Database Security Guide

22 Configuring Audit Policies

You can configure unified auditing by creating custom unified audit policies, using predefined unified auditing policies, or using fine-grained auditing.

Topics:

Selecting an Auditing Type

You must perform a specific set of steps depending on the type of auditing that you want to perform: general activities (such as SQL statement actions), commonly used auditing activities, or fine-grained auditing.

In addition to these types of auditing, remember that Oracle Database mandatorily audits some activities. See Activities That Are Mandatorily Audited (audit_admin.htm#GUID-AA781864-5756-464E-AFB6-675625AF0EF5)for more information.

Topics:

Auditing SQL Statements, Privileges, and Other General Activities

You can audit many types of objects, from SQL statements to other Oracle Database components, such as Oracle Database Vault..

In addition, you can create policies that use conditions. However, if you want to audit specific columns or use event handlers, you must use fine-grained auditing.

The general steps for performing this type of auditing are as follows:

1. In most cases, use the `CREATE AUDIT POLICY` statement to create an audit policy. If you must audit application context values, then use the `AUDIT` statement.
   See the relevant categories under Auditing Activities with Unified Audit Policies and the AUDIT Statement (audit_config.htm#GUID-A215CCAF-4AFF-448A-909C-736EBDED5A8A)

2. If you are creating an audit policy, then use the `AUDIT` statement to enable it and optionally apply (or exclude) the audit settings to one or more users, including administrative users who log in with the `SYSDBA` administrative privilege (for example, the `SYS` user).
   `AUDIT` also enables you to create an audit record upon an action's success, failure, or both.

   See Enabling Unified Audit Policies to Users (audit_config.htm#GUID-526A09B1-0782-47BA-BDF3-17E61E546174)

3. Query the `UNIFIED_AUDIT_TRAIL` view to find the generated audit records.
   See also Audit Policy Data Dictionary Views (audit_config.htm#GUID-3793F7A1-1679-4AC5-9DA3-61E30EE92035) for additional views.

4. Periodically archive and purge the contents of the audit trail.
   See Purging Audit Trail Records (audit_admin.htm#GUID-9B891A44-3DF4-4B52-98D4-A931DBBAEC1D) .

Auditing Commonly Used Security-Relevant Activities

Oracle Database provides a set default unified audit policies that you can choose from for commonly used security-relevant audits.

The general steps for performing this type of auditing are as follows:

1. See Auditing Activities with the Predefined Unified Audit Policies (audit_config.htm#GUID-C43651C6-A35C-4EEF-BEA7-EADA408BFF67) to learn about the default audit policies.
2. Use the `AUDIT` statement enable the policy and optionally apply (or exclude) the audit settings to one or more users.
   See Enabling Unified Audit Policies to Users (audit_config.htm#GUID-526A09B1-0782-47BA-BDF3-17E61E546174)
3. Query the `UNIFIED_AUDIT_TRAIL` view to find the generated audit records.
   See also Audit Policy Data Dictionary Views (audit_config.htm#GUID-3793F7A1-1679-4AC5-9DA3-61E30EE92035) for additional views.
4. Periodically archive and purge the contents of the audit trail.
   See Purging Audit Trail Records (audit_admin.htm#GUID-9B891A44-3DF4-4B52-98D4-A931DBBAEC1D) .

Auditing Specific, Fine-Grained Activities

Use fine-grained auditing if you want to audit individual columns and use event handlers.

This type of auditing provides all the features available in unified audit policies.

The general steps for fine-grained auditing are as follows:

1. See Auditing Specific Activities with Fine-Grained Auditing (audit_config.htm#GUID-B706FF6F-13A6-4944-AFCB-29971F5076FD) to understand more about auditing specific activities.
2. Use the `DBMS_FGA` PL/SQL package to configure fine-grained auditing policies. See Using the DBMS_FGA PL/SQL Package to Manage Fine-Grained Audit Policies (audit_config.htm#GUID-6F2F4D9E-408F-4C48-8ECB-B1E918456FE8).
3. Query the `UNIFIED_AUDIT_TRAIL` view to find the generated audit records.
   See also Audit Policy Data Dictionary Views (audit_config.htm#GUID-3793F7A1-1679-4AC5-9DA3-61E30EE92035) for additional views.
4. Periodically archive and purge the contents of the audit trail.
   See Purging Audit Trail Records (audit_admin.htm#GUID-9B891A44-3DF4-4B52-98D4-A931DBAEC1D).

Auditing Activities with Unified Audit Policies and the AUDIT Statement

You can use the `CREATE AUDIT POLICY` and `AUDIT` statements to use unified auditing policies.

Topics:

- About Auditing Activities with Unified Audit Policies and AUDIT (audit_config.htm#GUID-2435D929-10AD-43C7-8A6C-5133170074D0)
- Best Practices for Creating Unified Audit Policies (audit_config.htm#GUID-C1DA945F-7037-4867-8EC2-1A7703CE5ADA)
- Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)
- Auditing Roles (audit_config.htm#GUID-E96C25BE-7C5C-4743-AB53-78B3E66C43C9)
- Auditing System Privileges (audit_config.htm#GUID-5D6F6F38-B9F9-4681-8879-8F880E637D75)
- Auditing Administrative Users (audit_config.htm#GUID-D352B575-2EA9-451D-9170-FD9298993DEF)
- Auditing Object Actions (audit_config.htm#GUID-12B6375C-25F7-46A9-BA03-4714BAC6056)
- Auditing SELECT, READ ANY TABLE, or SELECT ANY TABLE (audit_config.htm#GUID-0D0AB9A5-B951-4481-8004-26283C0BE901)
- Auditing SQL Statements and Privileges in a Multitier Environment (audit_config.htm#GUID-66F4A51C-85CC-492C-929E-137C222637C7)
- Creating a Condition for a Unified Audit Policy (audit_config.htm#GUID-6801720F-6020-4608-93B9-C08478B36121)
- Auditing Application Context Values (audit_config.htm#GUID-1AC48317-FDF8-4D94-99AD-6B88E4909436)
- Auditing Oracle Database Real Application Security Events (audit_config.htm#GUID-4C76D168-B534-4E12-A4AA-B434FC3E3328)
- Auditing Oracle Database Vault Events (audit_config.htm#GUID-909CE574-EEDA-45A9-960B-DFD7B8004010)
- Auditing Oracle Recovery Manager Events (audit_config.htm#GUID-90CA2F59-E487-4A78-9881-E859DBB7DF5C)
- Auditing Oracle Label Security Events (audit_config.htm#GUID-777AE231-6593-42C5-A047-13CCC1E8ABE1)
- Auditing Oracle Data Mining Events (audit_config.htm#GUID-8495D1CB-5CDB-4CAE-BCCA-8FC531CC6968)
- Auditing Oracle Data Pump Events (audit_config.htm#GUID-45FF8A42-27DA-4A13-A87B-AB6CF9E860EF)
- Auditing Oracle SQL*Loader Direct Load Path Events (audit_config.htm#GUID-E7DAC7DA-7164-4B2D-81BC-4094BDDE4EC7)

- Using the Unified Audit Policies or AUDIT Settings in a Multitenant Environment (audit_config.htm#GUID-E02D0A5B-6591-4CD1-AF2B-29B0850BB6CB)
- Altering Unified Audit Policies (audit_config.htm#GUID-07F3ECF8-4B1C-47B3-95E5-F5C77B14392F)
- Enabling Unified Audit Policies to Users (audit_config.htm#GUID-526A09B1-0782-47BA-BDF3-17E61E546174)
- Disabling Unified Audit Policies (audit_config.htm#GUID-1577CCEB-2AFD-417C-9238-9DFF13149766)
- Dropping Unified Audit Policies (audit_config.htm#GUID-A178CF26-EF6F-41B6-BB08-1DF444722B2F)
- Tutorial: Auditing Nondatabase Users (audit_config.htm#GUID-BA3FB617-3719-46B3-A16A-B1EBAB629136)

> **See Also:**
>
> Auditing SQL Statements, Privileges, and Other General Activities (audit_config.htm#GUID-8243968C-475C-40E5-804D-CEC6541D2BBB)for general steps for performing this type of auditing

About Auditing Activities with Unified Audit Policies and AUDIT

You can audit the several types of activities, using unified audit policies and the `AUDIT` SQL statement.

The kinds of activities that you can audit are as follows:

- User accounts (including administrative users who log in with the `SYSDBA` administrative privilege), roles, and privileges
- Object actions, such as dropping a table or a running a procedure
- Application context values
- Activities from Oracle Database Real Application Security, Oracle Recovery Manager, Oracle Data Mining, Oracle Data Pump, Oracle SQL*Loader direct path events, Oracle Database Vault, and Oracle Label Security

To accomplish this, depending on what you want to audit, use the following:

- **Unified audit policies.** A unified audit policy is a named group of audit settings that enable you to audit a particular aspect of user behavior in the database. To create the policy, you use the `CREATE AUDIT POLICY` statement. The policy can be as simple as auditing the activities of a single user or you can create complex audit policies that use conditions. You can have more than one audit policy in effect at a time in a database. An audit policy can contain both system-wide and object-specific audit options. Most of the auditing that you will do for general activities (including standard auditing) requires the use of audit policies.
- **AUDIT and NOAUDIT SQL statements.** The `AUDIT` and `NOAUDIT` SQL statements enable you to, respectively, enable and disable an audit policy. The `AUDIT` statement also lets you include or exclude specific users for the policy. The `AUDIT` and `NOAUDIT` statements also enable you to audit application context values.
- **For Oracle Recovery Manager, you do not create unified audit policies.** The `UNIFIED_AUDIT_TRAIL` view automatically captures commonly audited Recovery Manager events.

Best Practices for Creating Unified Audit Policies

You can enable multiple policies at a time in the database, but ideally, limit the number of enabled policies.

The unified audit policy syntax is designed so that you can write one policy that covers all the audit settings that your database needs. A good practice is to group related options into a single policy instead of creating multiple small policies. This enables you to manage the policies much easier. As an example, the default audit policies described in Auditing Activities with the Predefined Unified Audit Policies (audit_config.htm#GUID-C43651C6-A35C-4EEF-BEA7-EADA408BFF67)each contain multiple audit settings within one unified audit policy.

Limiting the number of enabled audit policies for a user session has the following benefits:

- It reduces the logon overhead that is associated with loading the audit policy's details into the session's UGA memory. If the enabled policy count is less, then less time is spent in loading the policy information.
- It reduces the session's UGA memory consumption, because a fewer number of policies are required to be cached in UGA memory.
- It makes the internal audit check functionality more efficient, which determines whether to generate an audit record for its associated event.

Syntax for Creating a Unified Audit Policy

To create a unified audit policy, you must use the `CREATE AUDIT POLICY` statement.

When you create a unified audit policy, Oracle Database stores it in a first class object that is owned by the `SYS` schema, not in the schema of the user who created the policy.

Example 22-1 (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5__CHDBAGCF)shows the syntax for the `CREATE AUDIT POLICY` statement.

Example 22-1 Syntax for the CREATE AUDIT POLICY Statement

```
CREATE AUDIT POLICY policy_name { {privilege_audit_clause [action_audit_clause ]
[role_audit_clause ]} | { action_audit_clause [role_audit_clause ] } | {
role_audit_clause } } [WHEN audit_condition EVALUATE PER {STATEMENT|SESSION|INSTANCE}]
[CONTAINER = {CURRENT | ALL}];
```

In this specification:

- *`privilege_audit_clause`* describes privilege-related audit options. See Auditing System Privileges (audit_config.htm#GUID-5D6F6F38-B9F9-4681-8879-8F880E637D75)for details. The detailed syntax for configuring privilege audit options is as follows:

  ```
  privilege_audit_clause := PRIVILEGES privilege1 [, privilege2]
  ```

- *`action_audit_clause`* and *`standard_actions`* describe object action-related audit options. See Auditing Object Actions (audit_config.htm#GUID-12B6375C-25F7-46A9-BA03-4714BFAC6056) . The syntax is as follows:

  ```
  action_audit_clause := {standard_actions | component_actions} [, component_actions ]
  standard_actions := ACTIONS action1 [ ON {schema.obj_name | DIRECTORY directory_name
  | MINING MODEL schema.obj_name } ] [, action2 [ ON {schema.obj_name | DIRECTORY
  directory_name | MINING MODEL schema.obj_name } ]
  ```

- *component_actions* enables you to create an audit policy for Oracle Label Security, Oracle Database Real Application Security, Oracle Database Vault, Oracle Data Pump, or Oracle SQL*Loader. See the appropriate section under Auditing Activities with Unified Audit Policies and the AUDIT Statement (audit_config.htm#GUID-A215CCAF-4AFF-448A-909C-736EBDED5A8A)for more information. The syntax is:

  ```
  component_actions := ACTIONS COMPONENT=[OLS|XS] action1 [,action2 ] | ACTIONS
  COMPONENT=DV DV_action ON DV_object_name | ACTIONS COMPONENT=DATAPUMP [ EXPORT |
  IMPORT | ALL ] | ACTIONS COMPONENT=DIRECT_LOAD [ LOAD | ALL ]
  ```

- *role_audit_clause* enables you to audit roles. See Auditing Roles (audit_config.htm#GUID-E96C25BE-7C5C-4743-AB53-78B3E66C43C9). The syntax is:

  ```
  role_audit_clause := ROLES role1 [, role2]
  ```

- WHEN *audit_condition* EVALUATE PER enables you to specify a function to create a condition for the audit policy and the evaluation frequency. You must include the EVALUATE PER clause with the WHEN condition. See Creating a Condition for a Unified Audit Policy (audit_config.htm#GUID-6801720F-6020-4608-93B9-C08478B36121) The syntax is:

  ```
  WHEN 'audit_condition := function operation value_list' EVALUATE PER
  {STATEMENT|SESSION|INSTANCE}
  ```

- CONTAINER, used for multitenant environments, enables you to create an audit policy as either a local audit policy (for the local pluggable database (PDB)) or as a common audit policy. See Using the Unified Audit Policies or AUDIT Settings in a Multitenant Environment (audit_config.htm#GUID-E02D0A5B-6591-4CD1-AF2B-29B0850BB6CB).

This syntax is designed to audit any of the components listed in the policy. For example, suppose you create the following policy:

```
CREATE AUDIT POLICY table_pol PRIVILEGES CREATE ANY TABLE, DROP ANY TABLE ROLES
emp_admin, sales_admin;
```

The audit trail will capture SQL statements that require the CREATE ANY TABLE system privilege or the DROP ANY TABLE system privilege or any system privilege directly granted to the role emp_admin or any system privilege directly granted to the role sales_admin. (Be aware that it audits privileges that are *directly* granted, not privileges that are granted recursively through a role.)

After you create the policy, you must enable it by using the AUDIT statement. Optionally, you can apply the policy to one or more users, exclude one or more users from the policy, and designate whether an audit record is written when the audited action succeeds, fails, or both succeeds or fails. See Enabling Unified Audit Policies to Users (audit_config.htm#GUID-526A09B1-0782-47BA-BDF3-17E61E546174)

Auditing Roles

You can use the CREATE AUDIT POLICY statement to audit database roles.

Topics:

- About Role Auditing (audit_config.htm#GUID-CEC327AC-4C6A-4BCD-AD29-010CC2C3E093)
- Configuring Role Unified Audit Policies (audit_config.htm#GUID-075E8E00-B976-428D-BFB4-A0100D4FC4EC)

- Example: Auditing the DBA Role in a Multitenant Environment (audit_config.htm#GUID-335779FD-3DF8-4CBD-AC29-A02389749F93)

About Role Auditing

When you audit a role, Oracle Database audits all system privileges that are directly granted to the role.

You can audit any role, including user-defined roles. If you create a common unified audit policy for roles with the `ROLES` audit option, then you must specify only common roles in the role list. When such a policy is enabled, Oracle Database audits all system privileges that are commonly and directly granted to the common role. The system privileges that are locally granted to the common role will not be audited. To find if a role was commonly granted, query the `DBA_ROLES` data dictionary view. To find if the privileges granted to the role were commonly granted, query the `ROLE_SYS_PRIVS` view.

> **See Also:**
>
> Predefined Roles in an Oracle Database Installation (authorization.htm#GUID-A5B26A03-32CF-4F5D-A6BE-F2452AD8CB8A) for a list of predefined roles

Configuring Role Unified Audit Policies

To create a unified audit policy to capture role use, you must include the `ROLES` clause in the `CREATE AUDIT POLICY` statement.

- Use the following syntax to create a unified audit policy that audits roles:

```
CREATE AUDIT POLICY policy_name ROLES role1 [, role2];
```

For example:

```
CREATE AUDIT POLICY audit_roles_pol ROLES IMP_FULL_DATABASE, EXP_FULL_DATABASE;
```

You can build more complex role unified audit policies, such as those that include conditions. Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

> **See Also:**
>
> Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)

Example: Auditing the DBA Role in a Multitenant Environment

The `CREATE AUDIT POLICY` statement can audit roles in a multitenant environment.

Example 22-2 (audit_config.htm#GUID-335779FD-3DF8-4CBD-AC29-A02389749F93__CHDFEBFF) shows how to audit a predefined common role `DBA` in a multitenant environment.

Example 22-2 Auditing the DBA Role in a Multitenant Environment

```
CREATE AUDIT POLICY role_dba_audit_pol ROLES DBA CONTAINER = ALL; AUDIT POLICY
role_dba_audit_pol;
```

Auditing System Privileges

You can use the `CREATE AUDIT POLICY` statement to audit system privileges.

Topics:

About System Privilege Auditing

System privilege auditing audits activities that use a system privilege, such as `READ ANY TABLE`.

In this kind of auditing, SQL statements that require the audited privilege to succeed are recorded.

A single unified audit policy can contain both privilege and action audit options. Do not audit the privilege use of administrative users such as `SYS`. Instead, audit their object actions. See Auditing Object Actions (audit_config.htm#GUID-12B6375C-25F7-46A9-BA03-4714BFAC6056) for more information.

> **Note:**
>
> You can audit system privileges, objects, database events, and so on. However, if you must find database privilege usage (for example, which privileges that have been granted to a given role are used), and generate a report of the used and unused privileges, then you can create a privilege capture. See *Oracle Database Vault Administrator's Guide* (../DVADM/priv_analysis.htm#DVADM591) for more information.

System Privileges That Can Be Audited

You can audit the use of almost any system privilege.

To find a list of auditable system privileges, you can query the `SYSTEM_PRIVILEGE_MAP` table.

For example:

```
SELECT NAME FROM SYSTEM_PRIVILEGE_MAP; NAME ------------- ALTER ANY CUBE BUILD PROCESS
SELECT ANY CUBE BUILD PROCESS ALTER ANY MEASURE FOLDER ...
```

Similar to action audit options, privilege auditing audits the use of system privileges that have been granted to database users. If you set similar audit options for both SQL statement and privilege auditing, then only a single audit record is generated. For example, if two policies exist, with one auditing `EXECUTE PROCEDURE` specifically on the `HR.PROC` procedure and the second auditing `EXECUTE PROCEDURE` in general (all procedures), then only one audit record is written.

Privilege auditing does not occur if the action is already permitted by the existing owner and object privileges. Privilege auditing is triggered only if the privileges are insufficient, that is, only if what makes the action possible is a system privilege. For example, suppose that user `SCOTT` has been granted the `SELECT ANY TABLE` privilege and `SELECT ANY TABLE` is being audited. If `SCOTT` selects his own table (for example, `SCOTT.EMP`), then the `SELECT ANY TABLE` privilege is not used. Because he performed the `SELECT` statement within his own schema, no audit record is generated. On the other hand, if `SCOTT` selects from another schema (for example, the `HR.EMPLOYEES` table), then an audit record *is* generated. Because `SCOTT` selected a table outside his own schema, he needed to use the `SELECT ANY TABLE` privilege.

System Privileges That Cannot Be Audited

Several system privileges cannot be audited.

These privileges are:

- `INHERIT ANY PRIVILEGE`
- `INHERIT PRIVILEGE`
- `TRANSLATE ANY SQL`
- `TRANSLATE SQL`

Configuring a Unified Audit Policy to Capture System Privilege Use

The `PRIVILEGES` clause in the `CREATE AUDIT POLICY` statement audits system privilege use.

- Use the following syntax to create a unified audit policy that audits privileges:

  ```
  CREATE AUDIT POLICY policy_name PRIVILEGES privilege1 [, privilege2];
  ```

  For example:

  ```
  CREATE AUDIT POLICY my_simple_priv_policy PRIVILEGES SELECT ANY TABLE, CREATE
  LIBRARY;
  ```

You can build more complex privilege unified audit policies, such as those that include conditions. Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

> **See Also:**
>
> Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)

Example: Auditing a User Who Has ANY Privileges

The `CREATE AUDIT POLICY` statement can audit users for `ANY` privileges.

Example 22-3 (audit_config.htm#GUID-8553D570-C6E9-4F1F-B52A-AD35DB92BAFD__CHDEAIIH) shows how to audit several `ANY` privileges of the user `HR_MGR`.

Example 22-3 Auditing a User Who Has ANY Privileges

```
CREATE AUDIT POLICY hr_mgr_audit_pol PRIVILEGES DROP ANY TABLE, DROP ANY CONTEXT, DROP
ANY INDEX, DROP ANY LIBRARY; AUDIT POLICY hr_mgr_audit_pol BY HR_MGR;
```

Example: Using a Condition to Audit a System Privilege

The `CREATE AUDIT POLICY` statement can create an audit policy that uses a condition to audit a system privilege.

Example 22-4 (audit_config.htm#GUID-8246D84A-5062-4317-92B0-3408B5530AFD__CHDJIAEE) shows how to use a condition to audit privileges that are used by two operating system users, `psmith` and `jrawlins`.

Example 22-4 Using a Condition to Audit a System Privilege

```
CREATE AUDIT POLICY os_users_priv_pol PRIVILEGES SELECT ANY TABLE, CREATE LIBRARY WHEN
'SYS_CONTEXT (''USERENV'', ''OS_USER'') IN (''psmith'', ''jrawlins'')' EVALUATE PER
SESSION; AUDIT POLICY os_users_priv_pol;
```

How System Privilege Unified Audit Policies Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists system privilege audit events.

If necessary, you should run the `DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL` procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700) for more information.

The following example, based on the unified audit policy `os_users_priv_pol` that was created in Example 22-4 (audit_config.htm#GUID-8246D84A-5062-4317-92B0-3408B5530AFD__CHDJIAEE), shows a list of privileges used by the operating system user `psmith`.

```
SELECT SYSTEM_PRIVILEGE_USED FROM UNIFIED_AUDIT_TRAIL WHERE OS_USERNAME = 'PSMITH' AND
UNIFIED_AUDIT_POLICIES = 'OS_USERS_PRIV_POL'; SYSTEM_PRIVILEGE_USED ----------------
---- SELECT ANY TABLE DROP ANY TABLE
```

> **Note:**
>
> If you have created an audit policy for the `SELECT ANY TABLE` system privilege, whether the user has exercised the `READ` object privilege or the `SELECT` object privilege will affect the actions that the audit trail captures. See Auditing SELECT, READ ANY TABLE, or SELECT ANY TABLE (audit_config.htm#GUID-0D0AB9A5-B951-4481-8004-26283C0BE901) for more information.

Auditing Administrative Users

Oracle Database provides a set of default administrative user accounts, such as `SYS`. You can create unified audit policies to capture the actions of these users.

Topics:

- Administrative User Accounts That Can Be Audited (audit_config.htm#GUID-165DBDF0-581A-4EBA-B85A-EBD0842BC411)
- Configuring a Unified Audit Policy to Capture Administrator Activities (audit_config.htm#GUID-8AE94B2E-A853-40B5-8E71-CBF4413EA189)

- Example: Auditing the SYS User (audit_config.htm#GUID-DBA13F85-8B38-4F45-A0BD-C6241EC9DE4E)

Administrative User Accounts That Can Be Audited

Oracle Database provides administrative user accounts that are associated with administrative privileges.

Table 22-1 (audit_config.htm#GUID-165DBDF0-581A-4EBA-B85A-EBD0842BC411__CHDEHIEH) lists default administrative user accounts and the administrative privileges with which they are typically associated.

Table 22-1 Administrative Users and Administrative Privileges

Administrative User Account	Administrative Privilege
SYS	SYSDBA
PUBLIC[Foot 1] (#fn_1)	SYSOPER
SYSASM	SYSASM
SYSBACKUP	SYSBACKUP
SYSDG	SYSDG
SYSKM	SYSKM

Footnote 1

PUBLIC refers to the user PUBLIC, which is the effective user when you log in with the SYSOPER administrative privilege. It does not refer to the PUBLIC role.

> **See Also:**
>
> Activities That Are Mandatorily Audited (audit_admin.htm#GUID-AA781864-5756-464E-AFB6-675625AF0EF5)

Configuring a Unified Audit Policy to Capture Administrator Activities

The CREATE AUDIT POLICY statement can audit administrative users.

- To audit administrative users, create a unified audit policy and then apply this policy to the user, the same as you would for non-administrative users. Note that top-level statements by administrative users are mandatorily audited until the database opens.

Example: Auditing the SYS User

The CREATE AUDIT POLICY statement can audit the SYS user.

Example 22-5 (audit_config.htm#GUID-DBA13F85-8B38-4F45-A0BD-C6241EC9DE4E__BABJBBHC) shows how to audit grants of the `DBMS_FGA` PL/SQL package by user `SYS`.

Example 22-5 Auditing the SYS User

```
CREATE AUDIT POLICY dbms_fga_grants ACTIONS GRANT ON DBMS_FGA; AUDIT POLICY
dbms_fga_grants BY SYS;
```

Auditing Object Actions

You can use the `CREATE AUDIT POLICY` statement to audit object actions.

Topics:

- About Auditing Object Actions (audit_config.htm#GUID-EC62454E-47ED-4FAB-B5A4-36B6E8D6C7CD)
- Object Actions That Can Be Audited (audit_config.htm#GUID-6F94DC31-D0AE-4C1B-B97E-3B1FE1FE8CE8)
- Configuring an Object Action Unified Audit Policy (audit_config.htm#GUID-3553BD14-1077-40A7-9A8A-4519AE2F3B1C)
- Example: Auditing Actions on SYS Objects (audit_config.htm#GUID-88D5BBB5-C733-469F-9BB7-84B4190CC51C)
- Example: Auditing Multiple Actions on One Object (audit_config.htm#GUID-5F2969F9-3E8D-49FB-A894-73ADF320949D)
- Example: Auditing Both Actions and Privileges on an Object (audit_config.htm#GUID-D4E7A72A-59CD-47E5-93E9-188FD1D2BB9D)
- Example: Auditing All Actions on a Table (audit_config.htm#GUID-B1E2C21B-8D41-427B-98BF-B5DEEE44AAA1)
- Example: Auditing All Actions in the Database (audit_config.htm#GUID-570703F1-E248-4A07-975E-653BBFA895DD)
- How Object Action Unified Audit Policies Appear in the Audit Trail (audit_config.htm#GUID-C2A1F303-9D13-4FE2-A52C-BCF75B0BED6E)
- Auditing Functions, Procedures, Packages, and Triggers (audit_config.htm#GUID-50FB686D-D357-4066-ADF1-17F1B9B19DB5)
- Audit Policies for Oracle Virtual Private Database Policy Functions (audit_config.htm#GUID-C2436F57-0F6D-431B-BA42-A61685F4D38A)
- Unified Auditing with Editioned Objects (audit_config.htm#GUID-C8DF47D5-4E31-4715-AFBA-EC3BE294EC37)

About Auditing Object Actions

You can audit actions performed on specific objects, such as `UPDATE` statements on the `HR.EMPLOYEES` table.

The audit can include both DDL and DML statements that were used on the object. A single unified audit policy can contain both privilege and action audit options, as well as audit options set for multiple objects.

Object Actions That Can Be Audited

Auditing object actions can be broad or focused (for example, auditing all user actions or only a select list of user actions).

Table 22-2 (audit_config.htm#GUID-6F94DC31-D0AE-4C1B-B97E-3B1FE1FE8CE8__CHDFACCE) lists the object-level standard database action options. Audit policies for the `SELECT` SQL statement will capture `READ` actions as well as `SELECT` actions.

