR;
/
```

Figure 21 - Example of running trgcodex.sql in SQL-Developer

Secure Shadow Audit Tables

The intent of the PeopleSoft shadow audit tables to provide trust verification. That is to be able to establish a record of all changes to the security sensitive tables. Allowing those whose trust needs to be verified to also be able to modify the audit table negates the purpose of the audit table. To secure the integrity of the audit trails being written to the shadow audit tables, the shadow audit tables themselves need to be audited and monitored.

1. Appropriate to job personnel and staff job functions, restrict access to the accounts and password with access to the shadow audit tables and the sys.aud$ and/or sys.fga_log$ tables.
2. Enable auditing and monitoring on the audit triggers (e.g. AUDIT ALTER TRIGGER). If the audit triggers become disabled, it should be alerted.
3. Use Oracle Fine Grained Auditing (FGA) to audit updates and deletes on the shadow audit tables for accounts other than SYSADM. FGA polices will need to be created for each shadow table and ideally, the policies should also incorporate logic to detect SQL NOT coming the application sever – for example from direct database connection from a laptop using SQL-Developer or SQL-Plus.

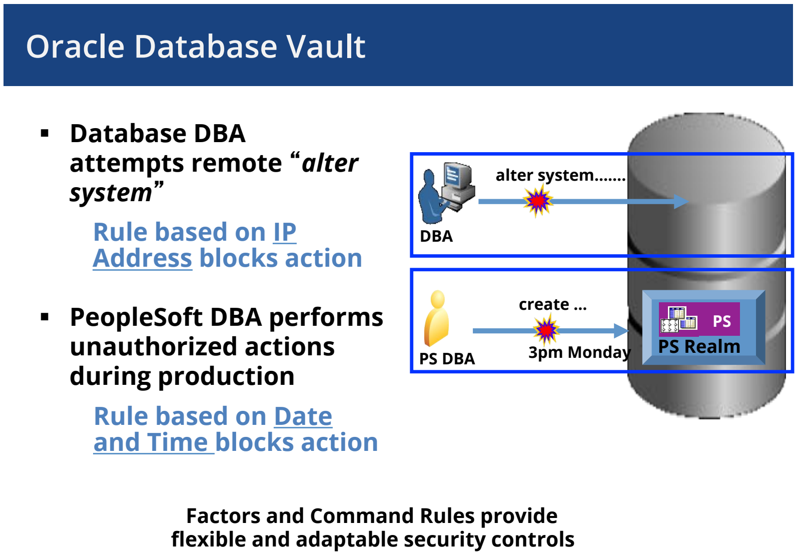
Refer to the Oracle RDBMS documentation for more information on Fine Grained Auditing[5]. One detail to note is that unlike traditional Oracle RDBMS auditing, to enable and start to use FGA, no bounce of the database is required.

Optional Step – Secure PeopleSoft Security Sensitive Tables

The PeopleSoft tables below should only be accessed by SYSADM. Any other accounts issuing DML against the tables below should trigger auditing and monitoring. Traditional database auditing could be used as well as FGA could be used. FGA offers a more sophisticated approach. Ideally, the Oracle Database Vault should be considered. PeopleSoft is fully certified for use with Oracle Database Vault[6].

[5] http://docs.oracle.com/database/121/DBSEG/audit_config.htm#DBSEG60681

[6] https://docs.oracle.com/cd/E58500_01/pt854pbh1/eng/pt/tadm/task_ProtectingandManagingPeopleSoftApplicationswithDatabaseVault-647d21.html#topofpage



Oracle Database Vault

- **Database DBA attempts remote “*alter system*”**

  Rule based on IP Address blocks action

- **PeopleSoft DBA performs unauthorized actions during production**

  Rule based on Date and Time blocks action

Factors and Command Rules provide flexible and adaptable security controls

Figure 22 - Data Vault with PeopleSoft

Security Sensitive Tables	
Integrigy Framework	**Table**
E1 – Login	PSOPRDEFN, PSPTLOGINAUDIT, PSACCESSLOG
E2 – Logoff	PSACCESSLOG
E3 – Unsuccessful login	PSPTLOGINAUDIT, PSACCESSLOG
E4 – Modify authentication mechanisms	PSSECOPTIONS
E5 — Create user account E6 – Modify user account	PSOPRDEFN
E7 – Create role E8 – Modify role	Permission lists and roles: PSAUTHITEM, PSROLECLASS, PSROLEDEFN
E9 – Grant/revoke user privileges	PSROLEUSER, PSOPRCLS
E10 – Grant/revoke role privileges	PSPGEACCESSDESC
E12 – Modify audit and logging	PeopleTools: PSRECDEFN, PSRECFIELD, Financials: AUDIT_CNTRL_TBL Audit records: PSAUDIT and all shadow tables
E13 – Objects: Create object Modify object Delete object	PSRECDEFN, PSRECFIELDALL, PSPNLDEFN, PSMENUITEM, PSPROJECTITEM

Security Sensitive Tables	
Integrigy Framework	**Table**
E14 – Modify configuration settings	PSOPTIONS , PSSECOPTIONS, PS_SJT_PERSON, PSSECNODEOPR, PSSEC_PPC_OPTN, PSIBPROFILE, PS_HCR_SCRTY_INSTL, PS_INSTALLATION_FS, PS_INSTALLATION_BN, PS_GPSINSTALLATION, PS_EP_INSTALLATION, PS_GP_INSTALLATION, PS_US_INSTALLATION, PS_INSTALLATION, PS_INSTALLATION_HR, PS_JPMINSTALLATION, PS_INSTALLATION_PA, PS_INSTALLATION_PY, PS_HRSINSTALLATION, PS_TL_INSTALLATION, PS_INSTALLATION_PB, PS_INSTALLATION_AA, PS_INSTALLATION_AD, PS_INSTALLATION_AV, S_INSTALLATION_SA, PS_INSTALLATION_CC, PS_INSTALLATION_FA, PS_INSTALLATION_SR, PS_BUS_UNIT_OPT_HR, PS_SCRTY_SET_TBL , PS_SCRTY_QUERY, PS_SCRTY_TBL_DEPT, w_SCRTY_DEPT, PSPTSCRTY_ADS_A, PSRF_RSCRTY_TBL, PS_SCRTY_ACC_GRP, PSPTSCRTY_ADS_P, PS_SCRTY_SRCHGRP, PS_SCRTY_TBL_INST

Setup Rolling Purge of Audit Tables

Step up rolling purge on shadow audit tables per business requirements. Also, be sure to setup rolling purges of both the FGA and traditional Oracle database auditing. Refer to respective Oracle RDBMS and PeopleSoft Archiving documentation.

