30

Creating Custom Unified Audit Policies

Oracle Database provides the flexibility to create and manage custom unified audit policies for your specialized needs.

- About Custom Unified Audit Policies
  You can create custom unified audit policies for specialized needs that are typically not met with predefined unified audit policies.
- Best Practices for Creating Custom Unified Audit Policies
  You can optimize the number of enabled policies as a best practice though you can enable multiple policies at a time in the database.
- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the `CREATE AUDIT POLICY` statement.
- Auditing Standard Oracle Database Components
  You can create unified audit policies to monitor components such as roles, system privileges, administrative users, and actions performed on objects such as tables.
- Unified Auditing with Configurable Conditions
  You can use the `CREATE AUDIT POLICY` statement to create conditions for a unified audit policy.
- Auditing for Multitier or Multitenant Configurations
  You can create unified audit policies using conditions and application contexts, and in multitier and multitenant environments.
- Extending Unified Auditing to Capture Custom Attributes
  You can extend the unified audit trail to capture custom attributes by auditing application context values.
- Auditing Components of Other Oracle Products and Features
  You can create unified audit policies for Oracle products and features such as Oracle Database Vault, Oracle Real Application Security, Oracle Data Pump, and Oracle Machine Learning for SQL events.
- Managing Unified Audit Policies
  After you create a unified audit policy, you must enable it. You can alter disable, and drop unified audit policies.
- Tutorial: Auditing Nondatabase Users
  Auditing nondatabase users who are typical application service accounts is crucial. They are identified in the database using the `CLIENT_IDENTIFIER` attribute.
- Unified Audit Policy Data Dictionary Views
  You can query data dictionary and dynamic views to find detailed auditing information about custom unified audit policies.

30.1 About Custom Unified Audit Policies

You can create custom unified audit policies for specialized needs that are typically not met with predefined unified audit policies.

For example, you may have the following audit requirements:

- Audit access to the database from untrusted database connection paths.
- Audit access to specific sensitive database objects.
- Audit use of certain system privileges.

To create the unified audit policy, you use the `CREATE AUDIT POLICY` statement. The `AUDIT` and `NOAUDIT` SQL statements enable and disable audit policies respectively. The `AUDIT` statement also lets you include or exclude specific users for the policy.

You can have more than one custom unified audit policy effective at any given time. An audit policy can contain both system-wide and object-specific audit options. To find system actions to audit, you can query the `AUDITABLE_SYSTEM_ACTIONS` system table.

30.2 Best Practices for Creating Custom Unified Audit Policies

You can optimize the number of enabled policies as a best practice though you can enable multiple policies at a time in the database.

This optimization 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 makes the internal audit check functionality more efficient, which determines whether to generate an audit record for its associated event.
- If you have configured a unified audit policy for `LOGON` statements, then audit records for both direct logins as well as `ALTER SESSION` and `SET CONTAINER` statements are generated.

The unified audit policy syntax is designed to group multiple audit settings in a single policy. Refer to predefined audit policies of Oracle Database to see how multiple audit settings are grouped within one unified audit policy.

Related Topics

- Auditing Activities with the Predefined Unified Audit Policies
  Oracle Database provides predefined unified audit policies that cover commonly used security-relevant audit settings.

30.3 Syntax for Creating a Custom Unified Audit Policy

To create a custom 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 30-1 shows the syntax for the `CREATE AUDIT POLICY` statement.

Example 30-1 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}]
    [ONLY TOPLEVEL]
    [CONTAINER = {CURRENT | ALL}];
```

In this specification:

- *privilege_audit_clause* describes privilege-related audit options. 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. 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. 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 ] |
     ACTIONS COMPONENT=PROTOCOL [ HTTP | FTP ] |
     ACTIONS COMPONENT=SQL_FIREWALL [SQL VIOLATION | CONTEXT VIOLATION | ALL]
```

- *role_audit_clause* enables you to audit roles. 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. The syntax is:

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

- `ONLY TOPLEVEL` allows users to audit only the top-level operations that are performed for the actions that were configured as part of this audit policy.
- `CONTAINER`, allows users to specify if the audit policy will apply to the current CDB or application PDB (`CURRENT`) or across the entire multitenant environment (`ALL`).

  However, `CONTAINER=ALL` is only applicable to common objects and only common audit policies can be created to audit common objects.

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`.

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.

Related Topics

- Auditing System Privileges
  You can use the `CREATE AUDIT POLICY` statement to audit system privileges.
- Auditing Object Actions
  You can use the `CREATE AUDIT POLICY` statement to audit object actions.
- Creating Custom Unified Audit Policies
  Oracle Database provides the flexibility to create and manage custom unified audit policies for your specialized needs.
- Auditing Roles
  You can use the `CREATE AUDIT POLICY` statement to audit database roles.
- Unified Auditing with Configurable Conditions
  You can use the `CREATE AUDIT POLICY` statement to create conditions for a unified audit policy.
- Auditing in a Multitenant Deployment
  You can create unified audit policies for individual PDBs and in the root.
- Auditing Only Top-Level Statements
  You can audit top-level user-initiated SQL or PL/SQL statements to reduce audit volume.
- Enabling and Applying Unified Audit Policies to Users and Roles
  You can use the `AUDIT POLICY` statement to enable and apply unified audit policies to users and roles.

30.4 Auditing Standard Oracle Database Components

You can create unified audit policies to monitor components such as roles, system privileges, administrative users, and actions performed on objects such as tables.

- Auditing Roles
  You can use the `CREATE AUDIT POLICY` statement to audit database roles.
- Auditing System Privileges
  You can use the `CREATE AUDIT POLICY` statement to audit system privileges.
- Auditing Administrative Users
  You can create unified audit policies to capture the actions of administrative user accounts, such as `SYS`.
- Auditing Object Actions
  You can use the `CREATE AUDIT POLICY` statement to audit object actions.
- Auditing the READ ANY TABLE and SELECT ANY TABLE Privileges
  The `CREATE AUDIT POLICY` statement can audit the `READ ANY TABLE` and `SELECT ANY TABLE` privileges.
- Auditing Only Top-Level Statements
  You can audit top-level user-initiated SQL or PL/SQL statements to reduce audit volume.

30.4.1 Auditing Roles

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

- About Role Auditing
  Role auditing audits all system privileges that have been assigned directly (or indirectly) to the role if that system privilege is used. This type of auditing does not audit the use of privileges apart from system privileges.
- 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.
- Example: Auditing the Predefined Common DBA Role
  The `CREATE AUDIT POLICY` statement can audit roles in both the root and in PDBs.

30.4.1.1 About Role Auditing

Role auditing audits all system privileges that have been assigned directly (or indirectly) to the role if that system privilege is used. This type of auditing does not audit the use of privileges apart from system privileges.

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.

> **Note:**
>
> Role auditing will audit all the system privileges that are assigned directly (or indirectly) to the role if a user uses that system privilege.

Related Topics

- Predefined Roles in an Oracle Database Installation
  Oracle Database provides a set of predefined roles to help in database administration.

30.4.1.2 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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the `CREATE AUDIT POLICY` statement.

30.4.1.3 Example: Auditing the Predefined Common DBA Role

The `CREATE AUDIT POLICY` statement can audit roles in both the root and in PDBs.

The following example shows how to audit a predefined common role `DBA`.

Example 30-2 Auditing the Predefined Common DBA Role

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

AUDIT POLICY role_dba_audit_pol;
```

30.4.2 Auditing System Privileges

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

- About System Privilege Auditing
  System privilege auditing audits activities that successfully use a system privilege, such as `READ ANY TABLE`.
- System Privileges That Can Be Audited
  To find a list of auditable system privileges, you can query the `SYSTEM_PRIVILEGE_MAP` table.
- System Privileges That Cannot Be Audited
  A few system privileges cannot be audited.
- Configuring a Unified Audit Policy to Capture System Privilege Use
  The `PRIVILEGES` clause in the `CREATE AUDIT POLICY` statement audits system privilege use.
- Example: Auditing a User Who Has ANY Privileges
  The `CREATE AUDIT POLICY` statement can audit users for `ANY` privileges.
- 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.
- How System Privilege Unified Audit Policies Appear in the Audit Trail
  The `UNIFIED_AUDIT_TRAIL` data dictionary view lists system privilege audit events.

30.4.2.1 About System Privilege Auditing

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

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.

> **Note:**
>
> Use privilege analysis in the Oracle database to find the system privileges which are used and unused..

Related Topics

- Auditing Object Actions
  You can use the `CREATE AUDIT POLICY` statement to audit object actions.
- Performing Privilege Analysis to Identify Privilege Use
  Privilege analysis dynamically analyzes the privileges and roles that users use and do not use.

30.4.2.2 System Privileges That Can Be Audited

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 `SCOTT` 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.

30.4.2.3 System Privileges That Cannot Be Audited

A few system privileges cannot be audited.

These privileges are:

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

- TRANSLATE SQL

30.4.2.4 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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the CREATE AUDIT POLICY statement.

30.4.2.5 Example: Auditing a User Who Has ANY Privileges

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

Example 30-3 shows how to audit several ANY privileges of the user HR_MGR.

Example 30-3 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;
```

30.4.2.6 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 30-4 shows how to use a condition to audit privileges that are used by two operating system users, psmith and jrawlins.

Example 30-4 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;
```

30.4.2.7 How System Privilege Unified Audit Policies Appear in the Audit Trail

The UNIFIED_AUDIT_TRAIL data dictionary view lists system privilege audit events.

The following example 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.

Related Topics

- Auditing the READ ANY TABLE and SELECT ANY TABLE Privileges
  The `CREATE AUDIT POLICY` statement can audit the `READ ANY TABLE` and `SELECT ANY TABLE` privileges.

30.4.3 Auditing Administrative Users

You can create unified audit policies to capture the actions of administrative user accounts, such as `SYS`.

- Administrative User Accounts That Can Be Audited
  Oracle Database provides administrative user accounts that are associated with administrative privileges.
- Configuring a Unified Audit Policy to Capture Administrator Activities
  The `CREATE AUDIT POLICY` statement can audit administrative users.
- Example: Auditing the SYS User
  The `CREATE AUDIT POLICY` statement can audit the `SYS` user.

30.4.3.1 Administrative User Accounts That Can Be Audited

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

Table 30-1 lists default administrative user accounts and the administrative privileges with which they are typically associated.

Table 30-1 Administrative Users and Administrative Privileges

Administrative User Account	Administrative Privilege
SYS	SYSDBA
PUBLIC[1]	SYSOPER
SYSASM	SYSASM
SYSBACKUP	SYSBACKUP
SYSDG	SYSDG
SYSKM	SYSKM

[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.

Related Topics

- Activities That Are Mandatorily Audited
  Certain security sensitive database activities are always audited and such audit configurations cannot be disabled.

30.4.3.2 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.

30.4.3.3 Example: Auditing the SYS User

The CREATE AUDIT POLICY statement can audit the SYS user.

Example 30-5 shows how to audit grants of the DBMS_FGA PL/SQL package by user SYS.

Example 30-5 Auditing the SYS User

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

AUDIT POLICY dbms_fga_grants BY SYS;
```

30.4.4 Auditing Object Actions

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

- About Auditing Object Actions
  You can audit actions performed on specific objects, such as UPDATE statements on the HR.EMPLOYEES table.
- 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).
- Guidelines for Column Level Auditing and Virtual Columns
  When you create unified audit policies for columns, you should be aware of guidelines for handling virtual columns.
- Configuring an Object Action Unified Audit Policy
  The ACTIONS clause in the CREATE AUDIT POLICY statement creates a policy that captures object actions.
- Example: Auditing Actions on SYS Objects
  The CREATE AUDIT POLICY statement can audit actions on SYS objects.
- Example: Auditing Multiple Actions on One Object
  The CREATE AUDIT POLICY statement can audit multiple actions on one object.
- Example: Auditing GRANT and REVOKE Operations on an Object
  The CREATE AUDIT POLICY statement can audit GRANT and REVOKE operations on objects, such as tables.

- 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: Auditing an Action on a Table Column
  The `CREATE AUDIT POLICY` statement can audit actions on table or view columns.
- Example: Auditing All Actions on a Table
  The `CREATE AUDIT POLICY` statement can audit all actions on a table.
- Example: Auditing All Actions in the Database
  The `CREATE AUDIT POLICY` statement can audit all actions in the database.
- How Object Action Unified Audit Policies Appear in the Audit Trail
  The `UNIFIED_AUDIT_TRAIL` data dictionary view lists object action audit events.
- Auditing Functions, Procedures, Packages, and Triggers
  You can audit functions, procedures, PL/SQL packages, and triggers.
- Auditing of Oracle Virtual Private Database Predicates
  The unified audit trail automatically captures the predicates that are used in Oracle Virtual Private Database (VPD) policies.
- Audit Policies for Oracle Virtual Private Database Policy Functions
  Auditing can affect dynamic VPD policies, static VPD policies, and context-sensitive VPD policies.
- Unified Auditing with Editioned Objects
  An audit policy created to audit an action on an editioned object will be applied to all its editions.

