

Oracle® Database Vault Administrator's Guide



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Oracle Database Vault Administrator's Guide, 21c

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Preface

Oracle Database Vault Administrator's Guide explains how to configure access control-based security in an Oracle Database environment by using Oracle Database Vault.

- [Audience](#)
- [Documentation Accessibility](#)
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Audience

This document is intended for security managers, audit managers, label administrators, and Oracle database administrators (DBAs) who are involved in the configuration of Oracle Database Vault.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

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Diversity and Inclusion

Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers, and partners, we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

Related Documents

For more information refer to the following documents:

- *Oracle Database Security Guide*

- *Oracle Label Security Administrator's Guide*
- *Oracle Database Administrator's Guide*
- *Oracle Database SQL Language Reference*
- *Oracle Multitenant Administrator's Guide*

Oracle Technical Services

To download the product data sheet, frequently asked questions, links to the latest product documentation, product download, and other collateral, visit Oracle Technical Resources (formerly Oracle Technology Network). You must register online before using Oracle Technical Services. Registration is free and can be done at

<https://www.oracle.com/technical-resources/>

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You can find information about security patches, certifications, and the support knowledge base by visiting My Oracle Support (formerly OracleMetaLink) at

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Conventions

The following text conventions are used in this document:

| Convention | Meaning |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------|
| boldface | Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary. |
| <i>italic</i> | Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values. |
| monospace | Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter. |

Changes in This Release for Oracle Database Vault Administrator's Guide

This preface contains:

- [Changes in Oracle Database Vault 21c](#)

Changes in Oracle Database Vault 21c

The following are changes in *Oracle Database Vault Administrator's Guide* for Oracle Database 21c.

- [ADMINISTER KEY MANAGEMENT Statement Now Supported by Oracle Database Vault Command Rules](#)
You now can protect the `ADMINISTER KEY MANAGEMENT` statement with Oracle Database Vault command rules.
- [DBA_DV_SIMULATION_LOG View Columns REALM_NAME and RULE_SET_NAME Now VARCHAR2 Data Type](#)
Starting with this release, the `REALM_NAME` and `RULE_SET_NAME` columns will use the `VARCHAR2` data type instead of being in nested tables.
- [Ability to Prevent Local Oracle Database Vault Policies from Blocking Common Operations](#)
Starting with this release, a `DV_OWNER` common user in the root can prevent local users from creating Oracle Database Vault controls on common objects in a pluggable database (PDB).
- [Uninstalling and Installing Oracle Label Security and Oracle Database Vault Now Supported](#)
You now can install and uninstall Oracle Database Vault and Oracle Label Security in PDBs.
- [No Need to Disable Oracle Database Vault Before Upgrades](#)
Starting with this release, you do not need to disable Oracle Database Vault in every container before upgrading from an earlier release to the current release.
- [Removal of the Default DDL Authorization of \(% , %\)](#)
When Oracle Database Vault DDL authorization was introduced in Oracle Database 12.1, it included the default DDL authorization of `(% , %)`.

ADMINISTER KEY MANAGEMENT Statement Now Supported by Oracle Database Vault Command Rules

You now can protect the `ADMINISTER KEY MANAGEMENT` statement with Oracle Database Vault command rules.

The `ADMINISTER KEY MANAGEMENT` statement manages Transparent Data Encryption (TDE) features.

Related Topics

- [SQL Statements That Can Be Protected by Command Rules](#)
You can protect a large number of SQL statements by using command rules.

DBA_DV_SIMULATION_LOG View Columns REALM_NAME and RULE_SET_NAME Now VARCHAR2 Data Type

Starting with this release, the `REALM_NAME` and `RULE_SET_NAME` columns will use the `VARCHAR2` data type instead of being in nested tables.

This enhancement enables multiple realm names and rule set names to be separated by a comma in a `VARCHAR2` data type instead of using a nested table in the columns. In the unlikely situation where you may have so many realms or rule set names protecting a single object in which the `VARCHAR2` data exceeds 4000 characters, Oracle Database Vault will truncate the list of realms or rule sets at 4000 characters in the column and if the full set is needed, it can be retrieved from the nested table in the `DVSYS.SIMULATION_LOG$` base table.

Storing realm names and rule set names as a `VARCHAR2` data type makes it easier for you to read the realm name or rule set name in the simulation log. Most users only use a single realm or rule set to protect their sensitive data objects and even if they do use multiple realms or rule sets, it is easier to read data in a `VARCHAR2` data type rather than a nested table.

Related Topics

- [DBA_DV_SIMULATION_LOG View](#)
The `DBA_DV_SIMULATION_LOG` data dictionary view captures simulation log information for realms and command rules that have had simulation mode enabled.

Ability to Prevent Local Oracle Database Vault Policies from Blocking Common Operations

Starting with this release, a `DV_OWNER` common user in the root can prevent local users from creating Oracle Database Vault controls on common objects in a pluggable database (PDB).

In previous releases, in a multitenant environment, a local Oracle Database Vault user could create Database Vault policies that could potentially block common operations to manage the application or overall database. Blocking common users from common operations can prevent the execution of SQL commands that are necessary for managing the application or CDB database. To prevent this occurrence, a user who has the `DV_OWNER` role in the root can run the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure to control whether local PDB users can create Database Vault controls on common users' objects (database or application).

This enhancement enables database administrators to manage the CDB database and application database administrators to manage PDBs without being blocked by local Database Vault controls from a PDB. Infrastructure database administrators can also manage the CDB database without being blocked by application common Database Vault controls.

Related Topics

- [Preventing Multitenant Local Users from Blocking Common Operations](#)
You can prevent multitenant local users from blocking common operations when they attempt to create Oracle Database Vault protections on common user objects.

Uninstalling and Installing Oracle Label Security and Oracle Database Vault Now Supported

You now can install and uninstall Oracle Database Vault and Oracle Label Security in PDBs.

To install a feature into a PDB requires that the feature already be installed in the CDB root.

This enhancement enables you to configure your own databases with Oracle Label Security and Oracle Database Vault to meet your site's requirements.

Related Topics

- [Uninstalling Oracle Database Vault](#)
You can uninstall Oracle Database Vault from an Oracle Database installation, for PDBs (but not the root) and Oracle RAC installations.

No Need to Disable Oracle Database Vault Before Upgrades

Starting with this release, you do not need to disable Oracle Database Vault in every container before upgrading from an earlier release to the current release.

You only need to grant the `DV_PATCH_ADMIN` role to `SYS` commonly before you perform the upgrade. After the upgrade is complete the Database Vault controls work as before. Then revoke the `DV_PATCH_ADMIN` role from `SYS` commonly.

Alternatively, you can explicitly disable Oracle Database Vault in all containers before the upgrade, and then after the upgrade, explicitly enable Oracle Database Vault in all the containers.

Related Topics

- [When You Must Disable Oracle Database Vault](#)
You may need to disable Oracle Database Vault to perform upgrade tasks or correct erroneous configurations.

Removal of the Default DDL Authorization of (%, %)

When Oracle Database Vault DDL authorization was introduced in Oracle Database 12.1, it included the default DDL authorization of (%, %).

The (%, %) authorization enabled users to perform DDL operations on any schema without explicit DDL authorizations. It was designed to prevent any undesirable disruption due to unexpected DDL failures in an Oracle Database Vault environment. Starting with Oracle Database 21c, however, there is no default DDL authorization in Oracle Database Vault, and the existing default DDL authorization of (%, %) will be removed when Oracle Database is upgraded to release 21c. To prevent any problems, you must identify and authorize proper database users for DDL operations or optionally re-authorize (%, %) so that every user is allowed to perform DDL operations without explicit authorization. For better security, Oracle recommends that only trusted users are authorized for DDL operations.

Related Topics

- [Performing DDL Operations in Oracle Database Vault](#)
Data Definition Language (DDL) operations in Oracle Database Vault can be affected by situations such as schema ownership and patch upgrades.

1

Introduction to Oracle Database Vault

Oracle Database Vault enables you to control administrative access to your data.

- [What Is Oracle Database Vault?](#)
Oracle Database Vault provides controls to prevent unauthorized privileged users from accessing sensitive data and to prevent unauthorized database changes.
- [What Privileges Do You Need to Use Oracle Database Vault?](#)
Oracle Database Vault provides database roles that enable different users to perform specific tasks, based on separation-of-duty guidelines.
- [Components of Oracle Database Vault](#)
Oracle Database Vault has a set of components that include PL/SQL packages and other special tools.
- [How Oracle Database Vault Addresses Compliance Regulations](#)
One of the biggest side benefits resulting from regulatory compliance has been security awareness.
- [How Oracle Database Vault Protects Privileged User Accounts](#)
Many security breaches, both external and internal, target privileged database user accounts to steal data from databases.
- [How Oracle Database Vault Allows for Flexible Security Policies](#)
Oracle Database Vault helps you design flexible security policies for your database.
- [How Oracle Database Vault Addresses Database Consolidation Concerns](#)
Consolidation and cloud environments reduce cost but can expose sensitive application data to those without a true need-to-know.
- [How Oracle Database Vault Works in a Multitenant Environment](#)
Using Oracle Database Vault in a multitenant environment increases security for consolidation.

1.1 What Is Oracle Database Vault?

Oracle Database Vault provides controls to prevent unauthorized privileged users from accessing sensitive data and to prevent unauthorized database changes.

- [About Oracle Database Vault](#)
The Oracle Database Vault security controls protect application data from unauthorized access, and helps you to comply with privacy and regulatory requirements.
- [Controls for Privileged Accounts](#)
Privileged database accounts are one of the most commonly used pathways for gaining access to sensitive applications data in the database.
- [Controls for Database Configuration](#)
Common audit findings are unauthorized changes to database entitlements and grants of the DBA role to too many users.
- [Enterprise Applications Protection Policies](#)
Application-specific Oracle Database Vault protection policies and guidelines are available for major enterprise applications.

1.1.1 About Oracle Database Vault

The Oracle Database Vault security controls protect application data from unauthorized access, and helps you to comply with privacy and regulatory requirements.

Oracle Database Vault is a licensable option of Oracle Database Enterprise Edition. Its purpose is to mitigate the potential impact of privileged account abuse, misuse, insider and external threats, and human error on your sensitive data.

Privileged accounts can be administrator accounts, such as database administrators, or application administrators, application owners, or data analysts. Most users with these type of accounts have far more privileges and access than they need on a daily basis.

Oracle Database Vault is built into the kernel of the Oracle database and makes decisions after system or object privileges are verified. If the command is authorized by a system or object privilege, then Oracle Database Vault then determines if the command is controlled by an Oracle Database Vault realm or command rule. The realm or command rule controls are determined by you. Oracle Database Vault does not replace your existing existing grants or roles but augments them by allowing you to decide when, where, why, and how object or system privileges or roles are used by the grantee.

For example, any user who is granted the `SELECT ANY TABLE` system privilege can use their privilege to query virtually any table in the database, including tables you consider sensitive or important. Oracle Database Vault can restrict the `SELECT ANY TABLE` system privilege usage on your sensitive tables or other database objects. In addition, Oracle Database Vault can restrict privileged users and the object owner from performing destructive commands on objects. For example, `DROP TABLE` or `DROP INDEX` commands are rarely, or never, used on a production schema and should be disabled to prevent mistakes.

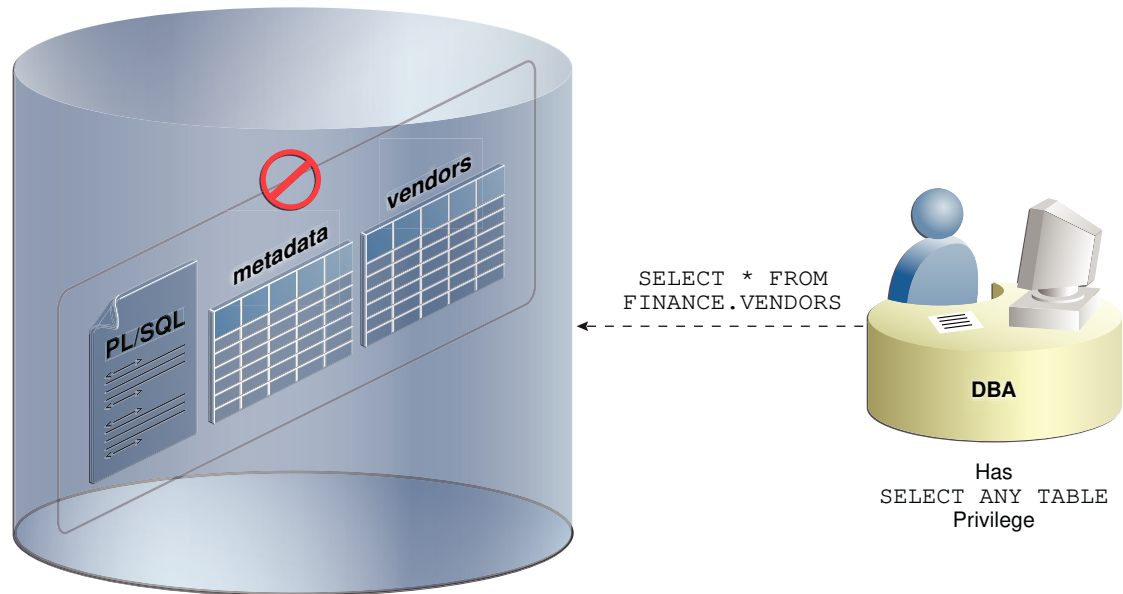
Oracle Database Vault helps you increase the security of existing applications through transparent controls that are determined by your requirements.

1.1.2 Controls for Privileged Accounts

Privileged database accounts are one of the most commonly used pathways for gaining access to sensitive applications data in the database.

While their broad and unrestricted access facilitates database maintenance, the same access also creates a point of attack for gaining access to large amounts of data. Oracle Database Vault realms around application schemas, sensitive tables, and stored procedures provide controls to prevent privileged accounts from being exploited by intruders and insiders to access sensitive application data.