Table 22-2 Object-Level Standard Database Action Audit Option

Object	SQL Action That Can Be Audited
Table	`ALTER`, `AUDIT`, `COMMENT`, `DELETE`, `FLASHBACK`, `GRANT`, `INDEX`, `INSERT`, `LOCK`, `RENAME`, `SELECT`, `UPDATE`
View	`AUDIT`, `COMMENT`, `DELETE`, `FLASHBACK`, `GRANT`, `INSERT`, `LOCK`, `RENAME`, `SELECT`, `UPDATE`
Sequence	`ALTER`, `AUDIT`, `GRANT`, `SELECT`
Procedure (including triggers)	`AUDIT`, `EXECUTE`, `GRANT`
Function	`AUDIT`, `EXECUTE`, `GRANT`
Package	`AUDIT`, `EXECUTE`, `GRANT`
Materialized views	`ALTER`, `AUDIT`, `COMMENT`, `DELETE`, `INDEX`, `INSERT`, `LOCK`, `SELECT`, `UPDATE`
Mining Model	`AUDIT`, `COMMENT`, `GRANT`, `RENAME`, `SELECT`
Directory	`AUDIT`, `GRANT`, `READ`
Library	`EXECUTE`, `GRANT`
Object type	`ALTER`, `AUDIT`, `GRANT`
Java schema objects (source, class, resource)	`AUDIT`, `EXECUTE`, `GRANT`

See Also:

- Auditing Functions, Procedures, Packages, and Triggers (audit_config.htm#GUID-50FB686D-D357-4066-ADF1-17F1B9B19DB5)
- Audit Policies for Oracle Virtual Private Database Policy Functions (audit_config.htm#GUID-C2436F57-0F6D-431B-BA42-A61685F4D38A)

Configuring an Object Action Unified Audit Policy

The `ACTIONS` clause in the `CREATE AUDIT POLICY` statement creates a policy that captures object actions.

- Use the following syntax to create a unified audit policy that audits object actions:

```
CREATE AUDIT POLICY policy_name ACTIONS action1 [, action2 ON object1] [, action3 ON
object2];
```

For example:

```
CREATE AUDIT POLICY my_simple_obj_policy ACTIONS SELECT ON OE.ORDERS, UPDATE ON
HR.EMPLOYEES;
```

Note that you can audit multiple actions on multiple objects, as shown in this example.

You can build complex object action unified audit policies, such as those that include conditions. Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

> **See Also:**
>
> Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)

Example: Auditing Actions on SYS Objects

The `CREATE AUDIT POLICY` statement can audit actions on SYS objects.

Example 22-6 (audit_config.htm#GUID-88D5BBB5-C733-469F-9BB7-84B4190CC51C__BABFFBCC) shows how to create an audit policy that audits `SELECT` statements on the `SYS.USER$` system table. The audit policy applies to all users, including `SYS` and `SYSTEM`.

Example 22-6 Auditing Actions on SYS Objects

```
CREATE AUDIT POLICY select_user_dictionary_table_pol ACTIONS SELECT ON SYS.USER$;
AUDIT POLICY select_user_dictionary_table_pol;
```

Example: Auditing Multiple Actions on One Object

The `CREATE AUDIT POLICY` statement can audit multiple actions on one object.

Example 22-7 (audit_config.htm#GUID-5F2969F9-3E8D-49FB-A894-73ADF320949D__CHDJDEFJ) shows how to audit multiple SQL statements performed by users `jrandolph` and `phawkins` on the `app_lib` library.

Example 22-7 Auditing Multiple Actions on One Object

```
CREATE AUDIT POLICY actions_on_hr_emp_pol1 ACTIONS EXECUTE, GRANT ON app_lib; AUDIT
POLICY actions_on_hr_emp_pol1 BY jrandolph, phawkins;
```

Example: Auditing Both Actions and Privileges on an Object

The `CREATE AUDIT POLICY` statement can audit both actions and privileges on an object, using a single policy.

Example 22-8 (audit_config.htm#GUID-D4E7A72A-59CD-47E5-93E9-188FD1D2BB9D__CHDHBBDJ) shows a variation of Example 22-7 (audit_config.htm#GUID-5F2969F9-3E8D-49FB-A894-73ADF320949D__CHDJDEFJ), in which all `EXECUTE` and `GRANT` statements on the `app_lib` library using the `CREATE LIBRARY` privilege are audited.

Example 22-8 Auditing Both Actions and Privileges on an Object

```
CREATE AUDIT POLICY actions_on_hr_emp_pol2 PRIVILEGES CREATE LIBRARY ACTIONS EXECUTE,
GRANT ON app_lib; AUDIT POLICY actions_on_hr_emp_pol2 BY jrandolph, phawkins;
```

You can audit directory objects. For example, suppose you create a directory object that contains a preprocessor program that the `ORACLE_LOADER` access driver will use. You can audit anyone who runs this program within this directory object.

Example: Auditing All Actions on a Table

The `CREATE AUDIT POLICY` statement can audit all actions on a table.

You can use the keyword `ALL` to audit all actions. Example 22-9 (audit_config.htm#GUID-B1E2C21B-8D41-427B-98BF-B5DEEE44AAA1__CHDDDCBH)shows how to audit all actions on the `HR.EMPLOYEES` table, except actions by user `pmulligan`.

Example 22-9 Auditing All Actions on a Table

```
CREATE AUDIT POLICY all_actions_on_hr_emp_pol ACTIONS ALL ON HR.EMPLOYEES; AUDIT
POLICY all_actions_on_hr_emp_pol EXCEPT pmulligan;
```

Example: Auditing All Actions in the Database

The `CREATE AUDIT POLICY` statement can audit all actions in the database.

Example 22-10 (audit_config.htm#GUID-570703F1-E248-4A07-975E-653BBFA895DD__CHDIGCEJ)shows how to audit all actions in the entire database.

Example 22-10 Auditing All Actions in the Database

```
CREATE AUDIT POLICY all_actions_pol ACTIONS ALL; AUDIT POLICY all_actions_pol;
```

How Object Action Unified Audit Policies Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists object action audit events.

If necessary, you should run the `DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL` procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700)for more information.

For example:

```
SELECT ACTION_NAME, OBJECT_SCHEMA, OBJECT_NAME FROM UNIFIED_AUDIT_TRAIL WHERE
DBUSERNAME = 'SYS'; ACTION_NAME OBJECT_SCHEMA OBJECT_NAME ----------- ------------- --
---------- SELECT HR EMPLOYEES
```

Auditing Functions, Procedures, Packages, and Triggers

You can audit functions, procedures, PL/SQL packages, and triggers.

The areas that you can audit are as follows:

- You can individually audit standalone functions, standalone procedures, and PL/SQL packages.
- If you audit a PL/SQL package, Oracle Database audits all functions and procedures within the package.
- If you enable auditing for all executions, Oracle Database audits all triggers in the database, as well as all the functions and procedures within PL/SQL packages.
- You cannot audit individual functions or procedures within a PL/SQL package.
- When you audit the `EXECUTE` operation on a PL/SQL stored procedure or stored function, the database considers only its ability to find the procedure or function and authorize its execution when determining the success or failure of the operation for the purposes of auditing. Therefore, if you specify the `WHENEVER NOT SUCCESSFUL` clause, then only invalid object errors, non-existent object errors, and authorization failures are audited; errors encountered during the execution of the procedure or function are not audited. If you specify the `WHENEVER SUCCESSFUL` clause, then all executions that are not blocked by invalid object errors, non-existent object errors, or authorization failures are audited, regardless of whether errors are encountered during execution.

Audit Policies for Oracle Virtual Private Database Policy Functions

Auditing can affect dynamic VPD policies, static VPD policies, and context-sensitive VPD policies.

- **Dynamic policies:** Oracle Database evaluates the policy function twice, once during SQL statement parsing and again during execution. As a result, two audit records are generated for each evaluation.
- **Static policies:** Oracle Database evaluates the policy function once and then caches it in the SGA. As a result, only one audit record is generated.
- **Context-sensitive policies:** Oracle Database executes the policy function once, during statement parsing. As a result, only one audit record is generated.

Unified Auditing with Editioned Objects

When an editioned object has a unified audit policy, it applies in all editions in which the object is visible.

When an editioned object is actualized, any unified audit policies that are attached to it are newly attached to the new actual occurrence. When you newly apply a unified audit policy to an inherited editioned object, this action will actualize it.

You can find the editions in which audited objects appear by querying the `OBJECT_NAME` and `OBJ_EDITION_NAME` columns in the `UNIFIED_AUDIT_TRAIL` data dictionary view.

> **See Also:**
>
> *Oracle Database Development Guide* (../ADFNS/adfns_editions.htm#ADFNS020)for detailed information about editions

Auditing SELECT, READ ANY TABLE, or SELECT ANY TABLE

You can use the CREATE AUDIT POLICY statement to audit the SELECT statement and the READ ANY TABLE or SELECT ANY TABLE privilege.

Topics:

- About Auditing the SELECT Statement and READ ANY TABLE System Privilege (audit_config.htm#GUID-AE79EDB3-B72B-44BA-B44A-4F3C9389D42C)
- Creating a Unified Audit Policy to Capture READ Object Privilege Operations (audit_config.htm#GUID-150E28A3-6CA4-48EC-AB90-BB11D17F98FF)
- How the Unified Audit Trail Captures READ ANY TABLE and SELECT ANY TABLE (audit_config.htm#GUID-86DA014F-DA52-4232-8188-10CE1D08BCE5)

About Auditing the SELECT Statement and READ ANY TABLE System Privilege

You can create unified audit policies that capture the use of the READ ANY TABLE system privilege.

Based on the action that the user tried to perform and the privilege that was granted to the user, the SYSTEM_PRIVILEGE_USED column of the UNIFIED_AUDIT_TRAIL data dictionary view will record either the READ ANY TABLE system privilege or the SELECT ANY TABLE system privilege. For example, suppose the user has been granted the SELECT ANY TABLE privilege and then performs a query on a table. The audit trail will record that the user used the SELECT ANY TABLE system privilege. If the user was granted READ ANY TABLE and performed the same query, then the READ ANY TABLE privilege is recorded.

Creating a Unified Audit Policy to Capture READ Object Privilege Operations

You can create unified audit policies that capture READ object privilege operations.

- To create a unified audit policy to capture READ object operations, create the policy for the SELECT statement, not for the READ statement.

For example:

```
CREATE AUDIT POLICY read_hr_employees ACTIONS SELECT ON HR.EMPLOYEES;
```

How the Unified Audit Trail Captures READ ANY TABLE and SELECT ANY TABLE

The unified audit trail captures SELECT behavior based on whether a user has the READ ANY TABLE or the SELECT ANY TABLE privilege.

Table 22-3 (audit_config.htm#GUID-86DA014F-DA52-4232-8188-10CE1D08BCE5__BABCCEII) describes how the unified audit trail captures these actions.

Table 22-3 Auditing Behavior for READ ANY TABLE and SELECT ANY TABLE

Statement User Issues	Privilege Granted to User	System Privilege Being Audited	Expected UNIFIED_AUDIT_TRAIL Behavior

SELECT	SELECT ANY TABLE	SELECT ANY TABLE	Record inserted into SYSTEM_PRIVILEGE_USED: SELECT ANY TABLE
SELECT	SELECT ANY TABLE	READ ANY TABLE	No record
SELECT	SELECT ANY TABLE	Both SELECT ANY TABLE and READ ANY TABLE	Record inserted into SYSTEM_PRIVILEGE_USED: SELECT ANY TABLE
SELECT	SELECT ANY TABLE	Neither SELECT ANY TABLE nor READ ANY TABLE	No record
SELECT	READ ANY TABLE	SELECT ANY TABLE	No record
SELECT	READ ANY TABLE	READ ANY TABLE	Record inserted into SYSTEM_PRIVILEGE_USED: READ ANY TABLE
SELECT	READ ANY TABLE	Both SELECT ANY TABLE and READ ANY TABLE	Record inserted into SYSTEM_PRIVILEGE_USED: READ ANY TABLE
SELECT	READ ANY TABLE	Neither SELECT ANY TABLE nor READ ANY TABLE	No record
SELECT	Both SELECT ANY TABLE and READ ANY TABLE	SELECT ANY TABLE	No record, because READ ANY TABLE was used for access

SELECT	Both SELECT ANY TABLE and READ ANY TABLE	READ ANY TABLE	Record inserted into SYSTEM_PRIVILEGE_USED: READ ANY TABLE
SELECT	Both SELECT ANY TABLE and READ ANY TABLE	Both SELECT ANY TABLE and READ ANY TABLE	Record inserted into SYSTEM_PRIVILEGE_USED: READ ANY TABLE
SELECT	Both SELECT ANY TABLE and READ ANY TABLE	Neither SELECT ANY TABLE nor READ ANY TABLE	No record
SELECT	Neither SELECT ANY TABLE nor READ ANY TABLE	SELECT ANY TABLE	No record
SELECT	Neither SELECT ANY TABLE nor READ ANY TABLE	READ ANY TABLE	No record
SELECT	Neither SELECT ANY TABLE nor READ ANY TABLE	Both SELECT ANY TABLE and READ ANY TABLE	No record
SELECT	Neither SELECT ANY TABLE nor READ ANY TABLE	Neither SELECT ANY TABLE nor READ ANY TABLE	No record
SELECT ... FOR UPDATE	SELECT ANY TABLE	SELECT ANY TABLE	Record inserted into SYSTEM_PRIVILEGE_USED: SELECT ANY TABLE
SELECT ... FOR UPDATE	SELECT ANY TABLE	READ ANY TABLE	No record

`SELECT ... FOR UPDATE`	`SELECT ANY TABLE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	Record inserted into `SYSTEM_PRIVILEGE_USED`: `SELECT ANY TABLE`
`SELECT ... FOR UPDATE`	`SELECT ANY TABLE`	Neither `SELECT ANY TABLE` nor `READ ANY TABLE`	No record
`SELECT ... FOR UPDATE`	`READ ANY TABLE`	`SELECT ANY TABLE`	No record
`SELECT ... FOR UPDATE`	`READ ANY TABLE`	`READ ANY TABLE`	No record
`SELECT ... FOR UPDATE`	`READ ANY TABLE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	No record
`SELECT ... FOR UPDATE`	`READ ANY TABLE`	Neither `SELECT ANY TABLE` nor `READ ANY TABLE`	No record
`SELECT ... FOR UPDATE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	`SELECT ANY TABLE`	Record inserted into `SYSTEM_PRIVILEGE_USED`: `SELECT ANY TABLE`
`SELECT ... FOR UPDATE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	`READ ANY TABLE`	No record, because `READ ANY TABLE` was used for access
`SELECT ... FOR UPDATE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	Record inserted into `SYSTEM_PRIVILEGE_USED`: `SELECT ANY TABLE`
`SELECT ... FOR UPDATE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	Neither `SELECT ANY TABLE` nor `READ ANY TABLE`	No record

`SELECT ... FOR UPDATE`	Neither `SELECT ANY TABLE` nor `READ ANY TABLE`	`SELECT ANY TABLE`	No record
`SELECT ... FOR UPDATE`	Neither `SELECT ANY TABLE` nor `READ ANY TABLE`	`READ ANY TABLE`	No record
`SELECT ... FOR UPDATE`	Neither `SELECT ANY TABLE` nor `READ ANY TABLE`	Both `SELECT ANY TABLE` and `READ ANY TABLE`	No record
`SELECT ... FOR UPDATE`	Neither `SELECT ANY TABLE` nor `READ ANY TABLE`	Neither `SELECT ANY TABLE` or `READ ANY TABLE`	No record

Auditing SQL Statements and Privileges in a Multitier Environment

You can create a unified audit policy to audit the activities of a client in a multitier environment.

In a multitier environment, Oracle Database preserves the identity of a client through all tiers. Thus, you can audit actions taken on behalf of the client by a middle-tier application, by using the `BY` *`user`* clause in the `AUDIT` statement for your policy. The audit applies to all user sessions, including proxy sessions.

The middle tier can also set the user client identity in a database session, enabling the auditing of end-user actions through the middle-tier application. The end-user client identity then shows up in the audit trail.

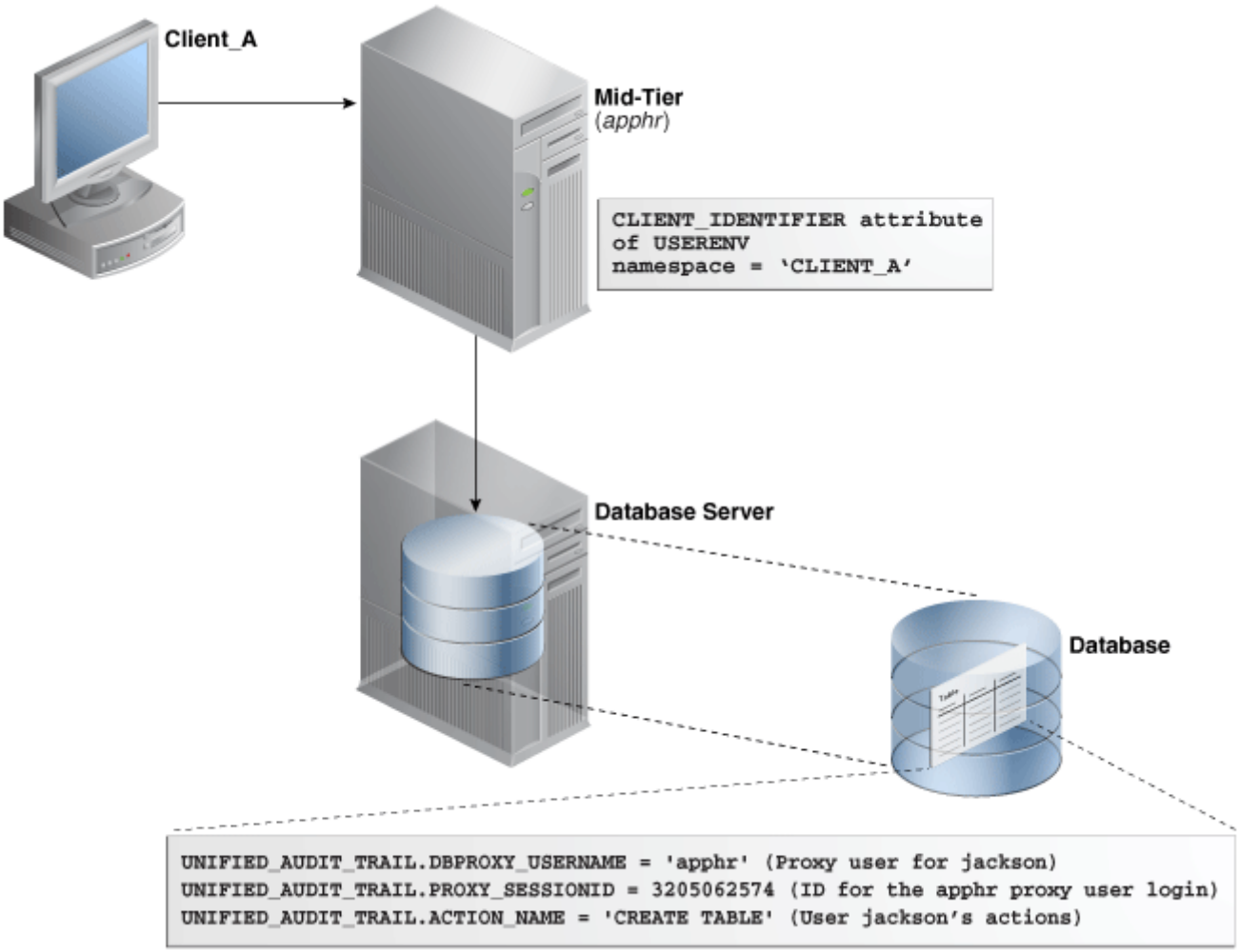
The following example shows how to audit `SELECT TABLE` statements issued by the user `jackson`:

```
CREATE AUDIT POLICY tab_pol PRIVILEGES CREATE ANY TABLE ACTIONS CREATE TABLE; AUDIT
tab_pol BY jackson;
```

You can audit user activity in a multitier environment. Once audited, you can verify these activities by querying the `UNIFIED_AUDIT_TRAIL` data dictionary view.

Figure 22-1 (audit_config.htm#GUID-66F4A51C-85CC-492C-929E-137C222637C7__BCGDEJEC) illustrates how you can audit proxy users by querying the `PROXY_SESSIONID`, `ACTION_NAME`, and `SESSION_ID` columns of the `UNIFIED_AUDIT_TRAIL` view. In this scenario, both the database user and proxy user accounts are known to the database. Session pooling can be used.

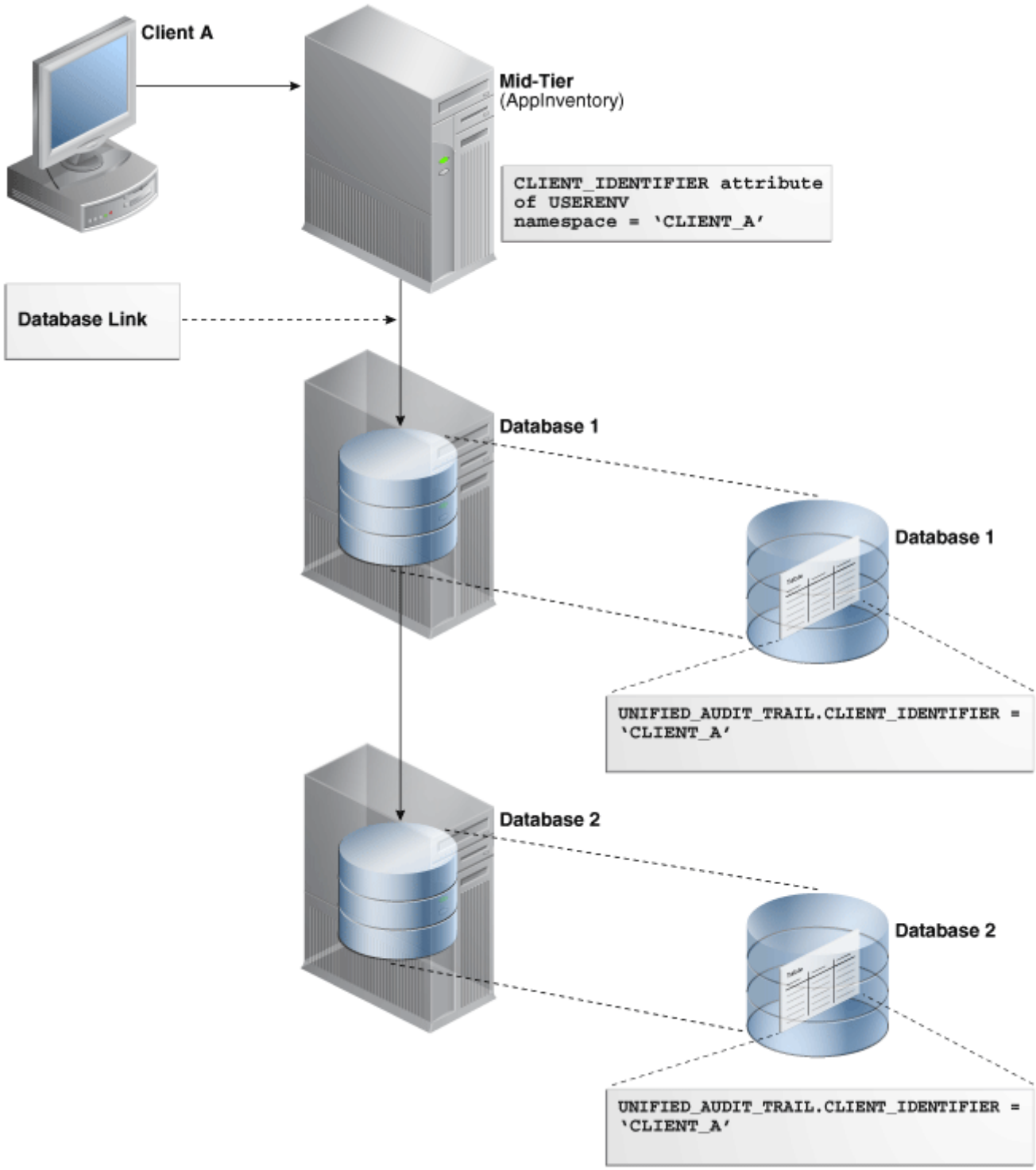
Figure 22-1 Auditing Proxy Users



Description of "Figure 22-1 Auditing Proxy Users" (img_text/GUID-2262A6C5-2FDE-43D6-ABDF-6E66101ED7A0-print.htm)

Figure 22-2 (audit_config.htm#GUID-66F4A51C-85CC-492C-929E-137C222637C7__BCGIIFCG) illustrates how you can audit client identifier information across multiple database sessions by querying the `CLIENT_ID` column of the `DBA_AUDIT_TRAIL` data dictionary view. In this scenario, the client identifier has been set to `CLIENT_A`. As with the proxy user-database user scenario described in Figure 22-1 (audit_config.htm#GUID-66F4A51C-85CC-492C-929E-137C222637C7__BCGDEJEC), session pooling can be used.

Figure 22-2 Auditing Client Identifier Information Across Sessions



Description of "Figure 22-2 Auditing Client Identifier Information Across Sessions" (img_text/GUID-E6A9712F-943E-4B61-AB72-755F84337642-print.htm)

> **See Also:**
>
> Preserving User Identity in Multitiered Environments (authentication.htm#GUID-94CF6D9C-08A0-4671-BD82-694EB67D06C9) for more information about user authentication in a multitiered environment

Creating a Condition for a Unified Audit Policy

You can use the `CREATE AUDIT POLICY` statement to create conditions for a unified audit policy.

Topics:

- About Conditions in Unified Audit Policies (audit_config.htm#GUID-952906CC-0711-46C7-B5C2-F42B0BD9B84F)
- Configuring a Unified Audit Policy with a Condition (audit_config.htm#GUID-9DC64995-0EF4-4FF6-8F60-FF3F9279BD85)

- Example: Auditing Access to SQL*Plus (audit_config.htm#GUID-A107C42E-94EF-4E11-AC65-D7334FC153AB)
- Example: Auditing Actions Not in Specific Hosts (audit_config.htm#GUID-B72BED89-6B3B-4925-A676-D345599BDF7E)
- Example: Auditing Both a System-Wide and a Schema-Specific Action (audit_config.htm#GUID-D79FB8DC-80DD-4F32-8D2E-F058838911E0)
- Example: Auditing a Condition Per Statement Occurrence (audit_config.htm#GUID-1EE7EAE0-8B06-4D9C-86BB-DD688AB311F5)
- Example: Unified Audit Session ID of a Current Administrative User Session (audit_config.htm#GUID-1C4238B7-ED25-4241-8EF2-FE08149DC440)
- Example: Unified Audit Session ID of a Current Non-Administrative User Session (audit_config.htm#GUID-0A4BE828-9B66-436D-A9AB-9F91919418FF)
- How Audit Records from Conditions Appear in the Audit Trail (audit_config.htm#GUID-1F835B5A-70D4-4D8B-B8C5-9C3EFFEC4415)

About Conditions in Unified Audit Policies

You can create a unified audit policy that uses a `SYS_CONTEXT` namespace-attribute pair to specify a condition.

For example, this audit condition can apply to a specific user who may fulfil the audit condition, or a computer host where the audit condition is fulfilled.

If the audit condition is satisfied, then Oracle Database creates an audit record for the event. As part of the condition definition, you must specify whether the audited condition is evaluated per statement occurrence, session, or database instance.

> **Note:**
>
> Audit conditions can use both secure and insecure application contexts.

Configuring a Unified Audit Policy with a Condition

The `WHEN` clause in the `CREATE AUDIT POLICY` statement defines the condition in the audit policy.

- Use the following syntax to create a unified audit policy that uses a condition:

```
CREATE AUDIT POLICY policy_name action_privilege_role_audit_option [WHEN
function_operation_value_list_1 [[AND | OR] function_operation_value_list_n]
EVALUATE PER STATEMENT | SESSION | INSTANCE];
```

In this specification:

- *`action_privilege_role_audit_option`* refers to audit options for system actions, object actions, privileges, and roles.
- `WHEN` defines the condition. It has the following components:
  - *`function`* uses the following types of functions:

    Numeric functions, such as `BITAND`, `CEIL`, `FLOOR`, and `LN` `POWER`

Character functions that return character values, such as `CONCAT`, `LOWER`, and `UPPER`

Character functions that return numeric values, such as `LENGTH` or `INSTR`

Environment and identifier functions, such as `SYS_CONTEXT` and `UID`. For `SYS_CONTEXT`, in most cases, you may want to use the `USERENV` namespace, which is described in *Oracle Database SQL Language Reference* (../SQLRF/functions199.htm#SQLRF51825).