30.4.4.1 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.

For tables that contain sensitive information, Oracle recommends that you include the `ACTIONS ALL` clause in the unified audit policy so that the audit record will capture indirect `SELECT` operations.

30.4.4.2 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 30-2 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 30-2 Object-Level Standard Database Action Audit Option

Object	SQL Action That Can Be Audited
Directory	`AUDIT`, `GRANT`, `READ`
Function	`AUDIT`, `EXECUTE`, `GRANT`

Table 30-2 (Cont.) Object-Level Standard Database Action Audit Option

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

Related Topics

- Auditing Functions, Procedures, Packages, and Triggers
  You can audit functions, procedures, PL/SQL packages, and triggers.
- Audit Policies for Oracle Virtual Private Database Policy Functions
  Auditing can affect dynamic VPD policies, static VPD policies, and context-sensitive VPD policies.
- Guidelines for Column Level Auditing and Virtual Columns
  When you create unified audit policies for columns, you should be aware of guidelines for handling virtual columns.

30.4.4.3 Guidelines for Column Level Auditing and Virtual Columns

When you create unified audit policies for columns, you should be aware of guidelines for handling virtual columns.

- An audit record is not be generated if an audit policy is defined on a virtual column and the base column is updated, causing an update to the virtual column.

  For example, suppose a table has a column `col1` and a virtual column `c_vir`. Depending on the value of `col1`, a column level audit policy defined on `c_vir` for action update will not generate an audit record when `col1` is updated, causing an update to `c_vir`. The same behavior is true for `INSERT` operation.

- If the value of a column is accessed through a virtual column, then an audit record is generated.

  For example, suppose a table has a column `col1` and a virtual column `c_vir`. Depending on the value of `col1`, a column level unified audit policy is defined on `col1`. In this case, accessing `c_vir` generates a unified audit record.

30.4.4.4 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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the `CREATE AUDIT POLICY` statement.

30.4.4.5 Example: Auditing Actions on SYS Objects

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

Example 30-6 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 30-6 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;
```

30.4.4.6 Example: Auditing Multiple Actions on One Object

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

Example 30-7 shows how to audit multiple SQL statements performed by users `jrandolph` and `phawkins` on the `app_lib` library.

Example 30-7 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;
```

30.4.4.7 Example: Auditing GRANT and REVOKE Operations on an Object

The `CREATE AUDIT POLICY` statement can audit `GRANT` and `REVOKE` operations on objects, such as tables.

Enabling auditing on `GRANT` operations on an object automatically enables the audit of `REVOKE` operations on the object as well.

Example 30-8 Auditing GRANT and REVOKE Operations

```
CREATE AUDIT POLICY grant_revoke_pol
ACTIONS GRANT ON HR.EMPLOYEES;

AUDIT POLICY grant_revoke_pol;
```

The `UNIFIED_AUDIT_TRAIL` view captures the relevant information for a grant operation as shown in the following query. The grantee name (to whom the privilege is granted) is recorded in the `TARGET_USER` column.

```
SELECT DBUSERNAME, OBJECT_PRIVILEGES, ACTION_NAME, OBJECT_SCHEMA, OBJECT_NAME,
TARGET_USER
FROM UNIFIED_AUDIT_TRAIL
WHERE ACTION_NAME IN ('GRANT', 'REVOKE');
```

30.4.4.8 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 30-9 shows how all `EXECUTE` and `GRANT` statements on the `app_lib` library using the `CREATE LIBRARY` privilege are audited.

Example 30-9 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.

30.4.4.9 Example: Auditing an Action on a Table Column

The `CREATE AUDIT POLICY` statement can audit actions on table or view columns.

Example 30-10 shows how to create an audit policy that audits `SELECT` statements on the `SALARY` column of the `HR.EMPLOYEES` table.

Example 30-10 Auditing Actions on a Table Column

```
CREATE AUDIT POLICY emp_hr_emp_sal_access_pol
 ACTIONS SELECT(SALARY) ON HR.EMPLOYEES;

AUDIT POLICY emp_hr_emp_sal_access_pol;
```

30.4.4.10 Example: Auditing All Actions on a Table

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

You can use the ALL keyword to audit all actions. Oracle recommends that you audit all actions only on sensitive objects. ALL is useful in that it captures indirect SELECT operations. Example 30-11 shows how to audit all actions on the HR.EMPLOYEES table by user pmulligan.

Example 30-11 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 BY pmulligan;
```

Related Topics

- Example: Auditing All Actions in the Database
  The CREATE AUDIT POLICY statement can audit all actions in the database.

30.4.4.11 Example: Auditing All Actions in the Database

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

Ensure that you include the ONLY TOPLEVEL clause to audit only the top-level user initiated actions. Consider adding conditions when you use the ACTIONS ALL clause to further reduce the audit volume.

> **Note:**
>
> Use ACTIONS ALL auditing with caution. Do not enable it for users who must perform online transaction processing (OLTP) workloads. This will avoid generating a large number of audit records.

Example 30-12 shows how to audit all actions in the entire database.

Example 30-12 Auditing All Actions in the Database

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

AUDIT POLICY all_actions_pol;
```

Related Topics

- Unified Auditing with Configurable Conditions
  You can use the CREATE AUDIT POLICY statement to create conditions for a unified audit policy.

30.4.4.12 How Object Action Unified Audit Policies Appear in the Audit Trail

The UNIFIED_AUDIT_TRAIL data dictionary view lists object action audit events.

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
```

30.4.4.13 Auditing Functions, Procedures, Packages, and Triggers

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

Points to consider:

- 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.

30.4.4.14 Auditing of Oracle Virtual Private Database Predicates

The unified audit trail automatically captures the predicates that are used in Oracle Virtual Private Database (VPD) policies.

You do not need to create a unified audit policy to capture the VPD predicate audit information.

This type of audit enables you to identify the predicate expression that was run as part of a DML operation and thereby help you to identify other actions that may have occurred as part of the DML operation. For example, if a malicious attack on your database is performed using a VPD predicate, then you can track the attack by using the unified audit trail. In addition to predicates from user-created VPD policies, the internal predicates from Oracle Label Security and Oracle Real Application Security policies are captured as well. For example, Oracle Label Security internally creates a VPD policy while applying an OLS policy to a table. Oracle Real Application Security generates a VPD policy while enabling an Oracle RAS policy.

The unified audit trail writes this predicate information to the `RLS_INFO` column of the `UNIFIED_AUDIT_TRAIL` data dictionary view. If you have fine-grained audit policies, then the `RLS_INFO` column of these views captures VPD predicate information as well.

The audit trail can capture the predicates and their corresponding policy names if multiple VPD policies are enforced on the object. The audit trail captures the policy schema and policy name to enable you to differentiate predicates that are generated from different policies. By default, this information is concatenated in the `RLS_INFO` column, but Oracle Database provides a function in the `DBMS_AUDIT_UTIL` PL/SQL package that enables you to reformat the results in an easy-to-read format.

The following example shows how you can audit the predicates of a VPD policy:

1. Create the following VPD policy function:

```
CREATE OR REPLACE FUNCTION auth_orders(
  schema_var IN VARCHAR2,
  table_var  IN VARCHAR2
 )
 RETURN VARCHAR2
 IS
  return_val VARCHAR2 (400);
 BEGIN
  return_val := 'SALES_REP_ID = 159';
  RETURN return_val;
 END auth_orders;
/
```

2. Create the following VPD policy:

```
BEGIN
  DBMS_RLS.ADD_POLICY (
    object_schema    => 'oe',
    object_name      => 'orders',
    policy_name      => 'orders_policy',
    function_schema  => 'sec_admin',
    policy_function  => 'auth_orders',
    statement_types  => 'select, insert, update, delete'
   );
 END;
/
```

3. Create and enable the following the unified audit policy:

```
CREATE AUDIT POLICY oe_pol
 ACTIONS SELECT ON OE.ORDERS;

AUDIT POLICY oe_pol;
```

4. Connect as user `OE` and query the `OE.ORDERS` table.

```
CONNECT OE@pdb_name
Enter password: password

SELECT COUNT(*) FROM ORDERS;
```

5. Connect as a user who has been granted the `AUDIT_ADMIN` role, and then query the `UNIFIED_AUDIT_TRAIL` data dictionary view.

```
CONNECT sec_admin@pdb_name
Enter password: password

SELECT RLS_INFO FROM UNIFIED_AUDIT_TRAIL;
```

   Output similar to the following should appear:

```
((POLICY_TYPE=[3]'VPD'),(POLICY_SCHEMA=[9]'SEC_ADMIN'),
(POLICY_NAME=[13]'ORDERS_POLICY'),(PREDICATE=[16]'SALES_REP_ID=159'));
```

6. To extract these details and add them to their own columns, run the appropriate function from the `DBMS_AUDIT_UTIL` PL/SQL package.

   For unified auditing, you must run the `DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_UNI` function.

   For example:

```
SELECT DBUSERNAME, ACTION_NAME, OBJECT_NAME, SQL_TEXT,
  RLS_PREDICATE, RLS_POLICY_TYPE, RLS_POLICY_OWNER, RLS_POLICY_NAME
  FROM TABLE (DBMS_AUDIT_UTIL.DECODE_RLS_INFO_ATRAIL_UNI
  (CURSOR (SELECT * FROM UNIFIED_AUDIT_TRAIL)));
```

The reformatted audit trail output appears similar to the following:

```
DBUSERNAME ACTION_NAME OBJECT_NAME SQL_TEXT
---------- ----------- ----------- --------------------------
RLS_PREDICATE       RLS_POLICY_TYPE RLS_POLICY_OWNER RLS_POLICY_NAME
------------------ ---------------  ---------------- ---------------
OE         SELECT      ORDERS      SELECT COUNT(*) FROM ORDERS
SALES_REP_ID = 159  VPD              SEC_ADMIN        ORDERS_POLICY
```

Related Topics

- Using Oracle Virtual Private Database to Control Data Access
  Oracle Virtual Private Database (VPD) enables you to filter users who access data.
- *Oracle Database PL/SQL Packages and Types Reference*

30.4.4.15 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.

30.4.4.16 Unified Auditing with Editioned Objects

An audit policy created to audit an action on an editioned object will be applied to all its editions.

In addition, newly created objects in an edition will inherit unified audit policies from the existing edition.

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.

Related Topics

- *Oracle Database Development Guide*

30.4.5 Auditing the READ ANY TABLE and SELECT ANY TABLE Privileges

The `CREATE AUDIT POLICY` statement can audit the `READ ANY TABLE` and `SELECT ANY TABLE` privileges.

- About Auditing the READ ANY TABLE and SELECT ANY TABLE Privileges
  You can create unified audit policies that capture the use of the `READ ANY TABLE` and `SELECT ANY TABLE` system privileges.
- Creating a Unified Audit Policy to Capture READ Object Privilege Operations
  You can create unified audit policies that capture `READ` object privilege operations.
- 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.

30.4.5.1 About Auditing the READ ANY TABLE and SELECT ANY TABLE Privileges

You can create unified audit policies that capture the use of the `READ ANY TABLE` and `SELECT ANY TABLE` system privileges.

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.

30.4.5.2 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 any `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;
```

For any `SELECT` object operations, also create the policy on the `SELECT` statement, as with other object actions that you can audit.

Related Topics

- Auditing Object Actions
  You can use the `CREATE AUDIT POLICY` statement to audit object actions.

30.4.5.3 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 30-3 describes how the unified audit trail captures these actions.

Table 30-3 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`

Table 30-3 (Cont.) 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	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

Table 30-3 (Cont.) 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 ... 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

30.4.6 Auditing Only Top-Level Statements

You can audit top-level user-initiated SQL or PL/SQL statements to reduce audit volume.

- About Auditing Only Top-Level SQL Statements
  A top-level statement is a statement that is executed directly by a user, not a statement that is run from within a PL/SQL procedure.
- Configuring a Unified Audit Policy to Capture Only Top-Level Statements
  The ONLY TOPLEVEL clause in the CREATE AUDIT POLICY statement enables you to audit only the SQL statements that are directly issued by an end user by honoring the audit configuration in the audit policy.

- Example: Auditing Top-Level Statements
  The `CREATE AUDIT POLICY` statement can include or exclude top-level statement audit records in the unified audit trail for any user.
- Example: Comparison of Top-Level SQL Statement Audits
  You can generate top-level SQL statement audit records from SQL statements that are run directly in SQL or from within a PL/SQL procedure.
- How the Unified Audit Trail Captures Top-Level SQL Statements
  The `ONLY TOPLEVEL` clause has no impact on the output for an individual unified audit trail record.

30.4.6.1 About Auditing Only Top-Level SQL Statements

A top-level statement is a statement that is executed directly by a user, not a statement that is run from within a PL/SQL procedure.