Figure 1-1 Oracle Database Vault Realm Blocking DBA Access to Data



1.1.3 Controls for Database Configuration

Common audit findings are unauthorized changes to database entitlements and grants of the DBA role to too many users.

Preventing unauthorized changes to production environments is important not only for security, but also for compliance as such changes can weaken security and open doors to intruders, violating privacy and compliance regulations. Oracle Database Vault SQL command rules enable you to control operations inside the database, including commands such as `CREATE TABLE`, `TRUNCATE TABLE`, and `DROP TABLE`. Various out-of-the-box factors such as IP address, authentication method, and program name help implement trusted path authorization to deter attacks leveraging stolen passwords. These controls prevent accidental configuration changes and also prevent hackers and malicious insiders from tampering with applications.

The Oracle Database Vault realms with the mandatory mode enables you to seal off access to application objects, even to those with direct object grants, including the object owner. With mandatory realms, you do not need to analyze who has access because this is clear from the list of authorized users.

1.1.4 Enterprise Applications Protection Policies

Application-specific Oracle Database Vault protection policies and guidelines are available for major enterprise applications.

These enterprise applications include Oracle Fusion Applications, Oracle E-Business Suit, Oracle PeopleSoft, Oracle Siebel, Oracle Financial Services (i-Flex), Oracle Primavera, SAP, and Finacle from Infosys. Because Oracle Database Vault does not modify the application nor require changes to the client, you can use it with most off-the-shelf and custom applications.

1.2 What Privileges Do You Need to Use Oracle Database Vault?

Oracle Database Vault provides database roles that enable different users to perform specific tasks, based on separation-of-duty guidelines.

The most commonly used roles are as follows:

- `DV_OWNER` and `DV_ADMIN` enable you to create and manage Database Vault policies.
- `DV_ACCTMGR` enables you to manage user accounts.

When you configure and enable Oracle Database Vault, the `DV_OWNER` role is granted to a user who must exist before you begin the configuration process, and the `DV_ACCTMGR` role is granted to a second, optional user, who must also exist before configuration. You can grant the Database Vault roles to other users, but ensure that these users are trusted.

During the registration process, you must create backup accounts for the `DV_OWNER` and `DV_ACCTMGR` users. As a best practice, Oracle strongly recommends that you keep and maintain these backup accounts.

Related Topics

- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.
- [Backup Oracle Database Vault Accounts](#)
As a best practice, you should maintain backup accounts for the `DV_OWNER` and `DV_ACCTMGR` roles.

1.3 Components of Oracle Database Vault

Oracle Database Vault has a set of components that include PL/SQL packages and other special tools.

- [Oracle Database Vault Access Control Components](#)
Oracle Database Vault enables you to create a set of components to manage security for your database instance.
- [Oracle Database Vault DVSYS and DVF Schemas](#)
Oracle Database Vault database objects and public functions are stored in the `DVSYS` and `DVF` schemas, respectively.
- [Oracle Database Vault PL/SQL Interfaces and Packages](#)
Oracle Database Vault provides PL/SQL interfaces and packages for security managers or application developers to configure access control policies.
- [Oracle Database Vault Reporting and Monitoring Tools](#)
Oracle Enterprise Manager generates and maintains the Oracle Database Vault reports.
- [Oracle Enterprise Manager Cloud Control Database Vault Administrator Pages](#)
Oracle Database Vault administration is fully integrated with Oracle Enterprise Manager Cloud Control, providing security administrators with a streamlined and centralized interface to manage Oracle Database Vault.

1.3.1 Oracle Database Vault Access Control Components

Oracle Database Vault enables you to create a set of components to manage security for your database instance.

These components are as follows:

- **Realms.** A realm is a protection zone inside the database where database schemas, objects, and roles can be secured. For example, you can secure a set of schemas, objects, and roles that are related to accounting, sales, or human resources. After you have secured these into a realm, you can use the realm to control the use of system and object privileges to specific accounts or roles. This enables you to provide fine-grained access controls for anyone who wants to use these schemas, objects, and roles. [Configuring Realms](#), discusses realms in detail. See also [Oracle Database Vault Realm APIs](#).
- **Command rules.** A command rule is a special security policy that you can create to control how users can run almost any SQL statement, including `SELECT`, `ALTER SYSTEM`, database definition language (DDL), and data manipulation language (DML) statements. Command rules use rule sets to determine whether the statement is allowed. [Configuring Command Rules](#), discusses command rules in detail. See also [Oracle Database Vault Command Rule APIs](#).
- **Rule sets.** A rule set is a collection of one or more rules that you can associate with a realm authorization, command rule, factor assignment, or secure application role. The rule set evaluates to true or false based on the evaluation of each rule it contains and the evaluation type (**All True** or **Any True**). Rule sets can be associated with zero, one, or multiple realm authorizations, command rules, or secure application roles. [Configuring Rule Sets](#), discusses rule sets in detail. See also [Oracle Database Vault Rule Set APIs](#).
- **Rules.** A rule is a PL/SQL expression that evaluates to true or false. You can use the same rule in multiple rule sets. For more information, see [How Rule Sets Work](#).
- **Factors.** A factor is a named variable or attribute, such as a user location, database IP address, or session user, which Oracle Database Vault can recognize and use as a trusted path. You can use factors in rules to control activities such as authorizing database accounts to connect to the database or the execution of a specific database command to restrict the visibility and manageability of data. Each factor can have one or more identities. An identity is the actual value of a factor. A factor can have several identities depending on the factor retrieval method or its identity mapping logic. [Configuring Factors](#), discusses factors in detail. See also [Oracle Database Vault Factor APIs](#).
- **Secure application roles.** A secure application role is a special Oracle Database role that can be enabled based on the evaluation of an Oracle Database Vault rule set. [Configuring Secure Application Roles for Oracle Database Vault](#), discusses secure application roles in detail. See also [Oracle Database Vault Secure Application Role APIs](#).

To augment these components, Oracle Database Vault provides a set of PL/SQL interfaces and packages. [Oracle Database Vault PL/SQL Interfaces and Packages](#) provides an overview.

In general, the first step you take is to create a realm composed of the database schemas or database objects that you want to secure. You can further secure the realm by creating rules, command rules, factors, identities, rule sets, and secure application roles. In addition, you can run reports on the activities these components monitor and protect. [Getting Started with Oracle Database Vault](#), provides a simple tutorial that will familiarize you with basic Oracle Database Vault functionality. Later chapters provide more advanced tutorials. [Oracle Database Vault Reports](#), provides more information about how you can run reports to check the configuration and other activities that Oracle Database Vault performs.

1.3.2 Oracle Database Vault DVSYS and DVF Schemas

Oracle Database Vault database objects and public functions are stored in the `DVSYS` and `DVF` schemas, respectively.

Oracle Database Vault provides a schema, `DVSYS`, which stores the database objects needed to process Oracle data for Oracle Database Vault. This schema contains the roles, views, accounts, functions, and other database objects that Oracle Database Vault uses. The `DVF` schema contains public functions to retrieve (at run time) the factor values set in the Oracle Database Vault access control configuration. Both of these schemas are authenticated as schema only accounts. These accounts are locked by default and should remain locked unless directed otherwise by Oracle Support.

Related Topics

- [Oracle Database Vault Schemas, Roles, and Accounts](#)
Oracle Database Vault provides schemas that contain Database Vault objects, roles that provide separation of duty for specific tasks, and default user accounts.

1.3.3 Oracle Database Vault PL/SQL Interfaces and Packages

Oracle Database Vault provides PL/SQL interfaces and packages for security managers or application developers to configure access control policies.

The PL/SQL procedures and functions allow the general database account to operate within the boundaries of access control policy in the context of a given database session.

See [Oracle Database Vault Realm APIs](#) through [Oracle Database Vault API Reference](#) for more information.

1.3.4 Oracle Database Vault Reporting and Monitoring Tools

Oracle Enterprise Manager generates and maintains the Oracle Database Vault reports.

Oracle Database Vault provides database views that enable you to retrieve information about Oracle Database Vault configuration settings, including status and component information.

In addition, you can monitor policy changes, security violation attempts, and Oracle Database Vault configuration and structure changes through the Oracle Database unified audit trail by using Oracle Enterprise Manager, Oracle Audit Vault and Database Firewall, or Oracle Data Safe.

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.
- [Monitoring Oracle Database Vault](#)
You can monitor Oracle Database Vault by checking for violations to the Database Vault configurations and by tracking changes to policies.

1.3.5 Oracle Enterprise Manager Cloud Control Database Vault Administrator Pages

Oracle Database Vault administration is fully integrated with Oracle Enterprise Manager Cloud Control, providing security administrators with a streamlined and centralized interface to manage Oracle Database Vault.

Oracle Enterprise Manager Cloud Control provides a graphical user interface you can use to view and configure Oracle Database Vault policies and view Oracle Database Vault alerts and reports. Oracle Database Vault Administrator provides an extensive collection of security-related reports that assist in understanding the baseline security configuration.

1.4 How Oracle Database Vault Addresses Compliance Regulations

One of the biggest side benefits resulting from regulatory compliance has been security awareness.

Historically, the focus of the information technology (IT) department has been on high availability and performance. The focus on regulatory compliance has required everyone to take a step back and look at their IT infrastructure, databases, and applications from a security angle. Common questions include:

- Where is the sensitive information stored?
- Who has access to this information?

Regulations such as the Sarbanes-Oxley Act, Health Insurance Portability and Accountability Act (HIPAA), International Convergence of Capital Measurement and Capital Standards: a Revised Framework (Basel II), Japan Privacy Law, Payment Card Industry Data Security Standard (PCI DSS), and the European Union Directive on Privacy and Electronic Communications have common themes that include internal controls, separation of duty, and access control.

While most changes required by regulations such as Sarbanes-Oxley and HIPAA are procedural in nature, the remainder may require technology investments. A common security requirement found in regulations is stringent internal controls. The degree to which Oracle Database Vault helps an organization achieve compliance varies with the regulation. In general, Oracle Database Vault realms, command rules, factors and separation of duty features, help reduce the overall security risks that regulation provisions worldwide address.

[Table 1-1](#) lists regulations that address potential security threats.

Table 1-1 Regulations That Address Potential Security Threats

| Regulation | Potential Security Threat |
|---------------------------------------------------------------------|--------------------------------------------------|
| Sarbanes-Oxley Section 302 | Unauthorized changes to data |
| Sarbanes-Oxley Section 404 | Modification to data, unauthorized access |
| Sarbanes-Oxley Section 409 | Denial of service, unauthorized access |
| Gramm-Leach-Bliley | Unauthorized access, modification, or disclosure |
| Health Insurance Portability and Accountability Act (HIPAA) 164.306 | Unauthorized access to data |

Table 1-1 (Cont.) Regulations That Address Potential Security Threats

| Regulation | Potential Security Threat |
|--------------------------------------------------------|------------------------------|
| HIPAA 164.312 | Unauthorized access to data |
| Basel II – Internal Risk Management | Unauthorized access to data |
| CFR Part 11 | Unauthorized access to data |
| Japan Privacy Law | Unauthorized access to data |
| EU Directive on Privacy and Electronic Communications | Unauthorized access to data |
| Payment Card Industry Data Security Standard (PCI DSS) | Unauthorized changes to data |

1.5 How Oracle Database Vault Protects Privileged User Accounts

Many security breaches, both external and internal, target privileged database user accounts to steal data from databases.

Oracle Database Vault helps to protect against compromised privilege user account attacks by using realms, factors, and command rules. Combined, these provide powerful security tools to help secure access to databases, applications, and sensitive information. You can combine rules and factors to control the conditions under which commands in the database are allowed to run, and to control access to data protected by a realm. For example, you can create rules and factors to control access to data based on IP addresses, the time of day, and specific program, such as JDBC, SQL Developer, or SQL*Plus. These can limit access to only those connections that pass these conditions. This can prevent unauthorized access to application data and access to the database by unauthorized applications. For example, you could define a rule to limit execution of the `DROP TABLE` statement to a specific IP address and host name.

1.6 How Oracle Database Vault Allows for Flexible Security Policies

Oracle Database Vault helps you design flexible security policies for your database.

For example, any database user who has the `DBA` role can use the `DROP ANY TABLE` system privilege granted to that role. Suppose an inexperienced administrator believes they are on a non-production database when they execute a `DROP TABLE` command and is instead on the production system and drops a critical application table. This will probably cause an application outage, data loss, and hours to recover from. With Oracle Database Vault, you can create a command rule to prevent this user from making such modifications by limiting their usage of the `DROP TABLE` statement. Furthermore, you can attach rule sets to the command rule to restrict activity further, such as limiting the statement's execution in the following ways:

- By time (for example, only outside of business hours of 8 a.m. to 6 p.m., Monday through Friday)
- By local access only, that is, not remotely
- Require two database users to authorize an action instead of one user
- If the user has an Oracle Database Vault secure application role enabled

- By host name or IP address (for example, the host name could be %appserver% or match an IP address of 192.0.2.150)

You can customize Oracle Database Vault separation of duties to fit the requirements of business of any size. For example, large customers with dedicated IT staff and some out sourced back end operations can further fine tune separation of duties to control what out sourced database administrators can do. For smaller organizations with some users handling multiple responsibilities, separation of duties can be tuned down and these users can create separate dedicated accounts for each responsibility. This helps such users keep track of all actions made and prevents intruders from exploiting compromised privileged database accounts to steal sensitive data. In addition, it helps auditors verify compliance.

1.7 How Oracle Database Vault Addresses Database Consolidation Concerns

Consolidation and cloud environments reduce cost but can expose sensitive application data to those without a true need-to-know.

Data from one country may be hosted in an entirely different country, but access to that data must be restricted based on regulations of the country to which the data belongs. Oracle Database Vault controls provide increased security for these environments by preventing database administrators from accessing the applications data. In addition, controls can be used to help block application bypass and enforce a trusted-path from the application tier to the application data.