Oracle provides standard functionality for the rolling purge of sys.aud$ and the sys.fga_log$ tables. Refer to the Oracle RDBMS documentation for more information. For the PeopleSoft shadow audit tables, you will need to manually purge them per your business requirements.

Level One - Monitoring and Auditing

For Level 1, the assumption is that centralized logging and analysis tools and/or a SIEM is not available. Recommendations are made below for what to monitor. Whom to notify in case of a monitoring alert is not possible to recommend because it will be unique to each client site and implementation.

The sources of what needs to be monitored specifically include the Oracle RDBMS audit sources SYS.AUD$ for traditional database auditing and SYS.FGA_LOG$ for FGA auditing. Oracle combines both these source into a view DBA_COMMON_AUDIT_TRAIL. Each of the PeopleSoft shadow audit tables would also need to be monitored. How these sources are monitored depend on tools available.

It is assumed that clients have reporting tools capable of creating custom and scheduling reports for email delivery – possibly even using the PeopleSoft scheduler. Whether or not the alerts are sent immediately or in the form of a daily summary should be determined by each customer's unique risk profile.

Our recommended security monitoring and auditing alerts (Table 4) are by no means conclusive. Simple things can trigger serious high-risk security events and can differ between PeopleSoft implementations. As such, the table below should be seen as much as a starting point as it is an educational tool. What to monitor for and whom to notify will largely be determined by each client's unique risk profile.

Table 4 – Level 1 Security Monitoring and Auditing Alerts

Frame work	What to Monitor For	Description	Source
E1	Direct database logins (successful or unsuccessful) to key database accounts	Direct database attempts, attempts to connect other than through PeopleSoft, should all be investigated - especially for the SYS, SYSTEM, SYSADM and PEOPLE.	SYS.AUD$
E1, E11	User ADMINISTRATOR or User with Power User Roles successful logins	Each login of the ADMINSTRATOR or Power User Roles (see table below) should be logged and reviewed. Daily support should not be done through this account.	PSPTLOGINAUDIT
E1, E11	Generic seeded application account logins	Except for the GUEST accounts, immediate action should be taken if there is attempted login to one of the accounts listed Table below of seeded generic users.	PSPTLOGINAUDIT
E1, E11	Unlocking of generic seeded application accounts	The accounts listed in Table 5 "Default PeopleSoft Users" should always be end-dated. If the end-date for one of these accounts changes, immediate action is required.	PSOPRDEFN shadow audit table

Table 4 – Level 1 Security Monitoring and Auditing Alerts

Framework	What to Monitor For	Description	Source
E1 E2	Login/Logoff	Basic login/logoff of user from PeopleSoft	PSPTLOGINAUDIT
E3	User ADMINISTRATOR or User with Power User Roles - unsuccessful login attempts	Multiple unsuccessful login attempts for ADMINISTRATOR or a user with a Power User Role should be considered as a security event. These attempts can also lock the SYSADMIN user. Locking this user can cause applications issues.	PSPTLOGINAUDIT
E4	Modify authentication configurations to database	Database profiles enforce password practices. Changes to how passwords are created, used and validated need to be audited.	Database Profile statements in SYS.AUD$
E4	Modify authentication configurations to PeopleSoft	How PeopleSoft authentication occurs (local or SSO) and, if local, how passwords are controlled all need to be logged and audited.	Changes to the audit tables for: PSSECOPTIONS, PSSECNODEOPR, PSWEBPROFILE
E6	New database accounts created	Any changes to the standard PeopleSoft database accounts or creation of new accounts should be audited. Such changes are rare and can indicate inappropriate activity.	SYS.AUD$
E9, E10, E12, E13, E14	Updates audit tables other than by the trigger	The tables recommended to be configured for Audit Trail should not change on a regular basis. Any change to these tables should be alerted or reported per client's risk polices.	FGA_LOG assuming FGA polices are being used.