Consider auditing top-level statements from all users, including user `SYS` to reduce the volume of audit. The feature audits all the user-initiated actions and ignores the recursive SQL statements. For example, auditing the `DBMS_STATS.GATHER_DATABASE_STATS` SQL statement can generate over 200,000 individual audit records and by adding top-level this reduces to a single audit record.

30.4.6.2 Configuring a Unified Audit Policy to Capture Only Top-Level Statements

The `ONLY TOPLEVEL` clause in the `CREATE AUDIT POLICY` statement enables you to audit only the SQL statements that are directly issued by an end user by honoring the audit configuration in the audit policy.

To find policies that include the `ONLY TOPLEVEL` clause, query the `AUDIT_ONLY_TOPLEVEL` column of the `AUDIT_UNIFIED_POLICIES` data dictionary view.

Use the following syntax to create a unified audit policy that audits only top-level SQL statements.

```
CREATE AUDIT POLICY policy_name
all_existing_options
ONLY TOPLEVEL;
```

For example, to limit the audit trail to top-level instances of the `SELECT` statement on the `HR.EMPLOYEES` table:

```
CREATE AUDIT POLICY actions_on_hr_emp_pol
ACTIONS SELECT ON HR.EMPLOYEES
ONLY TOPLEVEL;
```

30.4.6.3 Example: Auditing Top-Level Statements

The `CREATE AUDIT POLICY` statement can include or exclude top-level statement audit records in the unified audit trail for any user.

The following example shows an audit policy that will capture all top level statements executed by user `SYS`.

Example 30-13 Example: Auditing Top-Level Statements Run by User SYS

```
CREATE AUDIT POLICY actions_all_pol ACTIONS ALL
ONLY TOPLEVEL;

AUDIT POLICY actions_all_pol BY SYS;
```

30.4.6.4 Example: Comparison of Top-Level SQL Statement Audits

You can generate top-level SQL statement audit records from SQL statements that are run directly in SQL or from within a PL/SQL procedure.

This example shows how generating audit records differs when you access a view outside a PL/SQL procedure as opposed to accessing the view inside the PL/SQL procedure. The output illustrates the difference in volume in audit records that are generated from the two different audit policies.

1. Log in to the database instance as user `SYS` with the `SYSDBA` administrative privilege.
   In a multitenant environment, log in to the PDB. To find the available PDBs in a CDB, log in to the CDB root container and then query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.
2. Create the following procedure:

   ```
   CREATE OR REPLACE PROCEDURE proc1 AS
   cnt number;
   BEGIN
     SELECT COUNT(*) INTO CNT FROM SYS.DBA_USERS WHERE USER_ID=9999;
   END;
   /
   ```

3. Create the and enable following audit policy to capture top-level actions:

   ```
   CREATE AUDIT POLICY toplevel_pol ACTIONS ALL ONLY TOPLEVEL;
   AUDIT POLICY toplevel_pol;
   ```

4. Run the following query to generate an audit record and to access the `SYS.DBA_USERS` view outside of the `proc1` procedure that you just created:

   ```
   SELECT /* TOPLEVEL */ COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=0000;
   ```

   The output should be as follows:

   ```
     COUNT(*)
   ----------
            1
   ```

5. Run the `proc1` procedure that you created earlier, to access the `SYS.DBA_USERS` view again, but from within a procedure.

   ```
   EXEC proc1;
   ```

6. Query the `UNIFIED_AUDIT_TRAIL` data dictionary view as follows:

   ```
   SELECT ACTION_NAME, OBJECT_SCHEMA,OBJECT_NAME,STATEMENT_ID,ENTRY_ID,
     UNIFIED_AUDIT_POLICIES,SQL_TEXT
     FROM UNIFIED_AUDIT_TRAIL
     ORDER BY EVENT_TIMESTAMP;
   ```

Output similar to the following appears:

```
ACTION_NAME          OBJECT_SCHEMA
-------------------- ------------------------------
OBJECT_NAME                    STATEMENT_ID   ENTRY_ID
------------------------------ ------------ ----------
UNIFIED_AUDIT_POLICIES
------------------------------
SQL_TEXT
----------------------------------------------------------------
LOGON
                                          1          1
TOPLEVEL_POL


COMMIT
                                          3          2
TOPLEVEL_POL


COMMIT
                                          4          3
TOPLEVEL_POL


SELECT               SYS
USER$                                     5          4
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
RESOURCE_GROUP_MAPPING$                   5          5
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
TS$                                       5          6
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
TS$                                       5          7
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
TS$                                       5          8
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
```

```
PROFNAME$                                5          9
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
USER_ASTATUS_MAP                         5         10
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
PROFILE$                                 5         11
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
PROFILE$                                 5         12
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

SELECT               SYS
DBA_USERS                                5         13
TOPLEVEL_POL
select /* toplevel */ count(*) from sys.dba_users where user
_id=0000

EXECUTE              SYS
PROC1                                    7         14
TOPLEVEL_POL
BEGIN proc1; END;

14 rows selected.
```

7. Disable and then drop the `toplevel_pol` audit policy.

```
NOAUDIT POLICY toplevel_pol;
DROP AUDIT POLICY toplevel_pol;
```

8. Create and enable a new audit policy to capture all actions.

```
CREATE AUDIT POLICY recursive_pol ACTIONS ALL;
AUDIT POLICY recursive_pol;
```

9. Clean up the audit trail.

```
DBMS_AUDIT_MGMT.CLEAN_AUDIT_TRAIL(DBMS_AUDIT_MGMT.AUDIT_TRAIL_UNIFIED,FALSE
);
```

10. Run the following query to generate an audit record and to access the `SYS.DBA_USERS` view outside of the `proc1` procedure:

```
SELECT /* TOPLEVEL */ COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=0000;
```

The output should be as follows:

```
  COUNT(*)
----------
         1
```

11. Run the `proc1` procedure to access the `SYS.DBA_USERS` again, but from within the `proc1` procedure.

```
EXEC proc1;
```

12. Query the `UNIFIED_AUDIT_TRAIL` data dictionary view as follows:

```
SELECT ACTION_NAME, OBJECT_SCHEMA,OBJECT_NAME,STATEMENT_ID,ENTRY_ID,
  UNIFIED_AUDIT_POLICIES,SQL_TEXT
  FROM UNIFIED_AUDIT_TRAIL
  ORDER BY EVENT_TIMESTAMP;
```

Output similar to the following should appear:

```
ACTION_NAME          OBJECT_SCHEMA
-------------------- ------------------------------
OBJECT_NAME                    UNIFIED_AUDIT_POLICIES         STATEMENT_ID
------------------------------ ------------------------------ ------------
  ENTRY_ID SQL_TEXT
---------- ----------------------------------------------------------------
LOGON
                               RECURSIVE_POL                             1
         1

ALTER SESSION
                               RECURSIVE_POL                             1
         2 ALTER SESSION SET TIME_ZONE='-07:00'

COMMIT
                               RECURSIVE_POL                             3
         3
COMMIT
                               RECURSIVE_POL                             4
         4

SELECT               SYS
USER$                          RECURSIVE_POL                             5
         5 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
RESOURCE_GROUP_MAPPING$        RECURSIVE_POL                             5
         6 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
TS$                            RECURSIVE_POL                             5
         7 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000
```

```
SELECT               SYS
TS$                            RECURSIVE_POL                              5
         8 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
TS$                            RECURSIVE_POL                              5
         9 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
PROFNAME$                      RECURSIVE_POL                              5
        10 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
USER_ASTATUS_MAP               RECURSIVE_POL                              5
        11 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
PROFILE$                       RECURSIVE_POL                              5
        12 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
PROFILE$                       RECURSIVE_POL                              5
        13 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
DBA_USERS                      RECURSIVE_POL                              5
        14 select /* toplevel */ count(*) from sys.dba_users where user
           _id=0000

SELECT               SYS
USER$                          RECURSIVE_POL                              7
        15 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT               SYS
RESOURCE_GROUP_MAPPING$        RECURSIVE_POL                              7
        16 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT               SYS
TS$                            RECURSIVE_POL                              7
        17 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT               SYS
TS$                            RECURSIVE_POL                              7
        18 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT               SYS
TS$                            RECURSIVE_POL                              7
        19 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999
```

```
SELECT                SYS
PROFNAME$                          RECURSIVE_POL                               7
        20 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT                SYS
USER_ASTATUS_MAP                   RECURSIVE_POL                               7
        21 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT                SYS
PROFILE$                           RECURSIVE_POL                               7
        22 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT                SYS
PROFILE$                           RECURSIVE_POL                               7
        23 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

SELECT                SYS
DBA_USERS                          RECURSIVE_POL                               7
        24 SELECT COUNT(*) FROM SYS.DBA_USERS WHERE USER_ID=9999

EXECUTE               SYS
PROC1                              RECURSIVE_POL                               7
        25 BEGIN proc1; END;

25 rows selected.
```

The output in this query generates 25 records, as opposed to the 14 that were generated earlier.

13. Disable and remove the `recursive_pol` policy.

```
NOAUDIT POLICY recursive_pol;
DROP AUDIT POLICY recursive_pol;
```

30.4.6.5 How the Unified Audit Trail Captures Top-Level SQL Statements

The `ONLY TOPLEVEL` clause has no impact on the output for an individual unified audit trail record.

The only effect that `ONLY TOPLEVEL` has on a policy is to limit the number of records generated for the given unified audit policy.

30.5 Unified Auditing with Configurable Conditions

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

- About Conditions in Unified Audit Policies
  You can use conditions in unified audit policies to create focused and selective audit policies.
- Configuring a Unified Audit Policy with a Condition
  The `WHEN` clause in the `CREATE AUDIT POLICY` statement defines the condition in the audit policy.
- Example: Auditing Access to SQL*Plus
  The `CREATE AUDIT POLICY` statement can audit access to SQL*Plus.

- Example: Auditing Actions Not in Specific Hosts
  The `CREATE AUDIT POLICY` statement can audit actions that are not in specific hosts.
- 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: Auditing a Condition Per Statement Occurrence
  The `CREATE AUDIT POLICY` statement can audit conditions.
- Example: Unified Audit Session ID of a Current Administrative User Session
  The `SYS_CONTEXT` function can be used to find session IDs.
- 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.
- 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.

30.5.1 About Conditions in Unified Audit Policies

You can use conditions in unified audit policies to create focused and selective audit policies.

You can use the `CREATE AUDIT POLICY` statement to create conditions for a unified audit policy. For example, you can create policy that audits only when access is from a specific host or IP address. If the audit condition is satisfied, then only then the audit record is generated 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 attributes from the `USERENV` namespace, or from named application contexts (both secure and insecure).

30.5.2 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.

- *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.

Related Topics

- *Oracle Database SQL Language Reference*

30.5.3 Example: Auditing Access to SQL*Plus

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

Example 30-14 shows how to audit access to the database with SQL*Plus by users who have been directly granted the roles `emp_admin` and `sales_admin`.

Example 30-14 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 USERS WITH GRANTED ROLES emp_admin, sales_admin;
```

30.5.4 Example: Auditing Actions Not in Specific Hosts

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

Example 30-15 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 30-15 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;
```

30.5.5 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 30-16 shows a variation of Example 30-15 in which the `UPDATE` statement is audited system wide. The `DELETE` statement audit is still specific to the `OE.ORDERS` table.

Example 30-16 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;
```

30.5.6 Example: Auditing a Condition Per Statement Occurrence

The `CREATE AUDIT POLICY` statement can audit conditions.

Example 30-17 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 30-17 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;
```

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

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

Example 30-18 shows how to find the unified audit session ID of current user session for an administrative user.

Example 30-18 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.

30.5.8 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 30-19 shows how to find the unified audit session ID of a current user session for a non-administrative user.

Example 30-19 Unified Audit Session ID of a Current Non-Administrative User Session

```
CONNECT mblake@pdb_name
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
```

30.5.9 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.

Related Topics

- Unified Audit Policy Data Dictionary Views
  You can query data dictionary and dynamic views to find detailed auditing information about custom unified audit policies.

30.6 Auditing for Multitier or Multitenant Configurations

You can create unified audit policies using conditions and application contexts, and in multitier and multitenant environments.

- Auditing in a Multitier Deployment
  You can create a unified audit policy to audit the activities of a client in a multitier environment.
- Auditing in a Multitenant Deployment
  You can create unified audit policies for individual PDBs and in the root.

30.6.1 Auditing in a Multitier Deployment

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.