Oracle Database Vault provides four distinct separation of duty controls for security administration:

- Day-to-day database administrator tasks using the default Oracle Database DBA role
- Security administrator tasks using the DV_OWNER and DV_ADMIN roles
- Account administrator tasks using the DV_ACCTMGR role
- Grants of roles and privileges by a named trusted user

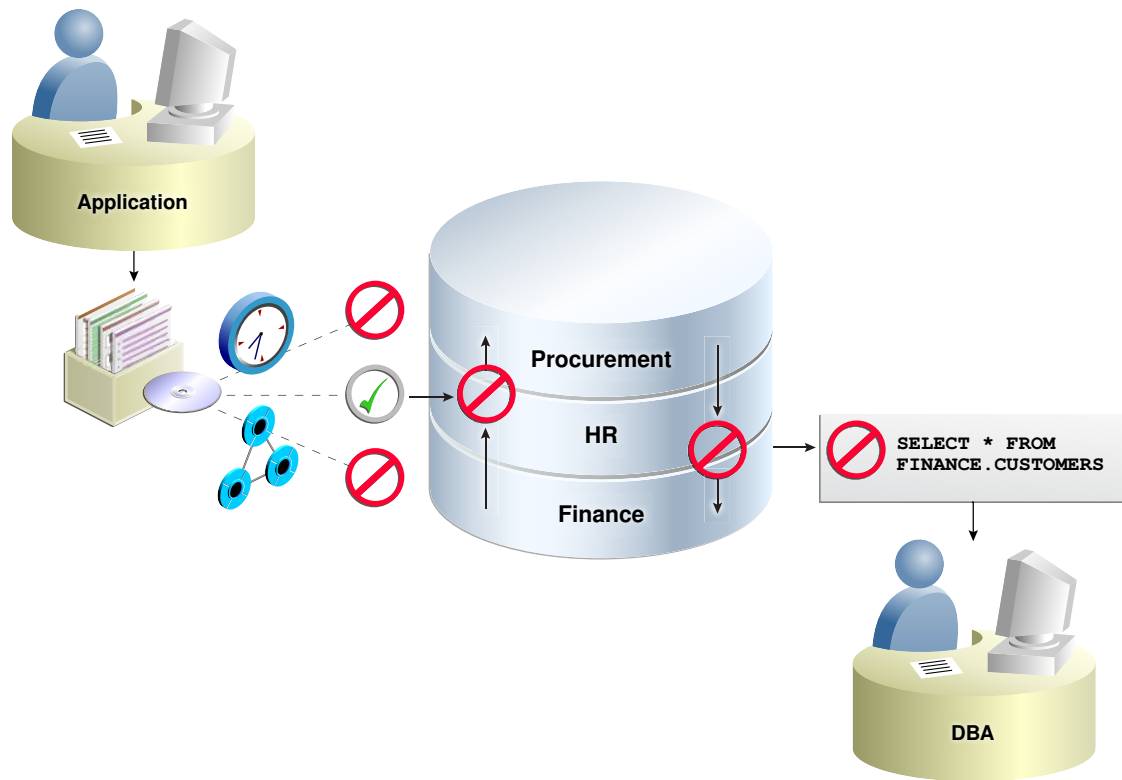
Oracle Database Vault separation of duty controls can be customized and organizations with limited resources can assign multiple Oracle Database Vault responsibilities to the same administrator, but using separate accounts for each separation-of-duty role to minimize damage to the database if any one account is stolen and leveraged.

Oracle customers today still have hundreds and even thousands of databases distributed throughout the enterprise and around the world. However, for database consolidation as a cost-saving strategy in the coming years to be effective, the physical security provided by the distributed database architecture must be available in the consolidated environment. Oracle Database Vault addresses the primary security concerns of database consolidation.

Figure 1-2 illustrates how Oracle Database Vault addresses the following database security concerns:

- **Administrative privileged account access to application data:** In this case, Oracle Database Vault prevents the database administrator from accessing the schemas that are protected by the Finance realm. Although the database administrator is the most powerful and trusted user, this administrator does not need access to application data residing within the database.
- **Separation of duties for application data access:** In this case, the HR realm owner has access to the HR realm schemas but not Procurement or Finance.

Figure 1-2 Oracle Database Vault Security



Database consolidation can result in multiple powerful user accounts residing in a single database. This means that in addition to the overall database administrator, individual application schema owners also may have powerful privileges. Revoking some privileges may adversely affect existing applications. Using Oracle Database Vault realms, you can enforce access to applications through a trusted application path, preventing the application schema user name and password from being used by anyone other than the application itself. For example, a database administrator who has the `SELECT ANY TABLE` system privilege can be prevented from using that privilege to view other application data residing in the same database.

1.8 How Oracle Database Vault Works in a Multitenant Environment

Using Oracle Database Vault in a multitenant environment increases security for consolidation.

Oracle Database Vault can prevent privileged user access inside a pluggable database (PDB) and between the PDB and the common privileged user at the container database. Each PDB has its own Database Vault metadata, such as realms, rule sets, command rules, default policies (such as default realms), and so on. In addition, the objects within the `DVSYS` and `DVF` schemas are automatically available to any child PDBs. Both schemas are common user schemas.

You can configure common realms in the application root only, but you can create common rule sets and command rules in either the application root or the CDB root. A common command rule in the application root applies to its associated PDBs, and common command rules in the CDB root apply to all PDBs in the CDB environment. The ability to create common realms and

command rules enables you to create policies that use a shared set of realms, rule sets, or command rules throughout the CDB environments, rather than having to create these same components for every PDB in the multitenant environment.

You can create individual local policies for each PDB. When you use Database Vault to protect an object, Database Vault subjects common privileges for common objects to the same enforcement rules as local system privileges.

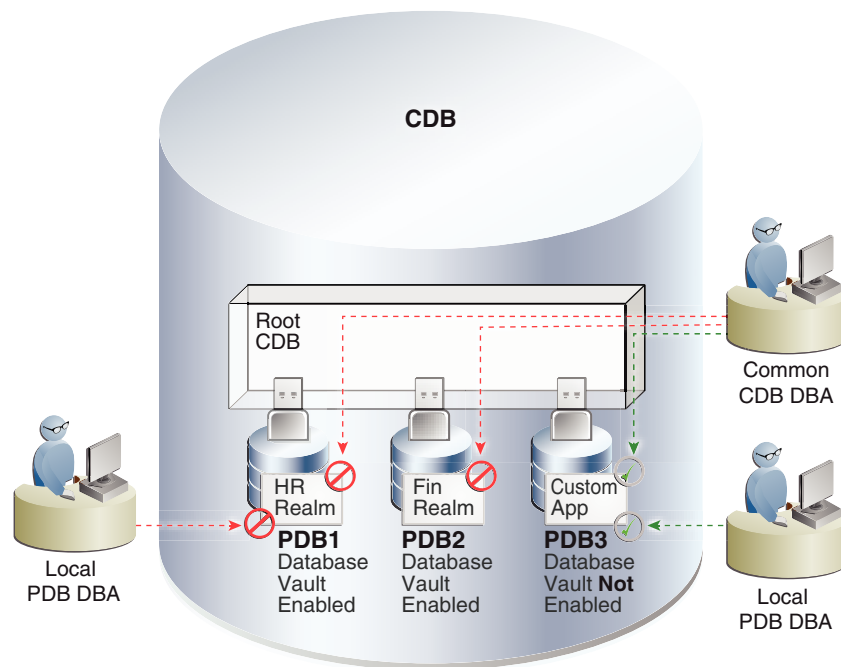
Note that when operations control is enabled, common users are not allowed to proxy as local users in PDBs.

When you configure a PDB that has Database Vault enabled, the `DVSYS` schema is a common user schema that is stored in the root. This means that all the objects within the `DVSYS` schema (tables, data dictionary views, user accounts, PL/SQL packages, default policies, and so on) are subject to the common privileges available for this schema. In other words, you can create realms, factors, and so on in the root to protect the schema in the root. Ensure that you configure Database Vault in the root first, before you configure it in the associated PDBs.

When you enable Oracle Database Vault in the CDB root, you can choose either regular mode or strict mode. The settings propagate throughout the CDB based on the setting you choose. For example, suppose a CDB contains both Database Vault-enabled PDBs and PDBs in which Database Vault is not enabled. If you enable Database Vault using regular mode, then both types of PDBs continue to function normally. If you enable Database Vault using strict mode, then the Database Vault-disabled PDBs operate in restricted mode.

The following figure illustrates how the database in regular mode allows different access for common and local database administrators depending if Database Vault is enabled. In this scenario, neither the common user nor the local users have access to the realms in PDB1 and PDB2. Both the common user and the PDB3 local user have access to the Custom App application in PDB3, where Database Vault is not enabled.

Figure 1-3 Oracle Database Vault in a Multitenant Environment with Regular Mode



Related Topics

- [Realms in a Multitenant Environment](#)
You can create a realm to protect common objects in the application root.
- [Rule Sets and Rules in a Multitenant Environment](#)
You can create a rule set and its associated rules in a PDB or an application root.
- [Command Rules in a Multitenant Environment](#)
You can create common and local command rules in either the CDB root or the application root.
- [Converting a Standalone Oracle Database to a PDB and Plugging It into a CDB](#)
You can convert a standalone Oracle Database database from release 12c through 19c to a PDB, and then plug this PDB into a CDB.

2

What to Expect After You Enable Oracle Database Vault

When you enable Oracle Database Vault, several Oracle Database security features, such as default user authorizations, are modified to provide stronger security restrictions.

- [Initialization and Password Parameter Settings That Change](#)
The Oracle Database Vault configuration modifies several database initialization parameter settings to better secure your database configuration.
- [How Oracle Database Vault Restricts User Authorizations](#)
Oracle Database Vault restricts user authorizations through the revocation of system and object privileges, the separation of responsibilities through new database roles, and the enforcement of new controls by Oracle Database Vault realms, command rules, and authorizations.
- [Oracle Database Vault-Specific Database Roles to Enforce Separation of Duties](#)
The Oracle Database Vault configuration implements the concept of *separation of duty* so that you can improve security and meet regulatory, privacy, and other compliance requirements.
- [Privileges That Are Revoked from Existing Users and Roles](#)
The Oracle Database Vault configuration revokes privileges from several Oracle Database-supplied users and roles, for better separation of duty.
- [Privileges That Are Prevented for Existing Users and Roles](#)
The Oracle Database Vault configuration prevents several privileges for all users and roles who have been granted these privileges, including users `SYS` and `SYSTEM`.
- [Modified AUDIT Statement Settings for a Non-Unified Audit Environment](#)
When you configure Oracle Database Vault and if you decide not to use unified auditing, then Database Vault configures several `AUDIT` statements.

2.1 Initialization and Password Parameter Settings That Change

The Oracle Database Vault configuration modifies several database initialization parameter settings to better secure your database configuration.

If these changes will affect your organizational processes or database maintenance procedures, then contact Oracle Support for help in resolving the issue.

[Table 2-1](#) describes the initialization parameter settings that Oracle Database Vault modifies. Initialization parameters are stored in the `init.ora` initialization parameter file. See *Oracle Database Reference* for more information about initialization parameters.

Table 2-1 Modified Database Initialization Parameter Settings

| Parameter | Default Value in Database | New Value Set by Database Vault | Impact of the Change |
|---------------------------|---------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUDIT_SYS_OPERATIONS | FALSE | TRUE | Enables the auditing of top-level operations directly issued by user SYS, and users connecting with SYSDBA or SYSOPER privilege. |
| OS_ROLES | Not configured | FALSE | Disables the operating system to completely manage the granting and revoking of roles to users. Any previous grants of roles to users using GRANT statements do not change, because they are still listed in the data dictionary. Only the role grants made at the operating system-level to users apply. Users can still grant privileges to roles and users. |
| REMOTE_LOGIN_PASSWORDFILE | EXCLUSIVE | EXCLUSIVE | Specifies whether Oracle Database checks for a password file. The EXCLUSIVE setting enforces the use of the password file, if you installed Oracle Database Vault into a database where REMOTE_LOGIN_PASSWORDFILE is not set to EXCLUSIVE. |
| SQL92_SECURITY | TRUE | TRUE | Ensures that if a user has been granted the UPDATE or DELETE object privilege, then the user must also be granted the SELECT object privilege before being able to perform UPDATE or DELETE operations on tables that have WHERE or SET clauses. Be aware that if the user is only granted the READ object privilege (instead of SELECT), then the user is not able to perform UPDATE or DELETE operations. |

2.2 How Oracle Database Vault Restricts User Authorizations

Oracle Database Vault restricts user authorizations through the revocation of system and object privileges, the separation of responsibilities through new database roles, and the enforcement of new controls by Oracle Database Vault realms, command rules, and authorizations.

In addition, several database roles are created. These roles are part of the separation of duties provided by Oracle Database Vault. One common audit problem that has affected several large organizations is the unauthorized creation of new database accounts by a database administrator within a production instance. Upon installation, Oracle Database Vault prevents anyone other than the Oracle Database Vault account manager or a user granted the Oracle Database Vault account manager role from creating users in the database.

Related Topics

- [Separation of Duty Guidelines](#)
Oracle Database Vault is designed to easily implement separation of duty guidelines.

2.3 Oracle Database Vault-Specific Database Roles to Enforce Separation of Duties

The Oracle Database Vault configuration implements the concept of *separation of duty* so that you can improve security and meet regulatory, privacy, and other compliance requirements.

Oracle Database Vault makes clear separation between the account management responsibility, data security responsibility, and database management responsibility inside the database. This means that the concept of a super-privileged role (for example, `DBA`) is divided among several new database roles to ensure no one user has full control over both the data and configuration of the system. Oracle Database Vault prevents privileged users (those with the `DBA` and other privileged roles and system privileges) from accessing designated protected areas of the database called realms. It also introduces new database roles called the Oracle Database Vault Owner (`DV_OWNER`) and the Oracle Database Vault Account Manager (`DV_ACCTMGR`). These new database roles separate the data security and the account management from the traditional `DBA` role. You should map these roles to distinct security professionals within your organization.

Related Topics

- [Separation of Duty Guidelines](#)
Oracle Database Vault is designed to easily implement separation of duty guidelines.
- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.