E12	Turning off or disabling the audit triggers	Disable defined trigger for auditing	SYS.AUD$ for disabling of the triggers defined in in PSTRIGGERDEFN. Assumed are auditing with Audit Alter Trigger.
E12	Turning audit sys operations off	If enabled, disabling audit sys operations is a security event.	V$PARAMETER for "audit_sys_operations"
E12	Turning native database audit off	Disabling database auditing off is a security event.	V$PARAMETER for auditing
E12	Disable/Enable and Alerting of FGA Policies	Disabling or altering FGA policies is a security event	AUDIT EXECUTE on DBMS_FGA BY ACCESS

Table 4 – Level 1 Security Monitoring and Auditing Alerts			
Frame work	**What to Monitor For**	**Description**	**Source**
E1, E2, E3	Log on/off successful/unsuccessful	If Oracle Data Vault is used, track ingress and egress activity.	Oracle Data Vault Logs

Seeded Generic Accounts		
BELHR	JCADMIN1	PSJPN
CAN	NLDHR	PSPOR
CFR	PS	TIME
CNHR	PSCFR	UKHR
ESP	PSDUT	UKNI
FRA	PSESP	USA
FRHR	PSFRA	HSHR
GER	PSGER	WEBGUEST
GRHR	PSINE	WEBMODEL

PeopleSoft Power User Roles		
ADMINISTER_SECURITY	MAINTAIN_SECURITY	PTPP_PORTAL_ADMIN
APPLICATION_DESIGNER	MANAGE_INTEGRATION_PROCESS	QUERY
APPLICATION_ENGINE	MANAGE_INTEGRATION_RULES	QUERY_MANAGER
CUBE MANAGER	MASS_CHANGE	TI_INTEGRATION
DATA_MOVER	NVISION	TREEMANAGER
DEFINITION_SECURITY	OBJECT_SECURITY	UTILITIES
FPY_INTEGRATION	PORTAL_ADMIN	WEB_PROFILE
FT_INTEGRATION	PROCESS_SCHEDULER	WORKFLOW_ADMINISTRATOR
IMPORT_MANAGER)	ADMINISTRATOR	

INTEGRIGY FRAMEWORK – LEVEL 2

The second level of the framework focuses on integrating with and/or building a centralized logging solution if such a solution does not exist. Such solutions are commonly built using enterprise logging solutions such as Splunk, HP ArcSight, RSA enVision, or Q1 Radar. There are a number of commercial and open-source solutions that can support all the logging and auditing in the Integrigy Framework. For Integrigy's framework, the specific tool is used is not important. What is important is the solution provides (1) ability to accept logs from Syslog, database connections, and reading files, (2) security and archiving of log data, and (3) unified alerting and reporting capabilities.

Centralized logging solutions protect the log data. Non-repudiation and division of duties is achieved by removing log data from each source and storing it in a secure, central location. Consolidating an organization's log data also offers significantly more options for creating security alerts that cross application, team, and geographic boundaries. Centralized logging is also a key requirement for security standards including PCI and HIPAA.

Once the foundation of centralized logging is created with Level 2, an organization can proceed to Level 3. Contact Integrigy with questions and/or assistance with specific centralized logging tools and/or vendors.

Level 2 Tasks

1. Implement centralized logging solution if does not exist
2. Redirect database logs to centralized logging
3. Configure database connector and send PeopleSoft Sign-on and shadow audit activity to centralized log collector.
4. Transition Level 1 alerts and build additional Level 2 alerts
5. Expand recommended alerts from Appendix A

IMPLEMENT CENTRALIZED LOGGING SOLUTION

The installation and configuration of tools such as Splunk (Free or Enterprise) or HP ArcSight is beyond the scope of this paper. The first requirement for Level 2 is for such a solution to be in place.