- *`operation`* can be any the following operators: `AND`, `OR`, `IN`, `NOT IN`, `=`, `<`, `>`, `<>`
- *`value_list`* refers to the condition for which you are testing.

You can include additional conditions for each *`function_operation_value_list`* set, separated by `AND` or `OR`.

When you write the `WHEN` clause, follow these guidelines:

- Enclose the entire *`function operation value`* setting in single quotation marks. Within the clause, enclose each quoted component within two pairs of single quotation marks. Do not use double quotation marks.
- Do not exceed 4000 bytes for the `WHEN` condition.

- `EVALUATE PER` refers to the following options:
  - `STATEMENT` evaluates the condition for each relevant auditable statement that occurs.
  - `SESSION` evaluates the condition only once during the session, and then caches and re-uses the result during the remainder of the session. Oracle Database evaluates the condition the first time the policy is used, and then stores the result in UGA memory afterward.
  - `INSTANCE` evaluates the condition only once during the database instance lifetime. After Oracle Database evaluates the condition, it caches and re-uses the result for the remainder of the instance lifetime. As with the `SESSION` evaluation, the evaluation takes place the first time it is needed, and then the results are stored in UGA memory afterward.

For example:

```
CREATE AUDIT POLICY oe_orders_pol ACTIONS UPDATE ON OE.ORDERS WHEN
'SYS_CONTEXT(''USERENV'', ''IDENTIFICATION_TYPE'') = ''EXTERNAL''' EVALUATE PER
STATEMENT;
```

Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

> **See Also:**
>
> *Oracle Database SQL Language Reference* (../SQLRF/functions199.htm#SQLRF06117)for more information about functions that you can use in conditions

Example: Auditing Access to SQL*Plus

The `CREATE AUDIT POLICY` statement can audit access to SQL*Plus.

Example 22-11 (audit_config.htm#GUID-A107C42E-94EF-4E11-AC65-D7334FC153AB__BABGFCBB) shows how to audit access to the database with SQL*Plus by the `HR` and `OE` users.

Example 22-11 Auditing Access to SQL*Plus

```
CREATE AUDIT POLICY logon_pol ACTIONS LOGON WHEN 'INSTR(UPPER(SYS_CONTEXT(''USERENV'',
''CLIENT_PROGRAM_NAME'')), ''SQLPLUS'') > 0' EVALUATE PER SESSION; AUDIT POLICY
logon_pol BY HR, OE;
```

Example: Auditing Actions Not in Specific Hosts

The `CREATE AUDIT POLICY` statement can audit actions that are not in specific hosts.

Example 22-12 (audit_config.htm#GUID-B72BED89-6B3B-4925-A676-D345599BDF7E__CHDFJHBG) shows how to audit two actions (`UPDATE` and `DELETE` statements) on the `OE.ORDERS` table, but excludes the host names `sales_24` and `sales_12` from the audit. It performs the audit on a per session basis and writes audit records for failed attempts only.

Example 22-12 Auditing Actions Not in Specific Hosts

```
CREATE AUDIT POLICY oe_table_audit1 ACTIONS UPDATE ON OE.ORDERS, DELETE ON OE.ORDERS
WHEN 'SYS_CONTEXT (''USERENV'', ''HOST'') NOT IN (''sales_24'',''sales_12'')' EVALUATE
PER SESSION; AUDIT POLICY oe_table_audit1 WHENEVER NOT SUCCESSFUL;
```

Example: Auditing Both a System-Wide and a Schema-Specific Action

The `CREATE AUDIT POLICY` statement can audit both system-wide and schema-specific actions.

Example 22-13 (audit_config.htm#GUID-D79FB8DC-80DD-4F32-8D2E-F058838911E0__CHDDEBJG) shows a variation of Example 22-12 (audit_config.htm#GUID-B72BED89-6B3B-4925-A676-D345599BDF7E__CHDFJHBG) in which the `UPDATE` statement is audited system wide. The `DELETE` statement audit is still specific to the `OE.ORDERS` table.

Example 22-13 Auditing Both a System-Wide and a Schema-Specific Action

```
CREATE AUDIT POLICY oe_table_audit2 ACTIONS UPDATE, DELETE ON OE.ORDERS WHEN
'SYS_CONTEXT (''USERENV'', ''HOST'') NOT IN (''sales_24'',''sales_12'')' EVALUATE PER
SESSION; AUDIT POLICY oe_table_audit2;
```

Example: Auditing a Condition Per Statement Occurrence

The `CREATE AUDIT POLICY` statement can audit conditions.

Example 22-14 (audit_config.htm#GUID-1EE7EAE0-8B06-4D9C-86BB-DD688AB311F5__CHDFJBBC) shows how to audit a condition based on each occurrence of the `DELETE` statement on the `OE.ORDERS` table and exclude user `jmartin` from the audit.

Example 22-14 Auditing a Condition Per Statement Occurrence

```
CREATE AUDIT POLICY sales_clerk_pol ACTIONS DELETE ON OE.ORDERS WHEN
'SYS_CONTEXT(''USERENV'', ''CLIENT_IDENTIFIER'') = ''sales_clerk''' EVALUATE PER
STATEMENT; AUDIT POLICY sales_clerk_pol EXCEPT jmartin;
```

Example: Unified Audit Session ID of a Current Administrative User Session

The `SYS_CONTEXT` function can be used to find session IDs.

Example 22-15 (audit_config.htm#GUID-1C4238B7-ED25-4241-8EF2-FE08149DC440__BABCDEJH) shows how to find the unified audit session ID of current user session for an administrative user.

Example 22-15 Unified Audit Session ID of a Current Administrative User Session

```
CONNECT SYS AS SYSDBA Enter password: password SELECT SYS_CONTEXT('USERENV',
'UNIFIED_AUDIT_SESSIONID') FROM DUAL;
```

Output similar to the following appears:

```
SYS_CONTEXT('USERENV','UNIFIED_AUDIT_SESSIONID') ----------------------------------
---------------------------------------- 2318470183
```

Note that in mixed mode auditing, the `UNIFIED_AUDIT_SESSIONID` value in the `USERENV` namespace is different from the value that is recorded by the `SESSIONID` parameter. Hence, if you are using mixed mode auditing and want to find the correct audit session ID, you should use the `USERENV UNIFIED_AUDIT_SESSIONID` parameter, not the `SESSIONID` parameter. In pure unified auditing, the `SESSIONID` and `UNIFIED_AUDIT_SESSIONID` values are the same.

Example: Unified Audit Session ID of a Current Non-Administrative User Session

The `SYS_CONTEXT` function can find the session ID of a current non-administrative user session.

Example 22-16 (audit_config.htm#GUID-0A4BE828-9B66-436D-A9AB-9F91919418FF__BABIAJAJ) shows how to find the unified audit session ID of a current user session for a non-administrative user.

Example 22-16 Unified Audit Session ID of a Current Non-Administrative User Session

```
CONNECT mblake -- Or, CONNECT mblake@hrpdb for a PDB Enter password: password SELECT
SYS_CONTEXT('USERENV', 'UNIFIED_AUDIT_SESSIONID') FROM DUAL;
```

Output similar to the following appears:

```
SYS_CONTEXT('USERENV','UNIFIED_AUDIT_SESSIONID') ----------------------------------
---------------------------------------- 2776921346
```

How Audit Records from Conditions Appear in the Audit Trail

The audit record conditions from a unified audit policy do not appear in the audit trail.

If the condition evaluates to true and the record is written, then the record appears in the audit trail. You can check the audit trail by querying the `UNIFIED_AUDIT_TRAIL` data dictionary view.

> **See Also:**
>
> Audit Policy Data Dictionary Views (audit_config.htm#GUID-3793F7A1-1679-4AC5-9DA3-61E30EE92035) for more audit trail views

Auditing Application Context Values

You can use the `AUDIT` statement to audit application context values.

Topics:

- About Auditing Application Context Values (audit_config.htm#GUID-5ED17BC5-6C39-42C9-AC4F-116F8B0B2FD8)
- Configuring Application Context Audit Settings (audit_config.htm#GUID-96C6C33F-A86F-4D9F-8452-4663837666C7)
- Disabling Application Context Audit Settings (audit_config.htm#GUID-4BF63875-E594-40C0-AC08-CA42D4347BCF)
- Example: Auditing Application Context Values in a Default Database (audit_config.htm#GUID-2A611BF9-F661-4F2B-BB80-16930C7CEBDE)
- Example: Auditing Application Context Values from Oracle Label Security (audit_config.htm#GUID-1845CD72-F930-47F8-B5C1-7444DFF3848F)
- How Audited Application Contexts Appear in the Audit Trail (audit_config.htm#GUID-A2AD2E60-004C-41F9-9D5D-E1C4E2E941C9)

About Auditing Application Context Values

You can capture application context values in the unified audit trail.

This feature enables you to capture any application context values set by the database applications, while executing the audited statement.

If you plan to audit Oracle Label Security, then this feature captures session label activity for the database audit trail. The audit trail records all the values retrieved for the specified context-attribute value pairs.

The application context audit setting or the audit policy have session static semantics. In other words, if a new policy is enabled for a user, then the subsequent user sessions will see an effect of this command. After the session is established, then the policies and contexts settings are loaded and the subsequent `AUDIT` statements have no effect on that session.

For multitenant environments, the application context audit policy applies only to the current PDB.

> **See Also:**
>
> - Using Application Contexts to Retrieve User Information (app_context.htm#GUID-51C9D5FA-6787-4F05-82EF-A5968BEDC5A0), for detailed information about application contexts
> - Using the Unified Audit Policies or AUDIT Settings in a Multitenant Environment (audit_config.htm#GUID-E02D0A5B-6591-4CD1-AF2B-29B0850BB6CB)
> - *Oracle Label Security Administrator's Guide* (../OLSAG/intro.htm#OLSAG001)for detailed information about Oracle Label Security

Configuring Application Context Audit Settings

The `AUDIT` statement with the `CONTEXT` keyword configures auditing for application context values.

You do not create an unified audit policy for this type of auditing.

- Use the following syntax to configure auditing for application context values:

  ```
  AUDIT CONTEXT NAMESPACE context_name1 ATTRIBUTES attribute1 [, attribute2] [,
  CONTEXT NAMESPACE context_name2 ATTRIBUTES attribute1 [, attribute2]] [BY
  user_list];
  ```

In this specification:

- *`context_name1`*: Optionally, you can include one additional `CONTEXT` name-attribute value pair.

- *user_list* is an optional list of database user accounts. Separate multiple names with a comma. If you omit this setting, then Oracle Database configures the application context policy for all users. When each user logs in, a list of all pertinent application contexts and their attributes is cached for the user session.

For example:

```
AUDIT CONTEXT NAMESPACE clientcontext3 ATTRIBUTES module, action, CONTEXT NAMESPACE
ols_session_labels ATTRIBUTES ols_pol1, ols_pol3 BY appuser1, appuser2;
```

To find a list of currently configured application context audit settings, query the AUDIT_UNIFIED_CONTEXTS data dictionary view.

Disabling Application Context Audit Settings

The NOAUDIT statement disables application context audit settings.

- To disable an application context audit setting, specify the namespace and attribute settings in the NOAUDIT statement. You can enter the attributes in any order (that is, they do not need to match the order used in the corresponding AUDIT CONTEXT statement.)

For example:

```
NOAUDIT CONTEXT NAMESPACE client_context ATTRIBUTES module, CONTEXT NAMESPACE
ols_session_labels ATTRIBUTES ols_pol1, ols_pol3 BY appuser1, appuser2;
```

To find the currently audited application contexts, query the AUDIT_UNIFIED_CONTEXTS data dictionary view.

Example: Auditing Application Context Values in a Default Database

The AUDIT CONTEXT NAMESPACE statement can audit application context values.

Example 22-17 (audit_config.htm#GUID-2A611BF9-F661-4F2B-BB80-16930C7CEBDE__CHDHFDH) shows how to audit the clientcontext application values for the module and action attributes, by the user appuser1.

Example 22-17 Auditing Application Context Values in a Default Database

```
AUDIT CONTEXT NAMESPACE clientcontext ATTRIBUTES module, action BY appuser1;
```

Example: Auditing Application Context Values from Oracle Label Security

The AUDIT CONTEXT NAMESPACE statement can audit application context values from Oracle Label Security.

Example 22-18 (audit_config.htm#GUID-1845CD72-F930-47F8-B5C1-7444DFF3848F__CHDDFJEH) shows how to audit an application context for Oracle Label Security called ols_session_labels, for the attributes ols_pol1 and ols_pol2.

Example 22-18 Auditing Application Context Values from Oracle Label Security

```
AUDIT CONTEXT NAMESPACE ols_session_labels ATTRIBUTES ols_pol1, ols_pol2;
```

How Audited Application Contexts Appear in the Audit Trail

The UNIFIED_AUDIT_POLICIES data dictionary view lists application context audit events.

If necessary, you should run the DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700)for more information.

The APPLICATION_CONTEXTS column of the UNIFIED_AUDIT_TRAIL data dictionary view shows application context audit data. The application contexts appear as a list of semi-colon separated values.

For example:

```
SELECT APPLICATION_CONTEXTS FROM UNIFIED_AUDIT_TRAIL WHERE UNIFIED_AUDIT_POLICIES =
'app_audit_pol'; APPLICATION_CONTEXTS ----------------------------------------------
---------- CLIENT_CONTEXT.APPROLE=MANAGER;E2E_CONTEXT.USERNAME=PSMITH
```

Auditing Oracle Database Real Application Security Events

You can use CREATE AUDIT POLICY statement to audit Oracle Database Real Application Security events.

Topics:

- About Auditing Oracle Database Real Application Security Events (audit_config.htm#GUID-01B8B2F7-09E0-4342-A8E1-EBDC485DD306)
- Oracle Database Real Application Security Auditable Events (audit_config.htm#GUID-5E559D2F-49DE-4932-ACA8-3AD12BAE6492)
- Oracle Database Real Application Security User and Role Audit Events (audit_config.htm#GUID-C8EA2CB7-17A5-42BC-B3EA-8C42C23978A5)
- Oracle Database Real Application Security Security Class and ACL Audit Events (audit_config.htm#GUID-D96E9FC6-C414-4E74-AD05-4D190EAFE119)
- Oracle Database Real Application Security Session Audit Events (audit_config.htm#GUID-E1A06E80-352D-47AE-A5ED-3DD346014B1A)
- Oracle Database Real Application Security ALL Events (audit_config.htm#GUID-DF37A7E4-5078-49A6-BF00-49B233548BC4)
- Configuring a Unified Audit Policy for Oracle Database Real Application Security (audit_config.htm#GUID-AA8CA461-F790-40DB-9E05-73B660A38999)
- Example: Auditing Real Application Security User Account Modifications (audit_config.htm#GUID-BA05779A-1AF2-4DB8-9652-971814C93BDE)
- Example: Using a Condition in a Real Application Security Unified Audit Policy (audit_config.htm#GUID-67F851C5-1523-4867-AECF-6236EA427BBC)
- How Oracle Database Real Application Security Events Appear in the Audit Trail (audit_config.htm#GUID-1944D877-CEAA-46C3-8618-FE5DFF366352)

> **See Also:**
>
> - Auditing Application Context Values (audit_config.htm#GUID-1AC48317-FDF8-4D94-99AD-6B88E4909436)

- Oracle Database Real Application Security Predfined Audit Policies (audit_config.htm#GUID-F43C50E5-866F-43E8-908A-893E4FD6953E)
- *Oracle Database Real Application Security Administrator's and Developer's Guide* (../DBFSG/intro.htm#DBFSG837)for detailed information about Oracle Database Real Application Security

About Auditing Oracle Database Real Application Security Events

You must have the `AUDIT_ADMIN` role to audit Oracle Database Real Application Security events.

To access the audit trail, you can query the `UNIFIED_AUDIT_TRAIL` data dictionary view, whose Real Application Security-specific columns begin with `XS_`.

Real Application Security-specific views are as follows:

- `DBA_XS_AUDIT_TRAIL` provides detailed information about Real Application Security events that were audited.
- `DBA_XS_AUDIT_POLICY_OPTIONS` describes the auditing options that were defined for Real Application Security unified audit policies.
- `DBA_XS_ENB_AUDIT_POLICIES` lists users for whom Real Application Security unified audit polices are enabled.

Oracle Database Real Application Security Auditable Events

Oracle Database provides Real Application Security events that you can audit, such `CREATE USER`, `UPDATE USER`.

To find a list of auditable Real Application Security events that you can audit, you can query the `COMPONENT` and `NAME` columns of the `AUDITABLE_SYSTEM_ACTIONS` data dictionary view, as follows:

```
SELECT NAME FROM AUDITABLE_SYSTEM_ACTIONS WHERE COMPONENT = 'XS'; NAME -------------
CREATE USER UPDATE USER DELETE USER ...
```

See Also::

- Oracle Database Real Application Security User and Role Audit Events (audit_config.htm#GUID-C8EA2CB7-17A5-42BC-B3EA-8C42C23978A5)
- Oracle Database Real Application Security Security Class and ACL Audit Events (audit_config.htm#GUID-D96E9FC6-C414-4E74-AD05-4D190EAFE119)
- Oracle Database Real Application Security Session Audit Events (audit_config.htm#GUID-E1A06E80-352D-47AE-A5ED-3DD346014B1A)
- Oracle Database Real Application Security ALL Events (audit_config.htm#GUID-DF37A7E4-5078-49A6-BF00-49B233548BC4)

Oracle Database Real Application Security User and Role Audit Events

The unified audit trail can capture Oracle Database Real Application Security events for users, privileges, and roles.

Table 22-4 (audit_config.htm#GUID-C8EA2CB7-17A5-42BC-B3EA-8C42C23978A5__CHDFGJDI) describes these events.

Table 22-4 Oracle Database Real Application Security User and Role Audit Events

Audit Event	Description
`CREATE USER`	Creates an Oracle Database Real Application Security user account through the `XS_PRINCIPAL.CREATE_USER` procedure
`UPDATE USER`	Updates an Oracle Database Real Application Security user account through the following procedures: • `XS_PRINCIPAL.SET_EFFECTIVE_DATES` • `XS_PRINCIPAL.SET_USER_DEFAULT_ROLES_ALL` • `XS_PRINCIPAL.SET_USER_SCHEMA` • `XS_PRINCIPAL.SET_GUID` • `XS_PRINCIPAL.SET_USER_STATUS` • `XS_PRINCIPAL.SET_DESCRIPTION`
`DELETE USER`	Deletes an Oracle Database Real Application Security user account through the through the `XS_PRINCIPAL.DELETE_PRINCIPAL` procedure
`CREATE ROLE`	Creates an Oracle Database Real Application Security role through the `XS_PRINCIPAL.CREATE_ROLE` procedure
`UPDATE ROLE`	Updates an Oracle Database Real Application Security role through the following procedures: • `XS_PRINCIPAL.SET_DYNAMIC_ROLE_SCOPE` • `XS_PRINCIPAL.SET_DYNAMIC_ROLE_DURATION` • `XS_PRINCIPAL.SET_EFFECTIVE_DATES` • `XS_PRINCIPAL.SET_ROLE_DEFAULT`
`DELETE ROLE`	Deletes an Oracle Database Real Application Security role through the through the `XS_PRINCIPAL.DELETE_ROLE` procedure
`GRANT ROLE`	Grants Oracle Database Real Application Security roles through the `XS_PRINCIPAL.GRANT_ROLES` procedure
`REVOKE ROLE`	Revokes Oracle Database Real Application Security roles through the `XS_PRINCIPAL.REVOKE_ROLES` procedure and all granted roles through the `XS_PRINCIPAL.REVOKE_ALL_GRANTED_ROLES` procedure

Audit Event	Description
ADD PROXY	Adds Oracle Database Real Application Security proxy user account through the XS_PRINCIPAL.ADD_PROXY_USER procedure, and proxies added to database users through the XS_PRINCIPAL.ADD_PROXY_TO_SCHEMA procedure
REMOVE PROXY	Removes an Oracle Database Real Application Security proxy user account through the XS_PRINCIPAL.REMOVE_PROXY_USER, XS_PRINCIPAL.REMOVE_ALL_PROXY_USERS, and XS_PRINCIPAL.REMOVE_PROXY_FROM_SCHEMA PROCEDURES
SET USER PASSWORD	Sets the Oracle Database Real Application Security user account password through the XS_PRINCIPAL.SET_PASSWORD procedure
SET USER VERIFIER	Sets the Oracle Database Real Application Security proxy user account verifier through the XS_PRINCIPAL.SET_VERIFIER procedure

Oracle Database Real Application Security Security Class and ACL Audit Events

The unified audit trail can capture Oracle Database Real Application Security security class and ACL audit events.

Table 22-5 (audit_config.htm#GUID-D96E9FC6-C414-4E74-AD05-4D190EAFE119__CHDDCHJG) describes these events.

Table 22-5 Oracle Database Real Application Security Security Class and ACL Audit Events

Audit Event	Description
CREATE SECURITY CLASS	Creates a security class through the XS_SECURITY_CLASS.CREATE_SECURITY_CLASS procedure

Audit Event	Description
UPDATE SECURITY CLASS	Creates a security class through the following procedures: • XS_SECURITY_CLASS.SET_DEFAULT_ACL • XS_SECURITY_CLASS.ADD_PARENTS • XS_SECURITY_CLASS.REMOVE_ALL_PARENTS • XS_SECURITY_CLASS.REMOVE_PARENTS • XS_SECURITY_CLASS.ADD_PRIVILEGES • XS_SECURITY_CLASS.REMOVE_ALL_PRIVILEGES • XS_SECURITY_CLASS.ADD_IMPLIED_PRIVILEGES • XS_SECURITY_CLASS.REMOVE_IMPLIED_PRIVILEGES • XS_SECURITY_CLASS.REMOVE_ALL_IMPLIED_PRIVILEGES • XS_SECURITY_CLASS.SET_DESCRIPTION
DELETE SECURITY CLASS	Deletes a security class through the XS_SECURITY_CLASS.DELETE_SECURITY_CLASS procedure
CREATE ACL	Creates an Access Control List (ACL) through the XS_ACL.CREATE_ACL procedure
UPDATE ACL	Updates an ACL through the following procedures: • XS_ACL.APPEND_ACES • XS_ACL.REMOVE_ALL_ACES • XS_ACL.SET_SECURITY_CLASS • XS_ACL.SET_PARENT_ACL • XS_ACL.ADD_ACL_PARAMETER • XS_ACL.REMOVE_ALL_ACL_PARAMETERS • XS_ACL.REMOVE_ACL_PARAMETER • XS_ACL.SET_DESCRIPTION
DELETE ACL	Deletes an ACL through the XS_ACL.DELETE_ACL procedure
CREATE DATA SECURITY-	Creates a data security policy through the XS_DATA_SECURITY.CREATE_DATA_SECURITY procedure

Audit Event	Description
`UPDATE DATA SECURITY`	Updates a data security policy through the following procedures: • `XS_DATA_SECURITY.CREATE_ACL_PARAMETER` • `XS_DATA_SECURITY.DELETE_ACL_PARAMETER` • `XS_DATA_SECURITY.SET_DESCRIPTION`
`DELETE DATA SECURITY`	Deletes a data security policy through the `XS_DATA_SECURITY.DELETE_DATA_SECURITY` procedure
`ENABLE DATA SECURITY`	Enables extensible data security for a database table or view through the `XS_DATA_SECURITY.ENABLE_OBJECT_POLICY` procedure
`DISABLE DATA SECURITY`	Disables extensible data security for a database table or view through the `XS_DATA_SECURITY.DISABLE_XDS` procedure

Oracle Database Real Application Security Session Audit Events

The unified audit trail can capture Oracle Database Real Application Security session audit events.

Table 22-4 (audit_config.htm#GUID-C8EA2CB7-17A5-42BC-B3EA-8C42C23978A5__CHDFGJDI) describes these events.

Table 22-6 Oracle Database Real Application Security Session Audit Events

Audit Event	Description
`CREATE SESSION`	Creates a session through the `DBMS_XS_SESSIONS.CREATE_SESSION` procedure
`DESTROY SESSION`	Destroys a session through the `DBMS_XS_SESSIONS.DESTROY_SESSION` procedure
`CREATE SESSION NAMESPACE`	Creates a namespace through the `DBMS_XS_SESSIONS.CREATE_NAMESPACE` procedure
`DELETE SESSION NAMESPACE`	Deletes a namespace through the `DBMS_XS_SESSIONS.DELETE_NAMESPACE` procedure
`CREATE NAMESPACE ATTRIBUTE`	Creates a namespace attribute through the `DBMS_XS_SESSIONS.CREATE_ATTRIBUTE` procedure
`SET NAMESPACE ATTRIBUTE`	Sets a namespace attribute through the `DBMS_XS_SESSIONS.SET_ATTRIBUTE` procedure

Audit Event	Description
GET NAMESPACE ATTRIBUTE	Gets a namespace attribute through the DBMS_XS_SESSIONS.GET_ATTRIBUTE procedure
DELETE NAMESPACE ATTRIBUTE	Deletes a namespace attribute through the DBMS_XS_SESSIONS.DELETE_ATTRIBUTE procedure
CREATE NAMESPACE TEMPLATE	Creates a namespace attribute through the XS_NS_TEMPLATE.CREATE_NS_TEMPLATE procedure
UPDATE NAMESPACE TEMPLATE	Updates a namespace attribute through the following procedures: • XS_NS_TEMPLATE.SET_HANDLER • XS_NS_TEMPLATE.ADD_ATTRIBUTES • XS_NS_TEMPLATE.REMOVE_ALL_ATTRIBUTES • XS_NS_TEMPLATE.REMOVE_ATTRIBUTES • XS_NS_TEMPLATE.SET_DESCRIPTION
DELETE NAMESPACE TEMPLATE	Deletes a namespace through the XS_NS_TEMPLATE.DELETE_NS_TEMPLATE procedure
ADD GLOBAL CALLBACK	Adds a global callback through the DBMS_XS_SESSIONS.ADD_GLOBAL_CALLBACK procedure
DELETE GLOBAL CALLBACK	Deletes a global callback through the DBMS_XS_SESSIONS.DELETE_GLOBAL_CALLBACK procedure
ENABLE GLOBAL CALLBACK	Enables a global callback through the DBMS_XS_SESSIONS.ENABLE_GLOBAL_CALLBACK procedure
SET COOKIE	Sets a session cookie through the DBMS_XS_SESSIONS.SET_SESSION_COOKIE procedure
SET INACTIVE TIMEOUT	Sets the time-out time for inactive sessions through the DBMS_XS_SESSIONS.SET_INACTIVITY_TIMEOUT procedure
SWITCH USER	Sets the security context of the current lightweight user session to a newly initialized security context for a specified user through the DBMS_XS_SESSIONS.SWITCH_USER procedure

Audit Event	Description
ASSIGN USER	Assigns or removes one or more dynamic roles for the specified user through the DBMS_XS_SESSIONS.ASSIGN_USER procedure
ENABLE ROLE	Enable a role for a lightweight user session through the DBMS_XS_SESSIONS.ENABLE_ROLE procedure
DISABLE ROLE	Disables a role for a lightweight user session through the DBMS_XS_SESSIONS.DISABLE_ROLE procedure

Oracle Database Real Application Security ALL Events

The unified audit trail can capture Oracle Database Real Application Security ALL events.

Table 22-7 (audit_config.htm#GUID-DF37A7E4-5078-49A6-BF00-49B233548BC4__CHDBCJEC) describes these events.

Table 22-7 Oracle Database Real Application Security ALL Events

Audit Event	Description
ALL	Captures all Real Application Security actions

Configuring a Unified Audit Policy for Oracle Database Real Application Security

The CREATE AUDIT POLICY statement can create a unified audit policy for Oracle Real Application Security.

- Use the following syntax to create a unified audit policy for Oracle Database Real Application Security:

```
CREATE AUDIT POLICY policy_name ACTIONS COMPONENT=XS component_action1 [, action2];
```

For example:

```
CREATE AUDIT POLICY audit_ras_pol ACTIONS COMPONENT=XS SWITCH USER, DISABLE ROLE;
```

You can build more complex policies, such as those that include conditions. Remember that after you create the policy, you must use the AUDIT statement to enable it.

> **See Also:**
>
> Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)

Example: Auditing Real Application Security User Account Modifications

The CREATE AUDIT POLICY statement can audit Real Application Security user account modifications.

Example 22-19 (audit_config.htm#GUID-BA05779A-1AF2-4DB8-9652-971814C93BDE__CHDIGAFC) shows how to audit user bhurst's attempts to switch users and disable roles.