2.4 Privileges That Are Revoked from Existing Users and Roles

The Oracle Database Vault configuration revokes privileges from several Oracle Database-supplied users and roles, for better separation of duty.

[Table 2-2](#) lists privileges that Oracle Database Vault revokes from the Oracle Database-supplied users and roles. Be aware that if you disable Oracle Database Vault, these privileges remain revoked. If your applications depend on these privileges, then grant them to application owner directly. These privileges are revoked from the users and roles in the CDB root and its PDBs and from the application root and its PDBs.

Table 2-2 Privileges Oracle Database Vault Revokes

| User or Role | Privilege That Is Revoked |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DBA role | <ul style="list-style-type: none"> • <code>BECOME USER</code> • <code>SELECT ANY TRANSACTION</code> • <code>CREATE ANY JOB</code> • <code>CREATE EXTERNAL JOB</code> • <code>EXECUTE ANY PROGRAM</code> • <code>EXECUTE ANY CLASS</code> • <code>MANAGE SCHEDULER</code> • <code>DEQUEUE ANY QUEUE</code> • <code>ENQUEUE ANY QUEUE</code> • <code>MANAGE ANY QUEUE</code> |

Table 2-2 (Cont.) Privileges Oracle Database Vault Revokes

| User or Role | Privilege That Is Revoked |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IMP_FULL_DATABASE role | <ul style="list-style-type: none"> BECOME USER MANAGE ANY QUEUE |
| EXECUTE_CATALOG_ROLE role | <ul style="list-style-type: none"> EXECUTE ON SYS.DBMS_LOGMNR_D EXECUTE ON SYS.DBMS_LOGMNR_LOGREP_DICT EXECUTE ON SYS.DBMS_FILE_TRANSFER EXECUTE ON SYS.DBMS_LOGMNR |
| PUBLIC user | <ul style="list-style-type: none"> EXECUTE ON UTL_FILE during the execution of the CONFIGURE_DV procedure, but before this revocation takes place, CONFIGURE_DV grants the object privilege directly to any schema that is dependent on this procedure |
| SCHEDULER_ADMIN role | <ul style="list-style-type: none"> CREATE ANY JOB CREATE EXTERNAL JOB EXECUTE ANY PROGRAM EXECUTE ANY CLASS MANAGE SCHEDULER |



Note:

Both the SYS and SYSTEM users retain the SELECT privilege for the DBA_USERS_WITH_DEFPWD data dictionary view, which lists user accounts that use default passwords. If you want other users to have access to this view, grant them the SELECT privilege on it.

Related Topics

- [Privileges of Oracle Database Vault Roles](#)
The Oracle Database Vault roles are designed to provide the maximum benefits of separation of duty.
- [DV_ACCTMGR Database Vault Account Manager Role](#)
The DV_ACCTMGR role is a powerful role, used for accounts management.

2.5 Privileges That Are Prevented for Existing Users and Roles

The Oracle Database Vault configuration prevents several privileges for all users and roles who have been granted these privileges, including users SYS and SYSTEM.

The DV_ACCTMGR role has these privileges for separation of duty:

- ALTER PROFILE
- ALTER USER
- CREATE PROFILE
- CREATE USER
- DROP PROFILE

- DROP USER

For better security and to maintain separation-of-duty standards, do not enable `SYS` or `SYSTEM` users the ability to create or manage user accounts.

Any role can be granted to user `SYS`, but `SYS` cannot use the role because no roles are enabled in the `SYS` session.

2.6 Modified AUDIT Statement Settings for a Non-Unified Audit Environment

When you configure Oracle Database Vault and if you decide not to use unified auditing, then Database Vault configures several `AUDIT` statements.

Related Topics

- [Oracle Database Audit Settings Created for Oracle Database Vault](#)
When you install Oracle Database Vault, it creates several `AUDIT` settings in the database.

3

Getting Started with Oracle Database Vault

Before you can start using Oracle Database Vault, you must configure and enable it with the Oracle database.

- [About Configuring and Enabling Oracle Database Vault in Oracle Database](#)
Oracle Database includes Database Vault when you choose to include a default database in the installation process, but you must configure and enable it before you can use it.
- [Configuring and Enabling Oracle Database Vault](#)
You can configure and enable Oracle Database Vault based on several scenarios.
- [Verifying That Database Vault Is Configured and Enabled](#)
The `DBA_DV_STATUS`, `CDB_DV_STATUS`, and `DBA_OLS_STATUS` data dictionary views verify if Oracle Database is configured and enabled.
- [Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#)
Oracle Enterprise Manager Cloud Control (Cloud Control) provides pages for managing Oracle Database Vault.
- [Quick Start Tutorial: Securing a Schema from DBA Access](#)
This tutorial shows how to create a realm around the `HR` schema.

3.1 About Configuring and Enabling Oracle Database Vault in Oracle Database

Oracle Database includes Database Vault when you choose to include a default database in the installation process, but you must configure and enable it before you can use it.

Oracle Database includes Database Vault when you choose to include a default database in the installation process, but you must configure and enable it before you can use it. The configuration and enablement process enables Oracle Label Security if it is not already enabled. Oracle Label Security is required for Oracle Database Vault but it does not require a separate license unless you begin using Oracle Label Security separately and create Oracle Label Security policies.

Oracle Database includes Database Vault when you choose to include a default database in the installation process, but you must configure and enable it before you can use it. If you create a custom database, then you can use DBCA to install and enable Database Vault for it. The registration process enables Oracle Label Security if it is not already enabled. Oracle Label Security is required for Oracle Database Vault but it does not require a separate license unless you begin using Oracle Label Security separately and create Oracle Label Security policies. This procedure applies to the CDB root, application root, and the current pluggable database (PDB), as well as to both single-instance and Oracle Real Application Clusters (Oracle RAC) installations. In a multitenant database, Database Vault must be configured with the CDB root before any of the PDBs can configure Database Vault.

As part of the configuration process, you created the Database Vault administrative accounts. These are accounts that hold the Database Vault roles `DV_OWNER` and `DV_ACCTMGR`. Use these accounts initially to provision the roles to named users with administrative privileges. Maintaining a backup account will allow you to recover from the named user losing or

somehow misplacing their credentials because `SYS` will not be able to reset these passwords for users with these roles.

 **Note:**

If you upgraded from a release earlier than Oracle Database 12c, then you disabled Oracle Database Vault to perform the upgrade. After the upgrade process is complete, then you must configure and enable Oracle Database Vault again. If you are migrating a non-Database Vault-enabled Oracle database from a release earlier than release 12c, then you must perform a manual installation of Database Vault.

Related Topics

- [Manually Installing Oracle Database Vault](#)
Under certain conditions, you must manually install Oracle Database Vault.
- [Verifying That Database Vault Is Configured and Enabled](#)
The `DBA_DV_STATUS`, `CDB_DV_STATUS`, and `DBA_OLS_STATUS` data dictionary views verify if Oracle Database is configured and enabled.
- [Configuring and Enabling Oracle Database Vault](#)
You can configure and enable Oracle Database Vault based on several scenarios.

3.2 Configuring and Enabling Oracle Database Vault

You can configure and enable Oracle Database Vault based on several scenarios.

- [About Configuring and Enabling Database Vault](#)
You must configure and enable Oracle Database Vault in the CDB root before you can perform the same action in any of the associated PDBs.
- [Configuring and Enabling Database Vault in the CDB Root](#)
You can configure and enable Oracle Database Vault with common users who will use the Database Vault-enforced roles in the CDB root.
- [Configuring and Enabling Database Vault Common Users to Manage Specific PDBs](#)
You must configure and enable Oracle Database Vault in the root first, then in the PDBs afterward.
- [Configuring and Enabling Database Vault Local Users to Manage Specific PDBs](#)
You must configure and enable Oracle Database Vault in the root first, and then in the PDBs afterward.
- [Configuring and Enabling Oracle Database Vault in an Oracle Real Application Clusters Environment](#)
You can configure Oracle Database Vault for an Oracle Real Application Clusters (Oracle RAC) environment, including each Oracle RAC node.
- [Creating a Profile to Protect the DV_OWNER and DV_ACCTMGR Users](#)
A profile provides additional protection for users who have been granted the `DV_OWNER` and `DV_ACCTMGR` roles.
- [Manually Installing Oracle Database Vault](#)
Under certain conditions, you must manually install Oracle Database Vault.

3.2.1 About Configuring and Enabling Database Vault

You must configure and enable Oracle Database Vault in the CDB root before you can perform the same action in any of the associated PDBs.

The common users who have been assigned the `DV_OWNER` and `DV_ACCTMGR` roles in the CDB root can also have the same role in the PDBs. PDBs can have Database Vault configured and enabled using the same common users or use separate PDB local users. The `DV_ACCTMGR` role is granted commonly to the common user in the CDB root. You can grant `DV_OWNER` locally or commonly to the CDB root common user when you configure and enable Database Vault with the CDB root. Granting `DV_OWNER` locally to the common user prevents the common `DV_OWNER` user from using this role in any PDB.

3.2.2 Configuring and Enabling Database Vault in the CDB Root

You can configure and enable Oracle Database Vault with common users who will use the Database Vault-enforced roles in the CDB root.

Before you begin, Oracle recommends that you ensure that all database-related objects are valid. You can use the `UTL_RECOMP` PL/SQL package to check the validity of objects. See *Oracle Database PL/SQL Packages and Types Reference*.

1. Log into the root of the database instance as a user who has privileges to create users and grant the `CREATE SESSION` and `SET CONTAINER` privileges.
2. Select user accounts (or create new users) that will be used for the Database Vault Owner (`DV_OWNER` role) and Database Vault Account Manager (`DV_ACCTMGR` role) accounts.

Oracle strongly recommends that you maintain two accounts for each role. One account, the primary named user account, will be used on a day-to-day basis and the other account will be used as a backup account in case the password of the primary account is lost and must be reset. If you do not have a backup for your account, then you cannot reset passwords. Store these passwords in a safe location, such as a privileged account management (PAM) system, in case they are needed in the future.

Prepend the names of these accounts with `c##` or `C##`. For example:

```
GRANT CREATE SESSION, SET CONTAINER TO c##sec_admin_owen
  IDENTIFIED BY password CONTAINER = ALL;
GRANT CREATE SESSION, SET CONTAINER TO c##dbv_owner_root_backup
  IDENTIFIED BY password CONTAINER = ALL;
GRANT CREATE SESSION, SET CONTAINER TO c##accts_admin_ace
  IDENTIFIED BY password CONTAINER = ALL;
GRANT CREATE SESSION, SET CONTAINER TO c##dbv_acctmgr_root_backup
  IDENTIFIED BY password CONTAINER = ALL;
```

This specification grants two system privileges, creates the accounts if they do not exist, assigns a password, and does this so all the users have access to the CDB and all PDB databases.

- Create the primary accounts (`c##sec_admin_owen` and `c##accts_admin_ace`) if these do not already exist for the new roles, `DV_ADMIN` and `DV_ACCTMGR`.
 - Replace `password` with a password that meets the password complexity requirements of the user's profile.
3. Connect to the root as user `SYS` with the `SYSDBA` administrative privilege

4. Configure the two backup Database Vault user accounts.

For example:

```
BEGIN
  CONFIGURE_DV (
    dvowner_uname          => 'c##dbv_owner_root_backup',
    dvacctmgr_uname       => 'c##dbv_acctmgr_root_backup',
    force_local_dvowner   => FALSE);
END;
/
```

In this example, setting `force_local_dvowner` to `FALSE` enables the common users to have `DV_OWNER` privileges for the PDBs that are associated with this CDB root. Setting it to `TRUE` restricts the common `DV_OWNER` user to have the `DV_OWNER` role privileges for the CDB root only. If you grant `DV_OWNER` locally to the CDB root common user, then that user cannot grant the `DV_OWNER` role commonly to any other user.

5. Run the `utlrp.sql` script to recompile invalidated objects in the root.

```
@?/rdbms/admin/utlrp.sql
```

If the script provides instructions, follow them, and then run the script again. If the script terminates abnormally without giving any instructions, then run it again.

6. Connect to the root as the primary Database Vault Owner user that you just configured.

For example:

```
CONNECT c##dbv_owner_root_backup
Enter password: password
```

7. Enable Oracle Database Vault using one of the following commands:

- To enable Oracle Database Vault to use regular mode:

```
EXEC DBMS_MACADM.ENABLE_DV;
```

- If every associated PDB will need to have Database Vault enabled in this database, then use the following command. (You will need to enable each of these PDBs after you complete this procedure.) PDBs that do not have Database Vault enabled will be in restricted mode after the database is restarted and until Database Vault is enabled in the PDB:

```
EXEC DBMS_MACADM.ENABLE_DV (strict_mode => 'y');
```

8. Connect with the `SYSOPER` administrative privilege.

9. Restart the database.

For a single-instance database:

```
SHUTDOWN IMMEDIATE
STARTUP
```

If you are in an Oracle Real Application Clusters (Oracle RAC) environment, then you can perform an Oracle RAC rolling enablement.

10. Connect with the `SYSDBA` administrative privilege.
11. Verify that Oracle Database Vault and Oracle Label Security are installed and enabled.

```
SELECT * FROM CDB_DV_STATUS;
SELECT * FROM CDB_OLS_STATUS;
```

12. Connect as the backup `DV_OWNER` user and then grant the `DV_OWNER` role, including the `WITH ADMIN OPTION` clause, to the primary `DV_OWNER` user that you created earlier.

For example:

```
CONNECT c##dbv_owner_root_backup
Enter password: password

GRANT DV_OWNER TO c##sec_admin_owen WITH ADMIN OPTION CONTAINER = ALL;
```

13. Connect as the backup `DV_ACCTMGR` user and then grant the `DV_ACCTMGR` role, including the `WITH ADMIN OPTION` clause, to the backup `DV_ACCTMGR` user.

For example:

```
CONNECT c##dbv_acctmgr_root_backup
Enter password: password

GRANT DV_ACCTMGR TO c##accts_admin_ace WITH ADMIN OPTION CONTAINER=ALL;
```

14. Store the two backup account passwords in a safe location such as a privileged account management (PAM) system in case they are needed in the future.