REDIRECT DATABASE LOGS TO CENTRALIZED LOGGING

Writing logs to the operating system is more secure for many reasons, including providing a separation of duties between DBAs and system administrators. There are two steps:

1. To route Oracle database audit logs to the operating system instead of the database set **AUDIT_TRAIL** parameter to **OS** and set **AUDIT_FILE_DEST** to provide a location to write the log files**.**
2. Write logs using the Syslog format. In the init.ora file for the instance, set the **AUDIT_TRAIL** parameter to **OS** and **AUDIT_SYSLOG_LEVEL** to 'LOCAL1.WARNING' or another valid Syslog setting. This setting may be used by the logging server to classify the event.

Transition Level 1 Alerts and Build Additional Level 2 Alerts

As much as possible transition all alerting built for Level 1 to the centralized logging solution. Alerting out of the logging solution (or SIEM) will be more efficient and can provide event correlation capabilities. Moreover, as more alerts will be built, it will consolidate alerting into a single tool.

As with Level 1, the table below is by no means conclusive. Simple things can trigger serious high risk security events. As such, the table below should be seen as much as a starting point as it is an educational tool. What to monitor for and whom to notify will largely be determined by each client's unique risk profile.

Table 7 – Level 2 Security Monitoring and Auditing Alerts

Event	What to Monitor For	Description	Source
E1	Successful or unsuccessful login attempts to PeopleSoft without network or system login	Logins or attempts to login into PeopleSoft without first logging onto the network or gaining access to the building should be flagged and investigated.	PSPTLOGINAUDIT
E1	Successful or unsuccessful logins of named database user without network or system login	Named database accounts, those associated with staff and employees for the purposes of support should be monitored for if the user has first logged on to the network and/or gained access to the building.	Database log
E3	Horizontal unsuccessful application attempts – more than 5 users more than 5 times within the hour	Attempts to brute force groups of users should be alerted and investigated. This alert may be based per IP address or other system identifier. The specific alert threshold will be unique to each client.	PSPTLOGINAUDIT
E3	Horizontal unsuccessful direct database attempts – more than 5 users more than 5 times within the hour	Attempts to brute force groups of users should be alerted and investigated. This alert may be based per IP address or other system identifier. The specific alert threshold will be unique to each client.	Database log
E9	End-users granted System Administration Roles	End-users gaining access to the highly privileged Power User Roles (See table below) should be carefully reviewed.	Audit tables for: PSROLEUSER, PSOPRCLS
N/A	Monitor for database attacks	The following standard Oracle error messages may indicate a potential database attack: ORA-29532, ORA-28000, ORA-24247,	Database log

Table 7 – Level 2 Security Monitoring and Auditing Alerts

Event	What to Monitor For	Description	Source
		ORA-29257, ORA-01031	

PeopleSoft Power User Roles		
ADMINISTER_SECURITY	MAINTAIN_SECURITY	PTPP_PORTAL_ADMIN
APPLICATION_DESIGNER	MANAGE_INTEGRATION_PROCESS	QUERY
APPLICATION_ENGINE	MANAGE_INTEGRATION_RULES	QUERY_MANAGER
CUBE MANAGER	MASS_CHANGE	TI_INTEGRATION
DATA_MOVER	NVISION	TREEMANAGER
DEFINITION_SECURITY	OBJECT_SECURITY	UTILITIES
FPY_INTEGRATION	PORTAL_ADMIN	WEB_PROFILE
FT_INTEGRATION	PROCESS_SCHEDULER	WORKFLOW_ADMINISTRATOR
IMPORT_MANAGER)	ADMINISTRATOR	

INTEGRIGY FRAMEWORK – LEVEL 3

Level 3 builds on the connectivity and basic centralized logging established in Level 2. This level identifies additional database and application server logs to be interfaced and also calls for the inclusion of PeopleSoft functional configuration tables to be monitored and for additional administration navigation activity to be logged. These additions to the centralized logs allow PeopleSoft clients to meet compliance requirements such as PCI, SOX, and HIPPA and provide vital automation of the compliance tasks.

People and business processes commonly use multiple applications and technologies. The objective of centralized logging is to consolidate logs from all applications and technologies. While PeopleSoft is but one application, as an Enterprise Resource Planning (ERP) application, it is the cornerstone of most business processes. This is why the objective of Level 3 is the integration of PeopleSoft functional logs with the centralized logging solution.

Level 3 is continuous. Once a baseline is established from which alerts and reports are used to report anomalies, as business processes change, tolerances and alerts need to be adjusted to the new baseline. As well, the possibilities of new security alerts and audits is limited by the data consolidated into the centralized logging solution from PeopleSoft, ticket systems, password vaults, network, badging systems, or any other sources capable of producing logs.