Example 22-19 Auditing Real Application Security User Account Modifications

```
CREATE AUDIT POLICY ras_users_pol ACTIONS COMPONENT=XS SWITCH USER, DISABLE ROLE;
AUDIT POLICY ras_users_pol BY bhurst;
```

Example: Using a Condition in a Real Application Security Unified Audit Policy

The `CREATE AUDIT POLICY` statement can set a condition for a Real Application Security unified audit policy.

Example 22-20 (audit_config.htm#GUID-67F851C5-1523-4867-AECF-6236EA427BBC__CHDFEDBH) shows how to create Real Application Security unified audit policy that applies the audit only to actions from the `nemosity` computer host.

Example 22-20 Using a Condition in a Real Application Security Unified Audit Policy

```
CREATE AUDIT POLICY ras_acl_pol ACTIONS DELETE ON OE.CUSTOMERS ACTIONS COMPONENT=XS
CREATE ACL, UPDATE ACL, DELETE ACL WHEN 'SYS_CONTEXT(''USERENV'', ''HOST'') =
''nemosity''' EVALUATE PER INSTANCE; AUDIT POLICY ras_acl_pol BY pfitch;
```

How Oracle Database Real Application Security Events Appear in the Audit Trail

The `DBA_XS_AUDIT_TRAIL` data dictionary view lists Oracle Real Application Security audit events.

If necessary, you should run the `DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL` procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700)for more information.

The following example queries the Real Application Security-specific view, `DBA_XS_AUDIT_TRAIL`:

```
SELECT XS_USER_NAME FROM DBA_XS_AUDIT_TRAIL WHERE XS_ENABLED_ROLE = 'CLERK';
XS_USER_NAME ------------- USER2
```

Auditing Oracle Recovery Manager Events

You can use the `CREATE AUDIT POLICY` statement to audit Oracle Recovery Manager events.

Topics:

- About Auditing Oracle Recovery Manager Events (audit_config.htm#GUID-2919B5F8-C41D-40DB-A656-7D9095A36850)
- Oracle Recovery Manager Unified Audit Trail Events (audit_config.htm#GUID-727B054F-EE14-40C1-AA72-92B9DE549297)
- How Oracle Recovery Manager Audited Events Appear in the Audit Trail (audit_config.htm#GUID-10E1EA65-9AC3-4796-A695-9B027E20EC3C)

> **See Also:**
>
> *Oracle Database Backup and Recovery User's Guide* (../BRADV/rcmintro.htm#BRADV8001)

About Auditing Oracle Recovery Manager Events

The UNIFIED_AUDIT_TRAIL data dictionary view automatically stores Oracle Recovery Manager audit events in the RMAN_column.

Unlike other Oracle Database components, you do not create a unified audit policy for Oracle Recovery Manager events.

However, you must have the AUDIT_ADMIN or AUDIT_VIEWER role in order to query the UNIFIED_AUDIT_TRAIL view to see these events. If you have the SYSBACKUP or the SYSDBA administrative privilege, then you can find additional information about Recovery Manager jobs by querying views such as V$RMAN_STATUS or V$RMAN_BACKUP_JOB_DETAILS.

> **See Also:**
>
> *Oracle Database Backup and Recovery User's Guide* (../BRADV/rcmintro.htm#BRADV8001)

Oracle Recovery Manager Unified Audit Trail Events

The unified audit trail can capture Oracle Recovery Manager events.

Table 22-8 (audit_config.htm#GUID-727B054F-EE14-40C1-AA72-92B9DE549297__CHDIGIEE) describes these events.

Table 22-8 Oracle Recovery Manager Columns in UNIFIED_AUDIT_TRAIL View

Recovery Manager Column	Description
RMAN_SESSION_RECID	**Recovery Manager session identifier.** Together with the RMAN_SESSION_STAMP column, this column uniquely identifies the Recovery Manager job. The Recovery Manager session ID is a a RECID value in the control file that identifies the Recovery Manager job. (Note that the Recovery Manager session ID is not the same as a user session ID.)
RMAN_SESSION_STAMP	**Timestamp for the session.** Together with the RMAN_SESSION_RECID column, this column identifies Recovery Manager jobs.
RMAN_OPERATION	**The Recovery Manager operation executed by the job.** One row is added for each distinct operation within a Recovery Manager session. For example, a backup job contains BACKUP as the RMAN_OPERATION value.

Recovery Manager Column	Description
RMAN_OBJECT_TYPE	**Type of objects involved in a Recovery Manager session.** It contains one of the following values. If the Recovery Manager session does not satisfy more than one of them, then preference is given in the following order, from top to bottom of the list. 1. DB FULL (Database Full) refers to a full backup of the database 2. RECVR AREA refers to the Fast Recovery area 3. DB INCR (Database Incremental) refers to incremental backups of the database 4. DATAFILE FULL refers to a full backup of the data files 5. DATAFILE INCR refers to incremental backups of the data files 6. ARCHIVELOG refers to archived redo log files 7. CONTROLFILE refers to control files 8. SPFILE refers to the server parameter file 9. BACKUPSET refers to backup files
RMAN_DEVICE_TYPE	**Device associated with a Recovery Manager session.** This column can be DISK, SBT (system backup tape), or * (asterisk). An asterisk indicates more than one device. In most cases, the value will be DISK and SBT.

How Oracle Recovery Manager Audited Events Appear in the Audit Trail

The UNIFIED_AUDIT_TRAIL data dictionary view lists Oracle Recovery Manager audit events.

If necessary, you should run the DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700)for more information.

Table 22-8 (audit_config.htm#GUID-727B054F-EE14-40C1-AA72-92B9DE549297__CHDIGIEE)lists the columns in the UNIFIED_AUDIT_TRAIL data dictionary view that you can query to find Oracle Recovery Manager-specific audit data.

For example:

```
SELECT RMAN_OPERATION FROM UNIFIED_AUDIT_TRAIL WHERE RMAN_OBJECT_TYPE = 'DB FULL';
RMAN_OPERATION --------------- BACKUP
```

Auditing Oracle Database Vault Events

In an Oracle Database Vault environment, the `CREATE AUDIT POLICY` statement can audit Database Vault activities.

Topics:

- About Auditing Oracle Database Vault Events (audit_config.htm#GUID-0CBDAD9E-7ACA-4EDF-B09B-E7378A613419)
- Who Is Audited in Oracle Database Vault? (audit_config.htm#GUID-B1E677DC-9114-43D1-A5F2-516E134B42B7)
- About Oracle Database Vault Unified Audit Trail Events (audit_config.htm#GUID-00876B18-C513-4FD6-9481-3EF26A38A01A)
- Oracle Database Vault Realm Audit Events (audit_config.htm#GUID-F3051991-6682-4D03-B47C-56DD101BADC6)
- Oracle Database Vault Rule Set and Rule Audit Events (audit_config.htm#GUID-3FE07CF9-2637-4C89-A26C-95B3A6F6C67C)
- Oracle Database Vault Command Rule Audit Events (audit_config.htm#GUID-F6CCF0D4-5763-4EA9-87B1-E908CFCD6428)
- Oracle Database Vault Factor Audit Events (audit_config.htm#GUID-3B2F255F-E42F-4439-A0BD-C30A84A799F5)
- Oracle Database Vault Secure Application Role Audit Events (audit_config.htm#GUID-452D8AF8-FE95-4029-8FD0-86D7D7F4F9CB)
- Oracle Database Vault Oracle Label Security Audit Events (audit_config.htm#GUID-B71F9EEE-2FBB-4C47-B970-F79EAD9CBEA9)
- Oracle Database Vault Oracle Data Pump Audit Events (audit_config.htm#GUID-4E5F5C9F-05A6-4BFF-806B-968B468C4C71)
- Oracle Database Vault Enable and Disable Audit Events (audit_config.htm#GUID-9B688987-24DC-45AF-9F1A-E0597D482B33)
- Configuring a Unified Audit Policy for Oracle Database Vault (audit_config.htm#GUID-632F0FFA-FD68-495B-B177-2EAA6EAACF5B)
- Example: Auditing Two Oracle Database Vault Events (audit_config.htm#GUID-D12316B3-4754-4F0C-B45C-F6C75D4C7924)
- Example: Auditing Oracle Database Vault Factors (audit_config.htm#GUID-0A53B577-17AA-4F25-81D5-C8E9588A12EA)
- How Oracle Database Vault Audited Events Appear in the Audit Trail (audit_config.htm#GUID-1AAC4229-A58A-4876-BECB-78E829DB39FE)

> **See Also:**
>
> - Oracle Database Vault Predefined Unified Audit Policy (audit_config.htm#GUID-FCE001D0-77A8-4EB4-BDF5-2BEE6CA50828)
> - *Oracle Database Vault Administrator's Guide* (../DVADM/reports.htm#DVADM009) for detailed information about Oracle Database Vault audit policies

About Auditing Oracle Database Vault Events

As with all unified auditing, you must have the `AUDIT_ADMIN` role before you can audit Oracle Database Vault events.

To create Oracle Database Vault unified audit policies, you must set the `CREATE AUDIT POLICY` statement's `COMPONENT` clause to `DV`, and then specify an action, such as `Rule Set Failure`, and an object, such as the name of a rule set.

To access the audit trail, you can query the following views:

- `UNIFIED_AUDIT_TRAIL`
- `SYS.DV$CONFIGURATION_AUDIT`
- `SYS.DV$ENFORCEMENT_AUDIT`

In the `UNIFIED_AUDIT_TRAIL` view, the Oracle Database Vault-specific columns begin with `DV_`. You must have the `AUDIT_VIEWER` role before you can query the `UNIFIED_AUDIT_TRAIL` view.

In addition to these views, the Database Vault reports capture the results of Database Vault-specific unified audit policies.

> ### See Also:
>
> - Oracle Database Vault Predefined Unified Audit Policy (audit_config.htm#GUID-FCE001D0-77A8-4EB4-BDF5-2BEE6CA50828)
> - *Oracle Database Vault Administrator's Guide* (../DVADM/reports.htm#DVADM009) for detailed information about Oracle Database Vault audit policies

Who Is Audited in Oracle Database Vault?

Audited Oracle Database Vault users include administrators and users whose activities affect Database Vault enforcement policies.

These users are as follows:

- **Database Vault administrators.** All configuration changes that are made to Oracle Database Vault are mandatorily audited. The auditing captures activities such as creating, modifying, or deleting realms, factors, command rules, rule sets, rules, and so on.The `SYS.DV$CONFIGURATION_AUDIT` data dictionary view captures configuration changes made by Database Vault administrators.
- **Users whose activities affect Oracle Database Vault enforcement policies.** The `SYS.DV$ENFORCEMENT_AUDIT` data dictionary view captures enforcement-related audits

> ### See Also:
>
> *Oracle Database Vault Administrator's Guide* (../DVADM/views.htm#DVADM71179) for more information about the `SYS.DV$CONFIGURATION_AUDIT` and `SYS.DV$ENFORCEMENT_AUDIT` data dictionary views

About Oracle Database Vault Unified Audit Trail Events

The audit trail in an Oracle Database Vault environment captures all configuration changes or attempts at changes to Database Vault policies.

It also captures violations by users to existing Database Vault policies.

You can audit the following kinds of Oracle Database Vault events:

- **All configuration changes or attempts at changes to Oracle Database Vault policies.** It captures both Database Vault administrator changes and attempts made by unauthorized users.

- **Violations by users to existing Database Vault policies.** For example, if you create a policy to prevent users from accessing a specific schema table during non-work hours, the audit trail will capture this activity.

Oracle Database Vault Realm Audit Events

The unified audit trail captures Oracle Database Vault realm events.

Table 22-9 (audit_config.htm#GUID-F3051991-6682-4D03-B47C-56DD101BADC6__CHDICIIE) describes these events.

Table 22-9 Oracle Database Vault Realm Audit Events

Audit Event	Description
`CREATE_REALM`	Creates a realm through the `DVSYS.DBMS_MACADM.CREATE_REALM` procedure
`UPDATE_REALM`	Updates a realm through the `DVSYS.DBMS_MACADM.UPDATE_REALM` procedure
`RENAME_REALM`	Renames a realm through the `DVSYS.DBMS_MACADM.RENAME_REALM` procedure
`DELETE_REALM`	Deletes a realm through the `DVSYS.DBMS_MACADM.DELETE_REALM` procedure
`DELETE_REALM_CASCADE`	Deletes a realm and its related Database Vault configuration information through the `DVSYS.DBMS_MACADM.DELETE_REALM_CASCADE` procedure
`ADD_AUTH_TO_REALM`	Adds an authorization to the realm through the `DVSYS.DBMS_MACADM.ADD_AUTH_TO_REALM` procedure
`DELETE_AUTH_FROM_REALM`	Removes an authorization from the realm through the `DVSYS.DBMS_MACADM.DELETE_AUTH_FROM_REALM` procedure
`UPDATE_REALM_AUTH`	Updates a realm authorization through the `DVSYS.DBMS_MACADM.UPDATE_REALM_AUTHORIZATION` procedure
`ADD_OBJECT_TO_REALM`	Adds an object to a realm authorization through the `DVSYS.DBMS_MACADM.ADD_AUTH_TO_REALM` procedure
`DELETE_OBJECT_FROM_REALM`	Removes an object from a realm authorization through the `DVSYS.DBMS_MACADM.DELETE_OBJECT_FROM_REALM` procedure

Oracle Database Vault Rule Set and Rule Audit Events

The unified audit trail can capture Oracle Database Vault rule set and rule audit events.

Table 22-10 (audit_config.htm#GUID-3FE07CF9-2637-4C89-A26C-95B3A6F6C67C__CHDECCAF) describes these events.

Table 22-10 Oracle Database Vault Rule Set and Rule Audit Events

Audit Event	Description
`CREATE_RULE_SET`	Creates a rule set through the `DVSYS.DBMS_MACADM.CREATE_RULE_SET` procedure
`UPDATE_RULE_SET`	Updates a rule set through the `DVSYS.DBMS_MACADM.UPDATE_RULE_SET` procedure
`RENAME_RULE_SET`	Renames a rule set through the `DVSYS.DBMS_MACADM.RENAME_RULE_SET` procedure
`DELETE_RULE_SET`	Deletes a rule set through the `DVSYS.DBMS_MACADM.DELETE_RULE_SET` procedure
`ADD_RULE_TO_RULE_SET`	Adds a rule to an existing rule set through the `DVSYS.DBMS_MACADM.ADD_RULE_TO_RULE_SET` procedure
`DELETE_RULE_FROM_RULE_SET`	Removes a rule from an existing rule set through the `DVSYS.DBMS_MACADM.DELETE_RULE_FROM_RULE_SET` procedure
`CREATE_RULE`	Creates a rule through the `DVSYS.DBMS_MACADM.CREATE_RULE` procedure
`UPDATE_RULE`	Updates a rule through the `DVSYS.DBMS_MACADM.UPDATE_RULE` procedure
`RENAME_RULE`	Renames a rule through the `DVSYS.DBMS_MACADM.RENAME_RULE` procedure
`DELETE_RULE`	Deletes a rule through the `DVSYS.DBMS_MACADM.DELETE_RULE` procedure
`SYNC_RULES`	Synchronizes the rules in Oracle Database Vault and Advanced Queuing Rules engine through the `DVSYS.DBMS_MACADM.SYNC_RULES` procedure

Oracle Database Vault Command Rule Audit Events

The unified audit trail can capture Oracle Database Vault command rule audit events.

Table 22-11 (audit_config.htm#GUID-F6CCF0D4-5763-4EA9-87B1-E908CFCD6428__CHDDDCCA) describes these events.

Table 22-11 Oracle Database Vault Command Rule Audit Events

Audit Event	Description
`CREATE_COMMAND_RULE`	Creates a command rule through the `DVSYS.DBMS_MACADM.CREATE_COMMAND_RULE` procedure
`DELETE_COMMAND_RULE`	Deletes a command rule through the `DVSYS.DBMS_MACADM.DELETE_COMMAND_RULE` procedure
`UPDATE_COMMAND_RULE`	Updates a command rule through the `DVSYS.DBMS_MACADM.UPDATE_COMMAND_RULE` procedure

Oracle Database Vault Factor Audit Events

The unified audit trail can capture Oracle Database Vault factor events.

Table 22-12 (audit_config.htm#GUID-3B2F255F-E42F-4439-A0BD-C30A84A799F5__CHDIIAEF) describes these events.

Table 22-12 Oracle Database Vault Factor Audit Events

Audit Event	Description
`CREATE_FACTOR_TYPE`	Creates a factor type through the `DVSYS.DBMS_MACADM.CREATE_FACTOR_TYPE` procedure
`DELETE_FACTOR_TYPE`	Deletes a factor type through the `DVSYS.DBMS_MACADM.DELETE_FACTOR_TYPE` procedure
`UPDATE_FACTOR_TYPE`	Updates a factor type through the `DVSYS.DBMS_MACADM.UPDATE_FACTOR_TYPE` procedure
`RENAME_FACTOR_TYPE`	Renames a factor type through the `DVSYS.DBMS_MACADM.RENAME_FACTOR_TYPE` procedure
`CREATE_FACTOR`	Creates a factor through the `DVSYS.DBMS_MACADM.CREATE_FACTOR` procedure
`UPDATE_FACTOR`	Updates a factor through the `DVSYS.DBMS_MACADM.UPDATE_FACTOR` procedure

Audit Event	Description
DELETE_FACTOR	Deletes a factor through the DVSYS.DBMS_MACADM.DELETE_FACTOR procedure
RENAME_FACTOR	Renames a factor through the DVSYS.DBMS_MACADM.RENAME_FACTOR procedure
ADD_FACTOR_LINK	Specifies a parent-child relationship between two factors through the DVSYS.DBMS_MACADM.ADD_FACTOR_LINK procedure
DELETE_FACTOR_LINK	Removes the parent-child relationship between two factors through the DVSYS.DBMS_MACADM.DELETE_FACTOR_LINK procedure
ADD_POLICY_FACTOR	Specifies that the label for a factor contributes to the Oracle Label Security label for a policy, through the DVSYS.DBMS_MACADM.ADD_POLICY_FACTOR procedure
DELETE_POLICY_FACTOR	Removes factor label from being associated with an Oracle Label Security label for a policy, through the DBMS_MACADM.DELETE_POLICY_FACTOR procedure
CREATE_IDENTITY	Creates a factor identity through the DVSYS.DBMS_MACADM.CREATE_IDENTITY procedure
UPDATE_IDENTITY	Updates a factor identity through the DVSYS.DBMS_MACADM.UPDATE_IDENTITY procedure
CHANGE_IDENTITY_FACTOR	Associates an identity with a different factor through the DVSYS.DBMS_MACADM.CHANGE_IDENTITY_FACTOR procedure
CHANGE_IDENTITY_VALUE	Updates the value of an identity through the DVSYS.DBMS_MACADM.CHANGE_IDENTITY_VALUE procedure
DELETE_IDENTITY	Deletes an existing factor identity through the DVSYS.DBMS_MACADM.DELETE_IDENTITY procedure
CREATE_IDENTITY_MAP	Creates a factor identity map through the DVSYS.DBMS_MACADM.CREATE_IDENTITY_MAP procedure

Audit Event	Description
DELETE_IDENTITY_MAP	Deletes a factor identity map through the DVSYS.DBMS_MACADM.DELETE_IDENTITY_MAP procedure
CREATE_DOMAIN_IDENTITY	Adds an Oracle Database Real Application Clusters database node to the domain factor identities and labels it according to the Oracle Label Security policy, through the DVSYS.DBMS_MACADM.CREATE_DOMAIN_IDENTITY procedure
DROP_DOMAIN_IDENTITY	Drops an Oracle RAC node from the domain factor identities through the DVSYS.DBMS_MACADM.DROP_DOMAIN_IDENTITY procedure

Oracle Database Vault Secure Application Role Audit Events

The unified audit trail can capture Oracle Database Vault secure application role audit events.

Table 22-13 (audit_config.htm#GUID-452D8AF8-FE95-4029-8FD0-86D7D7F4F9CB__CHDIDBFJ) describes these events.

Table 22-13 Oracle Database Vault Secure Application Role Audit Events

Audit Event	Description
CREATE_ROLE	Creates an Oracle Database Vault secure application role through the DVSYS.DBMS_MACADM.CREATE_ROLE procedure
DELETE_ROLE	Deletes an Oracle Database Vault secure application role through the DVSYS.DBMS_MACADM.DELETE_ROLE procedure
UPDATE_ROLE	Updates an Oracle Database Vault secure application role through the DVSYS.DBMS_MACADM.UPDATE_ROLE procedure
RENAME_ROLE	Renames an Oracle Database Vault secure application role through the DVSYS.DBMS_MACADM.RENAME_ROLE procedure

Oracle Database Vault Oracle Label Security Audit Events

The unified audit trail can capture Oracle Database Vault Oracle Label Security audit events.

Table 22-14 (audit_config.htm#GUID-B71F9EEE-2FBB-4C47-B970-F79EAD9CBEA9__CHDHEDFD) describes these events.

Table 22-14 Oracle Database Vault Oracle Label Security Audit Events

Audit Event	Description
CREATE_POLICY_LABEL	Creates an Oracle Label Security policy label through the DVSYS.DBMS_MACADM.CREATE_POLICY_LABEL procedure
DELETE_POLICY_LABEL	Deletes an Oracle Label Security policy label through the DVSYS.DBMS_MACADM.DELETE_POLICY_LABEL procedure
CREATE_MAC_POLICY	Specifies the algorithm that is used to merge labels when computing the label for a factor, or the Oracle Label Security Session label, through the DVSYS.DBMS_MACADM.CREATE_MAC_POLICY procedure
UPDATE_MAC_POLICY	Changes the Oracle Label Security merge label algorithm through the DVSYS.DBMS_MACADM.UPDATE_MAC_POLICY procedure
DELETE_MAC_POLICY_CASCADE	Deletes all Oracle Database Vault objects related to an Oracle Label Security policy, through the DVSYS.DBMS_MACADM.DELETE_MAC_POLICY_CASCADE procedure

Oracle Database Vault Oracle Data Pump Audit Events

The unified audit trail can capture Oracle Database Vault Oracle Data Pump audit events.

Table 22-15 (audit_config.htm#GUID-4E5F5C9F-05A6-4BFF-806B-968B468C4C71__CHDGADFI) describes these events.

Table 22-15 Oracle Database Vault Oracle Data Pump Audit Events

Audit Event	Description
AUTHORIZE_DATAPUMP_USER	Authorizes an Oracle Data Pump user through the DVSYS.DBMS_MACADM.AUTHORIZE_DATAPUMP_USER procedure
UNAUTHORIZE_DATAPUMP_USER	Removes from authorization an Oracle Data Pump user through the DVSYS.DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER procedure

Oracle Database Vault Enable and Disable Audit Events

The unified audit trail can capture Oracle Database Vault enable and disable audit events.

Table 22-16 (audit_config.htm#GUID-9B688987-24DC-45AF-9F1A-E0597D482B33__CHDBCAGD) describes these events.

Table 22-16 Oracle Database Vault Enable and Disable Audit Events

Event	Description
ENABLE_EVENT	DBMS_MACADM.ENABLE_EVENT
DISABLE_EVENT	DBMS_MACADM.DISABLE_EVENT

Configuring a Unified Audit Policy for Oracle Database Vault

The `ACTIONS` and `ACTIONS COMPONENT` clauses in the `CREATE AUDIT POLICY` statement can create unified audit policies for Oracle Database Vault events.

- Use the following syntax to create an Oracle Database Vault unified audit policy:

```
CREATE AUDIT POLICY policy_name ACTIONS action1 [,action2 ] ACTIONS COMPONENT= DV
DV_action ON DV_object [,DV_action2 ON DV_object2]
```

In this specification:

- *`DV_action`* is one of the following:
  - `Realm Violation`, `Realm Success`, `Realm Access`
  - `Rule Set Failure`, `Rule Set Success`, `Rule Set Eval`
  - `Factor Error`, `Factor Null`, `Factor Validate Error`, `Factor Validate False`, `Factor Trust Level Null`, `Factor Trust Level Neg`, `Factor All`
- *`DV_objects`* is one of the following:
  - *`Realm_Name`*
  - *`Rule_Set_Name`*
  - *`Factor_Name`*

If the object was created in lower or mixed case, then you must enclose *`DV_objects`* in double quotation marks. If you had created the object in all capital letters, then you can omit the quotation marks.

For example, to audit realm violations on the Database Vault Account Management realm:

```
CREATE AUDIT POLICY audit_dv ACTIONS CREATE TABLE, SELECT ACTIONS COMPONENT=DV Realm
Violation ON "Database Vault Account Management";
```

You can build more complex policies, such as those that include conditions. Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

Example: Auditing Two Oracle Database Vault Events

The `CREATE AUDIT POLICY` statement can audit multiple Oracle Database Vault events.

Example 22-21 (audit_config.htm#GUID-D12316B3-4754-4F0C-B45C-F6C75D4C7924__CHDCJJBE) shows how to audit a realm violation and a rule set failure.

Example 22-21 Auditing Two Oracle Database Vault Events

```
CREATE AUDIT POLICY audit_dv ACTIONS CREATE TABLE, SELECT ACTIONS COMPONENT=DV REALM
VIOLATION ON "Oracle Enterprise Manager", Rule Set Failure ON "Allow Sessions"; AUDIT
POLICY audit_dv EXCEPT psmith;
```

Example: Auditing Oracle Database Vault Factors

The `CREATE AUDIT POLICY` statement can audit Oracle Database Vault factors.

Example 22-22 (audit_config.htm#GUID-0A53B577-17AA-4F25-81D5-C8E9588A12EA__CHDHGBDF) shows how to audit two types of errors for one factor.

Example 22-22 Auditing Oracle Database Vault Factor Settings

```
CREATE AUDIT POLICY audit_dv_factor ACTIONS COMPONENT=DV FACTOR ERROR ON
"Database_Domain", Factor Validate Error ON "Client_IP"; AUDIT POLICY audit_dv_factor;
```

How Oracle Database Vault Audited Events Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle Database Vault audited events.

If necessary, you should run the `DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL` procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700) for more information.

The `DV_*`columns of the `UNIFIED_AUDIT_TRAIL` view show Oracle Database Vault-specific audit data.

For example:

```
SELECT DV_RULE_SET_NAME FROM UNIFIED_AUDIT_TRAIL WHERE ACTION_NAME = 'UPDATE';
DV_RULE_SET_NAME ---------------------- Allow System Parameters
```

Auditing Oracle Label Security Events

If you have Oracle Label Security enabled, then you can use the `CREATE AUDIT POLICY` statement to audit Oracle Label Security events.

Topics:

- About Auditing Oracle Label Security Events (audit_config.htm#GUID-B6FF9479-4E40-4E06-8EF7-D35F0B88857C)
- Oracle Label Security Unified Audit Trail Events (audit_config.htm#GUID-84293A12-A201-418D-B179-F28671170267)
- Oracle Label Security Auditable User Session Labels (audit_config.htm#GUID-952E4470-71C7-4396-8DD5-786105DAAE57)

- Configuring a Unified Audit Policy for Oracle Label Security (audit_config.htm#GUID-F868B089-B998-450C-B3E4-9A49FAE92982)
- Example: Auditing Oracle Label Security Session Label Attributes (audit_config.htm#GUID-4B1E1CAA-422D-4072-A89F-6CAFEAA63E4D)
- Example: Excluding a User from an Oracle Label Security Policy (audit_config.htm#GUID-3906FA25-AA23-4780-B747-C8CF61C8AFA5)
- Example: Auditing Oracle Label Security Policy Actions (audit_config.htm#GUID-56360697-542A-4A63-B784-29AA5B4F2FAA)
- How Oracle Label Security Audit Events Appear in the Audit Trail (audit_config.htm#GUID-C3356AAF-FAAB-4504-B6DF-7FC4919BA023)
- Example: Querying for Audited OLS Session Labels (audit_config.htm#GUID-F4BF1CB3-5497-494A-8A6C-42B740933E40)

> **See Also:**
>
> *Oracle Label Security Administrator's Guide* (../OLSAG/appc.htm#OLSAG3626)for information about Oracle Label Security data dictionary views

About Auditing Oracle Label Security Events

You must have the `AUDIT_ADMIN` role before you can audit Oracle Label Security (OLS) events.

To create Oracle Label Security unified audit policies, you must set the `CREATE AUDIT POLICY` statement `COMPONENT` clause to `OLS`.