Related Topics

- [Verifying That Database Vault Is Configured and Enabled](#)
The `DBA_DV_STATUS`, `CDB_DV_STATUS`, and `DBA_OLS_STATUS` data dictionary views verify if Oracle Database is configured and enabled.
- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.
- [Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#)
Oracle Enterprise Manager Cloud Control (Cloud Control) provides pages for managing Oracle Database Vault.

Related Topics

- [DV_PATCH_ADMIN Database Vault Database Patch Role](#)
The `DV_PATCH_ADMIN` role is used for patching operations.
- [CONFIGURE_DV General System Maintenance Procedure](#)
The `CONFIGURE_DV` procedure configures the initial two Oracle Database user accounts, which are granted the `DV_OWNER` and `DV_ACCTMGR` roles, respectively.
- [Configuring and Enabling Oracle Database Vault in an Oracle Real Application Clusters Environment](#)
You can configure Oracle Database Vault for an Oracle Real Application Clusters (Oracle RAC) environment, including each Oracle RAC node.
- [Resetting Oracle Database Vault Account Passwords](#)
Backup accounts can help you reset lost passwords for users who have been granted the `DV_OWNER` and `DV_ACCTMGR` roles.

3.2.3 Configuring and Enabling Database Vault Common Users to Manage Specific PDBs

You must configure and enable Oracle Database Vault in the root first, then in the PDBs afterward.

If you try to configure and enable in a PDB first, then an `ORA-47503: Database Vault is not enabled on CDB$ROOT` error appears.

1. If you have not already done so, then identify or create named common user accounts to be used as the Database Vault accounts along with associated backup accounts.
2. Ensure that you have configured and enabled Oracle Database Vault in the CDB root and that the `DV_OWNER` role was granted commonly to the common user.
3. Connect to the PDB as an administrator who is local to the PDB.
4. If necessary, open the database.

```
ALTER DATABASE OPEN;
```

5. Grant the `CREATE SESSION` and `SET CONTAINER` privileges to the users for this PDB.

For example:

```
GRANT CREATE SESSION, SET CONTAINER TO c##sec_admin_owen CONTAINER =
CURRENT;
GRANT CREATE SESSION, SET CONTAINER TO c##accts_admin_ace CONTAINER =
CURRENT;
```

6. Connect as user `SYS` with the `SYSDBA` administrative privilege
7. While still in the PDB, configure the two backup Database Vault user accounts.

```
BEGIN
  CONFIGURE_DV (
    dvowner_uname          => 'c##dbv_owner_root_backup',
    dvacctmgr_uname       => 'c##dbv_acctmgr_root_backup');
END;
/
```

In this example, the `force_local_dvowner` parameter is omitted because it is unnecessary. All common users who are configured within a PDB are restricted to the scope of the PDB.

8. Run the `utlrbp.sql` script to recompile invalidated objects in this PDB.

```
@?/rdbms/admin/utlrbp.sql
```

If the script provides instructions, follow them, and then run the script again. If the script terminates abnormally without giving any instructions, then run it again.

9. Connect to the PDB as the backup Database Vault Owner user that you just configured.

For example:

```
CONNECT c##dbv_owner_root_backup@pdb_name  
Enter password: password
```

10. Enable Oracle Database Vault in this PDB.

```
EXEC DBMS_MACADM.ENABLE_DV;
```

11. Connect to the CDB with the SYSDBA administrative privilege.
12. Close and reopen the PDB.

For example:

```
ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;  
ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

13. Verify that the PDB is configured and enabled for Database Vault and Oracle Label Security.

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

```
SELECT * FROM DBA_DV_STATUS;  
SELECT * FROM DBA_OLS_STATUS;
```

14. Connect as the backup DV_OWNER user and then grant the DV_OWNER role, including the WITH ADMIN OPTION clause, to the primary DV_OWNER user that you created earlier.

For example:

```
CONNECT c##dbv_owner_root_backup@pdb_name  
Enter password: password
```

```
GRANT DV_OWNER TO c##sec_admin_owen WITH ADMIN OPTION;
```

15. Connect as the backup DV_ACCTMGR user and then grant the DV_ACCTMGR role, including the WITH ADMIN OPTION clause, to the primary DV_ACCTMGR user.

For example:

```
CONNECT c##dbv_acctmgr_root_backup@pdb_name  
Enter password: password
```

```
GRANT DV_ACCTMGR TO c##accts_admin_ace WITH ADMIN OPTION;
```

16. Store the two backup account passwords in a safe location such as a privileged account management (PAM) system in case they are needed in the future.

Related Topics

- [Verifying That Database Vault Is Configured and Enabled](#)
The DBA_DV_STATUS, CDB_DV_STATUS, and DBA_OLS_STATUS data dictionary views verify if Oracle Database is configured and enabled.

- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.
- [Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#)
Oracle Enterprise Manager Cloud Control (Cloud Control) provides pages for managing Oracle Database Vault.

Related Topics

- [DV_PATCH_ADMIN Database Vault Database Patch Role](#)
The `DV_PATCH_ADMIN` role is used for patching operations.
- [CONFIGURE_DV General System Maintenance Procedure](#)
The `CONFIGURE_DV` procedure configures the initial two Oracle Database user accounts, which are granted the `DV_OWNER` and `DV_ACCTMGR` roles, respectively.
- [Configuring and Enabling Database Vault in the CDB Root](#)
You can configure and enable Oracle Database Vault with common users who will use the Database Vault-enforced roles in the CDB root.
- [Resetting Oracle Database Vault Account Passwords](#)
Backup accounts can help you reset lost passwords for users who have been granted the `DV_OWNER` and `DV_ACCTMGR` roles.

3.2.4 Configuring and Enabling Database Vault Local Users to Manage Specific PDBs

You must configure and enable Oracle Database Vault in the root first, and then in the PDBs afterward.

If you try to configure and enable in a PDB first, then an `ORA-47503: Database Vault is not enabled on CDB$ROOT` error appears.

1. Log in to the PDB as a user who has privileges to create users and to grant the `CREATE SESSION` and `SET CONTAINER` privileges.
2. If necessary, open the database.

```
ALTER DATABASE OPEN;
```

3. If you are not using existing local user named accounts for the new Database Vault roles, create new named local user accounts.

In both cases, you must create backup accounts to hold the Database Vault roles in case the named user loses or forgets their password.

```
GRANT CREATE SESSION, SET CONTAINER TO sec_admin_owen
  IDENTIFIED BY password;
GRANT CREATE SESSION, SET CONTAINER TO dbv_owner_backup
  IDENTIFIED BY password;
GRANT CREATE SESSION, SET CONTAINER TO accts_admin_ace
  IDENTIFIED BY password;
GRANT CREATE SESSION, SET CONTAINER TO dbv_acctmgr_backup
  IDENTIFIED BY password;
```

Oracle strongly recommends that you maintain two accounts for each role. One account, the primary named user account, will be used on a day-to-day basis and the other account

will be used as a backup account in case the password of the primary account is lost and must be reset. If you do not have a backup for your account, then you cannot reset passwords. Store these passwords in a safe location, such as a privileged account management (PAM) system, in case they are needed in the future.

4. Ensure that you have configured and enabled Oracle Database Vault in the CDB root.

Temporarily connect to the root and then query the `DBA_DV_STATUS` view.

```
CONNECT SYS / AS SYSDBA
Enter password: password

SELECT * FROM DBA_DV_STATUS;
```

5. Connect to the PDB as user `SYS` with the `SYSDBA` administrative privilege.
6. While still in the PDB, configure the two backup Database Vault user accounts.

```
BEGIN
  CONFIGURE_DV (
    dvowner_uname      => 'dbv_owner_backup',
    dvacctmgr_uname   => 'dbv_acctmgr_backup');
END;
/
```

In this example, the `force_local_dvowner` parameter is omitted because it is unnecessary. Database Vault roles are granted locally when configured in a PDB.

7. Run the `utlrbp.sql` script to recompile invalidated objects in this PDB.

```
@?/rdbms/admin/utlrbp.sql
```

If the script provides instructions, follow them, and then run the script again. If the script terminates abnormally without giving any instructions, run it again.

8. Connect to the PDB as the backup Database Vault Owner user that you just configured.

For example:

```
CONNECT dbv_owner_backup@pdb_name
Enter password: password
```

9. Enable Oracle Database Vault in this PDB.

```
EXEC DBMS_MACADM.ENABLE_DV;
```

10. Connect to the CDB with the `SYSDBA` administrative privilege.

```
CONNECT / AS SYSDBA
```

11. Close and reopen the PDB.

```
ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;
ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

12. Verify that the PDB is configured and enabled for Database Vault and Oracle Label Security.

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

```
SELECT * FROM DBA_DV_STATUS;
SELECT * FROM DBA_OLS_STATUS;
```

13. Connect as the backup DV_OWNER user and then grant the DV_OWNER role, including the WITH ADMIN OPTION clause, to the primary DV_OWNER user that you created earlier.

For example:

```
CONNECT dbv_owner_backup@pdb_name
Enter password: password
```

```
GRANT DV_OWNER TO sec_admin_owen WITH ADMIN OPTION;
```

14. Connect as the backup DV_ACCTMGR user and then grant the DV_ACCTMGR role, including the WITH ADMIN OPTION clause, to the backup DV_ACCTMGR user.

For example:

```
CONNECT dbv_acctmgr_backup@pdb_name
Enter password: password
```

```
GRANT DV_ACCTMGR TO accts_admin_ace WITH ADMIN OPTION;
```

15. Store the two backup account passwords in a safe location such as a privileged account management (PAM) system in case they are needed in the future.

Related Topics

- [Verifying That Database Vault Is Configured and Enabled](#)
The DBA_DV_STATUS, CDB_DV_STATUS, and DBA_OLS_STATUS data dictionary views verify if Oracle Database is configured and enabled.
- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.
- [Configuring and Enabling Database Vault in the CDB Root](#)
You can configure and enable Oracle Database Vault with common users who will use the Database Vault-enforced roles in the CDB root.
- [Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#)
Oracle Enterprise Manager Cloud Control (Cloud Control) provides pages for managing Oracle Database Vault.

3.2.5 Configuring and Enabling Oracle Database Vault in an Oracle Real Application Clusters Environment

You can configure Oracle Database Vault for an Oracle Real Application Clusters (Oracle RAC) environment, including each Oracle RAC node.

To configure Oracle Database vault for an Oracle RAC environment, you must configure and enable Oracle Database Vault on one node, then restart each of the instance nodes to enable

it everywhere. The following procedure assumes that you have a separate Oracle home for each node.

1. Configure and enable Oracle Database Vault in the CDB root.
2. Log into the PDB as user `SYS` with the `SYSDBA` administrative privilege.

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

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

3. If necessary, open the database.

```
ALTER DATABASE OPEN;
```

4. Run the following `ALTER SYSTEM` statements on either of the Oracle RAC nodes:

```
ALTER SYSTEM SET AUDIT_SYS_OPERATIONS=TRUE SCOPE=SPFILE; -- For non-unified auditing
environments
ALTER SYSTEM SET OS_ROLES=FALSE SCOPE=SPFILE;
ALTER SYSTEM SET RECYCLEBIN='OFF' SCOPE=SPFILE;
ALTER SYSTEM SET REMOTE_LOGIN_PASSWORDFILE='EXCLUSIVE' SCOPE=SPFILE;
ALTER SYSTEM SET SQL92_SECURITY=TRUE SCOPE=SPFILE;
```

5. Close and then reopen the PDB.

```
ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;
ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

Related Topics

- [Configuring and Enabling Database Vault in the CDB Root](#)
You can configure and enable Oracle Database Vault with common users who will use the Database Vault-enforced roles in the CDB root.

3.2.6 Creating a Profile to Protect the DV_OWNER and DV_ACCTMGR Users

A profile provides additional protection for users who have been granted the `DV_OWNER` and `DV_ACCTMGR` roles.

Database users who have been granted the `DV_OWNER` or `DV_ACCTMGR` roles are considered critical, privileged, accounts. Typically, these accounts should be considered service accounts and exempt from password lockout requirements. Oracle recommends that you create a custom profile that prevents the account from being locked. In addition, you should audit failed login attempts for these Database Vault-related accounts.

1. Log into the database instance as a user who has the `CREATE PROFILE` system privilege.
 - For common `DV_OWNER` and `DV_ACCTMGR` users: Log in to the root of the database instance.
 - For local `DV_OWNER` and `DV_ACCTMGR` users: Log in to the PDB in which you created the users.
2. Create a profile similar to the following:

- For common DV_OWNER and DV_ACCTMGR users: In the root, create the profile similar to the following:

```
CREATE PROFILE c##dv_profile limit
FAILED_LOGIN_ATTEMPTS UNLIMITED
PASSWORD_VERIFY_FUNCTION ORA12C_VERIFY_FUNCTION
PASSWORD_LOCK_TIME UNLIMITED
CONTAINER=ALL;
```

- For local DV_OWNER and DV_ACCTMGR users: In the PDB, create the profile similar to the following:

```
CREATE PROFILE dv_profile limit
FAILED_LOGIN_ATTEMPTS UNLIMITED
PASSWORD_VERIFY_FUNCTION ORA12C_VERIFY_FUNCTION
PASSWORD_LOCK_TIME UNLIMITED
CONTAINER=CURRENT;
```

3. Update the DV_OWNER and DV_ACCTMGR user accounts to use this profile.

- For common DV_OWNER and DV_ACCTMGR users:

```
ALTER USER c##sec_admin_owen PROFILE c##dv_profile CONTAINER = ALL;
ALTER USER c##dbv_owner_root_backup PROFILE c##dv_profile CONTAINER =
ALL;
ALTER USER c##accts_admin_ace PROFILE c##dv_profile CONTAINER = ALL;
ALTER USER c##dbv_acctmgr_root_backup PROFILE c##dv_profile CONTAINER =
ALL;
```

- For local DV_OWNER and DV_ACCTMGR users:

```
ALTER USER sec_admin_owen PROFILE dv_profile CONTAINER = CURRENT;
ALTER USER dbv_owner_backup PROFILE dv_profile CONTAINER = CURRENT;
ALTER USER accts_admin_ace PROFILE dv_profile CONTAINER = CURRENT;
ALTER USER dbv_acctmgr_backup PROFILE dv_profile CONTAINER = CURRENT;
```

4. Connect as a user who has been granted the AUDIT_ADMIN role.

5. Create and enable a unified audit policy to track failed logins by any user who has been granted the DV_OWNER or DV_ACCTMGR role.

- For common DV_OWNER and DV_ACCTMGR users: In the root, create a policy similar to the following:

```
CREATE AUDIT POLICY c##dv_logins ACTIONS LOGON;
AUDIT POLICY c##dv_logins BY USERS WITH GRANTED ROLES DV_OWNER,
DV_ACCTMGR
WHENEVER NOT SUCCESSFUL;
```

- For local DV_OWNER and DV_ACCTMGR users: In the PDB, create a policy similar to the following:

```
CREATE AUDIT POLICY dv_logins ACTIONS LOGON;
AUDIT POLICY dv_logins BY USERS WITH GRANTED ROLES DV_OWNER, DV_ACCTMGR
WHENEVER NOT SUCCESSFUL;
```

Related Topics

- *Oracle Database SQL Language Reference*
- *Oracle Database Security Guide*

3.2.7 Manually Installing Oracle Database Vault

Under certain conditions, you must manually install Oracle Database Vault.

For example, you must manually install Oracle Database Vault if a release 11g Oracle database without Database Vault is upgraded to release 12c, then converted to a PDB to be plugged into a 12c Database Vault-enabled database. In addition, you must manually install Oracle Database Vault (and Oracle Label Security) in a PDB if this PDB does not have these products when the PDB has been plugged into a CDB where Database Vault and Label Security are installed.

1. As user who has been granted the `SYSDBA` administrative privilege, log in to the PDB in which you want to install Oracle Database Vault.

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

Alternatively, log in to the CDB root as a user with `DV_OWNER` or `DV_ADMIN` role, and then check that all of the PDBs are open and if Oracle Database Vault is in all of the associated PDBs. You can check if the PDB is open by connecting to it and then querying the `OPEN_MODE` column from the `V$DATABASE` view. To find if there is an Oracle Database Vault installation on the CDB, run this query:

```
SELECT * FROM CDB_DV_STATUS;
```

2. If necessary, check if Oracle Database Vault and Oracle Label Security are already installed on this PDB.

If the `DVSYSD` and `DVF` accounts (for Database Vault) and the `LBACSYS` account (for Label Security) exist, then Database Vault and Label Security exist on the PDB.

```
SELECT USERNAME FROM DBA_USERS WHERE USERNAME IN ('DVSYS', 'DVF',
'LBACSYS');
```

3. If neither Database Vault nor Label Security have been installed, then install Oracle Label Security by executing the `catols.sql` script.

```
@$ORACLE_HOME/rdbms/admin/catols.sql
```

Oracle Label Security must be installed before you can install Oracle Database Vault.

4. Install Oracle Database Vault by executing the `catmac.sql` script.

```
@$ORACLE_HOME/rdbms/admin/catmac.sql
```

5. At the Enter value for 1 prompt, enter `SYSTEM` as the tablespace to install `DVSYS`.
6. At the Enter value for 2 prompt, enter the temporary tablespace for the PDB.

After the installation is complete, you can configure and enable Oracle Database Vault in the PDB. If Database Vault is not configured and enabled in the CDB already, then you must close

the PDB before you can configure and enable Database Vault in the CDB root. Database Vault must be configured and enabled in CDB root before it can be configured and enabled in the PDB. After Database Vault is configured and enabled in the CDB root and the database has been restarted, then you can open the PDB and configure and enable Database Vault.

Related Topics

- [Configuring and Enabling Oracle Database Vault](#)
You can configure and enable Oracle Database Vault based on several scenarios.

3.3 Verifying That Database Vault Is Configured and Enabled

The `DBA_DV_STATUS`, `CDB_DV_STATUS`, and `DBA_OLS_STATUS` data dictionary views verify if Oracle Database is configured and enabled.

In addition to Oracle Database Vault administrators, the Oracle Database `SYS` user and users who have been granted the `DBA` role can query these views.

- For Database Vault:
 - If you want to find the Database Vault status for the root only or an individual PDB, then query `DBA_DV_STATUS`. For example:

```
SELECT * FROM DBA_DV_STATUS;
```

Output similar to the following appears:

| NAME | STATUS |
|---------------------|----------------|
| ----- | ----- |
| DV_APP_PROTECTION | NOT CONFIGURED |
| DV_CONFIGURE_STATUS | TRUE |
| DV_ENABLE_STATUS | TRUE |

`DV_APP_PROTECTION` refers to operations control, which automatically restricts common users from accessing PDB local data in Oracle Database multitenant environments.

- If you want to find the Database Vault status of all PDBs in the multitenant environment, then as a common user with administrative privileges, query `CDB_DV_STATUS`, which provides the addition of a container ID (`CON_ID`) field.
- For Oracle Label Security, query the `DBA_OLS_STATUS` data dictionary view.

Related Topics

- [Using Database Vault Operations Control to Restrict Multitenant Common User Access to Local PDB Data](#)
You can control PDB access by CDB root common users, such as infrastructure database administrators.

3.4 Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control

Oracle Enterprise Manager Cloud Control (Cloud Control) provides pages for managing Oracle Database Vault.

Only Oracle Enterprise Manager Cloud Control is supported, not Oracle EM Express. The Oracle Database Vault pages can be used to administer and monitor Database Vault-protected databases from a centralized console. This console enables you to automate alerts, view Database Vault reports, and propagate Database Vault policies to other Database Vault-protected databases.

Before you try to log in, ensure that you have configured the Cloud Control target databases that you plan to use with Database Vault by following the Oracle Enterprise Manager online help. Oracle Database Vault must also be configured and enabled with the Oracle database.

1. Log in to Oracle Enterprise Manager Cloud Control with the credentials that were provided by your Cloud Control administrator.
2. In the Cloud Control home page, from the **Targets** menu, select **Databases**.
3. In the Databases page, select the link for the Oracle Database Vault-protected database to which you want to connect.

The Database home page appears.

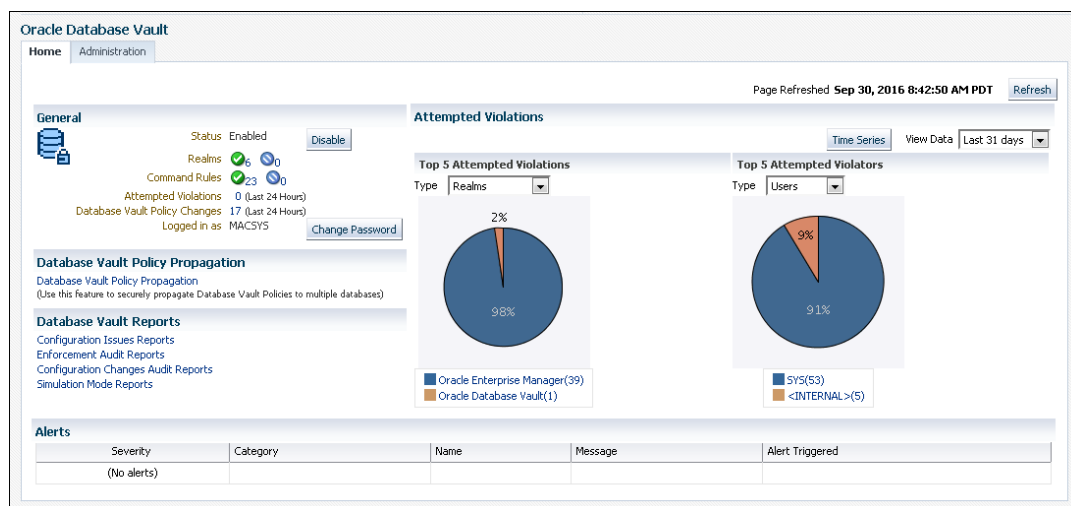
4. From the **Security** menu, select **Database Vault**.

The Database Login page appears.

5. Enter the following information:

- **Username:** Enter the name of a user who has been granted the appropriate Oracle Database Vault role:
 - Creating and propagating Database Vault policies: `DV_OWNER` or `DV_ADMIN` role, `SELECT ANY DICTIONARY` privilege
 - Viewing Database Vault alerts and reports: `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role, `SELECT ANY DICTIONARY` privilege
- **Password:** Enter your password.
- **Role:** Select **NORMAL** from the list.
- **Save as:** Select this check box if you want these credentials to be automatically filled in for you the next time that this page appears. The credentials are stored in Enterprise Manager in a secure manner. Access to these credentials depends on the user who is currently logged in.

The Database Vault home page appears.



Related Topics

- [About Oracle Database Vault Roles](#)
Oracle Database Vault provides a set of roles that are required for managing Oracle Database Vault.
- [Using Oracle Database Vault with Oracle Enterprise Manager](#)
Oracle Database Vault administrators can perform tasks in Oracle Enterprise Manager Cloud Control such as propagating policies to other databases.

3.5 Quick Start Tutorial: Securing a Schema from DBA Access

This tutorial shows how to create a realm around the `HR` schema.

- [About This Tutorial](#)
In this tutorial, you create a realm around for the `HR` sample database schema by using the Oracle Database Vault PL/SQL packages.
- [Step 1: Log On as SYSTEM to Access the HR Schema](#)
You must enable the `HR` schema for this tutorial.
- [Step 2: Create a Realm](#)
Realms can protect one or more schemas, individual schema objects, and database roles.
- [Step 3: Create the SEBASTIAN User Account](#)
At this stage, there are no database accounts or roles authorized to access or otherwise manipulate the database objects the realm will protect.
- [Step 4: Have User SEBASTIAN Test the Realm](#)
At this stage, user `SEBASTIAN` can test the realm by trying to query the `HR.EMPLOYEES` table.
- [Step 5: Create an Authorization for the Realm](#)
Next, user `SEBASTIAN` must be granted authorization to the `HR Apps` realm, so that they can access the `HR.EMPLOYEES` table.
- [Step 6: Test the Realm](#)
To test the realm, you must try to access the `EMPLOYEES` table as a user other than `HR`.
- [Step 9: Remove the Components for This Tutorial](#)
You can remove the components that you created for this tutorial if you no longer need them.

3.5.1 About This Tutorial

In this tutorial, you create a realm around for the HR sample database schema by using the Oracle Database Vault PL/SQL packages.

In the HR schema, the EMPLOYEES table has information such as salaries that should be hidden from most employees in the company, including those with administrative access. To accomplish this, you add the HR schema to the secured objects of the protection zone, which in Oracle Database Vault is called a *realm*, inside the database. Then you grant limited authorizations to this realm. Afterward, you test the realm to make sure it has been properly secured.

3.5.2 Step 1: Log On as SYSTEM to Access the HR Schema

You must enable the HR schema for this tutorial.

Before you begin this tutorial, ensure that the HR sample schema is installed.

1. Log in to a PDB as a user who has been granted the DBA role, and then access the HR schema.

For example:

```
sqlplus system@pdb_name
Enter password: password
```

To find the available PDBs, query the PDB_NAME column of the DBA_PDBS data dictionary view. To check the current container, run the show con_name command.

2. Query the HR.EMPLOYEES table as follows.

```
SELECT FIRST_NAME, LAST_NAME, SALARY FROM HR.EMPLOYEES WHERE ROWNUM < 10;
```

Output similar to the following appears:

| FIRST_NAME | LAST_NAME | SALARY |
|------------|-----------|--------|
| Steven | King | 24000 |
| Neena | Kochhar | 17000 |
| Lex | De Haan | 17000 |
| Alexander | Hunold | 9000 |
| Bruce | Ernst | 6000 |
| David | Austin | 4800 |
| Valli | Pataballa | 4800 |
| Diana | Lorentz | 4200 |
| Nancy | Greenberg | 12008 |

9 rows selected.

3. If the HR schema is locked and expired, log in to the database instance as the DV_ACCTMGR user and unlock and unexpire the account. For example:

```
sqlplus accts_admin_ace@pdb_name
Enter password: password
```

```
ALTER USER HR ACCOUNT UNLOCK IDENTIFIED BY password
```

Replace *password* with a password that meets the password complexity requirements of the user's profile.

As you can see, `SYSTEM` has access to the salary information in the `EMPLOYEES` table of the `HR` schema. This is because `SYSTEM` is automatically granted the `DBA` role, which includes the `SELECT ANY TABLE` system privilege.

4. Do not exit `SQL*Plus`.

Related Topics

- *Oracle Database Sample Schemas*
- *Oracle Database Security Guide*

3.5.3 Step 2: Create a Realm

Realms can protect one or more schemas, individual schema objects, and database roles.

After you create a realm, you can create security restrictions that apply to the schemas and their schema objects within the realm. You will need to create a realm for the `HR` schema.

1. Connect to a PDB as a user who has been granted the `DV_OWNER` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

2. Create the `HR` App realm around the `HR.EMPLOYEES` table.

- a. Create the `HR Apps` realm itself.

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name    => 'HR Apps',
    description   => 'Realm to protect the HR schema',
    enabled       => DBMS_MACUTL.G_YES,
    audit_options => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type    => 0);
END;
/
```

- b. Add the `HR.EMPLOYEES` table to this realm.

```
BEGIN
  DBMS_MACADM.ADD_OBJECT_TO_REALM(
    realm_name    => 'HR Apps',
    object_owner  => 'HR',
    object_name   => 'EMPLOYEES',
    object_type   => 'TABLE');
END;
/
```

At this stage, you have created the realm but you have not assigned any authorizations to it. You will take care of that later on in this tutorial.

3.5.4 Step 3: Create the SEBASTIAN User Account

At this stage, there are no database accounts or roles authorized to access or otherwise manipulate the database objects the realm will protect.