For example, suppose the proxy user `apphr` can connect as user `jackson`. The policy and enablement can be as follows:

```
CREATE AUDIT POLICY prox_pol ACTIONS LOGON;
AUDIT POLICY prox_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. For example:

```
SELECT DBUSERNAME, DB_PROXY_USERNAME, PROXY_SESSIONID, ACTION_NAME
FROM UNIFIED_AUDIT_TRAIL
WHERE DBPROXY_USERNAME IS NOT NULL;
```

Output similar to the following appears:

```
DBUSERNAME  DBPROXY_USERNAME  PROXY_SESSIONID  ACTION_NAME
----------  ----------------  ---------------  -----------
JACKSON     APPHR             1214623540       LOGON
```

Figure 30-1 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 30-1 Auditing Proxy Users

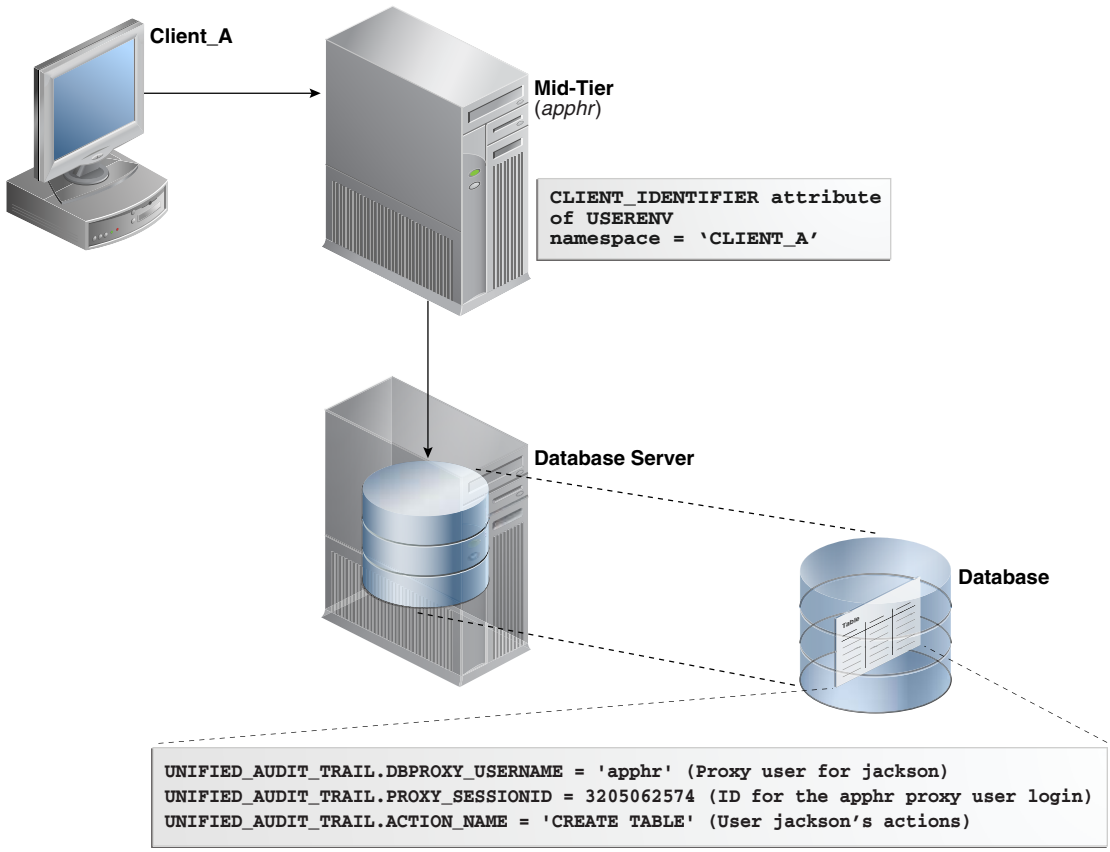
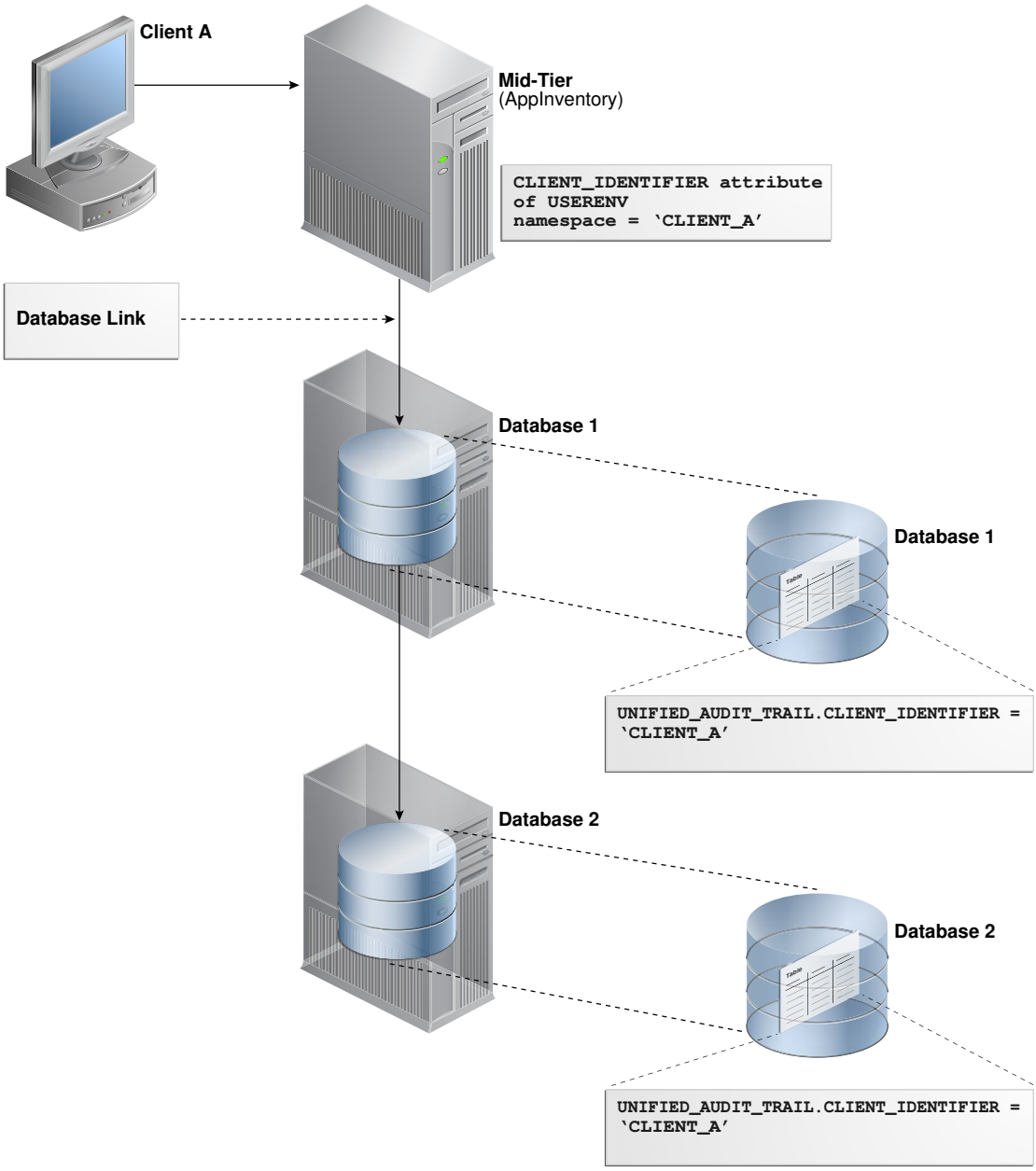


Figure 30-2 illustrates how you can audit client identifier information across multiple database sessions by querying the `CLIENT_ID` column of the `DBA_AUDIT_TRAIL` data dictionary view. In this scenario, the client identifier has been set to `CLIENT_A`. As with the proxy user-database user scenario described in Figure 30-1, session pooling can be used.

Figure 30-2 Auditing Client Identifier Information Across Sessions



Related Topics

- Preserving User Identity in Multitiered Environments
  You can use middle tier servers for proxy authentication and client identifiers to identify application users who are not known to the database.

30.6.2 Auditing in a Multitenant Deployment

You can create unified audit policies for individual PDBs and in the root.

- About Local, CDB Common, and Application Common Audit Policies
  An audit policy can be either a local audit policy, a CDB common audit policy, or an application common audit policy.

- Common Audit Configurations Across All PDBs
  A common audit configuration is visible and enforced across all PDBs.
- Unified Audit Policies in an Application Root
  When you create an application root from a regular PDB, any local unified audit policies in this PDB are added to this application root.
- 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.
- Example: Local Unified Audit Policy
  The `CREATE AUDIT POLICY` statement can create a local unified audit policy in either the root or a PDB.
- Example: CDB Common Unified Audit Policy
  The `CREATE AUDIT POLICY` statement can create a CDB common unified audit policy.
- Example: Application Common Unified Audit Policy
  For application container common unified audit policies, you can audit action options and system privilege options, and refer to common objects and roles.
- 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.

30.6.2.1 About Local, CDB Common, and Application Common Audit Policies

An audit policy can be either a local audit policy, a CDB common audit policy, or an application common audit policy.

This applies to both unified audit policies and policies that are created using the `AUDIT` SQL statement.

- **Local audit policy.** This type of policy can exist in either the root (CDB or application) or the PDB (CDB or application). 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. You can enable a local audit policy for both local and common users and roles.

  You can create local audit policies for application local objects and application local roles, as well as system action options and system privilege options. You cannot enforce a local audit policy for a common user across all containers, nor can you enforce a common audit policy for a local user.
- **CDB 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. You can enable a common audit policy for common users and roles only.

  The name of a CDB common audit policy must begin with the value of the `COMMON_USER_PREFIX` initialization parameter. The default value of the `COMMON_USER_PREFIX` parameter is `c##`. For example, `c##hr_admin` is a valid common audit policy name. The length of the audit policy name cannot exceed 128 bytes and must contain ASCII characters only.

  You cannot enforce a common audit policy for a local user across all containers.

- **Application common audit policy.** Similar to CDB common audit policies, this type of policy is available to all PDBs in the multitenant environment. You can create common audit policies for application common objects and application common roles, as well as system action options and system privilege options. You can only create this type of policy in the application root container, but you can enable it on both application common users and CDB common users. If you want to audit objects, then ensure that these objects are application common objects. You can determine whether an object is an application common object by querying the `SHARING` column of the `DBA_OBJECTS` data dictionary view.

  The naming conventions for application common audit policies follow the same rules as those for CDB common audit policies, except that the value of the `COMMON_USER_PREFIX` is fetched from the application root. The default value in application root is an empty string. For example, `hr_admin` is a valid application common audit policy name.

By default, audit policies are local to the current PDB, for both CDB and application scenarios.

The following table explains how audit policies apply in different multitenant environments.

Table 30-4 How Audit Policies Apply to the CDB Root, Application Root, and Individual PDBs

Audit Option Type	CDB Root	Application Root	Individual PDB
Common audit statement or audit policy	Applies to CDB common users	Applies to CDB common users	Applies to CDB common users
Application container common audit statement or audit policy	Not applicable	• Applies to CDB common users and are valid for the current application container only • Applies to application container common users	• Applies to CDB common users and are valid for this application container only • Applies to application common users
Local audit statement or audit policy	Local configurations not allowed	Local configurations not allowed	• Applies to CDB common users • Applies to application common users

30.6.2.2 Common Audit Configurations Across All PDBs

A common audit configuration is visible and enforced across all PDBs.

Audit configurations are either local or common. The scoping rules that apply to other local or common phenomena, such as users and roles, all apply to audit configurations.

> **Note:**
>
> Audit initialization parameters exist at the CDB level and not in each PDB.

PDBs support the following auditing options:

- Object auditing

Object auditing refers to audit configurations for specific objects. Only common objects can be part of the common audit configuration. A local audit configuration cannot contain common objects.

- Audit policies

  Audit policies can be local or common:

  – Local audit policies

    A local audit policy applies to a single PDB. You can enforce local audit policies for local and common users in this PDB only. Attempts to enforce local audit policies across all containers result in an error.

    In all cases, enforcing of a local audit policy is part of the local auditing framework.

  – Common audit policies

    A common audit policy applies to all containers. When you create a common audit policy, prefix the name with `C##` or `c##` (for example, `c##all_select_pol`). This policy can only contain actions, system privileges, common roles, and common objects. You can apply a common audit policy only to common users. Attempts to enforce a common audit policy for a local user across all containers result in an error.

A common audit configuration is stored in the `SYS` schema of the root. A local audit configuration is stored in the `SYS` schema of the PDB to which it applies.

Audit trails are stored in the `SYS` or `AUDSYS` schemas of the relevant CDB or PDB container. Operating system and XML audit trails for PDBs are stored in subdirectories of the directory specified by the `AUDIT_FILE_DEST` (deprecated) initialization parameter.

30.6.2.3 Unified Audit Policies in an Application Root

When you create an application root from a regular PDB, any local unified audit policies in this PDB are added to this application root.

This applies to both unified audit policies and policies that are created using the `AUDIT` SQL statement.

In this situation, you will need to convert the local unified audit policies to common unified audit policies. To do so, drop each existing local unified audit policy from the application root and then use the `CREATE AUDIT POLICY` statement to recreate it as an application common audit policy.

Related Topics

- Example: Application Common Unified Audit Policy
  For application container common unified audit policies, you can audit action options and system privilege options, and refer to common objects and roles.

30.6.2.4 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.

To create a local or common (CDB or application) unified audit policy in either the CDB environment or an application container environment, include the `CONTAINER` clause in 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:

- 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 re-create 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* and later 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 = CURRENT`.
- For objects:
  - Common audit policies can have common objects only and local audit policies can have both local objects and common objects.
  - 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.

- For application containers, you can run a common unified audit policy from the application container script that is used for application install, upgrade, patch, and uninstall operations. To do so:

  1. Create a common unified audit policy in the application container root, and set this policy to `CONTAINER = ALL`. Alternatively, you can include this policy in the script that is described in this next step.
  2. Create a custom version of the script you normally would use to install, upgrade, patch, or uninstall Oracle Database.
  3. Within this script, include the SQL statements that you want to audit within the following lines:

     ```
     ALTER PLUGGABLE DATABASE APPLICATION BEGIN INSTALL
     List SQL statements here. Separate each statement with a semi-colon.
     ALTER PLUGGABLE DATABASE APPLICATION END INSTALL
     ```

     If you include the unified audit policy in the script, then ensure that you include both the `CREATE AUDIT POLICY` and `AUDIT POLICY` statements.

  After the audit policy is created and enabled, all user access to the application common objects is audited irrespective of whether the audit policy is defined in the database or from the script.

- To audit application install, upgrade, patch, and uninstall operations locally in an application root or an application PDB, follow a procedure similar to the preceding procedure for common unified audit policies, but synchronize the application PDB afterward. For example:

  ```
  ALTER PLUGGABLE DATABASE APPLICATION application_name SYNC;
  ```

Related Topics

- *Oracle Multitenant Administrator's Guide*

30.6.2.5 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.

The following example 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 30-20 Local Unified Audit Policy

```
CONNECT c##sec_admin@pdb_name
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;
```

30.6.2.6 Example: CDB Common Unified Audit Policy

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

Example 30-21 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 30-21 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;
```

30.6.2.7 Example: Application Common Unified Audit Policy

For application container common unified audit policies, you can audit action options and system privilege options, and refer to common objects and roles.

You can create the application common audit policy only from the application root, and enable the policy for both application common users and CDB common users.

The following example shows how to create a policy that audits the application common user `SYSTEM` for the application container `app_pdb`. The audit policy audits `SELECT` actions on the `SYSTEM.utils_tab` table and on `DROP TABLE` actions on any of the PDBs in the container database, including the CDB root. The policy also audits the use of the `SELECT ANY TABLE` system privilege across all containers.

Example 30-22 Application Common Unified Audit Policy

```
CONNECT c##sec_admin@app_pdb
Enter password: password
Connected.

CREATE AUDIT POLICY app_pdb_admin_pol
 ACTIONS SELECT ON hr_app_cdb.utils_tab, DROP TABLE
 PRIVILEGES SELECT ANY TABLE
 CONTAINER = ALL;

AUDIT POLICY app_pdb_admin_pol by SYSTEM, c##hr_admin;
```

In the preceding example, setting `CONTAINER` to `ALL` applies the policy only to all the relevant object accesses in the application root and on all the application PDBs that belong to the application root. It does not apply the policy outside this scope.

30.6.2.8 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
Enter password: password
Connected.

SELECT DBID, ACTION_NAME, OBJECT_SCHEMA, OBJECT_NAME FROM
CDB_UNIFIED_AUDIT_TRAIL WHERE DBUSERNAME = 'c##hr_admin';
46892-1
DBID        ACTION_NAME  OBJECT_SCHEMA  OBJECT_NAME
----------- -----------  -------------  -----------
653916017   UPDATE       HR             EMPLOYEES
653916018   UPDATE       HR             JOB_HISTORY
653916017   UPDATE       HR             JOBS
```

30.7 Extending Unified Auditing to Capture Custom Attributes

You can extend the unified audit trail to capture custom attributes by auditing application context values.

- About Auditing Application Context Values
  In many cases, you may want to bring your custom attributes into the unified audit trail while auditing (for example, application attributes from the application session).
- Configuring Application Context Audit Settings
  The `AUDIT` statement with the `CONTEXT` keyword configures auditing for application context values.
- Disabling Application Context Audit Settings
  The `NOAUDIT` statement disables application context audit settings.

- Example: Auditing Application Context Values in a Default Database
  The `AUDIT CONTEXT NAMESPACE` statement can audit application context values.
- Example: Auditing Application Context Values from Oracle Label Security
  The `AUDIT CONTEXT NAMESPACE` statement can audit application context values from Oracle Label Security.
- How Audited Application Contexts Appear in the Audit Trail
  The `UNIFIED_AUDIT_POLICIES` data dictionary view lists application context audit events.

30.7.1 About Auditing Application Context Values

In many cases, you may want to bring your custom attributes into the unified audit trail while auditing (for example, application attributes from the application session).

You can extend the unified audit trail to capture such custom attributes by auditing application context values. This feature enables you to capture any application context values set by the database applications, while executing the audited statement.

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.

Note that the application context audit policy applies only to the current PDB.

Related Topics

- Using Application Contexts to Retrieve User Information
  An application context stores user identification that can enable or prevent a user from accessing data in the database.
- Auditing in a Multitenant Deployment
  You can create unified audit policies for individual PDBs and in the root.
- *Oracle Label Security Administrator's Guide*

30.7.2 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.

30.7.3 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 USERS WITH GRANTED ROLES emp_admin;
```

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

30.7.4 Example: Auditing Application Context Values in a Default Database

The `AUDIT CONTEXT NAMESPACE` statement can audit application context values.

Example 30-23 shows how to audit the `clientcontext` application values for the `module` and `action` attributes, by the user `appuser1`.

Example 30-23 Auditing Application Context Values in a Default Database

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

30.7.5 Example: Auditing Application Context Values from Oracle Label Security

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

Example 30-24 shows how to audit an application context for Oracle Label Security called `ORA_OLS_SESSION_LABELS`, for the attributes `ols_pol1` and `ols_pol2`.

Example 30-24 Auditing Application Context Values from Oracle Label Security

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

30.7.6 How Audited Application Contexts Appear in the Audit Trail

The `UNIFIED_AUDIT_POLICIES` data dictionary view lists application context audit events.

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
```

30.8 Auditing Components of Other Oracle Products and Features

You can create unified audit policies for Oracle products and features such as Oracle Database Vault, Oracle Real Application Security, Oracle Data Pump, and Oracle Machine Learning for SQL events.

- Auditing Oracle SQL Firewall
  You can audit Oracle SQL Firewall violations with a unified audit policy.
- Auditing Oracle Database Vault Events
  In an Oracle Database Vault environment, the `CREATE AUDIT POLICY` statement can audit Database Vault activities.
- Auditing Oracle Database Real Application Security Events
  You can use `CREATE AUDIT POLICY` statement to audit Oracle Database Real Application Security events.
- Auditing Oracle Recovery Manager Events
  You can use the `CREATE AUDIT POLICY` statement to audit Oracle Recovery Manager events.
- Auditing Oracle Label Security Events
  In an Oracle Label Security environment, the `CREATE AUDIT POLICY` statement can audit Oracle Label Security activities.
- Auditing Oracle Data Pump Events
  You can use the `CREATE AUDIT POLICY` statement to audit Oracle Data Pump.
- 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.
- Auditing Oracle XML DB HTTP and FTP Protocols
  You can use the `CREATE AUDIT POLICY` statement to audit Oracle XML DB HTTP and FTP protocol messages.
- Auditing Oracle Machine Learning for SQL Events
  You can use the `CREATE AUDIT POLICY` statement to audit Oracle Machine Learning for SQL events.

30.8.1 Auditing Oracle SQL Firewall

You can audit Oracle SQL Firewall violations with a unified audit policy.

- About Auditing Oracle SQL Firewall
  The occurrence of Oracle SQL Firewall violations potentially indicates abnormal database access attempts, including SQL injection and credential theft or abuse.
- Example: Auditing Oracle SQL Firewall Violations
  You can use the `COMPONENT` clause to set the unified audit policy to track all Oracle SQL Firewall violations.
- How Oracle SQL Firewall Events Appear in the Audit Trail
  The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle SQL Firewall audit events.

30.8.1.1 About Auditing Oracle SQL Firewall

The occurrence of Oracle SQL Firewall violations potentially indicates abnormal database access attempts, including SQL injection and credential theft or abuse.

Auditing violations record the violation in the database audit trail, which can be protected from tampering. As an administrator with `AUDIT_ADMIN` role, you can create unified audit policy with the `CREATE AUDIT POLICY` statement and with the `COMPONENT` clause set to `SQL Firewall`.

The data dictionary views for SQL Firewall begin with the name `DBA_SQL_FIREWALL_`. The columns `FW_ACTION_NAME` and `FW_RETURN_CODE` in the `UNIFIED_AUDIT_TRAIL` data dictionary view stores the relevant information on Oracle SQL Firewall violations.

Related Topics

-

30.8.1.2 Example: Auditing Oracle SQL Firewall Violations

You can use the `COMPONENT` clause to set the unified audit policy to track all Oracle SQL Firewall violations.

Example 30-25 shows how to create and enable this type of a unified audit policy. You can consider setting the `SQL_FIREWALL` component to `SQL VIOLATION` or `CONTEXT VIOLATION` to be more specific.

Example 30-25 Auditing SQL Firewall Violations

```
CREATE AUDIT POLICY sql_firewall_pol
ACTIONS COMPONENT = SQL_FIREWALL ALL
ON pfitch;

AUDIT POLICY sql_firewall_pol;
```

30.8.1.3 How Oracle SQL Firewall Events Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle SQL Firewall audit events.

The `FW_ACTION_NAME` and `FW_RETURN_CODE` columns of the `UNIFIED_AUDIT_TRAIL` data dictionary view track SQL Firewall violations. To retrieve all the audited Oracle SQL Firewall

violations, consider filtering the AUDIT_TYPE component to include the Oracle SQL Firewall component from V$UNIFIED_AUDIT_RECORD_FORMAT. For example:

```
SELECT DBUSERNAME, ACTION_NAME, CURRENT_USER, SQL_TEXT,
UNIFIED_AUDIT_POLICIES, FW_ACTION_NAME, FW_RETURN_CODE
FROM UNIFIED_AUDIT_TRAIL
WHERE AUDIT_TYPE
IN (SELECT UNIQUE COMPONENT FROM V$UNIFIED_AUDIT_RECORD_FORMAT WHERE
COMPONENT = 'SQL Firewall')
AND ACTION_NAME <> 'FW ADMIN ACTION';
```

Output similar to the following appears:

```
DBUSERNAME ACTION_NAME   CURRENT_USER SQL_TEXT
UNIFIED_AUDIT_POLICIES FW_ACTION_NAME FW_RETURN_CODE
---------- ------------- ------------ ------------------------------
---------------------- -------------- -------------
PFITCH     SQL VIOLATION PFITCH       SELECT SALARY FROM HS.EMPLOYEES
HR_FW_POL              SQL Violation 0
```

30.8.2 Auditing Oracle Database Vault Events

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

- About Auditing Oracle Database Vault Events
  As an administrator with the AUDIT_ADMIN role, you can create unified audit policies with the CREATE AUDIT POLICY statement and with the COMPONENT clause set to DV.
- Who Is Audited in Oracle Database Vault?
  Audited Oracle Database Vault users include administrators and users whose activities affect Database Vault enforcement policies.
- 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.
- Oracle Database Vault Realm Audit Events
  The unified audit trail captures Oracle Database Vault realm events.
- Oracle Database Vault Rule Set and Rule Audit Events
  The unified audit trail can capture Oracle Database Vault rule set and rule audit events.
- Oracle Database Vault Command Rule Audit Events
  The unified audit trail can capture Oracle Database Vault command rule audit events.
- Oracle Database Vault Factor Audit Events
  The unified audit trail can capture Oracle Database Vault factor events.
- Oracle Database Vault Secure Application Role Audit Events
  The unified audit trail can capture Oracle Database Vault secure application role audit events.
- Oracle Database Vault Oracle Label Security Audit Events
  The unified audit trail can capture Oracle Database Vault Oracle Label Security audit events.
- Oracle Database Vault Oracle Data Pump Audit Events
  The unified audit trail can capture Oracle Database Vault Oracle Data Pump audit events.

- Oracle Database Vault Enable and Disable Audit Events
  The unified audit trail can capture Oracle Database Vault enable and disable audit events.
- 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.
- Example: Auditing an Oracle Database Vault Realm
  The `CREATE AUDIT POLICY` statement can audit Oracle Database Vault realms.
- Example: Auditing an Oracle Database Vault Rule Set
  The `CREATE AUDIT POLICY` statement can audit Oracle Database Vault rule sets.
- Example: Auditing Two Oracle Database Vault Events
  The `CREATE AUDIT POLICY` statement can audit multiple Oracle Database Vault events.
- Example: Auditing Oracle Database Vault Factors
  The `CREATE AUDIT POLICY` statement can audit Oracle Database Vault factors.
- How Oracle Database Vault Audited Events Appear in the Audit Trail
  The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle Database Vault audited events.

30.8.2.1 About Auditing Oracle Database Vault Events

As an administrator with the `AUDIT_ADMIN` role, you can create unified audit policies with the `CREATE AUDIT POLICY` statement and with the `COMPONENT` clause set to `DV`.

To do so, you must specify an action, such as `Rule Set Failure`, and an object, such as the name of a rule set.

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`
- `AUDSYS.DV$CONFIGURATION_AUDIT`
- `AUDSYS.DV$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.

Related Topics

- Oracle Database Vault Predefined Unified Audit Policy for DVSYS and LBACSYS Schemas
  The `ORA_DV_SCHEMA_CHANGES` (previously called `ORA_DV_AUDPOL`) predefined unified audit policy audits Oracle Database Vault `DVSYS` and `LBACSYS` schema objects.
- *Oracle Database Vault Administrator's Guide*

30.8.2.2 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 `AUDSYS.DV$CONFIGURATION_AUDIT` data dictionary view captures configuration changes made by Database Vault administrators.
- **Users whose activities affect Oracle Database Vault enforcement policies.** The `AUDSYS.DV$ENFORCEMENT_AUDIT` data dictionary view captures enforcement-related audits

30.8.2.3 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.

30.8.2.4 Oracle Database Vault Realm Audit Events

The unified audit trail captures Oracle Database Vault realm events.

Table 30-5 describes these events.

Table 30-5 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

Table 30-5 (Cont.) Oracle Database Vault Realm Audit Events

Audit Event	Description
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

30.8.2.5 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 30-6 describes these events.

Table 30-6 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

30.8.2.6 Oracle Database Vault Command Rule Audit Events

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

Table 30-7 describes these events.

Table 30-7 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

30.8.2.7 Oracle Database Vault Factor Audit Events

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

Table 30-8 describes these events.

Table 30-8 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
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

Table 30-8 (Cont.) Oracle Database Vault Factor Audit Events

Audit Event	Description
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
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

30.8.2.8 Oracle Database Vault Secure Application Role Audit Events

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

Table 30-9 describes these events.

Table 30-9 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

Table 30-9 (Cont.) Oracle Database Vault Secure Application Role Audit Events

Audit Event	Description
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

30.8.2.9 Oracle Database Vault Oracle Label Security Audit Events

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

Table 30-10 describes these events.

Table 30-10 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

30.8.2.10 Oracle Database Vault Oracle Data Pump Audit Events

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

Table 30-11 describes these events.

Table 30-11 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

30.8.2.11 Oracle Database Vault Enable and Disable Audit Events

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

Table 30-12 describes these events.

Table 30-12 Oracle Database Vault Enable and Disable Audit Events

Event	Description
ENABLE_EVENT	DBMS_MACADM.ENABLE_EVENT
DISABLE_EVENT	DBMS_MACADM.DISABLE_EVENT

30.8.2.12 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 COMPONENT= DV DV_action ON DV_object [,DV_action2 ON DV_object2]
```

In this specification:

- *DV_action* is one of the following:
  - Realm-related actions:

    `Realm Violation` audits realm violations (for example, when an unauthorized user attempts to access a realm-protected object).

    `Realm Success` audits when a realm-protected object is successfully accessed by an authorized user.

    `Realm Access` audits both realm violation and realm success cases, that is, audits whenever the realm access attempt has been made, whether the access succeeded or failed.
  - Rule set-related actions: `Rule Set Failure`, `Rule Set Success`, `Rule Set Eval`
  - Factor-related actions: `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 COMPONENT=DV Realm Violation ON "Database Vault Account Management";
```

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

30.8.2.13 Example: Auditing an Oracle Database Vault Realm

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

Example 30-26 shows how to audit a realm violation on the `HR` schema.

Example 30-26 Auditing a Realm Violation

```
CREATE AUDIT POLICY dv_realm_hr
 ACTIONS COMPONENT=DV Realm Violation ON "HR Schema Realm";

AUDIT POLICY dv_realm_hr;
```

30.8.2.14 Example: Auditing an Oracle Database Vault Rule Set

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

Example: Auditing an Oracle Database Vault Rule Set shows how to audit the Can Maintain Accounts/Profile rule set.

Example 30-27 Auditing a Rule Set

```
CREATE AUDIT POLICY dv_rule_set_accts
 ACTIONS COMPONENT=DV RULE SET FAILURE ON "Can Maintain Accounts/Profile";

AUDIT POLICY dv_rule_set_accts;
```

30.8.2.15 Example: Auditing Two Oracle Database Vault Events

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

Example 30-28 shows how to audit a realm violation and a rule set failure.

Example 30-28 Auditing Two Oracle Database Vault Events

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

AUDIT POLICY audit_dv;
```

30.8.2.16 Example: Auditing Oracle Database Vault Factors

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

Example 30-29 shows how to audit two types of errors for one factor.

Example 30-29 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;
```

30.8.2.17 How Oracle Database Vault Audited Events Appear in the Audit Trail

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

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

For example:

```
SELECT DBUSERNAME, SQL_TEXT, UNIFIED_AUDIT_POLICIES, DV_ACTION_NAME,
DV_ACTION_OBJECT_NAME, DV_RULE_SET_NAME
FROM UNIFIED_AUDIT_TRAIL
WHERE AUDIT_TYPE = 'DATABASE VAULT'
ORDER BY EVENT_TIMESTAMP;

DBUSERNAME SQL_TEXT                    UNIFIED_AUDIT_POLICIES DV_ACTION_NAME
DV_ACTION_OBJECT_NAME DV_RULE_SET_NAME
---------- --------------------------- ---------------------- ----------------------
---------------------- ------------------
PFITCH     SELECT * FROM HR.EMPLOYEES DV_AUDIT_POLICY         Command Failure Audit
SELECT                HR_data_protection
```

30.8.3 Auditing Oracle Database Real Application Security Events

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

- About Auditing Oracle Database Real Application Security Events
  You must have the `AUDIT_ADMIN` role to audit Oracle Database Real Application Security events.
- Oracle Database Real Application Security Auditable Events
  Oracle Database provides Real Application Security events that you can audit, such `CREATE USER`, `UPDATE USER`.
- Oracle Database Real Application Security User, Privilege, and Role Audit Events
  The unified audit trail can capture Oracle Database Real Application Security events for users, privileges, and roles.
- 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.
- Oracle Database Real Application Security Session Audit Events
  The unified audit trail can capture Oracle Database Real Application Security session audit events.
- Oracle Database Real Application Security ALL Events
  The unified audit trail can capture Oracle Database Real Application Security `ALL` events.
- 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.

- Example: Auditing Real Application Security User Account Modifications
  The `CREATE AUDIT POLICY` statement can audit Real Application Security user account modifications.
- 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.
- 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.

30.8.3.1 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_`. If you want to find audit information about the internally generated VPD predicate that is created while an Oracle Real Application Security policy is being enabled, then you can query the `RLS_INFO` column.

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.

Related Topics

- Extending Unified Auditing to Capture Custom Attributes
  You can extend the unified audit trail to capture custom attributes by auditing application context values.
- Oracle Database Real Application Security Predefined Audit Policies
  You can use predefined unified audit policies for Oracle Database Real Application Security events.
- Auditing of Oracle Virtual Private Database Predicates
  The unified audit trail automatically captures the predicates that are used in Oracle Virtual Private Database (VPD) policies.
- *Oracle Database Real Application Security Administrator's and Developer's Guide*

30.8.3.2 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
...
```

Related Topics

- Oracle Database Real Application Security User, Privilege, and Role Audit Events
  The unified audit trail can capture Oracle Database Real Application Security events for users, privileges, and roles.
- 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.
- Oracle Database Real Application Security Session Audit Events
  The unified audit trail can capture Oracle Database Real Application Security session audit events.
- Oracle Database Real Application Security ALL Events
  The unified audit trail can capture Oracle Database Real Application Security `ALL` events.

30.8.3.3 Oracle Database Real Application Security User, Privilege, and Role Audit Events

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

Table 30-13 describes these events.

Table 30-13 Oracle Database Real Application Security User, Privilege, 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
`AUDIT_GRANT_PRIVILEGE`	Audits the `GRANT_SYSTEM_PRIVILEGE` privilege
`AUDIT_REVOKE_PRIVILEGE`	Audits the `REVOKE_SYSTEM_PRIVILEGE` privilege
`CREATE ROLE`	Creates an Oracle Database Real Application Security role through the `XS_PRINCIPAL.CREATE_ROLE` procedure

Table 30-13 (Cont.) Oracle Database Real Application Security User, Privilege, and Role Audit Events

Audit Event	Description
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 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 revokes all granted roles through the XS_PRINCIPAL.REVOKE_ALL_GRANTED_ROLES procedure
ADD PROXY	Adds Oracle Database Real Application Security proxy user account through the XS_PRINCIPAL.ADD_PROXY_USER procedure, and adds proxies 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

30.8.3.4 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 30-14 describes these events.

Table 30-14 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

Table 30-14 (Cont.) Oracle Database Real Application Security Security Class and ACL Audit Events

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
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

30.8.3.5 Oracle Database Real Application Security Session Audit Events

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

Table 30-13 describes these events.

Table 30-15 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
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
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

30.8.3.6 Oracle Database Real Application Security ALL Events

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

Table 30-16 describes these events.

Table 30-16 Oracle Database Real Application Security ALL Events

Audit Event	Description
`ALL`	Captures all Real Application Security actions

30.8.3.7 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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the `CREATE AUDIT POLICY` statement.

30.8.3.8 Example: Auditing Real Application Security User Account Modifications

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

Example 30-30 shows how to audit user `bhurst`'s attempts to switch users and disable roles.

Example 30-30 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;
```

30.8.3.9 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 30-31 shows how to create Real Application Security unified audit policy that applies the audit only to actions from the `nemosity` computer host.

Example 30-31 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;
```

30.8.3.10 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.

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
```

30.8.4 Auditing Oracle Recovery Manager Events

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

- About Auditing Oracle Recovery Manager Events
  The `UNIFIED_AUDIT_TRAIL` data dictionary view automatically stores Oracle Recovery Manager audit events in the `RMAN_`column.
- Oracle Recovery Manager Unified Audit Trail Events
  The unified audit trail can capture Oracle Recovery Manager events.
- How Oracle Recovery Manager Audited Events Appear in the Audit Trail
  The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle Recovery Manager audit events.

30.8.4.1 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`.

Related Topics

- *Oracle Database Backup and Recovery User's Guide*

30.8.4.2 Oracle Recovery Manager Unified Audit Trail Events

The unified audit trail can capture Oracle Recovery Manager events.

Table 30-17 describes these events.

Table 30-17 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.
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.

30.8.4.3 How Oracle Recovery Manager Audited Events Appear in the Audit Trail

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

Table 30-17 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
```

30.8.5 Auditing Oracle Label Security Events

In an Oracle Label Security environment, the CREATE AUDIT POLICY statement can audit Oracle Label Security activities.

- About Auditing Oracle Label Security Events
  As with all unified auditing, you must have the AUDIT_ADMIN role before you can audit Oracle Label Security (OLS) events.
- Oracle Label Security Unified Audit Trail Events
  The unified audit trail can capture Oracle Label Security audit events.
- 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.
- 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.
- Example: Auditing Oracle Label Security Session Label Attributes
  The AUDIT CONTEXT NAMESPACE statement can audit Oracle Label Security session label attributes.
- Example: Excluding a User from an Oracle Label Security Policy
  The CREATE AUDIT POLICY statement can exclude users from policies.
- Example: Auditing Oracle Label Security Policy Actions
  The CREATE AUDIT POLICY statement can audit Oracle Label Security policy actions.
- 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.
- How Oracle Label Security Audit Events Appear in the Audit Trail
  The UNIFIED_AUDIT_TRAIL data dictionary view lists Oracle Label Security audit events.

30.8.5.1 About Auditing Oracle Label Security Events

As with all unified auditing, 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, you can query the UNIFIED_AUDIT_TRAIL data dictionary view. This view contains Oracle Label Security-specific columns whose names begin with OLS_. If you want to find audit information about the internally generated VPD predicate that is created when you apply an Oracle Label Security policy to a table, then you can query the RLS_INFO column.

Related Topics

- Auditing of Oracle Virtual Private Database Predicates
  The unified audit trail automatically captures the predicates that are used in Oracle Virtual Private Database (VPD) policies.
- *Oracle Label Security Administrator's Guide*

30.8.5.2 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 30-18 describes the Oracle Label Security audit events.