To audit user session label information, you use the `AUDIT` statement to audit application context values.

To access the audit trail, query the `UNIFIED_AUDIT_TRAIL` data dictionary view. This view contains Oracle Label Security-specific columns whose names begin with `OLS_`.

Oracle Label Security Unified Audit Trail Events

The unified audit trail can capture Oracle Label Security audit events.

To find a list of auditable Oracle Label Security events that you can audit, you can query the `COMPONENT` and `NAME` columns of the `AUDITABLE_SYSTEM_ACTIONS` data dictionary view.

For example:

```
SELECT NAME FROM AUDITABLE_SYSTEM_ACTIONS WHERE COMPONENT = 'Label Security'; NAME ---
---------- CREATE POLICY ALTER POLICY DROP POLICY ...
```

Table 22-17 (audit_config.htm#GUID-84293A12-A201-418D-B179-F28671170267__CHDGFCJH) describes the Oracle Label Security audit events.

Table 22-17 Oracle Label Security Audit Events

Audit Event	Description
`CREATE POLICY`	Creates an Oracle Label Security policy through the `SA_SYSDBA.CREATE_POLICY` procedure

Audit Event	Description
`ALTER POLICY`	Alters an Oracle Label Security policy through the `SA_SYSDBA.ALTER_POLICY` procedure
`DROP POLICY`	Drops an Oracle Label Security policy through the `SA_SYSDBA.DROP_POLICY` procedure
`APPLY POLICY`	Applies a table policy through the `SA_POLICY_ADMIN.APPLY_TABLE_POLICY` procedure or a schema policy through the `SA_POLICY_ADMIN.APPLY_SCHEMA_POLICY` procedure
`REMOVE POLICY`	Removes a table policy through the `SA_POLICY_ADMIN.REMOVE_TABLE_POLICY` procedure or a schema policy through the `SA_POLICY_ADMIN.REMOVE_SCHEMA_POLICY` procedure
`SET AUTHORIZATION`	Covers all Oracle Label Security authorizations, including Oracle Label Security privileges and user labels to either users or trusted stored procedures. The PL/SQL procedures that correspond to the `SET AUTHORIZATION` event are `SA_USER_ADMIN.SET_USER_LABELS`, `SA_USER_ADMIN.SET_USER_PRIVS`, and `SA_USER_ADMIN.SET_PROG_PRIVS`.
`PRIVILEGED ACTION`	Covers any action that requires the user of an Oracle Label Security privilege. These actions are logons, `SA_SESSION.SET_ACCESS_PROFILE` executions, and the invocation of trusted stored procedures.
`ENABLE POLICY`	Enables an Oracle Label Security policy through the following procedures: • `SA_SYSDBA.ENABLE_POLICY`: Enforces access control on the tables and schemas protected by the policy • `SA_POLICY_ADMIN.ENABLE_TABLE_POLICY`: Enables an Oracle Label Security policy for a specified table • `SA_POLICY_ADMIN.ENABLE_SCHEMA_POLICY`: Enables an Oracle Label Security policy for all the tables in a specified schema

Audit Event	Description
DISABLE POLICY	Disables an Oracle Label Security policy through the following procedures: • SA_SYSDBA.DISABLE_POLICY: Disables the enforcement of an Oracle Label Security policy • SA_POLICY_ADMIN.DISABLE_TABLE_POLICY: Disables the enforcement an Oracle Label Security policy for a specified table • SA_POLICY_ADMIN.DISABLE_SCHEMA_POLICY: Disables the enforcement of an Oracle Label Security policy for all the tables in a specified schema
SUBSCRIBE OID	Subscribes to an Oracle Internet Directory-enabled Oracle Label Security policy through the SA_POLICY_ADMIN.POLICY_SUBSCRIBE procedure
UNSUBSCRIBE OID	Unsubscribes to an Oracle Internet Directory-enabled Oracle Label Security policy through the SA_POLICY_ADMIN.POLICY_UNSUBSCRIBE procedure
CREATE DATA LABEL	Creates an Oracle Label Security data label through the SA_LABEL_ADMIN.CREATE_LABEL procedure. CREATE DATA LABEL also corresponds to the LBACSYS.TO_DATA_LABEL function.
ALTER DATA LABEL	Alters an Oracle Label Security data label through the SA_LABEL_ADMIN.ALTER_LABEL procedure
DROP DATA LABEL	Drops an Oracle Label Security data label through the SA_LABEL_ADMIN.DROP_LABEL procedure
CREATE LABEL COMPONENT	Creates an Oracle Label Security component through the following procedures: • **Levels:** SA_COMPONENTS.CREATE_LEVEL • **Compartments:** SA_COMPONENTS.CREATE_COMPARTMENT • **Groups:** SA_COMPONENTS.CREATE_GROUP

Audit Event	Description
`ALTER LABEL COMPONENTS`	Alters an Oracle Label Security component through the following procedures: • **Levels:** `SA_COMPONENTS.ALTER_LEVEL` • **Compartments:** `SA_COMPONENTS.ALTER_COMPARTMENT` • **Groups:** `SA_COMPONENTS.ALTER_GROUP` and `SA_COMPONENTS.ALTER_GROUP_PARENT`
`DROP LABEL COMPONENTS`	Drops an Oracle Label Security component through the following procedures: • **Levels:** `SA_COMPONENTS.DROP_LEVEL` • **Compartments:** `SA_COMPONENTS.DROP_COMPARTMENT` • **Groups:** `SA_COMPONENTS.DROP_GROUP`
`ALL`	Enables auditing of all Oracle Label Security actions

Oracle Label Security Auditable User Session Labels

The `ORA_OLS_SESSION_LABELS` application context can capture user session label usage for each Oracle Database event.

The attributes used by this application context refer to Oracle Label Security policies. .

The syntax is the same as the syntax used for application context auditing, described on Configuring Application Context Audit Settings (audit_config.htm#GUID-96C6C33F-A86F-4D9F-8452-4663837666C7) For example:

```
AUDIT CONTEXT NAMESPACE ORA_SESSION_LABELS ATTRIBUTES policy1, policy2;
```

Because the recording of session labels is not user-session specific, the `BY` *`user_list`* clause is not required for auditing Oracle Label Security application contexts.

To disable the auditing of user session label information, you use the `NOAUDIT` statement. For example, to stop auditing for policies `policy1` and `policy2`, enter the following statement:

```
NOAUDIT CONTEXT NAMESPACE ORA_SESSION_LABELS ATTRIBUTES policy1, policy2;
```

Configuring a Unified Audit Policy for Oracle Label Security

The `ACTIONS` and `ACTIONS COMPONENT` clauses in the `CREATE AUDIT POLICY` statement can be used to create Oracle Label Security event audit policies.

- Use the following syntax to create an Oracle Label Security unified audit policy:

  `CREATE AUDIT POLICY` *`policy_name`* `ACTIONS` *`action1`* `[,`*`action2`* `] ACTIONS COMPONENT=OLS` *`component_action1 [, action2]`*`;`

For example:

```
CREATE AUDIT POLICY audit_ols ACTIONS SELECT ON OE.ORDERS ACTIONS COMPONENT=OLS ALL;
```

You can build more complex policies, such as those that include conditions. Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

> **See Also:**
>
> Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)

Example: Auditing Oracle Label Security Session Label Attributes

The `AUDIT CONTEXT NAMESPACE` statement can audit Oracle Label Security session label attributes.

Example 22-23 (audit_config.htm#GUID-4B1E1CAA-422D-4072-A89F-6CAFEAA63E4D__CHDJGEEI) shows how to audit `ORA_OLS_SESSION_LABELS` application context attributes for the Oracle Label Security policies `usr_pol1` and `usr_pol2`.

Example 22-23 Auditing Oracle Label Security Session Label Attributes

```
AUDIT CONTEXT NAMESPACE ORA_SESSION_LABELS ATTRIBUTES usr_pol1, usr_pol2;
```

Example: Excluding a User from an Oracle Label Security Policy

The `CREATE AUDIT POLICY` statement can exclude users from policies.

Example 22-24 (audit_config.htm#GUID-3906FA25-AA23-4780-B747-C8CF61C8AFA5__CHDIEFJJ) shows how to create a unified audit policy that excludes actions from user `ols_mgr`.

Example 22-24 Excluding a User from an Oracle Label Security Policy

```
CREATE AUDIT POLICY auth_ols_audit_pol ACTIONS SELECT ON HR.EMPLOYEES ACTIONS
COMPONENT=OLS DROP POLICY, DISABLE POLICY; AUDIT POLICY auth_ols_audit_pol EXCEPT
ols_mgr;
```

Example: Auditing Oracle Label Security Policy Actions

The `CREATE AUDIT POLICY` statement can audit Oracle Label Security policy actions.

Example 22-25 (audit_config.htm#GUID-56360697-542A-4A63-B784-29AA5B4F2FAA__CHDFGFIE) shows how to audit the `DROP POLICY`, `DISABLE POLICY`, `UNSUBSCRIBE OID` events, and `UPDATE` and `DELETE` statements on the `HR.EMPLOYEES` table. Then this policy is applied to the `HR` and `LBACSYS` users, and audit records are written to the unified audit trail only when the audited actions are successful.

Example 22-25 Auditing Oracle Label Security Policy Actions

```
CREATE AUDIT POLICY generic_audit_pol ACTIONS UPDATE ON HR.EMPLOYEES, DELETE ON
HR.EMPLOYEES ACTIONS COMPONENT=OLS DROP POLICY, DISABLE POLICY, UNSUBSCRIBE OID; AUDIT
POLICY generic_audit_pol BY HR, LBACSYS WHENEVER SUCCESSFUL;
```

Example: Querying for Audited OLS Session Labels

The LBACSYS.ORA_GET_AUDITED_LABEL function can be used in a UNIFIED_AUDIT_TRAIL query to find audited Oracle Label Security session labels.

Example 22-26 (audit_config.htm#GUID-F4BF1CB3-5497-494A-8A6C-42B740933E40__CHDHAFGG) shows how to use the LBACSYS.ORA_GET_AUDITED_LABEL function in a UNIFIED_AUDIT_TRAIL data dictionary view query.

Example 22-26 Querying for Audited Oracle Label Security Session Labels

```
SELECT ENTRY_ID, SESSIONID, LBACSYS.ORA_GET_AUDITED_LABEL(
APPLICATION_CONTEXTS,'GENERIC_AUDIT_POL1') AS SESSION_LABEL1,
LBACSYS.ORA_GET_AUDITED_LABEL( APPLICATION_CONTEXTS,'GENERIC_AUDIT_POL2') AS
SESSION_LABEL2 FROM UNIFIED_AUDIT_TRAIL; / ENTRY_ID SESSIONID SESSION_LABEL1
SESSION_LABEL2 -------- --------- -------------- -------------- 1 1023 SECRET
LEVEL_ALPHA 2 1024 TOP_SECRET LEVEL_BETA
```

How Oracle Label Security Audit Events Appear in the Audit Trail

The UNIFIED_AUDIT_TRAIL data dictionary view lists Oracle Label Security audit events.

If necessary, you should run the DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700) for more information.

The OLS_* columns of the UNIFIED_AUDIT_TRAIL view show Oracle Label Security-specific audit data. For example:

```
SELECT OLS_PRIVILEGES_USED FROM UNIFIED_AUDIT_TRAIL WHERE DBUSERNAME = 'psmith';
OLS_PRIVILEGES_USED ------------------- READ WRITEUP WRITEACROSS
```

The session labels that the audit trail captures are stored in the APPLICATION_CONTEXTS column of the UNIFIED_AUDIT_TRAIL view. You can use the LBACSYS.ORA_GET_AUDITED_LABEL function to retrieve session labels that are stored in the APPLICATION_CONTEXTS column. This function accepts the UNIFIED_AUDIT_TRAIL.APPLICATION_CONTEXTS column value, and the Oracle Label Security policy name as arguments, and then returns the session label that is stored in the column for the specified policy.

> **See Also:**
>
> *Oracle Label Security Administrator's Guide* (../OLSAG/appxa.htm#OLSAG3678) for more information about the ORA_GET_AUDITED_LABEL function

Auditing Oracle Data Mining Events

You can use the CREATE AUDIT POLICY statement to audit Oracle Data Mining events.

Topics:

- About Auditing Oracle Data Mining Events (audit_config.htm#GUID-823518DB-E2AB-49B6-B79C-662B8044C0E3)
- Oracle Data Mining Unified Audit Trail Events (audit_config.htm#GUID-DB5EE523-A4CF-415D-84F7-21DA4DEA8C23)

- Configuring a Unified Audit Policy for Oracle Data Mining (audit_config.htm#GUID-F89A811E-9C64-49E8-B63D-8DAC4D87D1C5)
- Example: Auditing Multiple Oracle Data Mining Operations by a User (audit_config.htm#GUID-33B8C38F-4222-4A7D-AA42-12BA36B1C723)
- Example: Auditing All Failed Oracle Data Mining Operations by a User (audit_config.htm#GUID-278B1AFB-016B-494D-9105-83641E2AEFBF)
- How Oracle Data Mining Events Appear in the Audit Trail (audit_config.htm#GUID-B937EB4F-190D-4CCC-8355-F7C54E55D010)

About Auditing Oracle Data Mining Events

You must have the `AUDIT_ADMIN` role to audit Oracle Data Mining events.

To access the audit trail, you can query the `UNIFIED_AUDIT_TRAIL` data dictionary view.

> **See Also:**
>
> *Oracle Data Mining Concepts* (../DMCON/process.htm#DMCON002)for more information about Oracle Data Mining

Oracle Data Mining Unified Audit Trail Events

The unified audit trail can capture Oracle Data Mining audit events..

Table 22-18 (audit_config.htm#GUID-DB5EE523-A4CF-415D-84F7-21DA4DEA8C23__CHDDGEEC) describes these events.

Table 22-18 Oracle Data Mining Audit Events

Audit Event	Description
`AUDIT`	Generates an audit record for a Data Mining model
`COMMENT`	Adds a comment to a Data Mining model
`GRANT`	Gives permission to a user to access the Data Mining model
`RENAME`	Changes the name of the Data Mining model
`SELECT`	Applies the Data Mining model or view its signature

Configuring a Unified Audit Policy for Oracle Data Mining

The `CREATE AUDIT POLICY` statement `ACTIONS` and `ON MINING MODEL` clauses can be used to create Oracle Data Mining event unified audit policies.

- Use the following syntax to create a unified audit policy for Oracle Data Mining:

```
CREATE AUDIT POLICY policy_name ACTIONS {operation | ALL} ON MINING MODEL
schema_name.model_name;
```

For example:

```
CREATE AUDIT POLICY dm_ops ACTIONS RENAME ON MINING MODEL hr.dm_emp;
```

Example: Auditing Multiple Oracle Data Mining Operations by a User

The `CREATE AUDIT POLICY` statement can audit multiple Oracle Data Mining operations.

Example 22-27 (audit_config.htm#GUID-33B8C38F-4222-4A7D-AA42-12BA36B1C723__CHDECJEJ) shows how to audit multiple Oracle Data Mining operations by user `psmith`. Include the `ON MINING MODEL` *`schema_name.model_name`* clause for each event, and separate each with a comma. This example specifies the same *`schema_name.model_name`* for both actions, but the syntax enables you to specify different *`schema_name.model_name`* settings for different schemas and data models.

Example 22-27 Auditing Multiple Oracle Data Mining Operations by a User

```
CREATE AUDIT POLICY dm_ops_pol ACTIONS SELECT ON MINING MODEL dmuser1.nb_model, ALTER
ON MINING MODEL dmuser1.nb_model; AUDIT POLICY dm_ops_pol BY psmith;
```

Example: Auditing All Failed Oracle Data Mining Operations by a User

The `CREATE AUDIT POLICY` statement can audit failed Oracle Data Mining operations by a user.

Example 22-28 (audit_config.htm#GUID-278B1AFB-016B-494D-9105-83641E2AEFBF__CHDEFCJA) shows how to audit all failed Oracle Data Mining operations by user `psmith`.

Example 22-28 Auditing All Failed Oracle Data Mining Operations by a User

```
CREATE AUDIT POLICY dm_all_ops_pol ACTIONS ALL ON MINING MODEL dmuser1.nb_model; AUDIT
POLICY dm_all_ops_pol BY psmith WHENEVER NOT SUCCESSFUL;
```

How Oracle Data Mining Events Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle Data Mining audit events.

If necessary, you should run the `DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL` procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700) for more information.

The following example shows how to query the `UNIFIED_AUDIT_TRAIL` data dictionary view for Data Mining audit events.

```
SELECT DBUSERNAME, ACTION_NAME, SYSTEM_PRIVILEGE_USED, RETURN_CODE, OBJECT_SCHEMA,
OBJECT_NAME, SQL_TEXT FROM UNIFIED_AUDIT_TRAIL; DBUSERNAME ACTION_NAME
SYSTEM_PRIVILEGE_USED RETURN_CODE ---------- -------------------- --------------------
----- ----------- OBJECT_SCHEMA OBJECT_NAME ------------------- -------------------
SQL_TEXT ------------------------------------------------------------------------
--- DMUSER1 CREATE MINING MODEL CREATE MINING MODEL 0 DMUSER1 BEGIN
dbms_data_mining.create_model(model_name => 'nb_model', mining_function =>
dbms_data_mining.classification, data_table_name => 'dm_data', case_id_column_name =>
'case_id', target_column_name => 'target'); END; DMUSER1 SELECT MINING MODEL 0 DMUSER1
NB_MODEL select prediction(nb_model using *) from dual DMUSER2 SELECT MINING MODEL
40284 DMUSER1 NB_MODEL select prediction(dmuser1.nb_model using *) from dual DMUSER1
ALTER MINING MODEL 0 DMUSER1 NB_MODEL BEGIN dbms_data_mining.rename_model('nb_model',
'nb_model1'); END; DMUSER2 ALTER MINING MODEL 40284 DMUSER1 NB_MODEL BEGIN
dbms_data_mining.rename_model('dmuser1.nb_model1', 'nb_model'); END; DMUSER2 ALTER
MINING MODEL 40284 DMUSER1 NB_MODEL BEGIN
dbms_data_mining.rename_model('dmuser1.nb_model1', 'nb_model'); END;
```

Auditing Oracle Data Pump Events

You can use the `CREATE AUDIT POLICY` statement to audit Oracle Data Pump.

Topics:

- About Auditing Oracle Data Pump Events (audit_config.htm#GUID-AFDFFB7D-5AC2-4336-A2FD-90BC8DF2F2EC)
- Oracle Data Pump Unified Audit Trail Events (audit_config.htm#GUID-D22FAFAC-0E99-46E8-B84E-420A77A1046C)
- Configuring a Unified Audit Policy for Oracle Data Pump (audit_config.htm#GUID-3F8CDB09-EA27-4D1B-9946-5492409E5F7A)
- Example: Auditing Oracle Data Pump Import Operations (audit_config.htm#GUID-A57C0DC0-245E-4353-983C-5A7FFB0CC5AB)
- Example: Auditing All Oracle Data Pump Operations (audit_config.htm#GUID-C068D71D-D654-404B-9FB8-972988E50A48)
- How Oracle Data Pump Audited Events Appear in the Audit Trail (audit_config.htm#GUID-7FC3DCD1-39C0-4BB7-95B3-9481FFD064C5)

About Auditing Oracle Data Pump Events

The `CREATE AUDIT POLICY` statement `COMPONENT` clause must be set to `DATAPUMP` to create Oracle Data Pump unified audit policies.

You can audit Data Pump export (`expdp`) and import (`impdp`) operations.

As with all unified auditing, you must have the `AUDIT_ADMIN` role before you can audit Oracle Data Pump events.

To access the audit trail, query the `UNIFIED_AUDIT_TRAIL` data dictionary view. The Data Pump-specific columns in this view begin with `DP_`.

> **See Also:**
>
> *Oracle Database Utilities* (../SUTIL/GUID-17FAE261-0972-4220-A2E4-44D479F519D4.htm#SUTIL100) for detailed information about Oracle Data Pump

Oracle Data Pump Unified Audit Trail Events

The unified audit trail can capture Oracle Data Pump events.

The unified audit trail captures information about both export (`expdp`) and import (`impdp`) operations.

Configuring a Unified Audit Policy for Oracle Data Pump

The `ACTIONS COMPONENT` clause in the `CREATE AUDIT POLICY` statement can be used to create an Oracle Data Pump event unified audit policy.

- Use the following syntax to create a unified audit policy for Oracle Data Pump:

```
CREATE AUDIT POLICY policy_name ACTIONS COMPONENT=DATAPUMP { EXPORT | IMPORT | ALL
};
```

For example:

```
CREATE AUDIT POLICY audit_dp_export_pol ACTIONS COMPONENT=DATAPUMP EXPORT;
```

You can build more complex policies, such as those that include conditions. Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

> **See Also:**
>
> Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)

Example: Auditing Oracle Data Pump Import Operations

The `CREATE AUDIT POLICY` statement can audit Oracle Data Pump import operations.

Example 22-29 (audit_config.htm#GUID-A57C0DC0-245E-4353-983C-5A7FFB0CC5AB__CHDHDEIA) shows how to audit all Oracle Data Pump import operations.

Example 22-29 Auditing Oracle Data Pump Import Operations

```
CREATE AUDIT POLICY audit_dp_import_pol ACTIONS COMPONENT=DATAPUMP IMPORT; AUDIT
POLICY audit_dp_import_pol;
```

Example: Auditing All Oracle Data Pump Operations

The `CREATE AUDIT POLICY` statement can audit all Oracle Data Pump operations.

Example 22-30 (audit_config.htm#GUID-C068D71D-D654-404B-9FB8-972988E50A48__CHDJJIFH) shows how to audit both Oracle Database Pump export and import operations.

Example 22-30 Auditing All Oracle Data Pump Operations

```
CREATE AUDIT POLICY audit_dp_all_pol ACTIONS COMPONENT=DATAPUMP ALL; AUDIT POLICY
audit_dp_all_pol BY SYSTEM;
```

How Oracle Data Pump Audited Events Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle Data Pump audited events.

If necessary, you should run the DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL procedure to write the audit records to disk.

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700)for more information.

The DP_* columns of the UNIFIED_AUDIT_TRAIL view show Oracle Data Pump-specific audit data. For example:

```
SELECT DP_TEXT_PARAMETERS1, DP_BOOLEAN_PARAMETERS1 FROM UNIFIED_AUDIT_TRAIL WHERE
AUDIT_TYPE = 'DATAPUMP'; DP_TEXT_PARAMETERS1 DP_BOOLEAN_PARAMETERS1 ------------------
--------------------------- -------------------------------- MASTER TABLE:
"SCOTT"."SYS_EXPORT_TABLE_01", MASTER_ONLY: FALSE, JOB_TYPE: EXPORT, DATA_ONLY: FALSE,
METADATA_JOB_MODE: TABLE_EXPORT, METADATA_ONLY: FALSE, JOB VERSION: 12.1.0.0,
DUMPFILE_PRESENT: TRUE, ACCESS METHOD: DIRECT_PATH, JOB_RESTARTED: FALSE DATA OPTIONS:
0, DUMPER DIRECTORY: NULL REMOTE LINK: NULL, TABLE EXISTS: NULL, PARTITION OPTIONS:
NONE
```

(This output was reformatted for easier readability.)

Auditing Oracle SQL*Loader Direct Load Path Events

You can use the CREATE AUDIT POLICY statement to audit Oracle SQL*Loader direct load path events.

Topics:

- About Auditing in Oracle SQL*Loader Direct Path Load Events (audit_config.htm#GUID-FB95E495-EB22-4F8D-A1CC-3E7941C587FC)
- Oracle SQL*Loader Direct Load Path Unified Audit Trail Events (audit_config.htm#GUID-763CB41D-95C6-41E7-893A-625628436081)
- Configuring a Unified Audit Trail Policy for Oracle SQL*Loader Direct Path Events (audit_config.htm#GUID-6FF4B103-6AF1-41A0-A319-B8603565F068)
- Example: Auditing Oracle SQL*Loader Direct Path Load Operations (audit_config.htm#GUID-61E426CA-DEB8-49A0-AD9F-2C7C64D38675)
- How SQL*Loader Direct Path Load Audited Events Appear in the Audit Trail (audit_config.htm#GUID-0B701360-918E-4EC2-A0B8-F016302BA184)

About Auditing in Oracle SQL*Loader Direct Path Load Events

You must have the AUDIT_ADMIN role to audit Oracle SQL*Loader direct path events.

To create SQL*Loader unified audit policies, you must set the CREATE AUDIT POLICY statement's COMPONENT clause to DIRECT_LOAD. You can audit direct path load operations only, not other SQL*Loader loads, such as conventional path loads.

To access the audit trail, you can query the DIRECT_PATH_NUM_COLUMNS_LOADED column in the UNIFIED_AUDIT_TRAIL data dictionary view.

> **See Also:**

> *Oracle Database Utilities* (../SUTIL/GUID-8D037494-07FA-4226-B507-E1B2ED10C144.htm#SUTIL3311) for detailed information about Oracle SQL*Loader

Oracle SQL*Loader Direct Load Path Unified Audit Trail Events

The unified audit trail can capture SQL*Loader Direct Load Path events.

The unified audit trail captures information about direct path loads that SQL*Loader performs (that is, when you set `direct=true` on the SQL*Loader command line or in the SQL*Loader control file).

It also audits Oracle Call Interface (OCI) programs that use the direct path API.

> **See Also:**
>
> *Oracle Database Utilities* (../SUTIL/GUID-1F89DC04-53CE-41FD-A2B4-1BBB3459C9F2.htm#SUTIL1299) for detailed information about direct path loads in Oracle SQL*Loader

Configuring a Unified Audit Trail Policy for Oracle SQL*Loader Direct Path Events

The `CREATE AUDIT POLICY` statement `ACTIONS COMPONENT` clause can create unified audit policies for Oracle SQL*Loader direct path events.

- Use the following syntax to create an Oracle SQL*Loader unified audit policy:

  ```
  CREATE AUDIT POLICY policy_name ACTIONS COMPONENT=DIRECT_LOAD { LOAD };
  ```

For example:

```
CREATE AUDIT POLICY audit_sqlldr_pol ACTIONS COMPONENT=DIRECT_LOAD LOAD;
```

You can build more complex policies, such as those that include conditions. Remember that after you create the policy, you must use the `AUDIT` statement to enable it.

> **See Also:**
>
> Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)

Example: Auditing Oracle SQL*Loader Direct Path Load Operations

The `CREATE AUDIT POLICY` statement can audit Oracle SQL*Loader direct path load operations.

Example 22-29 (audit_config.htm#GUID-A57C0DC0-245E-4353-983C-5A7FFB0CC5AB__CHDHDEIA) shows how to audit SQL*Loader direct path load operations.

Example 22-31 Auditing Oracle SQL*Loader Direct Path Load Operations

```
CREATE AUDIT POLICY audit_sqlldr_load_pol ACTIONS COMPONENT=DIRECT_LOAD LOAD; AUDIT
POLICY audit_sqlldr_load_pol;
```

How SQL*Loader Direct Path Load Audited Events Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists SQL*Loader direct path load audited events. .

If necessary, you should run the `DBMS_AUDIT_MGMT.FLUSH_UNIFIIED_AUDIT_TRAIL` procedure to write the audit records to disk

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700)for more information.

The `DIRECT_PATH_NUM_COLUMNS_LOADED` column of the `UNIFIED_AUDIT_TRAIL` view shows the number of columns that were loaded using the SQL*Loader direct path load method. For example:

```
SELECT DBUSERNAME, ACTION_NAME, OBJECT_SCHEMA, OBJECT_NAME,
DIRECT_PATH_NUM_COLUMNS_LOADED FROM UNIFIED_AUDIT_TRAIL WHERE AUDIT_TYPE = 'DIRECT
PATH API'; DBUSERNAME ACTION_NAME OBJECT_SCHEMA OBJECT_NAME
DIRECT_PATH_NUM_COLUMNS_LOADED ----------- ----------- ------------- ------------ ----
------------------------- RLAYTON INSERT HR EMPLOYEES 4
```

Using the Unified Audit Policies or AUDIT Settings in a Multitenant Environment

In a multitenant environment, you can create unified audit policies in both the root and in PDBs.