So, the next step is to authorize database accounts or database roles so that they can have access to the schemas within the realm. You will create the `SEBASTIAN` user account.

1. In `SQL*Plus`, connect to the PDB as the Database Vault Account Manager, who has the `DV_ACCTMGR` role, and create the local user `SEBASTIAN`.

For example:

```
CONNECT accts_admin_ace@pdb_name
Enter password: password

GRANT CREATE SESSION TO SEBASTIAN IDENTIFIED BY password;
```

Replace *password* with a password that meets the password complexity requirements of the user's profile.

2. Connect as SYS with the SYSDBA privilege, and then grant SEBASTIAN the following additional privilege.

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

GRANT READ ANY TABLE TO SEBASTIAN;
```

3. Do not exit SQL*Plus.

Related Topics

- [Oracle Database Security Guide](#)

3.5.5 Step 4: Have User SEBASTIAN Test the Realm

At this stage, user SEBASTIAN can test the realm by trying to query the HR.EMPLOYEES table.

1. Connect as user SEBASTIAN.
2. Query the HR.EMPLOYEES table.

```
SELECT COUNT(*) FROM HR.EMPLOYEES;
```

The following output should appear:

```
ERROR at line 1:
ORA-01031: insufficient privileges
```

Even though user SEBASTIAN has the READ ANY TABLE system privilege, they cannot query the HR.EMPLOYEES table, because the HR Apps realm takes precedence over the READ ANY TABLE system privilege.

3.5.6 Step 5: Create an Authorization for the Realm

Next, user SEBASTIAN must be granted authorization to the HR Apps realm, so that they can access the HR.EMPLOYEES table.

1. Connect to the PDB as a user who has been granted the DV_OWNER role.
2. Create an authorization for the HR Apps realm.

This authorization allows SEBASTIAN to use the READ ANY TABLE system privilege on the HR.EMPLOYEES table that is protected by this realm.

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name => 'HR Apps',
    grantee    => 'SEBASTIAN');
END;
/
```


3.5.7 Step 6: Test the Realm

To test the realm, you must try to access the `EMPLOYEES` table as a user other than `HR`.

(This tutorial does not cover the ability to prevent `HR` from accessing its own objects.)

The `SYSTEM` account normally has access to all objects in the `HR` schema because it has the `SELECT ANY TABLE` privilege, but now that you have safeguarded the `EMPLOYEES` table with Oracle Database Vault, this is no longer the case.

1. In SQL*Plus, connect to the PDB as `SYSTEM`.

```
CONNECT SYSTEM@pdb_name
Enter password: password
```

2. Try querying any of the rows in the `EMPLOYEES` table again.

For example:

```
SELECT FIRST_NAME, LAST_NAME, SALARY FROM HR.EMPLOYEES WHERE ROWNUM <10;
```

The following output should appear:

```
Error at line 1:
ORA-01031: insufficient privileges
```

`SYSTEM` no longer has access to the `EMPLOYEES` table. (In fact, even user `SYS` does not have any access to this table.) However, user `SEBASTIAN` does have access to this information because `SEBASTIAN` is an authorized participant in the `HR Apps` realm.

3. Connect as user `SEBASTIAN`.

```
CONNECT sebastian@pdb_name
Enter password: password
```

4. Perform the following query:

```
SELECT FIRST_NAME, LAST_NAME, SALARY FROM HR.EMPLOYEES WHERE ROWNUM <10;
```

Output similar to the following appears:

| FIRST_NAME | LAST_NAME | SALARY |
|------------|-----------|--------|
| Steven | King | 24000 |
| Neena | Kochhar | 17000 |
| Lex | De Haan | 17000 |
| Alexander | Hunold | 9000 |
| Bruce | Ernst | 6000 |
| David | Austin | 4800 |
| Valli | Pataballa | 4800 |
| Diana | Lorentz | 4200 |
| Nancy | Greenberg | 12008 |

9 rows selected.

3.5.8 Step 9: Remove the Components for This Tutorial

You can remove the components that you created for this tutorial if you no longer need them.

1. As the user `cmack`, disable and drop the `aud_hrapps_dv` unified audit policy.

```
NOAUDIT POLICY aud_hrapps_dv;  
DROP AUDIT POLICY aud_hrapps_dv;
```

2. As a user who has the `DV_ACCTMGR` role, drop users `cmack` and `sebastian`.

```
DROP USER cmack;  
DROP USER sebastian;
```

3. Delete the `HR Apps` realm.

- a. Connect to the PDB as a user who has been granted the `DV_OWNER` role.
- b. Run the following statement to drop the `HR Apps` realm and its authorizations:

```
EXEC DBMS_MACADM.DELETE_REALM_CASCADE('HR Apps');
```

4. If necessary, lock and expire the `HR` account.

- a. Connect as a user who has the `DV_ACCTMGR` role (for example, user `accts_admin_ace`).
- b. Run the following `ALTER USER` statement:

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

4

Configuring Realms

You can create a realm around database objects to protect them, and then set authorizations to control user access to this data.

- [What Are Realms?](#)
Realms enable you to protect database objects, including specific object types.
- [Default Realms](#)
Oracle Database Vault provides default realms to protect Database Vault and SYS-related schemas, system and object privileges, roles, and audit-related objects.
- [Creating a Realm](#)
The first step in enabling realm protection is to create the realm itself, and then add realm-secured objects, roles, and authorizations.
- [Modifying a Realm](#)
You can use the `DBMS_MACADM.UPDATE_REALM` procedure to modify the definition of a realm.
- [Deleting a Realm](#)
You can use the `DBMS_MACADM.DELETE_REALM` procedure to delete a realm.
- [About Realm-Secured Objects](#)
Realm-secured objects define the territory—a set of schema and database objects and roles—that a realm protects.
- [About Realm Authorization](#)
Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.
- [Realm Authorizations in a Multitenant Environment](#)
The rules and behavior for common realm authorizations are similar to the authorizations for other common objects.
- [How Realms Work](#)
When an appropriately privileged database account issues a SQL statement that affects an object within a realm, a special set of activities occur.
- [How Authorizations Work in a Realm](#)
Realm authorizations prevent users from performing activities if the users do not have the correct privileges.
- [Access to Objects That Are Protected by a Realm](#)
You can protect an object by a realm, but still enable access to objects that are part of this realm-protected object.
- [Example of How Realms Work](#)
Realms can provide protection in which two users who each have the same privileges must have separate access levels for an object.
- [How Realms Affect Other Oracle Database Vault Components](#)
Realms have no effect on factors, identities, or rule sets, but they do affect command rules.
- [Guidelines for Designing Realms](#)
Oracle provides a set of guidelines for designing realms.

- [How Realms Affect Performance](#)
Realms can affect database performance in a variety of situations, such as with DDL and DML operations.
- [Realm Related Reports and Data Dictionary Views](#)
Oracle Database Vault provides reports and data dictionary views that are useful for analyzing realms.

4.1 What Are Realms?

Realms enable you to protect database objects, including specific object types.

- [About Realms](#)
A realm is a grouping of database schemas, database objects, and database roles that must be secured for a given application.
- [Mandatory Realms to Restrict User Access to Objects within a Realm](#)
By default, users who own or have object privileges are allowed to access realm-protected objects without explicit realm authorization.
- [Realms in a Multitenant Environment](#)
You can create a realm to protect common objects in the application root.
- [Object Types That Realms Can Protect](#)
You can create realms around all objects in a schema of certain object types.

4.1.1 About Realms

A realm is a grouping of database schemas, database objects, and database roles that must be secured for a given application.

Think of a realm as a zone of protection for your database objects. A schema is a logical collection of database objects such as tables, views, and packages, and a role is a collection of privileges. By arranging schemas and roles into functional groups, you can control the ability of users to use system privileges against these groups and prevent unauthorized data access by the database administrator or other powerful users with system privileges. Oracle Database Vault does not replace the discretionary access control model in the existing Oracle database. It functions as a layer on top of this model for both realms and command rules.

Oracle Database Vault provides two types of realms: regular and mandatory. Both realm types can protect either an entire schema, individual database roles or crucial objects within a schema selectively, such as tables and indexes. With a regular realm, an object owner or users who has been granted object privileges can perform queries or DML operations without realm authorization but must have realm authorization to perform DDL operations. A mandatory realm provides stronger protection for objects within a realm. Mandatory realms block both object privilege and system privilege access and will not allow users with object privileges to perform queries, DML, or DDL operations without realm authorization. In other words, if the objects are protected by mandatory realms, even the object owner cannot access their own objects without proper realm authorization.

For example, you can create a realm to protect the database schemas that are used by an accounting department's application. The realm will prohibit any user from using their system privileges (for example, `SELECT ANY TABLE`) from accessing the realm-protected schema objects. When an entire schema is realm protected, all existing and new objects are protected. This includes tables, indexes, procedures, views, packages, and more. Users with direct object grants on objects protected by a regular realm are still allowed to use their grants. For example, if you are granted `SELECT` on `HR.EMPLOYEES`, you can perform the `SELECT` command on objects protected by a regular realm. However, if that object is protected by a mandatory realm, you

will not be allowed to perform the `SELECT` command unless you are a member of the realm authorization list. Mandatory realms require the granted user to be an authorized participant in the mandatory realm.

Note the following:

- You can run reports on realms that you create in Oracle Database Vault. Realms can be enabled, disabled, or placed in simulation mode where violations of the realm will be logged but the action will not be blocked. This enables you to quickly test applications using Database Vault realms.
- You can configure realms by using the Oracle Database Vault Administrator pages in Oracle Enterprise Manager Cloud Control. Alternatively, you can configure realms by using the PL/SQL interfaces and packages provided by Oracle Database Vault.

4.1.2 Mandatory Realms to Restrict User Access to Objects within a Realm

By default, users who own or have object privileges are allowed to access realm-protected objects without explicit realm authorization.

You optionally can configure the realm to prevent these users' access by configuring it to be a mandatory realm. Mandatory realms block system privilege-based access as well as object privilege-based access. This means that even the object owner cannot have access if the are not authorized to access the realm. Users can access secured objects in the mandatory realm only if the user or role is authorized to do so.

Mandatory realms have the following additional characteristics:

- If a role is protected by a mandatory realm, then no privileges can be granted to or revoked from the protected role except by the realm owner.
- You can update regular realms that you created in earlier releases to be mandatory realms. This way, you can block owner access and object-privileged users from accessing the realm-protected objects.
- `SYS`-owned objects are already protected by data dictionary protection and are not protected separately by Oracle Database Vault.

Mandatory realms have the following benefits:

- **Mandatory realms can block object owners and object privileged users.** In previous releases, blocking these users could only be done by defining complicated command rules.
- **Mandatory realms provide more flexible configurations for access control.** For example, suppose you want to enable a user to access an object with certain conditions, such as in a specific time range during the day. You cannot grant object privileges to that user because realms do not block object privileges. You only can grant system privileges to the user and then authorize this user to the realm with a rule, or make a command rule on the command directly. These solutions are either very expensive in terms of computational cost or undesirable because they entail the excessive granting of privileges such as system privileges to the user. With a mandatory realm, you only need to grant object privileges to the user, with a rule for specific conditions, and then authorize this user to be a realm owner or participant. Thus, with mandatory realms, Oracle Database Vault policies have more flexibility without granting users excessive privileges.
- **Mandatory realms add a layer of protection during patch upgrades.** During a patch upgrade, a database administrator may need to have direct access to a realm-protected object in order to perform a patch on the object. If there are tables that contain sensitive data, such as social security numbers, you can protect these tables from the administrator's access with mandatory realms during the patch upgrade. When patching is

complete, and the database administrator no longer needs access to the objects, you can disable mandatory realm protection and then re-enable the normal application realm protection so that the application protection can return to its normal state.

- **You can use mandatory realms to secure tables during runtime.** During runtime, application data can be stored in many tables. It is better to have a single user such as a runtime schema to access these tables so that you can maintain the integrity and correctness of the data. If the application data is scattered in many different schemas, then schema owners and users with object privileges can change the data if they log in to the database directly. To insure that users cannot update these tables without going through the runtime schema's procedures, you can use mandatory realms to protect the tables so that only the authorized user's procedures can access them. Because a regular realm does not block object owners and object-privileged users, you can use mandatory realms to block them. This way, only authorized users can access these tables during runtime.

If there are multiple mandatory realms on the same object, then you must authorize the user or role on all the mandatory realms before they can access the protected object.

Related Topics

- [CREATE_REALM Procedure](#)
The `CREATE_REALM` procedure creates both common and local realms.
- [UPDATE_REALM Procedure](#)
The `UPDATE_REALM` procedure updates a realm.

4.1.3 Realms in a Multitenant Environment

You can create a realm to protect common objects in the application root.

The advantage of creating a realm in the application root instead of creating a large number of objects and realms around these objects within individual pluggable databases (PDBs) is that you can create them in one place, the application root. This way, you can manage them centrally.

You cannot create a common realm in the CDB root.

A Database Vault common realm can be either a regular realm or a mandatory realm. The realm protects only objects within the application root, not local objects in a PDB. The CDB root, application root, and any affected PDBs all must be Database Vault enabled.

To configure a common realm, you must be commonly granted the `DV_OWNER` or `DV_ADMIN` role. To grant common authorizations for a common realm, you must be in the application root. To propagate the realm to the PDBs that are associated with the application root, you must synchronize the application root. For example, to synchronize an application called `saas_sales_app`:

```
ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;
```

Related Topics

- [About Realm Authorization](#)
Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.

4.1.4 Object Types That Realms Can Protect

You can create realms around all objects in a schema of certain object types.

These object types are as follows:

| Object Types C-J | Object Types L-P | Object Types R-V |
|------------------|-----------------------|------------------|
| CLUSTER | LIBRARY | ROLE |
| DIMENSION | MATERIALIZED VIEW | SEQUENCE |
| FUNCTION | MATERIALIZED VIEW LOG | SYNONYM |
| INDEX | OPERATOR | TABLE |
| INDEX PARTITION | PACKAGE | TRIGGER |
| INDEXTYPE | PROCEDURE | TYPE |
| JOB | PROGRAM | VIEW |

4.2 Default Realms

Oracle Database Vault provides default realms to protect Database Vault and SYS-related schemas, system and object privileges, roles, and audit-related objects.