Throughout this document, the recommended logging alerts are all able to be mapped back to PCI, HIPAA, NIST 800-53, IS0 27000, and SOX (COBIT). Once Level 3 is reached, efforts should be spent to automate compliance tasks.

ADDITIONAL DATABASE AND APPLICATION LOGS

Each log management or SIEM vendor will have their own set of log parsers and capabilities. The recommendation for Level 3 is to send additional database and web server logs to assist with additional logging for who is coming into PeopleSoft, from where and when.

Apache Logs

Apache server logging is defined in the Apache configuration file (HTTPD.CONF). Refer to WebLogic documentation or OHS (Apache) log configuration and setup. Integrigy recommends the default log setting of 'warn'.

Apache Log Levels	Description
emerg	Emergencies, system is not useable
alert	Action must be taken
crit	Critical conditions
error	Error conditions
warn	**Warning conditions - Default**
notice	Normal but significant condition
info	Information
debug	Debug level messages

Apache Logs	Location within PeopleSoft Instance Home

Database Listener Log

The database listener log provides information regarding database connections, for example IP addresses of clients, and it should be sent to the centralized logging solution. Within the listener's control file ($TNS_ADMIN/listener.ora), confirm that logging is enabled (LOG_STATUS = On) and the location of the listener log (parameter = LOG_DIRECTORY_listener_name).

Additional Audit Records

Expand the number of PeopleSoft audit tables from Appendix A.

History Tables

The PeopleSoft Data Archive Manager allows for the creation of history tables where production data can be moved and held. For key security sensitive tables, for example configuration and setup tables, history records can be loaded into the SIEM for advanced correlation and alerting.

Financials Audit Framework

The Financials Audit Framework is a separate audit engine unique to PeopleSoft Financials. Adding the Financials Audit Framework should be considered once Level III is reached. Setting up the Financials Audit Framework uses the following components and uses the table AUDIT_CNTRL_TBL to store the configurations:

- Enable Audit Logging (FS_AUDITLOG_ENABLE)
- Search Audit Logs (FS_AUDITLOG_SEARCH)
- Purge Audit Logs (FS_AUDITLOG_PURGE)

Audit log data can become very large very quickly. As part of the setup process, processes for a rolling purge should be defined. Use the Purge Audit Logs page (FS_AUDITLOG_PURGE) to delete selected audit logs.

PeopleSoft Financials Audit Sources		
Application	**Audit Log Record**	**Transaction Flows**
Asset Management	AM_ASST_AUD_TBL	Asset Adds and Copy Adjustments and Transfers Depreciation Interunit Transfers Recategorizations Retirements and Reinstatements Revaluation
Billing	BI_IVC_AUD_TBL	Create and Edit Billing Invoice Online Copy and Adjust Billing Invoice Correct Budget Stage Error

PeopleSoft Financials Audit Sources		
Application	**Audit Log Record**	**Transaction Flows**
		Finalize Billing Invoice Create Installment Invoice Create Recurring Invoice Interface Create/Edit Invoice Billing Invoice Maintenance Approve/Delete Worksheet
General Ledger	GL_AUD_JRNL	Create, Edit and Post Journal Delete Journal Mark to Post and Unpost Journal Unpost Journal Update Journal Unmark to Post and Unpost Journal Journal Date Change
Payables	AP_VCHR_AUD_TBL AP_PYMT_AUD_TBL AP_CNTL_GRP_TBL	Voucher transactions Payment transactions Control Group transactions
Receivables	AR_AUD_DEPOSIT AR_AUD_DRAFT AR_AUD_ITEM AR_AUD_PND_ITEM AR_AUD_PYMNT	Items Drafts Payments Deposits

Application Logging (LogFence)

Log Fence is part of PeopleTools. It allows for application error messages to be consolidated and is set in the application server configuration file (PSSYSADMRV.CFG.) The log can consolidate SQL, application traces along with PeopleTools actions. The logs are written to: PS_CFG_HOME/appserv/prcs/<Database Name>/LOGS which can be loaded into your SIEM.

Verification:

1. On the application server configuration file look in *PS_CFG_HOME*\SYSADMerv*domain_name* for the file PSSYSADMRV.CFG
2. Locate the section: General settings for PSTOOLS
3. Set AppLogFence (see table below).
4. Specify the Log/Output Directory variable in the configuration file to set a common log and output directory. The default is: Log/Output Directory=%PS_SERVDIR%\log_output
5. The default is three (3). For level 3 logging and above, all detailed messages created on the analytic server will be logged both in the application server as well as in analytic server log file
6. For level 4 logging or above, all tracing information is as well logged to the analytic server log file.

7. Be sure to set the corresponding purge rotation settings to not fill the file system (e.g. Recycle Count and Dynamic Change). Note however that dynamic recycling is not recommended for production environments.