Topics:

- About Local and Common Audit Policies (audit_config.htm#GUID-DDEF2483-1E3A-4DCD-9DA1-520CBFB4BCAF)
- Traditional Auditing in a Multitenant Environment (audit_config.htm#GUID-BFCF47B5-4A96-4984-A07E-F210DD625590)
- Configuring a Local Unified Audit Policy or Common Unified Audit Policy (audit_config.htm#GUID-F4394DDB-CD5F-4B54-B2AC-3649DF03541F)
- Example: Local Unified Audit Policy (audit_config.htm#GUID-92AAA230-841F-4214-940E-C7C47AB0CA39)
- Example: Common Unified Audit Policy (audit_config.htm#GUID-FA84D9C3-4D81-41FE-9A05-964D3B74DBC0)
- How Local or Common Audit Policies or Settings Appear in the Audit Trail (audit_config.htm#GUID-6D918DF7-CE61-41DD-8BD3-38CA55E66B7E)

> **See Also:**
>
> *Oracle Database Concepts* (../CNCPT/glossary.htm#CNCPT89367) for information about the common audit configurations in a multitenant environment

About Local and Common Audit Policies

An audit policy to be either a local audit policy or a CDB common audit policy.

- **Local audit policy.** This type of policy can exist in either the root or the PDB. A local audit policy that exists in the root can contain object audit options for both local and common objects. Both local and common users who have been granted the `AUDIT_ADMIN` role can enable local policies: local users from their PDBs and common users from the root or the PDB to which they have privileges. If you are connected to the root, then you can specify object audit options but not privilege or role audit options.

- **Common audit policy.** This type of policy is available to all PDBs in the multitenant environment. Only common users who have been granted the `AUDIT_ADMIN` role can create and maintain common audit policies. You can enable common audit policies only for common users. You must create common audit policies only in the root. This type of policy can contain object audit options of only common objects, and be enabled only for common users.

By default, audit policies are local to the current PDB.

Traditional Auditing in a Multitenant Environment

In traditional auditing (not unified auditing), the `AUDIT` and `NOAUDIT` statements can audit statements and privileges in a multitenant environment.

To configure the audit policy to be either a local audit policy or a common audit policy, you must include the `CONTAINER` clause, as you normally do for other SQL creation or modification statements. The audit record will be created in the container where the action was performed.

- If you want to apply the `AUDIT` or `NOAUDIT` statement to the current PDB, then in the PDB, you must set `CONTAINER` to `CURRENT`. For example:

```
AUDIT DROP ANY TABLE BY SYSTEM BY ACCESS CONTAINER = CURRENT;
```

- If you want to apply the `AUDIT` or `NOAUDIT` statement to the entire multitenant environment, then in root, you must set `CONTAINER` to `ALL`. For example:

```
AUDIT DROP ANY TABLE BY SYSTEM BY ACCESS CONTAINER = ALL;
```

> **See Also:**
>
> *Oracle Database SQL Language Reference* for more information about the traditional `AUDIT` (../SQLRF/statements_4007.htm#SQLRF01107)and `NOAUDIT` (../SQLRF/statements_9018.htm#SQLRF01607)SQL statements

Configuring a Local Unified Audit Policy or Common Unified Audit Policy

The `CONTAINER` clause is specific to multitenant environment use for the `CREATE AUDIT POLICY` statement.

- Use the following syntax to create a local or common unified audit policy:

```
CREATE AUDIT POLICY policy_name action1 [,action2 ] [CONTAINER = {CURRENT | ALL}];
```

In this specification:

- `CURRENT` sets the audit policy to be local to the current PDB.
- `ALL` makes the audit policy a common audit policy, that is, available to the entire multitenant environment.

For example, for a common unified audit policy:

```
CREATE AUDIT POLICY dict_updates ACTIONS UPDATE ON SYS.USER$, DELETE ON SYS.USER$,
UPDATE ON SYS.LINK$, DELETE ON SYS.LINK$ CONTAINER = ALL;
```

Note the following:

- For unified audit policies, you can set the `CONTAINER` clause for the `CREATE AUDIT POLICY` statement but not for `ALTER AUDIT POLICY` or `DROP AUDIT POLICY`. If you want to change the scope of an existing unified audit policy to use this setting, then you must drop and recreate the policy.

- For `AUDIT` statements, you can set the `CONTAINER` clause for audit settings only if you have an Oracle database that has not been migrated to the Release 12.*x* audit features. You cannot use the `CONTAINER` clause in an `AUDIT` statement that is used to enable a unified audit policy.

- If you are in a PDB, then you can only set the `CONTAINER` clause to `CURRENT`, not `ALL`. If you omit the setting while in the PDB, then the default is `CONTAINER = CURRENT`.

- If you are in the root, then you can set the `CONTAINER` clause to either `CURRENT` if you want the policy to apply to the root only, or to `ALL` if you want the policy to apply to the entire CDB. If you omit the `CONTAINER` clause, then default is `CONTAINER = COMMON`.

- For objects:

  - Common audit policies can have common objects only and local audit policies can have local objects only.

  - You cannot set `CONTAINER` to `ALL` if the objects involved are local. They must be common objects.

- For privileges:

  - You can set the `CONTAINER` to `CURRENT` (or omit the `CONTAINER` clause) if the user accounts involved are a mixture of local and common accounts. This creates a local audit configuration that applies only to the current PDB.

  - You cannot set `CONTAINER` to `ALL` if the users involved are local users. They must be common users.

  - If you set `CONTAINER` to `ALL` and do not specify a user list (using the `BY` clause in the `AUDIT` statement), then the configuration applies to all common users in each PDB.

> **See Also:**
>
> - Syntax for Creating a Unified Audit Policy (audit_config.htm#GUID-5E618BEF-A197-4A9F-B856-5D2941DFB4E5)
> - Creating a Condition for a Unified Audit Policy (audit_config.htm#GUID-6801720F-6020-4608-93B9-C08478B36121)
> - Enabling Unified Audit Policies to Users (audit_config.htm#GUID-526A09B1-0782-47BA-BDF3-17E61E546174)
> - Auditing Application Context Values (audit_config.htm#GUID-1AC48317-FDF8-4D94-99AD-6B88E4909436)

Example: Local Unified Audit Policy

The `CREATE AUDIT POLICY` statement can create a local unified audit policy in either the root or a PDB.

When you create a local unified audit policy in the root, it only applies to the root and not across the multitenant environment.

Example 22-32 (audit_config.htm#GUID-92AAA230-841F-4214-940E-C7C47AB0CA39__CHDGAGBG) shows a local unified audit policy that has been created by the common user `c##sec_admin` from a PDB and applied to common user `c##hr_admin`.

Example 22-32 Local Unified Audit Policy

```
CONNECT c##sec_admin@hrpdb Enter password: password Connected. CREATE AUDIT POLICY
table_privs PRIVILEGES CREATE ANY TABLE, DROP ANY TABLE CONTAINER = CURRENT; AUDIT
POLICY table_privs BY c##hr_admin;
```

Example: CDB Common Unified Audit Policy

The `CREATE AUDIT POLICY` statement can create a CDB common unified audit policy.

Example 22-33 (audit_config.htm#GUID-FA84D9C3-4D81-41FE-9A05-964D3B74DBC0__CHDDFHEH)shows a common unified audit policy that has been created by the common user `c##sec_admin` from the root and applied to common user `c##hr_admin`.

Example 22-33 Common Unified Audit Policy

```
CONNECT c##sec_admin Enter password: password Connected. CREATE AUDIT POLICY admin_pol
ACTIONS CREATE TABLE, ALTER TABLE, DROP TABLE ROLES c##hr_mgr, c##hr_sup CONTAINER =
ALL; AUDIT POLICY admin_pol BY c##hr_admin;
```

How Local or Common Audit Policies or Settings Appear in the Audit Trail

You can query unified audit policy views from either the root or the PDB in which the action occurred.

You can perform the following types of queries:

- **Audit records from all PDBs.** The audit trail reflects audited actions that have been performed in the PDBs. For example, if user `lbrown` in `PDB1` performs an action that has been audited by either a common or a local audit policy, then the audit trail will capture this action. The `DBID` column in the `UNIFIED_AUDIT_TRAIL` data dictionary view indicates the PDB in which the audited action takes place and to which the policy applies. If you want to see audit records from all PDBs, you should query the `CDB_UNIFIED_AUDIT_TRAIL` data dictionary view from the root.

- **Audit records from common audit policies.** This location is where the common audit policy results in an audit record. The audit record can be generated anywhere in the multitenant environment—the root or the PDBs, depending on where the action really occurred. For example, the common audit policy `fga_pol` audits the `EXECUTE` privilege on the `DBMS_FGA` PL/SQL package, and if this action occurs in `PDB1`, then the audit record is generated in `PDB1` and not in the root. Hence, the audit record can be seen in PDB1.

  You can query the `UNIFIED_AUDIT_TRAIL` data dictionary view for the policy from either the root or a PDB if you include a `WHERE` clause for the policy name (for example, `WHERE UNIFIED_AUDIT_POLICIES = 'FGA_POL'`).

The following example shows how to find the results of a common unified audit policy:

```
CONNECT c##sec_admin@root Enter password: password Connected. SELECT DBID,
ACTION_NAME, OBJECT_SCHEMA, OBJECT_NAME FROM CDB_UNIFIED_AUDIT_TRAIL WHERE DBUSERNAME
= 'c##hr_admin'; DBID ACTION_NAME OBJECT_SCHEMA OBJECT_NAME ----------- ----------- --
---------- ----------- 653916017 UPDATE HR EMPLOYEES 653916018 UPDATE HR JOB_HISTORY
653916017 UPDATE HR JOBS
```

> **Note:**

To view the latest audit records in the audit trail, if necessary, run the following procedure to write the records to disk:

```
EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
```

See Manually Flushing Audit Records to the Audit Trail in Queued-Write Mode (audit_admin.htm#GUID-11FEBEC6-608F-48D9-8582-47BB555FC700)for more information.

Altering Unified Audit Policies

You can use the `ALTER AUDIT POLICY` statement to modify a unified audit policy.

Topics:

- About Altering Unified Audit Policies (audit_config.htm#GUID-F5ECDD14-FD7E-4B10-A40D-F7465BA73904)
- Altering a Unified Audit Policy (audit_config.htm#GUID-75B3ACC9-391A-40A9-B28C-D1A2E0522A27)
- Example: Altering a Condition in a Unified Audit Policy (audit_config.htm#GUID-1DFA0D12-19E6-4169-85BA-D546E266F4A5)
- Example: Altering an Oracle Label Security Component in a Unified Audit Policy (audit_config.htm#GUID-1C4965CE-7801-46D7-B980-D5565B61D467)
- Example: Altering an Oracle Label Security Component in a Unified Audit Policy (audit_config.htm#GUID-1C4965CE-7801-46D7-B980-D5565B61D467)
- Example: Dropping a Condition from a Unified Audit Policy (audit_config.htm#GUID-87491E67-A909-417E-AEF0-DB9D212E78CC)

About Altering Unified Audit Policies

You can change most properties in a unified audit policy, except for its `CONTAINER` setting.

You cannot alter unified audit policies in a multitenant environment. For example, you cannot turn a common unified audit policy into a local unified audit policy.

To find existing unified audit policies, query the `AUDIT_UNIFIED_POLICIES` data dictionary view. If you want to find only the enabled unified audit policies, then query the `AUDIT_UNIFIED_ENABLED_POLICIES` view. You can alter both enabled and disabled audit policies. If you alter an enabled audit policy, it remains enabled after you alter it.

After you alter an object unified audit policy, the new audit settings take place immediately, for both the active and subsequent user sessions. If you alter system audit options, or audit conditions of the policy, then they are activated for new user sessions, but not the current user session.

Altering a Unified Audit Policy

The `ALTER AUDIT POLICY` statement can modify a unified audit policy.

- Use the following syntax to alter a unified audit policy, you use the `ALTER AUDIT POLICY` statement.

```
ALTER AUDIT POLICY policy_name [ADD [privilege_audit_clause][action_audit_clause]
[role_audit_clause]] [DROP [privilege_audit_clause][action_audit_clause]
[role_audit_clause]] [CONDITION {DROP | audit_condition EVALUATE PER
{STATEMENT|SESSION|INSTANCE}}]
```

In this specification:

- `ADD` enables you to alter the following the following settings:
  - *`privilege_audit_clause`* describes privilege-related audit options. See Auditing System Privileges (audit_config.htm#GUID-5D6F6F38-B9F9-4681-8879-8F880E637D75) for details. The detailed syntax for configuring privilege audit options is as follows:

    ```
    ADD privilege_audit_clause := PRIVILEGES privilege1 [, privilege2]
    ```

  - *`action_audit_clause`* and *`standard_actions`* describe object action-related audit options. See Auditing Object Actions (audit_config.htm#GUID-12B6375C-25F7-46A9-BA03-4714BFAC6056) . The syntax is as follows:

    ```
    ADD action_audit_clause := {standard_actions | component_actions} [,
    component_actions ] standard_actions := ACTIONS action1 [ ON {schema.obj_name |
    DIRECTORY directory_name | MINING MODEL schema.obj_name } ] [, action2 [ ON
    {schema.obj_name | DIRECTORY directory_name | MINING MODEL schema.obj_name } ]
    ```

  - *`role_audit_clause`* enables you to add or drop the policy for roles. See Auditing Roles (audit_config.htm#GUID-E96C25BE-7C5C-4743-AB53-78B3E66C43C9) The syntax is:

    ```
    ADD role_audit_clause := ROLES role1 [, role2]
    ```

- `DROP` enables you to drop the same components that are described for the `ADD` clause. For example:

  ```
  DROP role_audit_clause := ROLES role1 [, role2]
  ```

- `CONDITION {DROP...` enables you to add or drop a condition for the policy. If you are altering an existing condition, then you must include the `EVALUATE PER` clause with the condition. See Creating a Condition for a Unified Audit Policy (audit_config.htm#GUID-6801720F-6020-4608-93B9-C08478B36121) The syntax is:

  ```
  CONDITION 'audit_condition := function operation value_list' EVALUATE PER
  {STATEMENT|SESSION|INSTANCE}
  ```

  If you want to drop a condition, then omit the condition definition and the `EVALUATE PER` clause. For example:

  ```
  CONDITION DROP
  ```

Example: Altering a Condition in a Unified Audit Policy

The `ALTER AUDIT POLICY` statement can alter conditions in unified audit policies.

Example 22-34 (audit_config.htm#GUID-1DFA0D12-19E6-4169-85BA-D546E266F4A5__CHDDBJJE) shows how to change a condition in an existing unified audit policy.

Example 22-34 Altering a Condition in a Unified Audit Policy

```
ALTER AUDIT POLICY orders_unified_audpol ADD ACTIONS INSERT ON SCOTT.EMP CONDITION
'SYS_CONTEXT(''ENTERPRISE'', ''GROUP'') = ''ACCESS_MANAGER''' EVALUATE PER SESSION;
```

Example: Altering an Oracle Label Security Component in a Unified Audit Policy

The `ALTER AUDIT POLICY` statement can alter Oracle Label Security components in an audit policy.

Example 22-35 (audit_config.htm#GUID-1C4965CE-7801-46D7-B980-D5565B61D467__CHDGFDBI) shows how to alter an Oracle Label Security component in an audit policy.

Example 22-35 Altering an Oracle Label Security Component in a Unified Audit Policy

```
ALTER AUDIT POLICY audit_ols ADD ACTIONS SELECT ON HR.EMPLOYEES ACTIONS COMPONENT=OLS
DROP POLICY, DISABLE POLICY, REMOVE POLICY;
```

Example: Altering Roles in a Unified Audit Policy

The `ALTER AUDIT POLICY` statement can alter roles in a unified audit policy.

Example 22-36 (audit_config.htm#GUID-AB5C9D6F-F889-489D-BDEB-C19D83E7A528__CHDDBGFI) shows how to add roles to a common unified audit policy.

Example 22-36 Altering Roles in a Unified Audit Policy

```
CONNECT c##sec_admin Enter password: password Connected. ALTER AUDIT POLICY
RoleConnectAudit ADD ROLES c##role1, c##role2;
```

Example: Dropping a Condition from a Unified Audit Policy

The `ALTER AUDIT POLICY` statement can drop a condition from a unified audit policy.

Example 22-37 (audit_config.htm#GUID-87491E67-A909-417E-AEF0-DB9D212E78CC__CHDIGJGH) shows how to drop a condition from an existing unified audit policy.

Example 22-37 Dropping a Condition from a Unified Audit Policy

```
ALTER AUDIT POLICY orders_unified_audpol CONDITION DROP;
```

Enabling Unified Audit Policies to Users

You can use the `AUDIT POLICY` statement to enable and apply unified audit policies to users.

Topics:

- About Enabling Unified Audit Policies (audit_config.htm#GUID-8DBB6192-7587-4A4E-97C0-FE8B55FED731)
- Enabling a Unified Audit Policy (audit_config.htm#GUID-A12AE8E2-733B-4C92-8860-76AAF85E64B8)
- Example: Enabling a Unified Audit Policy (audit_config.htm#GUID-C80E4E35-F21C-4B14-BCCC-AEEA463D7121)

About Enabling Unified Audit Policies

The `AUDIT` statement with the `POLICY` clause enables a unified audit policy, applying for all types of audit options, including object-level options.

The policy does not take effect until after the audited users log into the database instance. In other words, if you create and enable a policy while the audited users are logged in, then the policy cannot collect audit data; the users must log out and then log in again before auditing can begin. Once the session is set up with auditing for it, then the setting lasts as long as the user session and then ends when the session ends.

You can check the results of the audit by querying the `UNIFIED_AUDIT_TRAIL` data dictionary view. To find a list of existing unified audit policies, query the `AUDIT_UNIFIED_POLICIES` data dictionary view.

The `AUDIT` statement lets you specify the following optional additional settings:

- **Whether to apply the unified audit policy to one or more users.** To apply the policy to one or more users, including administrative users who log in with the `SYSDBA` administrative privilege (such as `SYS`), use the `BY` clause.

  For example:

  ```
  AUDIT POLICY role_connect_audit_pol BY SYS, SYSTEM;
  ```

- **Whether to exclude users from the unified audit policy.** To exclude users from the audit policy, include the `EXCEPT` clause.

  For example:

  ```
  AUDIT POLICY role_connect_audit_pol EXCEPT rlee, jrandolph;
  ```

- **Whether to create an audit record if the activity succeeds or fails.** This method of auditing reduces the audit trail, helping you to focus on specific actions. This can aid in maintaining good database performance. Enter one of the following clauses:

  - `WHENEVER SUCCESSFUL` audits only successful executions of the user's activity.

  - `WHENEVER NOT SUCCESSFUL` audits only failed executions of the user's activity. Monitoring unsuccessful SQL statement can expose users who are snooping or acting maliciously, though most unsuccessful SQL statements are neither.

  For example:

  ```
  AUDIT POLICY role_connect_audit_pol WHENEVER NOT SUCCESSFUL;
  ```

  If you omit this clause, then both failed and successful user activities are written to the audit trail.

Note the following:

- The unified audit policy only can have either the `BY` clause or the `EXCEPT` clause, but not both for the same policy.

- If you run multiple `AUDIT` statements on the same unified audit policy but specify different `BY` users, then Oracle Database audits all of these users.

- If you run multiple `AUDIT` statements on the same unified audit policy but specify different `EXCEPT` users, then Oracle Database uses the last exception user list, not any of the users from the preceding lists. This means the effect of the earlier `AUDIT POLICY ... EXCEPT` statements are overridden by the latest `AUDIT POLICY ... EXCEPT` statement.

- You can only enable common unified audit policies for common users.
- In a multitenant environment, you can enable a common audit policy only from the root and a local audit policy only from the PDB to which it applies.

Enabling a Unified Audit Policy

The `AUDIT POLICY` statement can enable a unified audit policy.

- Use the following syntax to enable a unified audit policy:

  ```
  AUDIT POLICY { policy_auditing } [WHENEVER [NOT] SUCCESSFUL]
  ```

In this specification:

- *`policy_auditing`* refers to the following components:
  - **The name of the unified audit policy.** To find all existing policies, query the `AUDIT_UNIFIED_POLICIES` data dictionary view. To find currently enabled policies, query `AUDIT_UNIFIED_ENABLED_POLICIES`.
  - **Users to whom the unified audit policy applies.** To apply the policy to one or more users (including user `SYS`), enter the `BY` clause. For example:

    ```
    BY psmith, rlee
    ```

  - **Users to exclude from the unified audit policy.** To exclude one or more users from the policy, enter the `EXCEPT` clause. For example:

    ```
    EXCEPT psmith, rlee
    ```

    Mandatory audit records are captured in the `UNIFIED_AUDIT_TRAIL` data dictionary view for the `AUDIT POLICY` SQL statement. To find users who have been excluded in the audit records, you can query the `EXCLUDED_USER` column in the `UNIFIED_AUDIT_TRAIL` view to list the excluded users.

  You cannot enable the same audit policy with the `BY`, `BY USERS WITH GRANTED ROLES`, and `EXCEPT` clauses in the same statement. This action throws an error for the subsequent `AUDIT` statement with the conflicting clause.
- `WHENEVER [NOT] SUCCESSFUL` enables the policy to generate audit records based on whether the user's actions failed or succeeded. See About Enabling Unified Audit Policies (audit_config.htm#GUID-8DBB6192-7587-4A4E-97C0-FE8B55FED731)for more information.

After you enable the unified audit policy and it is generating records, you can find the audit records by querying the `UNIFIED_AUDIT_TRAIL` data dictionary view.

Example: Enabling a Unified Audit Policy

The `AUDIT POLICY` statement can enable a unified audit policy using conditions, such as `WHENEVER NOT SUCCESSFUL`.

Example 22-38 (audit_config.htm#GUID-C80E4E35-F21C-4B14-BCCC-AEEA463D7121__CHDIBJAC) shows how to enable a unified audit policy to record only failed actions by the user `dv_admin`.

Example 22-38 Enabling a Unified Audit Policy

```
AUDIT POLICY dv_admin_pol BY tjones WHENEVER NOT SUCCESSFUL;
```

Disabling Unified Audit Policies

You can use the `NOAUDIT POLICY` statement to disable a unified audit policy.

Topics:

- About Disabling Unified Audit Policies (audit_config.htm#GUID-FB5308D3-6BFA-4794-BD0B-DB9258B37E4C)
- Disabling a Unified Audit Policy (audit_config.htm#GUID-BF0CD538-376D-4FEE-9A9B-882DE52B31B8)
- Example: Disabling a Unified Audit Policy (audit_config.htm#GUID-D7AAFA3F-CFAD-4CF4-A495-99826A36E965)

About Disabling Unified Audit Policies

The `NOAUDIT` statement with the `POLICY` clause can disable a unified audit policy.

In the `NOAUDIT` statement, you can specify a `BY` user list, but not an `EXCEPT` user list. The disablement of a unified audit policy takes effect on subsequent user sessions.

You can find a list of existing unified audit policies by querying the `AUDIT_UNIFIED_POLICIES` data dictionary view.

In a multitenant environment, you can disable a common audit policy only from the root and a local audit policy only from the PDB to which it applies.

Disabling a Unified Audit Policy

The `NOAUDIT` statement can disable a unified audit policy.

- Use the following syntax to disable a unified audit policy:

  ```
  NOAUDIT POLICY {policy_auditing | existing_audit_options};
  ```

  In this specification:

  - *`policy_auditing`* is the name of the policy. To find all currently enabled policies, query the `AUDIT_UNIFIED_ENABLED_POLICIES` data dictionary view. As part of this specification, you optionally can include the `BY` clause, but not the `EXCEPT` clause. See About Enabling Unified Audit Policies (audit_config.htm#GUID-8DBB6192-7587-4A4E-97C0-FE8B55FED731) for more information.
  - *`existing_audit_options`* refers to `AUDIT` options that were available in releases earlier than Oracle Database 12*c* Release 1 (12.1), such as the following:
    - `SELECT ANY TABLE, UPDATE ANY TABLE BY SCOTT, HR`
    - `UPDATE ON SCOTT.EMP`

Example: Disabling a Unified Audit Policy

The `NOAUDIT POLICY` statement disable a unified audit policy using filtering, such as by user name.

Example 22-39 (audit_config.htm#GUID-D7AAFA3F-CFAD-4CF4-A495-99826A36E965__CHDFFBJI)shows how to disable a unified audit policy for a user.

Example 22-39 Disabling a Unified Audit Policy

```
NOAUDIT POLICY dv_admin_pol BY tjones;
```

Dropping Unified Audit Policies

You can use the `DROP AUDIT POLICY` statement to drop a unified audit policy.

Topics:

- About Dropping Unified Audit Policies (audit_config.htm#GUID-CBC1FAB7-9F00-407B-992F-ED2459EC7007)
- Dropping a Unified Audit Policy (audit_config.htm#GUID-666180F8-B127-49BD-8E4A-68192CB417D6)
- Example: Disabling and Dropping a Unified Audit Policy (audit_config.htm#GUID-F64EBFC7-4278-446A-B0BF-79770E08D560)

About Dropping Unified Audit Policies

The `DROP AUDIT POLICY` statement can be used to unified audit policies.

If a unified audit policy is already enabled for a session, the effect of dropping the policy is not seen by this existing session. Until that time, the unified audit policy's settings remain in effect. For object-related unified audit policies, however, the effect is immediate.

You can find a list of existing unified audit policies by querying the `AUDIT_UNIFIED_POLICIES` data dictionary view.

When you disable an audit policy before dropping it, ensure that you disable it using the same settings that you used to enable it. For example, suppose you enabled the `logon_pol` policy as follows:

```
AUDIT POLICY logon_pol BY HR, OE;
```

Before you can drop it, your `NOAUDIT` statement must include the `HR` and `OE` users as follows:

```
NOAUDIT POLICY logon_pol BY HR, OE;
```

In a multitenant environment, you can drop a common audit policy only from the root and a local audit policy only from the PDB to which it applies.

Dropping a Unified Audit Policy

To drop a unified audit policy, you must first disable it, and then run the `DROP AUDIT POLICY` statement to remove it.

- Use the following the following syntax to drop a unified audit policy:

  `DROP AUDIT POLICY` *`policy_name`*`;`

In a multitenant environment, the unified audit policy drop applies to the current PDB. If the unified audit policy was created as a common unified audit policy, then you cannot drop it from the local PDB. See Using the Unified Audit Policies or AUDIT Settings in a Multitenant Environment (audit_config.htm#GUID-E02D0A5B-6591-4CD1-AF2B-29B0850BB6CB)for more information about common unified audit policies.

Example: Disabling and Dropping a Unified Audit Policy

The `NOAUDIT POLICY` and `DROP AUDIT POLICY` statements can disable and drop a unified audit policy.

Example 22-40 (audit_config.htm#GUID-F64EBFC7-4278-446A-B0BF-79770E08D560__CHDCGBGC)shows how to disable and drop a common unified audit policy.

Example 22-40 Disabling and Dropping a Unified Audit Policy

```
CONNECT c##sec_admin Enter password: password Connected. NOAUDIT POLICY dv_admin_pol;
DROP AUDIT POLICY dv_admin_pol
```

Tutorial: Auditing Nondatabase Users

This tutorial shows how to create a unified audit policy that audits a nondatabase user's actions, based on the identity set in the client identifier.

Topics:

- Step 1: Create the User Accounts and Ensure the User OE Is Active (audit_config.htm#GUID-E95290E1-784B-4F45-B0AE-9F0DA24D6047)
- Step 2: Create the Unified Audit Policy (audit_config.htm#GUID-BD6455E5-F800-4E76-9EF0-14D89DC98F94)
- Step 3: Test the Policy (audit_config.htm#GUID-34D98565-0DEA-47AE-B130-CC3F099BC51D)
- Step 4: Remove the Components of This Tutorial (audit_config.htm#GUID-C589E80C-BB0F-4E34-8E4E-F205F753949A)

Step 1: Create the User Accounts and Ensure the User OE Is Active

You must first create users and ensure that the user `OE` is active.

1. Log on as user `SYS` with the `SYSDBA` administrative privilege.

   ```
   sqlplus sys as sysdba Enter password: password
   ```

2. In a multitenant environment, connect to the appropriate PDB.
   For example:

   ```
   CONNECT SYS@hrpdb AS SYSDBA Enter password: password
   ```

   To find the available PDBs, query the `DBA_PDBS` data dictionary view. To check the current PDB, run the `show con_name` command.

3. Create the local user `policy_admin`, who will create the fine-grained audit policy.

   ```
   CREATE USER policy_admin IDENTIFIED BY password; GRANT CREATE SESSION,
   AUDIT_ADMIN TO policy_admin;
   ```

Replace *password* with a password that is secure. See Minimum Requirements for Passwords (authentication.htm#GUID-AA1AA635-1CD5-422E-B8CA-681ED7C253CA)for more information.