Table 30-18 Oracle Label Security Audit Events

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

Table 30-18 (Cont.) Oracle Label Security Audit Events

Audit Event	Description
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
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
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
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

Table 30-18 (Cont.) Oracle Label Security Audit Events

Audit Event	Description
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

30.8.5.3 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. 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;
```

Related Topics

- Configuring Application Context Audit Settings
  The AUDIT statement with the CONTEXT keyword configures auditing for application context values.

30.8.5.4 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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the `CREATE AUDIT POLICY` statement.

30.8.5.5 Example: Auditing Oracle Label Security Session Label Attributes

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

Example 30-32 shows how to audit `ORA_OLS_SESSION_LABELS` application context attributes for the Oracle Label Security policies `usr_pol1` and `usr_pol2`.

Example 30-32 Auditing Oracle Label Security Session Label Attributes

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

30.8.5.6 Example: Excluding a User from an Oracle Label Security Policy

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

Example 30-33 shows how to create a unified audit policy that excludes actions from user `ols_mgr`.

Example 30-33 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;
```

30.8.5.7 Example: Auditing Oracle Label Security Policy Actions

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

Example 30-34 shows how to audit the `DROP POLICY` and `DISABLE POLICY` 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 30-34 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;

AUDIT POLICY generic_audit_pol BY HR, LBACSYS WHENEVER SUCCESSFUL;
```

30.8.5.8 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 30-35 shows how to use the `LBACSYS.ORA_GET_AUDITED_LABEL` function in a `UNIFIED_AUDIT_TRAIL` data dictionary view query.

Example 30-35 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
```

30.8.5.9 How Oracle Label Security Audit Events Appear in the Audit Trail

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

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.

Related Topics

- *Oracle Label Security Administrator's Guide*

30.8.6 Auditing Oracle Data Pump Events

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

- 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.
- Oracle Data Pump Unified Audit Trail Events
  The unified audit trail can capture Oracle Data Pump events.
- 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.
- Example: Auditing Oracle Data Pump Import Operations
  The `CREATE AUDIT POLICY` statement can audit Oracle Data Pump import operations.
- Example: Auditing All Oracle Data Pump Operations
  The `CREATE AUDIT POLICY` statement can audit all Oracle Data Pump operations.

- How Oracle Data Pump Audit Events Appear in the Audit Trail
  The UNIFIED_AUDIT_TRAIL data dictionary view lists Oracle Data Pump audited events.

30.8.6.1 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_.

Oracle Database records the Oracle Data Pump record before the worker process has determined or dispatched the actual workload. Therefore, there is no success or failure code that is captured in the audit record. A return code of 0 is expected behavior irrespective of the success or failure of the Data Pump job. Additionally, because Data Pump is restartable, reports on the success and failure status of the export or import operations might not be feasible to obtain.

Related Topics

- *Oracle Database Utilities*

30.8.6.2 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.

30.8.6.3 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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the CREATE AUDIT POLICY statement.

30.8.6.4 Example: Auditing Oracle Data Pump Import Operations

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

Example 30-36 shows how to audit all Oracle Data Pump import operations.

Example 30-36 Auditing Oracle Data Pump Import Operations

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

AUDIT POLICY audit_dp_import_pol;
```

30.8.6.5 Example: Auditing All Oracle Data Pump Operations

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

Example 30-37 shows how to audit both Oracle Database Pump export and import operations.

Example 30-37 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;
```

30.8.6.6 How Oracle Data Pump Audit Events Appear in the Audit Trail

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

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, DP_WARNINGS1 FROM UNIFIED_AUDIT_TRAIL
WHERE AUDIT_TYPE = 'DATAPUMP';

DP_TEXT_PARAMETERS1                              DP_BOOLEAN_PARAMETERS1  DP_WARNINGS1
------------------------------------------------ ----------------------
--------------------------------------------------------------------------------

MASTER TABLE:  "SCOTT"."SYS_EXPORT_TABLE_01",  MASTER_ONLY: FALSE,     No warnings issued
JOB_TYPE: EXPORT,                              DATA_ONLY: FALSE,
METADATA_JOB_MODE: TABLE_EXPORT,               METADATA_ONLY: FALSE,
JOB VERSION: 23.1.0.0,                         DUMPFILE_PRESENT: TRUE,
ACCESS METHOD: DIRECT_PATH,                    JOB_RESTARTED: FALSE
DATA OPTIONS: 0,                               ENCRYPTED: TRUE
DUMPER DIRECTORY: NULL
REMOTE LINK: NULL,
TABLE EXISTS: NULL,
PARTITION OPTIONS: NONE
SCHEMA: SCOTT
```

(This output was reformatted for easier readability.)

Oracle Database records the Oracle Data Pump record before the worker process has determined or dispatched the actual workload. Therefore, there is no success or failure code that is captured in the audit record. A return code of 0 is expected behavior irrespective of the success or failure of the Data Pump job. Additionally, because Data Pump is restartable reports on the success and failure status of the export or import operations might not be feasible to obtain.

30.8.7 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.

- 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.
- Oracle SQL*Loader Direct Load Path Unified Audit Trail Events
  The unified audit trail can capture SQL*Loader Direct Load Path events.
- 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.
- Example: Auditing Oracle SQL*Loader Direct Path Load Operations
  The `CREATE AUDIT POLICY` statement can audit Oracle SQL*Loader direct path load operations.
- 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.

30.8.7.1 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.

Related Topics

- *Oracle Database Utilities*

30.8.7.2 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.

Related Topics

- *Oracle Database Utilities*

30.8.7.3 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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the `CREATE AUDIT POLICY` statement.

30.8.7.4 Example: Auditing Oracle SQL*Loader Direct Path Load Operations

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

Example 30-36 shows how to audit SQL*Loader direct path load operations.

Example 30-38 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;
```

30.8.7.5 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.

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
```

30.8.8 Auditing Oracle XML DB HTTP and FTP Protocols

You can use the `CREATE AUDIT POLICY` statement to audit Oracle XML DB HTTP and FTP protocol messages.

- About Auditing Oracle XML DB HTTP and FTP Protocols
  You must have the AUDIT_ADMIN role to audit Oracle XDB HTTP and FTP protocol messages.
- Configuring a Unified Audit Policy to Capture Oracle XML DB HTTP and FTP Protocols
  The CREATE AUDIT POLICY statement can create a unified audit policy for Oracle XML DB HTTP and FTP protocols.
- Example: Auditing Failed Oracle XML DB HTTP Messages
  The CREATE AUDIT POLICY statement can audit failed Oracle XML DB HTTP messages.
- Example: Auditing All Oracle XML DB FTP Messages
  The CREATE AUDIT POLICY statement can audit all Oracle XML DB FTP messages.
- Example: Auditing Oracle XML DB HTTP Messages That Have 401 AUTH Errors
  The CREATE AUDIT POLICY statement can audit HTTP messages that have 401 AUTH errors.
- How the Unified Audit Trail Captures Oracle XML DB HTTP and FTP Protocol Messages
  The UNIFIED_AUDIT_TRAIL data dictionary view lists Oracle XML DB HTTP and FTP protocol messages.

30.8.8.1 About Auditing Oracle XML DB HTTP and FTP Protocols

You must have the AUDIT_ADMIN role to audit Oracle XDB HTTP and FTP protocol messages.

Oracle Database can audit all or failed HTTP messages, 401 AUTH HTTP return code messages, and all or failed FTP messages. The UNIFIED_AUDIT_TRAIL data dictionary view captures the result of the audit in the PROTOCOL_* columns.

Be aware that a unified audit policy for HTTP and FTP protocols can affect performance.

30.8.8.2 Configuring a Unified Audit Policy to Capture Oracle XML DB HTTP and FTP Protocols

The CREATE AUDIT POLICY statement can create a unified audit policy for Oracle XML DB HTTP and FTP protocols.

- Use the following syntax to create a unified audit policy for Oracle XML DB HTTP and FTP protocols:

```
CREATE AUDIT POLICY policy_name
ACTIONS COMPONENT=PROTOCOL [ HTTP | FTP | AUTHENTICATION];
```

  In this specification:

  – HTTP enabling auditing of Oracle XML DB HTTP messages.

  – FTP enables auditing of Oracle XML DB FTP messages.

  – AUTHENTICATION enables auditing of HTTP 401 AUTH messages.

  For example:

```
CREATE AUDIT POLICY http_pol
ACTIONS COMPONENT=PROTOCOL HTTP;
```

30.8.8.3 Example: Auditing Failed Oracle XML DB HTTP Messages

The CREATE AUDIT POLICY statement can audit failed Oracle XML DB HTTP messages.

Example 30-39 shows an example of creating and enabling a unified audit policy that tracks failed HTTP messages.

Example 30-39 Auditing Failed Oracle XML DB HTTP Messages

```
CREATE AUDIT POLICY failed_http_pol
ACTIONS COMPONENT=PROTOCOL HTTP;

AUDIT POLICY failed_http_pol WHENEVER NOT SUCCESSFUL;
```

30.8.8.4 Example: Auditing All Oracle XML DB FTP Messages

The `CREATE AUDIT POLICY` statement can audit all Oracle XML DB FTP messages.

Example 30-40 shows an example of creating and enabling a unified audit policy that tracks all FTP messages.

Example 30-40 Auditing All Oracle XML DB FTP Messages

```
CREATE AUDIT POLICY all_ftp_pol
ACTIONS COMPONENT=PROTOCOL FTP;

AUDIT POLICY all_ftp_pol;
```

30.8.8.5 Example: Auditing Oracle XML DB HTTP Messages That Have 401 AUTH Errors

The `CREATE AUDIT POLICY` statement can audit HTTP messages that have `401 AUTH` errors.

Example 30-41 shows an example of creating and enabling a unified audit policy that tracks `401 AUTH` messages. When you enable this type of policy, you can set it without using the `WHENEVER` clause or set it using the `WHENEVER SUCCESSFUL` clause. Using a `WHENEVER NOT SUCCESSFUL` will not audit `401 AUTH` errors.

Example 30-41 Auditing Oracle XML DB HTTP Messages with 401 AUTH Errors

```
CREATE AUDIT POLICY 401_error_pol
ACTIONS COMPONENT=PROTOCOL AUTHENTICATION;

AUDIT POLICY 401_error_pol;
```

30.8.8.6 How the Unified Audit Trail Captures Oracle XML DB HTTP and FTP Protocol Messages

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle XML DB HTTP and FTP protocol messages.

The `PROTOCOL_*` columns capture HTTP- and FTP-specific information such as the session ID, the return code, the type of request, and the text of the request or reply.

For example, the following query shows that the `HTTP-GET` request/reply had a return code of `207`, which means the reply may have multiple components with separate return codes:

```
SELECT PROTOCOL_RETURN_CODE, PROTOCOL_ACTION_NAME
FROM UNIFIED_AUDIT_POLICY
WHERE USERHOST = "HR_SRV";

PROTOCOL_RETURN_CODE  PROTOCOL_ACTION_NAME
--------------------  --------------------
```

```
207                 HTTP-GET-CMD
207                 HTTP-GET
```

30.8.9 Auditing Oracle Machine Learning for SQL Events

You can use the `CREATE AUDIT POLICY` statement to audit Oracle Machine Learning for SQL events.

- About Auditing Oracle Machine Learning for SQL Events
  You must have the `AUDIT_ADMIN` role to audit Oracle Machine Learning for SQL events.
- Oracle Machine Learning for SQL Unified Audit Trail Events
  The unified audit trail can capture Oracle Machine Learning for SQL audit events..
- Configuring a Unified Audit Policy for Oracle Machine Learning for SQL
  The `CREATE AUDIT POLICY` statement `ACTIONS` and `ON MINING MODEL` clauses can be used to create Oracle Machine Learning for SQL event unified audit policies.
- Example: Auditing Multiple Oracle Machine Learning for SQL Operations by a User
  The `CREATE AUDIT POLICY` statement can audit multiple Oracle Machine Learning for SQL operations.
- Example: Auditing All Failed Oracle Machine Learning for SQL Operations by a User
  The `CREATE AUDIT POLICY` statement can audit failed Oracle Machine Learning for SQL operations by a user.
- How Oracle Machine Learning for SQL Events Appear in the Audit Trail
  The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle Machine Learning for SQL audit events.

30.8.9.1 About Auditing Oracle Machine Learning for SQL Events

You must have the `AUDIT_ADMIN` role to audit Oracle Machine Learning for SQL events.

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

Related Topics

- *Oracle Machine Learning for SQL Concepts*

30.8.9.2 Oracle Machine Learning for SQL Unified Audit Trail Events

The unified audit trail can capture Oracle Machine Learning for SQL audit events..

Table 30-19 describes these events.

Table 30-19 Oracle Machine Learning for SQL Audit Events

Audit Event	Description
`AUDIT`	Generates an audit record for a Oracle Machine Learning for SQL model
`COMMENT`	Adds a comment to a Oracle Machine Learning for SQL model
`GRANT`	Gives permission to a user to access the Oracle Machine Learning for SQL model
`RENAME`	Changes the name of the Oracle Machine Learning for SQL model

Table 30-19 (Cont.) Oracle Machine Learning for SQL Audit Events

Audit Event	Description
SELECT	Applies the Oracle Machine Learning for SQL model or view its signature

30.8.9.3 Configuring a Unified Audit Policy for Oracle Machine Learning for SQL

The CREATE AUDIT POLICY statement ACTIONS and ON MINING MODEL clauses can be used to create Oracle Machine Learning for SQL event unified audit policies.

- Use the following syntax to create a unified audit policy for Oracle Machine Learning for SQL:

```
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;
```

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.

Related Topics

- Syntax for Creating a Custom Unified Audit Policy
  To create a custom unified audit policy, you must use the CREATE AUDIT POLICY statement.

30.8.9.4 Example: Auditing Multiple Oracle Machine Learning for SQL Operations by a User

The CREATE AUDIT POLICY statement can audit multiple Oracle Machine Learning for SQL operations.

Example 30-42 shows how to audit multiple Oracle Machine Learning for SQL 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 30-42 Auditing Multiple Oracle Machine Learning for SQL 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;
```

30.8.9.5 Example: Auditing All Failed Oracle Machine Learning for SQL Operations by a User

The CREATE AUDIT POLICY statement can audit failed Oracle Machine Learning for SQL operations by a user.