Log Fence Settings	
Level	**Description**
-100	Suppress logging
-1	Protocol and memory errors
0	Status information only
1	General errors
2	Warnings
3	Tracing Level 1 – Default.
4	Tracing Level 2
5	Tracing Level 3

Navigation auditing

With level 1 and 2 auditing in place, adding navigation auditing to security sensitive forms and records is a logical next step. This is especially useful for monitoring who is viewing sensitive information such as bank account and credit card data etc…. To enable this functionality refer to the following Oracle support whitepaper: PeopleSoft Security Auditing (Doc ID 1963774.1). Once enabled, pull the logs into the SIEM.

Fine Grained Auditing On Sensitive Data

PeopleTools supports the use of Oracle Fine Grained Auditing (FGA). FGA is a standard (free) feature of the Oracle RDMBS Enterprise Edition. With FGA, policies can be created to trigger auditing against specific tables and columns for specific DML events (SELECT, INSERT, UPDATE, DELETE).

Using FGA to log DML against security sensitive tables as well as tables with Personally Identifiable Information (PII) such as social security numbers is an idea use case. To begin using FGA with PeopleSoft is outside the scope of this paper, but as Level III thinking is pursed to mature overall audit and logging capabilities, FGA should be seriously considered.

The first step would be to inventory the sensitive data within the database, inclusive of standard PeopleSoft tables as well as backup and 'old' tables. Ideally a cleanup effort will then follow to purge such tables of rouge sensitive data. Once the clean up effort is completed. FGA polices would then be created for each table containing PII data. These policies will need to exclude activity coming from the PeopleSoft application itself and seek to identify rogue direct database connections attempting to read and/or alter sensitive information.

The following links can assist in further reading on FGA with PeopleSoft:
https://docs.oracle.com/cd/E58500_01/pt854pbh1/eng/pt/tadm/task_WorkingwithOracleFineGrainedAuditing-4f7f7a.html - topofpage

Oracle RDBMS documentation on FGA: http://docs.oracle.com/database/121/DBSEG/audit_config.htm - DBSEG60681

Appendix A – Recommendations for PeopleSoft Auditing

The following table identifies the records and tables that could be used for PeopleSoft database auditing. Do not attempt to audit all of them. Select those believed appropriate for your specific needs.

Level	Framework	Record	DB Table	RECDESCR
1	E12		AUDIT_CNTRL_TBL	Defines auditing for PeopleSoft Financials
1	E14	PRCSDEFN	PS_PRCSDEFN	Process Defn
1	E7, E8	PSAUTHITEM	PSAUTHITEM	Authorized Menu Item
1	E14	PSCLASSDEFN	PSCLASSDEFN	Permissions Lists Definition
1	E14	PSMENUDEFN	PSMENUDEFN	Menu Definition
1	E13	PSMENUITEM	PSMENUITEM	Menu Item
1	E14	PSMSGNODEDEFN	PSMSGNODEDEFN	Message Node Definition
1	E14	PSOPROBJ	PSOPROBJ	Operator Object Group
1	E12, E13	PSRECDEFN	PSRECDEFN	Record Definition
1	E12	PSRECFIELD	PSRECFIELD	Field definition
1	E7, E8	PSROLECLASS	PSROLECLASS	Role Classes
1	E7, E8	PSROLEDEFN	PSROLEDEFN	Role Definition
1	E9	PSROLEUSER	PSROLEUSER	Role User
1	E4, E5, E6, E14	PSSECOPTIONS	PSSECOPTIONS	Password controls
1	E14	PSSQLTEXTDEFN	PSSQLTEXTDEFN	SQL Object Text
1	E12	PSTRIGGERDEFN	PSTRIGGERDEFN	Defined database triggers
1	E14	PSWEBPROFILE	PSWEBPROFILE	Web Profile
1	E9	PSROLEUSER	PSROLEUSER	User Roles
1	E4, E5	PSOPRDEFN	PSOPRDEFN	User definition
1	E1, E3	PSPTLOGINAUDIT	PSPTLOGINAUDIT	Login history
2	E14	SCRTY_ACC_GRP	PS_SCRTY_ACC_GRP	Access Group Security