4. Create the local user account `auditor`, who will check the audit trail for this policy.

   ```
   CREATE USER policy_auditor IDENTIFIED BY password; GRANT CREATE SESSION,
   AUDIT_VIEWER TO policy_auditor;
   ```

5. The sample user `OE` will also be used in this tutorial, so query the `DBA_USERS` data dictionary view to ensure that `OE` is not locked or expired.

   ```
   SELECT USERNAME, ACCOUNT_STATUS FROM DBA_USERS WHERE USERNAME = 'OE';
   ```

   The account status should be `OPEN`. If the `DBA_USERS` view lists user `OE` as locked and expired, log in as user `SYSTEM` and then enter the following statement to unlock the `OE` account and create a new password:

   ```
   ALTER USER OE ACCOUNT UNLOCK IDENTIFIED BY password;
   ```

   Enter a password that is secure. For greater security, do **not** give the `OE` account the same password from previous releases of Oracle Database. Minimum Requirements for Passwords (authentication.htm#GUID-AA1AA635-1CD5-422E-B8CA-681ED7C253CA)for the minimum requirements for creating passwords.

Step 2: Create the Unified Audit Policy

Next, you are ready to create the unified audit policy.

1. Connect to SQL*Plus as user `policy_admin`.

   ```
   CONNECT policy_admin -- Or, CONNECT policy_admin@hrpdb Enter password: password
   ```

2. Create the following policy:

   ```
   CREATE AUDIT POLICY orders_unified_audpol ACTIONS INSERT ON OE.ORDERS, UPDATE ON
   OE.ORDERS, DELETE ON OE.ORDERS, SELECT ON OE.ORDERS WHEN
   'SYS_CONTEXT(''USERENV'', ''CLIENT_IDENTIFIER'') = ''robert''' EVALUATE PER
   STATEMENT; AUDIT POLICY orders_unified_audpol;
   ```

   In this example, the `AUDIT_CONDITION` parameter assumes that the nondatabase user is named `robert`. The policy will monitor any `INSERT`, `UPDATE`, `DELETE`, and `SELECT` statements that `robert` will attempt. Remember that the user's `CLIENT_IDENTITIFER` setting that you enter in the policy is case sensitive and that the policy only recognizes the case used for the identity that you specify here. In other words, later on, if the user session is set to `Robert` or `ROBERT`, the policy's condition will not be satisfied.

Step 3: Test the Policy

To test the policy, use `OE` must try to select from the `OE.ORDERS` table.

A unified auditing policy takes effect in the next user session for the users who are being audited. So, before their audit records can be captured, the users must connect to the database *after* the policy has been created.

1. Connect as user `OE` and select from the `OE.ORDERS` table.

   ```
   CONNECT OE -- Or, CONNECT OE@hrpdb Enter password: password SELECT COUNT(*) FROM
   ORDERS;
   ```

The following output appears:

```
COUNT(*) ---------- 105
```

2. Connect as user `policy_admin` and if necessary, run the following procedure.

   ```
   CONNECT policy_admin -- Or, CONNECT policy_admin@hrpdb Enter password: password
   EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
   ```

   If the audit trail mode is `QUEUED`, then audit records are not written to disk until the in-memory queues are full. This command explicitly flushes the queues to disk, so that you can see the audit trail records in the `UNIFIED_AUDIT_TRAIL` view.

3. Connect as user `policy_auditor` and then check if any audit records were generated.

   ```
   CONNECT policy_auditor -- Or, CONNECT policy_auditor@hrpdb Enter password:
   password col dbusername format a10 col client_identifier format a20 col sql_text
   format a29 SELECT DBUSERNAME, CLIENT_IDENTIFIER, SQL_TEXT FROM
   UNIFIED_AUDIT_TRAIL WHERE SQL_TEXT LIKE '%FROM ORDERS%';
   ```

   The following output appears:

   ```
   no rows selected
   ```

4. Reconnect as user `OE`, set the client identifier to `robert`, and then reselect from the `OE.ORDERS` table.

   ```
   CONNECT OE -- Or, CONNECT OE@hrpdb Enter password: password EXEC
   DBMS_SESSION.SET_IDENTIFIER('robert'); SELECT COUNT(*) FROM ORDERS;
   ```

   The following output should appear:

   ```
   COUNT(*) ---------- 105
   ```

5. Connect as user `policy_admin` and run the `DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL` procedure.

   ```
   CONNECT policy_admin -- Or, CONNECT policy_admin@hrpdb Enter password: password
   EXEC DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
   ```

6. Reconnect as user `auditor` and then check the audit trail again.

   ```
   CONNECT policy_auditor -- Or, CONNECT policy_auditor@hrpdb Enter password:
   password SELECT DBUSERNAME, CLIENT_IDENTIFIER, SQL_TEXT FROM UNIFIED_AUDIT_TRAIL
   WHERE SQL_TEXT LIKE '%FROM ORDERS%';
   ```

   This time, because `robert` has made his appearance and queried the `OE.ORDERS` table, the audit trail captures his actions:

   ```
   DBUSERNAME CLIENT_IDENTIFIER SQL_TEXT ---------- ---------------- --------------
   -------------- OE robert SELECT COUNT(*) FROM ORDERS;
   ```

Step 4: Remove the Components of This Tutorial

If you no longer need the components of this tutorial, then you can remove them.

1. Connect to SQL*Plus as user `policy_admin`, and then manually disable and drop the `orders_unified_audpol` policy.

```
CONNECT policy_admin -- Or, CONNECT policy_admin@hrpdb Enter password: password
NOAUDIT POLICY orders_unified_audpol; DROP AUDIT policy orders_unified_audpol;
```

(Unified audit policies reside in the SYS schema, not the schema of the user who created them.)

2. Connect to SQL*Plus as user SYSTEM.

   ```
   CONNECT SYSTEM -- Or, CONNECT SYSTEM@hrpdb Enter password: password
   ```

3. Drop users policy_admin and policy_auditor.

   ```
   DROP USER policy_admin; DROP USER policy_auditor;
   ```

4. If you want, lock and expire OE, unless other users want to use this account:

   ```
   ALTER USER OE PASSWORD EXPIRE ACCOUNT LOCK;
   ```

Auditing Activities with the Predefined Unified Audit Policies

Oracle Database provides five predefined unified audit policies, which cover commonly used security-relevant audit settings.

Topics:

- Logon Failures Predefined Unified Audit Policy (audit_config.htm#GUID-AC30632D-80E0-40BB-91AF-0416A904A707)
- Secure Options Predefined Unified Audit Policy (audit_config.htm#GUID-C0070008-D2BB-425A-9DC3-153FB1575445)
- Oracle Database Parameter Changes Predefined Unified Audit Policy (audit_config.htm#GUID-D522F093-3B4C-40EA-B1FE-EB604F55E689)
- User Account and Privilege Management Predefined Unified Audit Policy (audit_config.htm#GUID-C9780AC5-B722-482C-9697-B2799CC26D1D)
- Center for Internet Security Recommendations Predefined Unified Audit Policy (audit_config.htm#GUID-89871AE1-F8E3-4C48-B88F-3F2CD37BBF96)
- Oracle Database Real Application Security Predfined Audit Policies (audit_config.htm#GUID-F43C50E5-866F-43E8-908A-893E4FD6953E)
- Oracle Database Vault Predefined Unified Audit Policy (audit_config.htm#GUID-FCE001D0-77A8-4EB4-BDF5-2BEE6CA50828)

> **See Also:**
>
> Auditing Commonly Used Security-Relevant Activities (audit_config.htm#GUID-AB0FD41D-95E0-49D5-AB32-5354726B213D) for general steps for performing this type of auditing

Logon Failures Predefined Unified Audit Policy

The ORA_LOGON_FAILURES unified audit policy tracks failed logons only, but not any other kinds of logons.

For new databases, this policy is enabled by default for both pure unified auditing and mixed-mode auditing environments. By default, this policy is not enabled.

The following `CREATE AUDIT POLICY` statement shows the `ORA_LOGON_FAILURES` unified audit policy definition:

```
CREATE AUDIT POLICY ORA_LOGON_FAILURES ACTIONS LOGON;
```

You should enable the `ORA_LOGON_FAILURES` unified audit policy as follows:

```
AUDIT POLICY ORA_LOGON_FAILURES WHENEVER NOT SUCCESSFUL;
```

Secure Options Predefined Unified Audit Policy

The `ORA_SECURECONFIG` unified audit policy provides all the secure configuration audit options.

For new databases, this policy is enabled by default for both pure unified auditing and mixed-mode auditing environments. By default, this policy is not enabled.

The following `CREATE AUDIT POLICY` statement shows the `ORA_SECURECONFIG` unified audit policy definition.

```
CREATE AUDIT POLICY ORA_SECURECONFIG PRIVILEGES ALTER ANY TABLE, CREATE ANY TABLE,
DROP ANY TABLE, CREATE ANY PROCEDURE, DROP ANY PROCEDURE, ALTER ANY PROCEDURE, GRANT
ANY PRIVILEGE, GRANT ANY OBJECT PRIVILEGE, GRANT ANY ROLE, AUDIT SYSTEM, CREATE
EXTERNAL JOB, CREATE ANY JOB, CREATE ANY LIBRARY, EXEMPT ACCESS POLICY, CREATE USER,
DROP USER, ALTER DATABASE, ALTER SYSTEM, CREATE PUBLIC SYNONYM, DROP PUBLIC SYNONYM,
CREATE SQL TRANSLATION PROFILE, CREATE ANY SQL TRANSLATION PROFILE, DROP ANY SQL
TRANSLATION PROFILE, ALTER ANY SQL TRANSLATION PROFILE, TRANSLATE ANY SQL, EXEMPT
REDACTION POLICY, PURGE DBA_RECYCLEBIN, LOGMINING, ADMINISTER KEY MANAGEMENT ACTIONS
ALTER USER, CREATE ROLE, ALTER ROLE, DROP ROLE, SET ROLE, CREATE PROFILE, ALTER
PROFILE, DROP PROFILE, CREATE DATABASE LINK, ALTER DATABASE LINK, DROP DATABASE LINK,
CREATE DIRECTORY, DROP DIRECTORY, CREATE PLUGGABLE DATABASE, DROP PLUGGABLE DATABASE,
ALTER PLUGGABLE DATABASE, EXECUTE ON DBMS_RLS;
```

> **See Also:**
>
> *Oracle Database SQL Language Reference* (../SQLRF/toc.htm) for detailed information about the SQL statements described in this section

Oracle Database Parameter Changes Predefined Unified Audit Policy

The `ORA_DATABASE_PARAMETER` policy audits commonly used Oracle Database parameter settings.

The following `CREATE AUDIT POLICY` statement shows the `ORA_DATABASE_PARAMETER` unified audit policy definition. By default, this policy is not enabled.

```
CREATE AUDIT POLICY ORA_DATABASE_PARAMETER ACTIONS ALTER DATABASE, ALTER SYSTEM,
CREATE SPFILE;
```

User Account and Privilege Management Predefined Unified Audit Policy

The `ORA_ACCOUNT_MGMT` policy audits commonly used user account and privilege settings.

The following `CREATE AUDIT POLICY` statement shows the `ORA_ACCOUNT_MGMT` unified audit policy definition. By default, this policy is not enabled.

```
CREATE AUDIT POLICY ORA_ACCOUNT_MGMT ACTIONS CREATE USER, ALTER USER, DROP USER,
CREATE ROLE, DROP ROLE, ALTER ROLE, SET ROLE, GRANT, REVOKE;
```

Center for Internet Security Recommendations Predefined Unified Audit Policy

The `ORA_CIS_RECOMMENDATIONS` policy performs audits that the Center for Internet Security (CIS) recommends.

The following `CREATE AUDIT POLICY` statement shows the `ORA_CIS_RECOMMENDATIONS` unified audit policy definition. By default, this policy is not enabled.

```
CREATE AUDIT POLICY ORA_CIS_RECOMMENDATIONS PRIVILEGES SELECT ANY DICTIONARY, CREATE
ANY LIBRARY, DROP ANY LIBRARY, CREATE ANY TRIGGER, ALTER ANY TRIGGER, DROP ANY
TRIGGER, ALTER SYSTEM ACTIONS CREATE USER, ALTER USER, DROP USER, CREATE ROLE, DROP
ROLE, ALTER ROLE, GRANT, REVOKE, CREATE DATABASE LINK, ALTER DATABASE LINK, DROP
DATABASE LINK, CREATE PROFILE, ALTER PROFILE, DROP PROFILE, CREATE SYNONYM, DROP
SYNONYM, CREATE PROCEDURE, DROP PROCEDURE, ALTER PROCEDURE;
```

Oracle Database Real Application Security Predfined Audit Policies

You can use predefined unified audit policies for Oracle Database Real Application Security events. By default, these policies are not enabled.

Topics:

- System Administrator Operations Predefined Unified Audit Policy (audit_config.htm#GUID-58C36ADE-1718-4331-B490-DEA9062FC436)
- Session Operations Predefined Unified Audit Policy (audit_config.htm#GUID-C7FFDEB0-19B9-495C-89AC-BA1B584BA163)

> **See Also:**
>
> Auditing Oracle Database Real Application Security Events (audit_config.htm#GUID-4C76D168-B534-4E12-A4AA-B434FC3E3328)

System Administrator Operations Predefined Unified Audit Policy

The `ORA_RAS_POLICY_MGMT` predefined unified audit policy audits policies for all Oracle Real Application Security administrative actions on application users, roles, and policies.

The following `CREATE AUDIT POLICY` statement describes the `ORA_RAS_POLICY_MGMT` audit policy. By default, this policy is not enabled.

```
CREATE AUDIT POLICY ORA_RAS_POLICY_MGMT ACTIONS COMPONENT=XS CREATE USER, UPDATE USER,
DELETE USER, CREATE ROLE, UPDATE ROLE, DELETE ROLE, GRANT ROLE, REVOKE ROLE, ADD
PROXY, REMOVE PROXY, SET USER PASSWORD, SET USER VERIFIER, SET USER PROFILE, CREATE
ROLESET, UPDATE ROLESET, DELETE ROLESET, CREATE SECURITY CLASS, UPDATE SECURITY CLASS,
DELETE SECURITY CLASS, CREATE NAMESPACE TEMPLATE, UPDATE NAMESPACE TEMPLATE, DELETE
NAMESPACE TEMPLATE, CREATE ACL, UPDATE ACL, DELETE ACL, CREATE DATA SECURITY, UPDATE
DATA SECURITY, DELETE DATA SECURITY, ENABLE DATA SECURITY, DISABLE DATA SECURITY, ADD
GLOBAL CALLBACK, DELETE GLOBAL CALLBACK, ENABLE GLOBAL CALLBACK;
```

Session Operations Predefined Unified Audit Policy

The `ORA_RAS_SESSION_MGMT` predefined unified audit policy audits policies for all run-time Oracle Real Application Security session actions and namespace actions.

The following `CREATE AUDIT POLICY` statement describes the `ORA_RAS_SESSION_MGMT` policy. By default, this policy is not enabled.

```
CREATE AUDIT POLICY ORA_RAS_SESSION_MGMT ACTIONS COMPONENT=XS CREATE SESSION, DESTROY
SESSION, ENABLE ROLE, DISABLE ROLE, SET COOKIE, SET INACTIVE TIMEOUT, SWITCH USER,
ASSIGN USER, CREATE SESSION NAMESPACE, DELETE SESSION NAMESPACE, CREATE NAMESPACE
ATTRIBUTE, GET NAMESPACE ATTRIBUTE, SET NAMESPACE ATTRIBUTE, DELETE NAMESPACE
ATTRIBUTE;
```

Oracle Database Vault Predefined Unified Audit Policy

The `ORA_DV_AUDPOL` predefined unified audit policy audits Oracle Database Vault schema objects.

The `ORA_DV_AUDPOL` policy audits all actions that are performed on the Oracle Database Vault `DVSYS` and `DVF` schema objects and the Oracle Label Security `LBACSYS` schema objects. It does not capture actions on the `F$*` factor functions in the `DVF` schema. By default, this policy is not enabled.

The following `CREATE AUDIT POLICY` statement shows the `ORA_DV_AUDPOL` unified audit policy definition.

```
CREATE AUDIT POLICY ORA_DV_AUDPOL ACTIONS AUDIT ON DVF.DBMS_MACSEC_FUNCTION;
```

> **See Also:**
>
> Auditing Oracle Database Vault Events (audit_config.htm#GUID-909CE574-EEDA-45A9-960B-DFD7B8004010)

Auditing Specific Activities with Fine-Grained Auditing

Fine-grained auditing enables you to create audit policies at the granular level.

Topics:

- About Fine-Grained Auditing (audit_config.htm#GUID-88636FFA-3AE7-4794-8834-FF6803D42F7C)
- Where Are Fine-Grained Audit Records Stored? (audit_config.htm#GUID-A32CDCD7-64F6-49BF-9452-4EB01E8B23A2)
- Who Can Perform Fine-Grained Auditing? (audit_config.htm#GUID-B74CD330-19F3-4D56-8D0F-2AE21496E29E)

- Fine-Grained Auditing on Tables or Views That Have Oracle VPD Policies (audit_config.htm#GUID-3B052194-5985-4858-9182-07789AC1D686)
- Fine-Grained Auditing in a Multitenant Environment (audit_config.htm#GUID-6F15B297-08C6-4904-938D-3DAA429E14B0)
- Fine-Grained Audit Policies with Editions (audit_config.htm#GUID-10C0FEC8-CD6A-468C-805E-166B65482E20)
- Using the DBMS_FGA PL/SQL Package to Manage Fine-Grained Audit Policies (audit_config.htm#GUID-6F2F4D9E-408F-4C48-8ECB-B1E918456FE8)
- Tutorial: Adding an Email Alert to a Fine-Grained Audit Policy (audit_config.htm#GUID-AAE7D86F-4C64-402A-9D3E-BE7D13196E22)

> **See Also:**
>
> Auditing Specific, Fine-Grained Activities (audit_config.htm#GUID-88DA3AF8-5F6A-4C6E-80EE-F65071E5BF46) for general steps for performing this type of auditing

About Fine-Grained Auditing

Fine-grained auditing enables you to create policies that define specific conditions that must take place for the audit to occur.

You cannot create unified audit policies using fine-grained auditing but you can use fine-grained auditing to create very customized audit settings, such as auditing the times that data is accessed.

This enables you to monitor data access based on content. It provides granular auditing of queries, and `INSERT`, `UPDATE`, and `DELETE` operations. You can use fine-grained auditing to audit the following types of actions:

- Accessing a table between 9 p.m. and 6 a.m. or on Saturday and Sunday
- Using an IP address from outside the corporate network
- Selecting or updating a table column
- Modifying a value in a table column

In general, fine-grained audit policies are based on simple, user-defined SQL predicates on table objects as conditions for selective auditing. During fetching, whenever policy conditions are met for a row, the query is audited.

The audit policies described in Auditing Activities with Unified Audit Policies and the AUDIT Statement (audit_config.htm#GUID-A215CCAF-4AFF-448A-909C-736EBDED5A8A) can perform most of the operations that fine-grained audit policies can perform, except for the following actions:

- **Auditing specific columns.** You can audit specific relevant columns that hold sensitive information, such as salaries or Social Security numbers.
- **Using event handlers.** For example, you can write a function that sends an email alert to a security administrator when an audited column that should not be changed at midnight is updated.

> **Note:**

- Fine-grained auditing is supported only with cost-based optimization. For queries using rule-based optimization, fine-grained auditing checks before applying row filtering, which could result in an unnecessary audit event trigger.
- Policies currently in force on an object involved in a flashback query are applied to the data returned from the specified flashback snapshot based on time or system change number (SCN).
- If you want to use fine-grained auditing to audit data that is being directly loaded (for example, using Oracle Warehouse Builder to execute DML statements), then Oracle Database transparently makes all direct loads that are performed in the database instance into conventional loads. If you want to preserve the direct loading of data, consider using unified audit policies instead.

Where Are Fine-Grained Audit Records Stored?

Fine-grained auditing records are stored in the `AUDSYS` schema.

These audit records are stored in the `SYSAUX` tablespace by default. You can supply a new tablespace by using the `DBMS_AUDIT_MGMT.SET_AUDIT_TRAIL_LOCATION` procedure. This tablespace can be an encrypted tablespace. (For more information about this procedure, see *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/d_audit_mgmt.htm#ARPLS65427).) To find the records have been generated for the audit policies that are in effect, you can query `UNIFIED_AUDIT_TRAIL` data dictionary view. For detailed information about this view, see *Oracle Database Reference* (../REFRN/GUID-B7CE1C02-2FD4-47D6-80AA-CF74A60CDD1D.htm#REFRN29162) .

The audit trail captures an audit record for each reference of a table or a view within a SQL statement. For example, if you run a `UNION` statement that references the `HR.EMPLOYEES` table twice, then an audit policy for statement generates two audit records, one for each access of the `HR.EMPLOYEES` table.

> **See Also:**
>
> Activities That Are Mandatorily Audited (audit_admin.htm#GUID-AA781864-5756-464E-AFB6-675625AF0EF5)

Who Can Perform Fine-Grained Auditing?

Oracle provides roles for privileges needed to create fine-grained audit policies and to view and analyze fine-grained audit policy data.

The fine-grained audit privileges are as follows:

- To create fine-grained audit policies, you must be granted d the `AUDIT_ADMIN` role or the `EXECUTE` privilege on the `DBMS_FGA` package.
- To view and analyze fine-grained audit data, you must be granted the `AUDIT_VIEWER` role.

The PL/SQL package is already granted to `AUDIT_ADMIN` role. As with all privileges, grant these roles to trusted users only. You can find the roles that user have been granted by querying the `DBA_ROLE_PRIVS` data dictionary view.

Fine-Grained Auditing on Tables or Views That Have Oracle VPD Policies

The audit trail captures the VPD predicate for fine-grained audited tables or views that are included in an Oracle VPD policy.

This behavior is similar to how the unified audit trail captures the VPD predicate for unified audit policies.

The predicate information is stored in the `RLS_INFO` column of the `UNIFIED_AUDIT_TRAIL` data dictionary view.

If there are multiple VPD policies applied to the same table or view, then by default the predicates for these policies are concatenated in the `RLS_INFO` column. You can reformat the output so that each predicate is in its own row (identified by its corresponding VPD policy name and other information) by using the `ORA_GET_RLS_PREDICATE` function

Fine-Grained Auditing in a Multitenant Environment

You can create fine-grained audit policies in the root or in PDBs.

Note the following:

- You cannot create policies on `SYS` objects.
- When you create a policy in the root, the policy cannot be applied to all PDBs; it only applies to objects within the root. (In other words, there is no such thing as a common fine-grained audit policy.) If you want to create a fine-grained audit policy to audit a common object's access in all the PDBs, then you must explicitly create that policy in each PDB and then enable it on the common objects that is accessible in the PDB.
- When you create a policy in a PDB, it applies only to objects within the PDB.

Fine-Grained Audit Policies with Editions

You can prepare an application for edition-based redefinition, and cover each table that the application uses with an editioning view.

If you do this, then you must move the fine-grained audit polices that protect these tables to the editioning view. You can find information about the currently configured editions by querying the `DBA_EDITIONS` data dictionary view. To find information about fine-grained audit policies, query `DBA_AUDIT_POLICIES`.

Using the DBMS_FGA PL/SQL Package to Manage Fine-Grained Audit Policies

The `DBMS_FGA` PL/SQL package manages fine-grained audit policies.

Topics:

- About the DBMS_FGA PL/SQL PL/SQL Package (audit_config.htm#GUID-F5F9CA47-9B07-493D-BBCD-33BDE99AB4F0)
- The DBMS_FGA PL/SQL Package with Editions (audit_config.htm#GUID-F36956E6-EAD6-4346-81E7-F732D0AFE47B)
- The DBMS_FGA PL/SQL Package in a Multitenant Environment (audit_config.htm#GUID-D8BFA2C1-DB8B-4119-A1DD-17C810C5F462)
- Creating a Fine-Grained Audit Policy (audit_config.htm#GUID-374564C6-AF17-44EC-8710-2C8440C5478D)
- Example: Using DBMS_FGA.ADD_POLICY to Create a Fine-Grained Audit Policy (audit_config.htm#GUID-7B732634-57CC-475D-9652-632D6F957C51)

- Disabling a Fine-Grained Audit Policy (audit_config.htm#GUID-18B5BD55-1530-4392-B3C4-EF549868A8A0)
- Dropping a Fine-Grained Audit Policy (audit_config.htm#GUID-847B4705-8E04-4EFE-B116-2F2C1B42DF3F)

About the DBMS_FGA PL/SQL PL/SQL Package

The `DBMS_FGA` PL/SQL package can be used to combine statements into one policy and perform other fine-grained auditing management tasks.

However, unless you want to perform column-level auditing or use event handlers with your audit policy, you should create audit policies as described in Auditing Activities with Unified Audit Policies and the AUDIT Statement (audit_config.htm#GUID-A215CCAF-4AFF-448A-909C-736EBDED5A8A)

The `DBMS_FGA` PL/SQL package enables you to add all combinations of `SELECT`, `INSERT`, `UPDATE`, and `DELETE` statements to one policy. You also can audit `MERGE` statements, by auditing the underlying actions of `INSERT` and `UPDATE`. To audit `MERGE` statements, configure fine-grained access on the `INSERT` and `UPDATE` statements. Only one record is generated for each policy for successful `MERGE` operations.

To administer fine-grained audit policies, you must have be granted the `AUDIT_ADMIN` role. Note also that the `EXECUTE` privilege for the `DBMS_FGA` package is mandatorily audited.

The audit policy is bound to the table for which you created it. This simplifies the management of audit policies because the policy only needs to be changed once in the database, not in each application. In addition, no matter how a user connects to the database—from an application, a Web interface, or through SQL*Plus or Oracle SQL Developer—Oracle Database records any actions that affect the policy.

If any rows returned from a query match the audit condition that you define, then Oracle Database inserts an audit entry into the fine-grained audit trail. This entry excludes all the information that is reported in the regular audit trail. In other words, only one row of audit information is inserted into the audit trail for every fine-grained audit policy that evaluates to true.

For detailed information about the syntax of the `DBMS_FGA` package, see *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/d_fga.htm#ARPLS015).

The DBMS_FGA PL/SQL Package with Editions

You can create `DBMS_FGA` policies for use in an editions environment.

If you plan to use the `DBMS_FGA` package policy across different editions, then you can control the results of the policy: whether the results are uniform across all editions, or specific to the edition in which the policy is used.

See How Editions Affects the Results of a Global Application Context PL/SQL Package (app_context.htm#GUID-075BCAB6-8462-4825-B738-B81F31DF033A)for more information.

The DBMS_FGA PL/SQL Package in a Multitenant Environment

In a multitenant environment, the `DBMS_FGA` PL/SQL package applies only to the current local PDBs.

You cannot create one policy for the entire multitenant environment. The policy must be specific to objects within a PDB. To find PDBs, you can query the `DBA_PDBS` data dictionary view.

Creating a Fine-Grained Audit Policy

The `DBMS_FGA.ADD_POLICY` procedure enables you to create a fine-grained audit policy.

Topics:

- About Creating a Fine-Grained Audit Policy (audit_config.htm#GUID-FF8437E8-01A6-45BC-96E4-4985535D27EE)
- Syntax for Creating a Fine-Grained Audit Policy (audit_config.htm#GUID-367F0ED4-CCB2-497C-985A-491EACC3D4AC)
- Audits of Specific Columns and Rows (audit_config.htm#GUID-D1D70049-B084-454D-BB85-1ACDE86D10FC)

About Creating a Fine-Grained Audit Policy

The `DBMS_FGA.ADD_POLICY` procedure creates an audit policy using the supplied predicate as the audit condition.

By default, Oracle Database executes the policy predicate with the privileges of the user who owns the policy. The maximum number of fine-grained policies on any table or view object is 256. Oracle Database stores the policy in the data dictionary table, but you can create the policy on any table or view that is not in the `SYS` schema. In a multitenant environment, the fine grained policy is only created in the local PDB.

You cannot modify a fine-grained audit policy after you have created it. If you must modify the policy, then drop and recreate it.

You can find information about a fine-grained audit policy by querying the `ALL_AUDIT_POLICIES`, `DBA_AUDIT_POLICIES`, and `ALL_AUDIT_POLICIES` views. The `UNIFIED_AUDIT_TRAIL` view contains a column entitled `FGA_POLICY_NAME`, which you can use to filter out rows that were generated using a specific fine-grained audit policy.