Example 30-43 shows how to audit all failed Oracle Machine Learning for SQL operations by user `psmith`.

Example 30-43 Auditing All Failed Oracle Machine Learning for SQL 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;
```

30.8.9.6 How Oracle Machine Learning for SQL Events Appear in the Audit Trail

The `UNIFIED_AUDIT_TRAIL` data dictionary view lists Oracle Machine Learning for SQL audit events.

The following example shows how to query the `UNIFIED_AUDIT_TRAIL` data dictionary view for Machine Learning for SQL 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;
```

30.9 Managing Unified Audit Policies

After you create a unified audit policy, you must enable it. You can alter disable, and drop unified audit policies.

- Altering Unified Audit Policies
  You can use the `ALTER AUDIT POLICY` statement to modify a unified audit policy.
- Enabling and Applying Unified Audit Policies to Users and Roles
  You can use the `AUDIT POLICY` statement to enable and apply unified audit policies to users and roles.
- Disabling Unified Audit Policies
  You can use the `NOAUDIT POLICY` statement to disable a unified audit policy.
- Dropping Unified Audit Policies
  You can use the `DROP AUDIT POLICY` statement to drop a unified audit policy.

30.9.1 Altering Unified Audit Policies

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

- About Altering Unified Audit Policies
  You can change most properties in a unified audit policy, except for its `CONTAINER` setting.
- Altering a Unified Audit Policy
  The `ALTER AUDIT POLICY` statement can modify a unified audit policy.
- Example: Altering a Condition in a Unified Audit Policy
  The `ALTER AUDIT POLICY` statement can alter conditions in unified audit policies.
- 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: Altering Roles in a Unified Audit Policy
  The `ALTER AUDIT POLICY` statement can alter roles in a unified audit policy.
- Example: Dropping a Condition from a Unified Audit Policy
  The `ALTER AUDIT POLICY` statement can drop a condition from a unified audit policy.
- Example: Altering an Existing Unified Audit Policy Top-Level Statement Audits
  The `ALTER AUDIT POLICY` statement can modify an existing unified audit policy so that the unified audit trail captures top-level SQL statements only.

30.9.1.1 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.

30.9.1.2 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] [ONLY TOPLEVEL] ]
[DROP [privilege_audit_clause][action_audit_clause]
    [role_audit_clause] [ONLY TOPLEVEL]]
[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. 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. 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. The syntax is:

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

    * `ONLY TOPLEVEL` includes in the unified audit trail only the top-level SQL statements that are affected by this policy.

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

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

  – `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. 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
```

Related Topics

- Auditing System Privileges
  You can use the `CREATE AUDIT POLICY` statement to audit system privileges.
- Auditing Roles
  You can use the `CREATE AUDIT POLICY` statement to audit database roles.
- Auditing Object Actions
  You can use the `CREATE AUDIT POLICY` statement to audit object actions.
- Unified Auditing with Configurable Conditions
  You can use the `CREATE AUDIT POLICY` statement to create conditions for a unified audit policy.

30.9.1.3 Example: Altering a Condition in a Unified Audit Policy

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

Example 30-44 shows how to change a condition in an existing unified audit policy.

Example 30-44 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;
```

30.9.1.4 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 30-45 shows how to alter an Oracle Label Security component in an audit policy.

Example 30-45 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;
```

30.9.1.5 Example: Altering Roles in a Unified Audit Policy

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

Example 30-46 shows how to add roles to a common unified audit policy.

Example 30-46 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;
```

30.9.1.6 Example: Dropping a Condition from a Unified Audit Policy

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

Example 30-47 shows how to drop a condition from an existing unified audit policy.

Example 30-47 Dropping a Condition from a Unified Audit Policy

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

30.9.1.7 Example: Altering an Existing Unified Audit Policy Top-Level Statement Audits

The `ALTER AUDIT POLICY` statement can modify an existing unified audit policy so that the unified audit trail captures top-level SQL statements only.

The following example shows how to modify the `orders_unified_audpol` policy to capture only top-level SQL statements.

Example 30-48 Altering an Existing Unified Audit Policy to Audit for Top-Level Statements

```
ALTER AUDIT POLICY orders_unified_audpol ADD ONLY TOPLEVEL;
```

Similarly, to remove the top-level SQL statement audit, use the `DROP` clause:

```
ALTER AUDIT POLICY orders_unified_audpol DROP ONLY TOPLEVEL;
```

30.9.2 Enabling and Applying Unified Audit Policies to Users and Roles

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

- 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.
- Enabling a Unified Audit Policy
  The `AUDIT POLICY` statement can enable a unified audit policy.
- Example: Enabling a Unified Audit Policy
  The `AUDIT POLICY` statement can enable a unified audit policy using conditions, such as `WHENEVER NOT SUCCESSFUL`.

30.9.2.1 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 is enabled immediately in the current session and in any ongoing active sessions, including sessions for other users who are logged in.

You can enable the audit policy for individual users or for roles. Enabling the audit policy for roles allows you to enable the policy for a group of users who have been directly granted the role. When the role has been directly granted to a new user, then the policy automatically

applies to the user. When the role is revoked from a user, then the policy no longer applies to the user.

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 or roles.**To apply the policy to one or more users or roles, including administrative users who log in with the `SYSDBA` administrative privilege (such as `SYS`), use the `BY` clause. For example, to apply the policy to users `SYS` and `SYSTEM`:

  For example, to apply the policy to two users:

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

  To apply a policy to users who have been directly granted the `DBA` and `CDB_DBA` roles:

  ```
  AUDIT POLICY admin_audit_pol BY USERS WITH GRANTED ROLES DBA, CDB_DBA;
  ```

- **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.** Auditing the successes and failures of actions helps to narrow down the events that matter the most. 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`, `BY USERS WITH GRANTED ROLES`, or the `EXCEPT` clause, but not more than one of these clauses for the same policy.
- If you run multiple `AUDIT` statements on the same unified audit policy but specify different BY users or different `BY USERS WITH GRANTED ROLES` roles, then Oracle Database audits all of these users or roles.
- 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 cannot use the `EXCEPT` clause for roles. It applies to users only.
- You can only enable common unified audit policies for common users or roles.

- You can enable a common audit policy only from the root and a local audit policy only from the PDB to which it applies.

30.9.2.2 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 or roles 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
      ```

      To apply the policy to one or more users to whom the list of roles are directly granted, use the `BY USERS WITH GRANTED ROLES` clause. For example:

      ```
      BY USERS WITH GRANTED ROLES HS_ADMIN_ROLE, HS_ADMIN_SELECT_ROLE
      ```

    - **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.

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.

Related Topics

- 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.

30.9.2.3 Example: Enabling a Unified Audit Policy

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

Example 30-49 shows how to enable a unified audit policy to record only failed actions by the user dv_admin.

Example 30-49 Enabling a Unified Audit Policy

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

30.9.3 Disabling Unified Audit Policies

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

- About Disabling Unified Audit Policies
  The NOAUDIT statement with the POLICY clause can disable a unified audit policy.
- Disabling a Unified Audit Policy
  The NOAUDIT statement can disable a unified audit policy using supported audit options.
- Example: Disabling a Unified Audit Policy
  The NOAUDIT POLICY statement disable a unified audit policy using filtering, such as by user name.

30.9.3.1 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 or BY USERS WITH GRANTED ROLES role 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.

You can disable a common audit policy only from the root and a local audit policy only from the PDB to which it applies.

30.9.3.2 Disabling a Unified Audit Policy

The NOAUDIT statement can disable a unified audit policy using supported audit options.

- 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 or BY USERS WITH GRANTED ROLES clause, but not the EXCEPT clause.

  – *existing_audit_options* refers to AUDIT options that were available in releases earlier than Oracle Database 12c release 1 (12.1), such as the following:

    * SELECT ANY TABLE, UPDATE ANY TABLE BY SCOTT, HR
    * UPDATE ON SCOTT.EMP

  If the unified policy had been applied to all users, then you only need to specify the policy name. For example:

```
NOAUDIT POLICY logons_pol;
```

Related Topics

- 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.

30.9.3.3 Example: Disabling a Unified Audit Policy

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

Example 30-50 shows examples of how to disable a unified audit policy for a user and for a role.

Example 30-50 Disabling a Unified Audit Policy

```
NOAUDIT POLICY dv_admin_pol BY tjones;

NOAUDIT POLICY dv_admin_pol BY USERS WITH GRANTED ROLES emp_admin;
```

30.9.4 Dropping Unified Audit Policies

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

- About Dropping Unified Audit Policies
  The `DROP AUDIT POLICY` statement can be used to unified audit policies.
- 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.
- Example: Disabling and Dropping a Unified Audit Policy
  The `NOAUDIT POLICY` and `DROP AUDIT POLICY` statements can disable and drop a unified audit policy.

30.9.4.1 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;
```

You can drop a common audit policy only from the root and a local audit policy only from the PDB to which it applies.

30.9.4.2 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;
```

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.

Related Topics

- Auditing in a Multitenant Deployment
  You can create unified audit policies for individual PDBs and in the root.

30.9.4.3 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 30-51 shows how to disable and drop a common unified audit policy.

Example 30-51 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
```

30.10 Tutorial: Auditing Nondatabase Users

Auditing nondatabase users who are typical application service accounts is crucial. They are identified in the database using the `CLIENT_IDENTIFIER` attribute.

- 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.
- Step 2: Create the Unified Audit Policy
  Next, you are ready to create the unified audit policy.
- Step 3: Test the Policy
  To test the policy, use `OE` must try to select from the `OE.ORDERS` table.
- Step 4: Remove the Components of This Tutorial
  If you no longer need the components of this tutorial, then you can remove them.

30.10.1 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 in to a PDB as user `SYS` with the `SYSDBA` administrative privilege.

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

To find the available PDBs in a CDB, log in to the CDB root container and then query the PDB_NAME column of the DBA_PDBS data dictionary view. To check the current container, run the show con_name command.

2. 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.

3. 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;
```

4. 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;
```

Replace *password* with a password that is secure. For greater security, do **not** give the OE account the same password from previous releases of Oracle Database.

Related Topics

- Guidelines for Securing Passwords
  Oracle provides guidelines for securing passwords in a variety of situations.

30.10.2 Step 2: Create the Unified Audit Policy

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

1. Connect to the PDB as user policy_admin.

```
CONNECT policy_admin@pdb_name
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.

30.10.3 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 then select from the `OE.ORDERS` table.

```
CONNECT OE@pdb_name
Enter password: password

SELECT COUNT(*) FROM ORDERS;
```

   The following output appears:

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

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

```
CONNECT policy_auditor@pdb_name
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
```

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

```
CONNECT OE@pdb_name
Enter password: password

EXEC DBMS_SESSION.SET_IDENTIFIER('robert');

SELECT COUNT(*) FROM ORDERS;
```

   The following output should appear:

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

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

```
CONNECT policy_auditor@pdb_name
Enter password: password

SELECT DBUSERNAME, CLIENT_IDENTIFIER, SQL_TEXT FROM UNIFIED_AUDIT_TRAIL
 WHERE SQL_TEXT LIKE '%FROM ORDERS%';
```

   This time, because `robert` has queried the `OE.ORDERS` table, the audit trail captures their actions:

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

30.10.4 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 as user `policy_admin`, and then manually disable and drop the `orders_unified_audpol` policy.

   ```
   CONNECT policy_admin@pdb_name
   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@pdb_name
   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;
   ```

30.11 Unified Audit Policy Data Dictionary Views

You can query data dictionary and dynamic views to find detailed auditing information about custom unified audit policies.

Table 30-20 lists these views.

> **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 30-20 Views for Use with Custom Unified Audit Policies

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

Table 30-20 (Cont.) Views for Use with Custom Unified Audit Policies

View	Description
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 CDB root and must be queried from there.
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.
UNIFIED_AUDIT_TRAIL	Displays all audit records

Related Topics

- *Oracle Database Reference*