2	E14	SCRTY_QUERY	PS_SCRTY_QUERY	PS/Query Profile
2	E14	SCRTY_SET_TBL	PS_SCRTY_SET_TBL	Security Set
2	E14	SCRTY_SRCHGRP	PS_SCRTY_SRCHGRP	Search Group Authorizations
2	E14	SCRTY_TBL_DEPT	PS_SCRTY_TBL_DEPT	OprID Access to Departments
2	E14	SCRTY_TBL_INST	PS_SCRTY_TBL_INST	OprID Access to Institutions
2	E14	SDK_SCRTY_DEPT	PS_SDK_SCRTY_DEPT	SDK User Access to Departments
3	E14	BUS_UNIT_OPT_HR	PS_BUS_UNIT_OPT_HR	Business Unit Options for HR
3	E14	EP_INSTALLATION	PS_EP_INSTALLATION	ePerformance Management
3	E14	GP_INSTALLATION	PS_GP_INSTALLATION	GP Installation
3	E14	GPSINSTALLATION	PS_GPSINSTALLATION	GPS ID get table
3	E14	HRSINSTALLATION	PS_HRSINSTALLATION	eRecruit Installation Table
3	E14	INSTALLATION	PS_INSTALLATION	Site-Specific Install Options

Level	Framework	Record	DB Table	RECDESCR
3	E14	INSTALLATION_AA	PS_INSTALLATION_AA	AA Installation Table
3	E14	INSTALLATION_AD	PS_INSTALLATION_AD	AD Installation Table
3	E14	INSTALLATION_AV	PS_INSTALLATION_AV	Advancement Installation Table
3	E14	INSTALLATION_BN	PS_INSTALLATION_BN	Benefits Installation table
3	E14	INSTALLATION_CC	PS_INSTALLATION_CC	CC Installation Table
3	E14	INSTALLATION_FA	PS_INSTALLATION_FA	Financial Aid Installation Tbl
3	E14	INSTALLATION_FS	PS_INSTALLATION_FS	System Options - PS/Financials
3	E14	INSTALLATION_HR	PS_INSTALLATION_HR	HR Installation Record
3	E14	INSTALLATION_PA	PS_INSTALLATION_PA	Pensions Installation Options
3	E14	INSTALLATION_PB	PS_INSTALLATION_PB	
3	E14	INSTALLATION_PY	PS_INSTALLATION_PY	PNA Installation table
3	E14	INSTALLATION_SA	PS_INSTALLATION_SA	Student Admin Install Options
3	E14	INSTALLATION_SR	PS_INSTALLATION_SR	
3	E14	JPMINSTALLATION	PS_JPMINSTALLATION	JPM Installation Table
3	E14	APPR_RULE_HDR	PS_APPR_RULE_HDR	Approval Rule Defn Hdr
3	E14	PSURLDEFN	PSURLDEFN	URL Table
3	E14	SJT_PERSON	PS_SJT_PERSON	Security dat for Person Access
3	E14	PSCRYPTDLLDEFN	PSCRYPTDLLDEFN	Encryption Libraries
3	E14	PSCRYPTKEYSET	PSCRYPTKEYSET	Encryption Libraries
3	E14	PSCRYPTPRFL	PSCRYPTPRFL	Encryption Libraries
3	E14	PSFILEREDEFN	PSFILEREDEFN	Libaries registered
3	E14	PSIBPROFILE	PSIBPROFILE	IB system settings.
3	E14	PSOPERATION	PSOPERATION	IB Services
3	E14	PSOPTIONS	PSOPTIONS	PeopleTools System Options
3	E1	PSPRDMDEFN	PSPRDMDEFN	Portal Definition Table
3	E13		PSRECFIELDALL	Field definition
3	E14	PSSEC_PPC_OPTN	PSSEC_PPC_OPTN	Defines PeopleCode Options
3	E14	PSSTATUS	PSSTATUS	PeopleTools System Control
3	E14	PSTREEDEFN	PSTREEDEFN	Tree Definition
3	E14	MAINTENANCE_LOG	PS_MAINTENANCE_LOG	Patch history
3	E14	TL_INSTALLATION	PS_TL_INSTALLATION	Installation Time & Labor Tbl
3	E14	US_INSTALLATION	PS_US_INSTALLATION	Installation Table USA
3	E14	PSBUSPROCDEFN	PSBUSPROCDEFN	Business Process Definition
3	E1, E2	PSACCESSLOG	PSACCESSLOG	Login history
3	E14	PSSERVERSTAT	PSSERVERSTAT	Process Server Statistics
3	E13	PSPNLDEFN	PSPNLDEFN	Panel Definition

APPENDIX B – USEFUL SQL

To list what tables are enabled for database trigger auditing:

Triggers Defined for Auditing

```
SELECT * FROM SYSADM.PSTRIGGERDEFN;

-- list tables with auditing triggers
SELECT PSRECDEFN.RECNAME , PSRECDEFN.SQLTABLENAME,
NVL(TRIM(PSRECDEFN.SQLTABLENAME),'PS_'||PSRECDEFN.RECNAME) THETABLE ,
PSRECDEFN.OBJECTOWNERID,
PSRECDEFN.FIELDCOUNT,
PSRECDEFN.RECDESCR,
PSRECDEFN.DESCRLONG,
OPTTRIGFLAG,
SYSTEMIDFIELDNAME,
TIMESTAMPFIELDNAME,
PSTRIGGERDEFN.*
FROM SYSADM.PSTRIGGERDEFN , SYSADM.PSRECDEFN
WHERE PSRECDEFN.RECNAME = PSTRIGGERDEFN.RECNAME;
```

Record auditing

The following SQL identifies records with auditing enabled.