Be aware that if a table column has a fine-grained audit policy, you cannot encrypt or decrypt this column (by using the `UPDATE` statement). To do so raises an `ORA-28133: full table access is restricted by fine-grained security` error. If you want to update the column, first temporarily disable the fine-grained audit policy and then encrypt or decrypt the column. Afterwards, re-enable the fine-grained audit policy. See Disabling a Fine-Grained Audit Policy (audit_config.htm#GUID-18B5BD55-1530-4392-B3C4-EF549868A8A0)for more information.

Syntax for Creating a Fine-Grained Audit Policy

The `DBMS_FGA.ADD_POLICY` procedure includes many settings, such as the ability to use a handler for complex auditing.

The `DBMS_FGA.ADD_POLICY` procedure syntax is as follows:

```
DBMS_FGA.ADD_POLICY( object_schema IN VARCHAR2 DEFAULT NULL object_name IN VARCHAR2,
policy_name IN VARCHAR2, audit_condition IN VARCHAR2 DEFAULT NULL, audit_column IN
VARCHAR2 DEFAULT NULL handler_schema IN VARCHAR2 DEFAULT NULL, handler_module IN
VARCHAR2 DEFAULT NULL, enable IN BOOLEAN DEFAULT TRUE, statement_types IN VARCHAR2
DEFAULT SELECT, audit_trail IN BINARY_INTEGER DEFAULT NULL, audit_column_opts IN
BINARY_INTEGER DEFAULT ANY_COLUMNS, policy_owner IN VARCHAR2 DEFAULT NULL);
```

In this specification:

- `object_schema` specifies the schema of the object to be audited. (If `NULL`, the current log-on user schema is assumed.)
- `object_name` specifies the name of the object to be audited.
- `policy_name` specifies the name of the policy to be created. Ensure that this name is unique.

- audit_condition specifies a Boolean condition in a row. NULL is allowed and acts as TRUE. See Audits of Specific Columns and Rows (audit_config.htm#GUID-D1D70049-B084-454D-BB85-1ACDE86D10FC) for more information. If you specify NULL or no audit condition, then any action on a table with that policy creates an audit record, whether or not rows are returned.

  Follow these guidelines:

  - Do not include functions, which execute the auditable statement on the same base table, in the audit_condition setting. For example, suppose you create a function that executes an INSERT statement on the HR.EMPLOYEES table. The policy's audit_condition contains this function and it is for INSERT statements (as set by statement_types). When the policy is used, the function executes recursively until the system has run out of memory. This can raise the error ORA-1000: maximum open cursors exceeded or ORA-00036: maximum number of recursive SQL levels (50) exceeded.

  - Do not issue the DBMS_FGA.ENABLE_POLICY or DBMS_FGA.DISABLE_POLICY statement from a function in a policy's condition.

- audit_column specifies one or more columns to audit, including hidden columns. If set to NULL or omitted, all columns are audited. These can include Oracle Label Security hidden columns or object type columns. The default, NULL, causes audit if any column is accessed or affected.

- handler_schema: If an alert is used to trigger a response when the policy is violated, specifies the name of the schema that contains the event handler. The default, NULL, uses the current schema. See also Tutorial: Adding an Email Alert to a Fine-Grained Audit Policy (audit_config.htm#GUID-AAE7D86F-4C64-402A-9D3E-BE7D13196E22).

- handler_module specifies the name of the event handler. Include the package the event handler is in. This function is invoked only after the first row that matches the audit condition in the query is processed.

  Follow these guidelines:

  - Do not create recursive fine-grained audit handlers. For example, suppose you create a handler that executes an INSERT statement on the HR.EMPLOYEES table. The policy that is associated with this handler is for INSERT statements (as set by the statement_types parameter). When the policy is used, the handler executes recursively until the system has run out of memory. This can raise the error ORA-1000: maximum open cursors exceeded or ORA-00036: maximum number of recursive SQL levels (50) exceeded.

  - Do not issue the DBMS_FGA.ENABLE_POLICY or DBMS_FGA.DISABLE_POLICY statement from a policy handler. Doing so can raise the ORA-28144: Failed to execute fine-grained audit handler error.

- enable enables or disables the policy using true or false. If omitted, the policy is enabled. The default is TRUE.

- statement_types: Specifies the SQL statements to be audited: INSERT, UPDATE, DELETE, or SELECT only. If you want to audit a MERGE operation, then set statement_types to 'INSERT,UPDATE'. The default is SELECT.

- audit_trail: If you have migrated to unified auditing, then Oracle Database ignores this parameter and writes the audit records immediately to the unified audit trail. If you have migrated to unified auditing, then omit this parameter.

Be aware that sensitive data, such as credit card information, can be recorded in clear text.

- `audit_column_opts`: If you specify more than one column in the `audit_column` parameter, then this parameter determines whether to audit all or specific columns. See Audits of Specific Columns and Rows (audit_config.htm#GUID-D1D70049-B084-454D-BB85-1ACDE86D10FC) for more information.

- `policy_owner` is the user who owns the fine-grained auditing policy. However, this setting is not a user-supplied argument. The Oracle Data Pump client uses this setting internally to recreate the fine-grained audit policies appropriately.

See *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/d_fga.htm#ARPLS225) for additional details about the `DBMS_FGA.ADD_POLICY` syntax.

Audits of Specific Columns and Rows

You can fine-tune the audit behavior by targeting a specific column, referred to as a *relevant column*, to be audited if a condition is met.

To accomplish this, you use the `audit_column` parameter to specify one or more sensitive columns. In addition, you can audit data in specific rows by using the `audit_condition` parameter to define a Boolean condition. (However, if your policy needs only to audit for conditions, consider using an audit policy condition described in Creating a Condition for a Unified Audit Policy (audit_config.htm#GUID-6801720F-6020-4608-93B9-C08478B36121).)

The following settings from Example 22-41 (audit_config.htm#GUID-7B732634-57CC-475D-9652-632D6F957C51__CEGBDHHI) enable you to perform an audit if anyone in Department 50 (`DEPARTMENT_ID = 50`) tries to access the `SALARY` and `COMMISSION_PCT` columns.

```
audit_condition => 'DEPARTMENT_ID = 50', audit_column => 'SALARY,COMMISSION_PCT,'
```

As you can see, this feature is enormously beneficial. It not only enables you to pinpoint particularly important types of data to audit, but it provides increased protection for columns that contain sensitive data, such as Social Security numbers, salaries, patient diagnoses, and so on.

If the `audit_column` lists more than one column, then you can use the `audit_column_opts` parameter to specify whether a statement is audited when the query references *any* column specified in the `audit_column` parameter or only when *all* columns are referenced. For example:

```
audit_column_opts => DBMS_FGA.ANY_COLUMNS, audit_column_opts => DBMS_FGA.ALL_COLUMNS,
```

If you do not specify a relevant column, then auditing applies to all columns.

For more information about the `audit_condition`, `audit_column`, and `audit_column_opts` parameters in the `DBMS_FGA.ADD_POLICY` procedure, see *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/d_fga.htm#ARPLS225). See also the usage notes for the `ADD_POLICY` procedure in that section.

Example: Using DBMS_FGA.ADD_POLICY to Create a Fine-Grained Audit Policy

The `DBMS_FGA.ADD_POLICY` procedure can create a fine-grained audit policy using multiple statement types.

Example 22-41 (audit_config.htm#GUID-7B732634-57CC-475D-9652-632D6F957C51__CEGBDHHI) shows how to audit statements `INSERT`, `UPDATE`, `DELETE`, and `SELECT` on table `HR.EMPLOYEES`.

Note that this example omits the `audit_column_opts` parameter, because it is not a mandatory parameter.

Example 22-41 Using DBMS_FGA.ADD_POLICY to Create a Fine-Grained Audit Policy

```
BEGIN DBMS_FGA.ADD_POLICY( object_schema => 'HR', object_name => 'EMPLOYEES',
policy_name => 'chk_hr_employees', audit_column => 'SALARY', enable => TRUE,
statement_types => 'INSERT, UPDATE, SELECT, DELETE'); END; /
```

After you create the policy, if you query the `DBA_AUDIT_POLICIES` view, you will find the new policy listed:

```
SELECT POLICY_NAME FROM DBA_AUDIT_POLICIES; POLICY_NAME ------------------------------
- CHK_HR_EMPLOYEES
```

Afterwards, any of the following SQL statements log an audit event record.

```
SELECT COUNT(*) FROM HR.EMPLOYEES WHERE COMMISSION_PCT = 20 AND SALARY > 4500; SELECT
SALARY FROM HR.EMPLOYEES WHERE DEPARTMENT_ID = 50; DELETE FROM HR.EMPLOYEES WHERE
SALARY > 1000000;
```

Disabling a Fine-Grained Audit Policy

The `DBMS_FGA.DISABLE_POLICY` procedure disables a fine-grained audit policy.

- Use the following syntax to disable a fine-grained audit policy:

  ```
  DBMS_FGA.DISABLE_POLICY( object_schema VARCHAR2, object_name VARCHAR2, policy_name
  VARCHAR2);
  ```

For example, to disable the fine-grained audit policy that was created in Example 22-41 (audit_config.htm#GUID-7B732634-57CC-475D-9652-632D6F957C51__CEGBDHHI).

```
BEGIN DBMS_FGA.DISABLE_POLICY( object_schema => 'HR', object_name => 'EMPLOYEES',
policy_name => 'chk_hr_employees'); END; /
```

For detailed information about the `DISABLE_POLICY` syntax, see *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/d_fga.htm#ARPLS226).

Enabling a Fine-Grained Audit Policy

The `DBMS_FGA.ENABLE_POLICY` procedure enables a fine-grained audit policy.

- Use the following syntax to enable a fine-grained audit policy:

  ```
  DBMS_FGA.ENABLE_POLICY( object_schema VARCHAR2, object_name VARCHAR2, policy_name
  VARCHAR2, enable BOOLEAN);
  ```

For example, to reenable the `chk_hr_emp` policy by using the `DBMS_FGA.ENABLE_POLICY` procedure

```
BEGIN DBMS_FGA.ENABLE_POLICY( object_schema => 'HR', object_name => 'EMPLOYEES',
policy_name => 'chk_hr_employees', enable => TRUE); END; /
```

For detailed information about the `ENABLE_POLICY` syntax, see *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/d_fga.htm#ARPLS228).

Dropping a Fine-Grained Audit Policy

The `DBMS_FGA.DROP_POLICY` procedure drops a fine-grained audit policy.

Oracle Database automatically drops the audit policy if you remove the object specified in the `object_name` parameter of the `DBMS_FGA.ADD_POLICY` procedure, or if you drop the user who created the audit policy.

- Use the following syntax to drop a fine-grained audit policy:

  ```
  DBMS_FGA.DROP_POLICY( object_schema VARCHAR2, object_name VARCHAR2, policy_name
  IVARCHAR2);
  ```

For example, to drop a fine-grained audit policy manually by using the `DBMS_FGA.DROP_POLICY` procedure:

```
BEGIN DBMS_FGA.DROP_POLICY( object_schema => 'HR', object_name => 'EMPLOYEES',
policy_name => 'chk_hr_employees'); END; /
```

See *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/d_fga.htm#ARPLS227)for detailed information about the `DROP_POLICY` syntax.

Tutorial: Adding an Email Alert to a Fine-Grained Audit Policy

This tutorial demonstrates how to create a fine-grained audit policy that generates an email alert when users violate the policy.

Topics:

About This Tutorial

This tutorial shows how you can add an email alert to a fine-grained audit policy that goes into effect when a user (or an intruder) violates the policy.

> **Note:**
>
> To complete this tutorial, you must use a database that has an SMTP server.

To add an email alert to a fine-grained audit policy, you first must create a procedure that generates the alert, and then use the following `DBMS_FGA.ADD_POLICY` parameters to call this function when someone violates this policy:

- `handler_schema`: The schema in which the handler event is stored
- `handler_module`: The name of the event handler

The alert can come in any form that best suits your environment: an email or pager notification, updates to a particular file or table, and so on. Creating alerts also helps to meet certain compliance regulations, such as California Senate Bill 1386. In this tutorial, you will create an email alert.

In this tutorial, you create an email alert that notifies a security administrator that a Human Resources representative is trying to select or modify salary information in the `HR.EMPLOYEES` table. The representative is permitted to make changes to this table, but to meet compliance regulations, we want to create a record of all salary selections and modifications to the table.

> **Note:**
> If you are using a multitenant environment, then this tutorial applies to the current PDB only.

Step 1: Install and Configure the UTL_MAIL PL/SQL Package

The `UTL_MAIL` PL/SQL manages email that includes commonly used email features, such as attachments, CC, and BCC.

You must install and configure this package before you can use it. It is not installed and configured by default.

1. Log on as user `SYS` with the `SYSDBA` administrative privilege.

   ```
   sqlplus sys as sysdba Enter password: password
   ```

2. In a multitenant environment, connect to the appropriate PDB.
   For example:

   ```
   CONNECT SYS@hrpdb AS SYSDBA Enter password: password
   ```

   To find the available PDBs, query the `DBA_PDBS` data dictionary view. To check the current PDB, run the `show con_name` command.

3. Install the `UTL_MAIL` package.

   ```
   @$ORACLE_HOME/rdbms/admin/utlmail.sql @$ORACLE_HOME/rdbms/admin/prvtmail.plb
   ```

   The `UTL_MAIL` package enables you to manage email. See *Oracle Database PL/SQL Packages and Types Reference* (../ARPLS/u_mail.htm#ARPLS384)for more information about `UTL_MAIL`.

   Be aware that currently, the `UTL_MAIL` PL/SQL package does not support SSL servers.

4. Check the current value of the `SMTP_OUT_SERVER` initialization parameter, and make a note of this value so that you can restore it when you complete this tutorial.
   For example:

   ```
   SHOW PARAMETER SMTP_OUT_SERVER
   ```

If the SMTP_OUT_SERVER parameter has already been set, then output similar to the following appears:

```
NAME TYPE VALUE ---------------------- ---------------- ----------------------
---------- SMTP_OUT_SERVER string some_imap_server.example.com
```

5. Issue the following ALTER SYSTEM statement:

   ```
   ALTER SYSTEM SET SMTP_OUT_SERVER="imap_mail_server.example.com";
   ```

   Replace *imap_mail_server.example.com* with the name of your SMTP server, which you can find in the account settings in your email tool. Enclose these settings in quotation marks. For example:

   ```
   ALTER SYSTEM SET SMTP_OUT_SERVER="my_imap_server.example.com";
   ```

6. Connect as SYS using the SYSOPER privilege and then restart the database.

   ```
   CONNECT SYS AS SYSOPER -- Or, CONNECT SYS@hrpdb AS SYSOPER Enter password:
   password SHUTDOWN IMMEDIATE STARTUP
   ```

7. Ensure that the SMTP_OUT_SERVER parameter setting is correct.

   ```
   CONNECT SYS AS SYSDBA -- Or, CONNECT SYS@hrpdb AS SYSDBA Enter password: password
   SHOW PARAMETER SMTP_OUT_SERVER
   ```

   Output similar to the following appears:

   ```
   NAME TYPE VALUE ---------------------- ---------------- ----------------------
   ---------- SMTP_OUT_SERVER string my_imap_server.example.com
   ```

Step 2: Create User Accounts

You must create an administrative account and an auditor user.

1. Ensure that you are connected as SYS using the SYSDBA administrative privilege, and then create the fga_admin user, who will create the fine-grained audit policy.
   For example:

   ```
   CONNECT SYS AS SYSDBA -- Or, CONNECT SYS@hrpdb AS SYSDBA Enter password: password
   CREATE USER fga_admin IDENTIFIED BY password; GRANT CREATE SESSION, CREATE
   PROCEDURE, AUDIT_ADMIN TO fga_admin; GRANT EXECUTE ON UTL_TCP TO fga_admin; GRANT
   EXECUTE ON UTL_SMTP TO fga_admin; GRANT EXECUTE ON UTL_MAIL TO fga_admin; GRANT
   EXECUTE ON DBMS_NETWORK_ACL_ADMIN TO fga_admin;
   ```

   Replace *password* with a password that is secure. See Minimum Requirements for Passwords (authentication.htm#GUID-AA1AA635-1CD5-422E-B8CA-681ED7C253CA) for more information.

   The UTL_TCP, UTL_SMTP, UTL_MAIL, and DBMS_NETWORK_ACL_ADMIN PL/SQL packages are used by the email security alert that you create.

2. Create the auditor user, who will check the audit trail for this policy.

   ```
   GRANT CREATE SESSION TO fga_auditor IDENTIFIED BY password; GRANT AUDIT_VIEWER TO
   fga_auditor;
   ```

3. Connect as user SYSTEM.

   ```
   CONNECT SYSTEM -- Or, CONNECT SYSTEM@hrpdb Enter password: password
   ```

4. Ensure that the HR schema account is unlocked and has a password. If necessary, unlock HR and grant this user a password.

   ```
   SELECT USERNAME, ACCOUNT_STATUS FROM DBA_USERS WHERE USERNAME = 'HR';
   ```

   The account status should be OPEN. If the DBA_USERS view lists user HR as locked and expired, then enter the following statement to unlock the HR account and create a new password:

   ```
   ALTER USER HR ACCOUNT UNLOCK IDENTIFIED BY password;
   ```

   Enter a password that is secure. For greater security, do **not** give the HR account the same password from previous releases of Oracle Database. Minimum Requirements for Passwords (authentication.htm#GUID-AA1AA635-1CD5-422E-B8CA-681ED7C253CA) for the minimum requirements for creating passwords.

5. Create a user account for Susan Mavris, who is an HR representative whose actions you will audit, and then grant this user access to the HR.EMPLOYEES table.

   ```
   GRANT CREATE SESSION TO smavris IDENTIFIED BY password; GRANT SELECT, INSERT,
   UPDATE, DELETE ON HR.EMPLOYEES TO SMAVRIS;
   ```

Step 3: Configure an Access Control List File for Network Services

An access control list (ACL) file can be used to enable fine-grained access to external network services.

Before you can use PL/SQL network utility packages such as UTL_MAIL, you must configure this type of access control list (ACL) file. For detailed information about this topic, see Managing Fine-Grained Access in PL/SQL Packages and Types (fine_grained_access.htm#GUID-B7DB516A-3245-417F-BB89-8E8212A97542)

1. Connect to SQL*Plus as user fga_admin.

   ```
   CONNECT fga_admin -- Or, CONNECT fga_admin@hrpdb Enter password: password
   ```

2. Configure the following access control setting and its privilege definitions.

   ```
   BEGIN DBMS_NETWORK_ACL_ADMIN.APPEND_HOST_ACE( host => 'SMTP_OUT_SERVER_setting',
   lower_port => 25, ace => xs$ace_type(privilege_list => xs$name_list('smtp'),
   principal_name => 'FGA_ADMIN', principal_type => xs_acl.ptype_db)); END; /
   ```

   In this example:

   - *SMTP_OUT_SERVER_setting*: Enter the SMTP_OUT_SERVER setting that you set for the SMTP_OUT_SERVER parameter in Step 1: Install and Configure the UTL_MAIL PL/SQL Package (audit_config.htm#GUID-A1927687-CA58-4B98-B902-5625DAB8C5E6) This setting should match exactly the setting that your email tool specifies for its outgoing server.

   - *lower_port*: Enter the port number that your email tool specifies for its outgoing server. Typically, this setting is 25. Enter this value for the lower_port setting. (Currently, the UTL_MAIL package does not support SSL. If your email server is an SSL server, then enter 25 for the port number, even if the email server uses a different port number.)

   - ace: Define the privileges here.

Step 4: Create the Email Security Alert PL/SQL Procedure

The email security alert PL/SQL procedure generates a message describing the violation and then sends this message to the appropriate users.

- As user `fga_admin`, create the following procedure.

```
CREATE OR REPLACE PROCEDURE email_alert (sch varchar2, tab varchar2, pol varchar2)
AS msg varchar2(20000) := 'HR.EMPLOYEES table violation. The time is: '; BEGIN msg
:= msg||TO_CHAR(SYSDATE, 'Day DD MON, YYYY HH24:MI:SS'); UTL_MAIL.SEND ( sender =>
'youremail@example.com', recipients => 'recipientemail@example.com', subject =>
'Table modification on HR.EMPLOYEES', message => msg); END email_alert; /
```

  In this example:

- `CREATE OR REPLACE PROCEDURE ...AS`: You must include a signature that describes the schema name (`sch`), table name (`tab`), and the name of the audit procedure (`pol`) that you will define in audit policy in the next step.

- `sender` and `recipients`: Replace *`youremail@example.com`* with your email address, and *`recipientemail@example.com`* with the email address of the person you want to receive the notification.

Step 5: Create and Test the Fine-Grained Audit Policy Settings

The fine-grained audit policy will trigger the alert when the policy is violated.

1. As user `fga_admin`, create the `chk_hr_emp` policy fine-grained audit policy as follows.

   ```
   BEGIN DBMS_FGA.ADD_POLICY ( object_schema => 'HR', object_name => 'EMPLOYEES',
   policy_name => 'CHK_HR_EMP', audit_column => 'SALARY', handler_schema =>
   'FGA_ADMIN', handler_module => 'EMAIL_ALERT', enable => TRUE, statement_types =>
   'SELECT, UPDATE'); END; /
   ```

2. Commit the changes you have made to the database.

   ```
   COMMIT;
   ```

3. Test the settings that you have created so far.

   ```
   EXEC email_alert ('hr', 'employees', 'chk_hr_emp');
   ```

   SQL*Plus should display a `PL/SQL procedure successfully completed` message, and in a moment, depending on the speed of your email server, you should receive the email alert.

   If you receive an `ORA-24247: network access denied by access control list (ACL)` error followed by `ORA-06512: at` *`string`*`line` *`string`* errors, then check the settings in the access control list file.

Step 6: Test the Alert

With the components in place, you are ready to test the alert.

1. Connect to SQL*Plus as user `smavris`, check your salary, and give yourself a nice raise.

   ```
   CONNECT smavris -- Or, CONNECT smavris@hrpdb Enter password: password SELECT
   SALARY FROM HR.EMPLOYEES WHERE LAST_NAME = 'Mavris'; SALARY ----------- 6500
   UPDATE HR.EMPLOYEES SET SALARY = 38000 WHERE LAST_NAME = 'Mavris';
   ```

By now, depending on the speed of your email server, you (or your recipient) should have received an email with the subject header `Table modification on HR.EMPLOYEES` notifying you of the tampering of the `HR.EMPLOYEES` table. Now all you need to do is to query the `UNIFIED_AUDIT_TRAIL` data dictionary view to find who the violator is.

2. If necessary, connect as user `fga_admin` and then execute the following procedure to write the audit records to disk:

   ```
   CONNECT fga_admin -- Or, CONNECT fga_admin@hrpdb Enter password: password EXEC
   DBMS_AUDIT_MGMT.FLUSH_UNIFIED_AUDIT_TRAIL;
   ```

3. As user `fga_auditor`, query the `UNIFIED_AUDIT_TRAIL` data dictionary view as follows:

   ```
   CONNECT fga_auditor -- Or, CONNECT fga_auditor@hrpdb Enter password: password col
   dbusername format a20 col sql_text format a66 col audit_type format a17 SELECT
   DBUSERNAME, SQL_TEXT, AUDIT_TYPE FROM UNIFIED_AUDIT_TRAIL WHERE OBJECT_SCHEMA =
   'HR' AND OBJECT_NAME = 'EMPLOYEES';
   ```

   Output similar to the following appears:

   ```
   DBUSERNAME SQL_TEXT AUDIT_TYPE ---------- ----------------------------------------
   ------------------------- ---------------- SMAVRIS UPDATE HR.EMPLOYEES SET
   SALARY = 38000 WHERE LAST_NAME = 'Mavris' FineGrainedAudit
   ```

   The audit trail captures the SQL statement that Susan Mavris ran that affected the `SALARY` column in the `HR.EMPLOYEES` table. The first statement she ran, in which she asked about her current salary, was not recorded because it was not affected by the audit policy. This is because Oracle Database executes the audit function as an autonomous transaction, committing only the actions of the `handler_module` setting and not any user transaction. The function has no effect on any user SQL transaction.

Step 7: Remove the Components of This Tutorial

If you no longer need the components of this tutorial, then you can remove them.

1. Connect to SQL*Plus as user `SYSTEM` privilege, and then drop users `fga_admin` (including the objects in the `fga_admin` schema), `fga_auditor`, and `smavris`.

   ```
   CONNECT SYSTEM -- Or, CONNECT SYSTEM@hrpdb Enter password: password DROP USER
   fga_admin CASCADE; DROP USER fga_auditor; DROP USER smavris;
   ```

2. Connect as user `HR` and remove the loftiness of Susan Mavris's salary.

   ```
   CONNECT HR -- Or, CONNECT HR@hrpdb Enter password: password UPDATE HR.EMPLOYEES
   SET SALARY = 6500 WHERE LAST_NAME = 'Mavris';
   ```

3. If you want, lock and expire `HR`, unless other users want to use this account:

   ```
   ALTER USER HR PASSWORD EXPIRE ACCOUNT LOCK;
   ```

4. Issue the following `ALTER SYSTEM` statement to restore the `SMTP_OUT_SERVER` parameter to the previous value, from Step 5 (audit_config.htm#GUID-A1927687-CA58-4B98-B902-5625DAB8C5E6__BCGDIDAI) under Step 1: Install and Configure the UTL_MAIL PL/SQL Package (audit_config.htm#GUID-A1927687-CA58-4B98-B902-5625DAB8C5E6):

   ```
   ALTER SYSTEM SET SMTP_OUT_SERVER="previous_value";
   ```

   Enclose this setting in quotation marks. For example:

   ```
   ALTER SYSTEM SET SMTP_OUT_SERVER="some_imap_server.example.com"
   ```

5. Restart the database instance.

Audit Policy Data Dictionary Views

Oracle Database provides data dictionary and dynamic views provide auditing information.

Table 22-19 (audit_config.htm#GUID-3793F7A1-1679-4AC5-9DA3-61E30EE92035__BCGJJAFI) lists these views. For detailed information about these views, see *Oracle Database Reference.* (../REFRN/toc.htm)

> **Tip:**
> To find error information about audit policies, check the trace files. The `USER_DUMP_DEST` initialization parameter sets the location of the trace files.

Table 22-19 Views That Display Information about Audited Activities

View	Description
`ALL_AUDIT_POLICIES`	Displays information about all fine-grained audit policies
`ALL_DEF_AUDIT_OPTS`	Lists default object-auditing options that are to be applied when objects are created
`AUDIT_UNIFIED_CONTEXTS`	Describes application context values that have been configured to be captured in the audit trail
`AUDIT_UNIFIED_ENABLED_POLICIES`	Describes all unified audit policies that are enabled in the database
`AUDIT_UNIFIED_POLICIES`	Describes all unified audit policies created in the database
`AUDIT_UNIFIED_POLICY_COMMENTS`	Shows the description of each unified audit policy, if a description was entered for the unified audit policy using the `COMMENT` SQL statement
`AUDITABLE_SYSTEM_ACTIONS`	Maps the auditable system action numbers to the action names
`CDB_UNIFIED_AUDIT_TRAIL`	Similar to the `UNIFIED_AUDIT_TRAIL` view, displays the audit records but from all PDBs in a multitenant environment. This view is available only in the root and must be queried from there.
`DBA_AUDIT_POLICIES`	Displays information about fine-grained audit policies

View	Description
DBA_SA_AUDIT_OPTIONS	Describes audited Oracle Label Security events performed by users, and indicates if the user's action failed or succeeded
DBA_XS_AUDIT_TRAIL	Displays audit trail information related to Oracle Database Real Application Security
DV$CONFIGURATION_AUDIT	Displays configuration changes made by Oracle Database Vault administrators
DV$ENFORCEMENT_AUDIT	Displays user activities that are affected by Oracle Database Vault policies
SYSTEM_PRIVILEGE_MAP (table)	Describes privilege (auditing option) type codes. This table can be used to map privilege (auditing option) type numbers to type names.
USER_AUDIT_POLICIES	Displays information about all fine-grained audit policies on table and views owned by the current user
UNIFIED_AUDIT_TRAIL	Displays all audit records
V$OPTION	You can query the PARAMETER column for Unified Auditing to find if unified auditing is enabled
V$XML_AUDIT_TRAIL	Displays standard, fine-grained, SYS, and mandatory audit records written in XML format files.