```
SELECT
RECNAME,
RECDESCR,
AUDITRECNAME as TABLE_WHERE_REC_WRITTEN,
CASE WHEN BITAND(RECUSE,1) > 0 THEN 'Y' ELSE 'N' END AUDIT_ADD, CASE WHEN
BITAND(RECUSE,2) > 0 THEN 'Y' ELSE 'N' END AUDIT_CHANGE, CASE WHEN
BITAND(RECUSE,4) > 0 THEN 'Y' ELSE 'N' END AUDIT_DELETE, CASE WHEN
BITAND(RECUSE,8) > 0 THEN 'Y' ELSE 'N' END AUDIT_SELECTIVE
FROM SYSADM.PSRECDEFN
WHERE TRIM(AUDITRECNAME) IS NOT NULL
ORDER BY RECNAME;
```

Field auditing enabled

The following SQL identifies fields on records that have field level auditing enabled. Field records will be written to the table PSAUDIT.

Verification:

```
SELECT
F.RECNAME,
F.FIELDNUM,
F.FIELDNAME,
F.USEEDIT,
CASE WHEN BITAND(F.USEEDIT,8) > 0 THEN 'Y' ELSE 'N' END AUDIT_FIELD_ADD, CASE
WHEN BITAND(F.USEEDIT,128) > 0 THEN 'Y' ELSE 'N' END AUDIT_FIELD_CHANGE, CASE
WHEN BITAND(F.USEEDIT,1024) > 0 THEN 'Y' ELSE 'N' END AUDIT_FIELD_DELETE
FROM
SYSADM.PSRECFIELD F
WHERE
F.FIELDNAME = (
SELECT
CASE WHEN (
BITAND(USEEDIT,8) > 0 OR BITAND(USEEDIT,128) > 0 OR BITAND(USEEDIT,1024) > 0
) THEN FIELDNAME ELSE '' END AS FIELD_AUDITED FROM SYSADM.PSRECFIELD
WHERE RECNAME = F.RECNAME
AND FIELDNAME = F.FIELDNAME )
ORDER BY F.RECNAME, F.FIELDNUM;
```

REFERENCES

GENERAL

Integrigy Guide to Database Auditing and Logging https://www.integrigy.com/security-resources/integrigy-guide-database-auditing-and-logging

Security, Audit and Control Features – Oracle PeopleSoft 3rd edition, ISACA, http://www.isaca.org/knowledge-center/research/researchdeliverables/pages/security-audit-and-control-features-oracle-peoplesoft-3rd-edition.aspx

PeopleBooks: PeopleTools 8.54: Data Management, Oracle Corporation, November 2016, Chapter Five: http://docs.oracle.com/cd/E58501_01/psft/pdf/pt854tadm-b1114.pdf

PeopleSoft Security Auditing (Doc ID 1963774.1), Oracle Corporation, January 2015 https://support.oracle.com/rs?type=doc&id=1963774.1

How to Enable PeopleSoft Database Level Auditing (Doc ID 612310.1) https://support.oracle.com/rs?type=doc&id=612310.1

Security, Audit and Control Features – Oracle RDBMS 3rd edition, ISACA, http://www.isaca.org/Knowledge-Center/Research/ResearchDeliverables/Pages/Security-Audit-and-Control-Features-Oracle-Database-3rd-Edition.aspx

PeopleSoft for the Oracle DBA, David Kurtz, Apress Publishing https://www.apress.com/la/book/9781430237075

Integrigy Oracle PeopleSoft Security Quick Reference Guide, Integrigy Corporation, Version 2.0, March 2016 http://www.Integrigy.com/files/Integrigy%20Oracle%20PeopleSoft%20Suite%20Security%20Quick%20Reference.pdf

About Integrigy

Integrigy Corporation (www.integrigy.com)

Integrigy Corporation is a leader in application security for enterprise mission-critical applications. AppSentry, our application and database security assessment tool, assists companies in securing their largest and most important applications through detailed security audits and actionable recommendations. AppDefend, our enterprise web application firewall is specifically designed for PeopleSoft. Integrigy Consulting offers comprehensive security assessment services for leading databases and ERP applications, enabling companies to leverage our in-depth knowledge of this significant threat to business operations.

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