You can add users to realms so that the user can perform tasks that are protected by the default realms.

- [Oracle Database Vault Realm](#)
The Oracle Database Vault realm protects configuration and role information in the Oracle Database Vault `DVSYSTEM`, `DVF`, and `LBACSYS` schemas.
- [Database Vault Account Management Realm](#)
The Database Vault Account Management realm defines the realm for the administrators who manage and create database accounts and database profiles.
- [Oracle Enterprise Manager Realm](#)
Oracle Database Vault provides a realm specifically for Oracle Enterprise Manager monitoring accounts.
- [Oracle Default Schema Protection Realm](#)
The Oracle Default Schema Protection Realm protects roles and schemas that are used with Oracle features such as Oracle Text.
- [Oracle System Privilege and Role Management Realm](#)
The Oracle System Privilege and Role Management Realm protects all Oracle-supplied roles in an Oracle database.
- [Oracle Default Component Protection Realm](#)
The Oracle Default Component Protection Realm protects the `SYSTEM` and `OUTLN` schemas.

4.2.1 Oracle Database Vault Realm

The Oracle Database Vault realm protects configuration and role information in the Oracle Database Vault `DVSYSTEM`, `DVF`, and `LBACSYS` schemas.

The owners of all three of the `DVSYSTEM`, `DVF`, and `LBACSYS` schemas are owners of this realm.

To find the objects that this realm protects, perform the following query:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE
FROM DBA_DV_REALM_OBJECT
```

```
WHERE REALM_NAME = 'Oracle Database Vault Realm'  
ORDER BY OWNER, OBJECT_NAME;
```

To find the realm-authorized users, their role as participant or owner, and if an Oracle Database Vault rule set is applied to the authorized user, perform the following query:

```
SELECT GRANTEE, AUTH_OPTIONS, AUTH_RULE_SET_NAME  
FROM DBA_DV_REALM_AUTH  
WHERE REALM_NAME = 'Oracle Database Vault Realm'  
ORDER BY GRANTEE;
```

Related Topics

- [Oracle Database Vault Schemas](#)
The Oracle Database Vault schemas, `DVSYS` and `DVF`, support the administration and run-time processing of Oracle Database Vault.

4.2.2 Database Vault Account Management Realm

The Database Vault Account Management realm defines the realm for the administrators who manage and create database accounts and database profiles.

The owner of this realm can grant or revoke the `CREATE SESSION` privilege to or from a user.

To find the objects that this realm protects, perform the following query:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE  
FROM DBA_DV_REALM_OBJECT  
WHERE REALM_NAME = 'Database Vault Account Management'  
ORDER BY OWNER, OBJECT_NAME;
```

To find the realm-authorized users, their role as participant or owner, and if an Oracle Database Vault rule set is applied to the authorized user, perform the following query:

```
SELECT GRANTEE, AUTH_OPTIONS, AUTH_RULE_SET_NAME  
FROM DBA_DV_REALM_AUTH  
WHERE REALM_NAME = 'Database Vault Account Management'  
ORDER BY GRANTEE;
```

Related Topics

- [DV_ACCTMGR Database Vault Account Manager Role](#)
The `DV_ACCTMGR` role is a powerful role, used for accounts management.

4.2.3 Oracle Enterprise Manager Realm

Oracle Database Vault provides a realm specifically for Oracle Enterprise Manager monitoring accounts.

The Oracle Enterprise Manager realm protects Oracle Enterprise Manager accounts that are used for monitoring and management (`DBSNMP` user and the `OEM_MONITOR` role).

To find the objects that this realm protects, perform the following query:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE
FROM DBA_DV_REALM_OBJECT
WHERE REALM_NAME = 'Oracle Enterprise Manager'
ORDER BY OWNER, OBJECT_NAME;
```

To find the realm-authorized users, their role as participant or owner, and if an Oracle Database Vault rule set is applied to the authorized user, perform the following query:

```
SELECT GRANTEE, AUTH_OPTIONS, AUTH_RULE_SET_NAME
FROM DBA_DV_REALM_AUTH
WHERE REALM_NAME = 'Oracle Enterprise Manager'
ORDER BY GRANTEE;
```

Related Topics

- [Using Oracle Database Vault with Oracle Enterprise Manager](#)
Oracle Database Vault administrators can perform tasks in Oracle Enterprise Manager Cloud Control such as propagating policies to other databases.

4.2.4 Oracle Default Schema Protection Realm

The Oracle Default Schema Protection Realm protects roles and schemas that are used with Oracle features such as Oracle Text.

The advantage of this grouping is that Oracle Spatial schemas (MDSYS, MDDATA) are used extensively with Oracle Text (CTXSYS), and Oracle OLAP is an application rather than a core Oracle Database kernel feature.

Oracle Default Schema Protection Realm protects several roles and schemas.

- To find the objects that this realm protects, perform the following query:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE
FROM DBA_DV_REALM_OBJECT
WHERE REALM_NAME = 'Oracle Default Schema Protection Realm'
ORDER BY OWNER, OBJECT_NAME;
```

- To find the realm-authorized users, their role as participant or owner, and if an Oracle Database Vault rule set is applied to the authorized user, perform the following query:

```
SELECT GRANTEE, AUTH_OPTIONS, AUTH_RULE_SET_NAME
FROM DBA_DV_REALM_AUTH
WHERE REALM_NAME = 'Oracle Default Schema Protection Realm'
ORDER BY GRANTEE;
```

- Roles that are protected by default: CTXAPP, OLAP_DBA, EJBCLIENT, OLAP_USER
- Schemas that are protected by default: CTXSYS, EXFSYS, MDDATA, MDSYS
- Schemas that are recommended for protection: APEX_030200, OWBSYS, WMSYS

The SYS, CTXSYS, and EXFSYS users are the default owners of Oracle Default Schema Protection Realm. These users can grant the roles protected by this realm to other users, and grant permissions on its schemas to other users as well.

4.2.5 Oracle System Privilege and Role Management Realm

The Oracle System Privilege and Role Management Realm protects all Oracle-supplied roles in an Oracle database.

This realm also contains authorizations for users who must grant system privileges.

User SYS is the only default owner of this realm. Any user who is responsible for managing system privileges should be authorized as an owner to this realm. These users can grant the roles that are protected by this realm to other users.

Examples of roles that the Oracle System Privilege and Role Management Realm protects are DBA, IMP_FULL_DATABASE, SELECT_CATALOG_ROLE, and SCHEDULER_ADMIN.

To find the objects that this realm protects, perform the following query:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE
FROM DBA_DV_REALM_OBJECT
WHERE REALM_NAME = 'Oracle System Privilege and Role Management Realm'
ORDER BY OWNER, OBJECT_NAME;
```

To find the realm-authorized users, their role as participant or owner, and if an Oracle Database Vault rule set is applied to the authorized user, perform the following query:

```
SELECT GRANTEE, AUTH_OPTIONS, AUTH_RULE_SET_NAME
FROM DBA_DV_REALM_AUTH
WHERE REALM_NAME = 'Oracle System Privilege and Role Management Realm'
ORDER BY GRANTEE;
```

4.2.6 Oracle Default Component Protection Realm

The Oracle Default Component Protection Realm protects the SYSTEM and OUTLN schemas.

The authorized users of this realm are users SYS and SYSTEM.

To find the objects that this realm protects, perform the following query:

```
SELECT OWNER, OBJECT_NAME, OBJECT_TYPE
FROM DBA_DV_REALM_OBJECT
WHERE REALM_NAME = 'Oracle Default Component Protection Realm'
ORDER BY OWNER, OBJECT_NAME;
```

To find the realm-authorized users, their role as participant or owner, and if an Oracle Database Vault rule set is applied to the authorized user, perform the following query:

```
SELECT GRANTEE, AUTH_OPTIONS, AUTH_RULE_SET_NAME
FROM DBA_DV_REALM_AUTH
WHERE REALM_NAME = 'Oracle Default Component Protection Realm'
ORDER BY GRANTEE;
```

4.3 Creating a Realm

The first step in enabling realm protection is to create the realm itself, and then add realm-secured objects, roles, and authorizations.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Execute the `DBMS_MACADM.CREATE_REALM` procedure to create the realm.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name      => 'HR Realm',
    description     => 'Realm to protect the HR schema',
    enabled         => DBMS_MACUTL.G_YES,
    audit_options   => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type      => 1,
    realm_scope     => DBMS_MACUTL.G_SCOPE_LOCAL,
    pl_sql_stack    => TRUE);
END;
/
```

In this specification:

- `realm_name` can be up to 128 characters in mixed-case. Oracle suggests that you use the name of the protected application as the realm name (for example, `hr_app` for an human resources application). This parameter is mandatory. The `DBA_DV_REALM` data dictionary view lists existing realms.
- `description` can be 1024 characters in mixed-case. You may want to include a description for the business objective of the given application protection and document all other security policies that compliment the realm's protection. Also document who is authorized to the realm, for what purpose, and any possible emergency authorizations.
- `enabled` controls realm checking. Valid settings are `DBMS_MACUTL.G_YES` 'y' to enable realm checking (default), `DBMS_MACUTL.G_NO` or 'n' to disable all realm checking, including the capture of violations in the simulation log, or `DBMS_MACUTL.G_SIMULATION` or 's' to enable SQL statements to run but capture violations in the simulation log.
- `audit_options` applies only to traditional auditing, not unified auditing environments. Starting with Oracle Database release 23c, traditional auditing is desupported. Oracle recommends that you create unified audit policies instead of using `audit_options`. Valid options for `audit_options` are as follows:
 - `DBMS_MACUTL.G_REALM_AUDIT_OFF`
 - `DBMS_MACUTL.G_REALM_AUDIT_FAIL`
 - `DBMS_MACUTL.G_REALM_AUDIT_SUCCESS`
 - `DBMS_MACUTL.G_REALM_AUDIT_FAIL + DBMS_MACUTL.G_REALM_AUDIT_SUCCESS`
- `realm_type` defines whether the realm is mandatory (1) or not mandatory (0). When set to mandatory, only realm owners or realm participants will have access to objects in a realm. Object owners and object-privileged users who are not realm owners or participants will have no access.
- `realm_scope` defines whether the realm is created in a PDB (`DBMS_MACUTL.G_SCOPE_LOCAL`) or in an application root

(`DBMS_MACUTL.G_SCOPE_COMMON`). If you create the common realm in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:

```
ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;
```

- `pl_sql_stack` is used for simulation mode, and when enabled (`TRUE`), it specifies whether to record the PL/SQL stack for failed operations. To disable, enter `FALSE`. The default is `FALSE`.

At this stage, the realm is created, but it protects no objects nor does it have any authorizations.

3. Run the `DBMS_MACADM.ADD_OBJECT_TO_REALM` procedure to add objects (such as tables or roles) to the realm so that they can be protected.

For example:

```
BEGIN
  DBMS_MACADM.ADD_OBJECT_TO_REALM(
    realm_name => 'HR Realm',
    object_owner => 'HR',
    object_name => 'EMPLOYEES',
    object_type => 'TABLE');
END;
/
```

In this specification:

- `realm_name` can be up to 128 characters in mixed-case.
 - `object_owner` is the owner of the object that is being added to a realm. You can enter the `%` character if the object you want to secure with the realm is a role.
 - `object_name` is the name of the object that the realm will protect. Alternatively, enter `%` to specify all objects (except roles) for the object owner that you have specified. If you enter `%`, then it can encompass all objects in the schema if `%` is also used for the `object_type` parameter. But if `object_type` is set to `TABLE`, then using `%` for the `object_name` refers to all tables in the schema. Note that the `%` wildcard character applies to objects that do not yet exist and currently existing objects.
 - `object_type` is the type of object, such as `TABLE`, `INDEX`, or `ROLE`. To create a realm for all types, enter `%` or `DBMS_MACUTL.G_ALL_OBJECT`. You can add as many objects of any type as you want to the realm.
4. Run the `DBMS_MACADM.ADD_AUTH_TO_REALM` procedure to authorize users for the realm.

For example:

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name => 'HR Realm',
    grantee => 'HR',
    rule_set_name => 'Enabled',
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER,
    auth_scope => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

In this specification:

- `realm_name` can be up to 128 characters in mixed-case.

- `grantee` is the user or role name to authorize as an owner or a participant. To find the existing users and roles in the current database instance, query the `DBA_USERS` and `DBA_ROLES` views. To find the authorization of a particular user or role, query the `DVA_DV_REALM_AUTH` view. To find existing secure application roles used in privilege management, query the `DBA_DV_ROLE` view.
- `rule_set_name` is an optional rule set to check during runtime. The `DBA_DV_RULE_SET` data dictionary view lists available rule sets. You can only specify one rule set, but this rule set can have multiple rules.
- `auth_options` determines how to authorize a realm. Valid settings are as follows:
 - `DBMS_MACUTL.G_REALM_AUTH_PARTICIPANT` provides system or direct privileges to access, manipulate, and create objects protected by the realm, provided these rights have been granted using the standard Oracle Database privilege grant process. (Default)
 - `DBMS_MACUTL.G_REALM_AUTH_OWNER` has the same authorization as the realm participant, plus the authorization to grant or revoke realm-secured roles and privileges on realm-protected objects.

A realm can have multiple participants or owners.
- `auth_scope` defines whether the realm is authorized locally in the current PDB (`DBMS_MACUTL.G_SCOPE_LOCAL`) or in an application root (`DBMS_MACUTL.G_SCOPE_COMMON`).

Related Topics

- [Oracle Database Vault Realm APIs](#)
The `DBMS_MACADM` PL/SQL package enables you to configure Oracle Database Vault realms.
- [About Realm-Secured Objects](#)
Realm-secured objects define the territory—a set of schema and database objects and roles—that a realm protects.
- [About Realm Authorization](#)
Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.
- [About Auditing in Oracle Database Vault](#)
All activities in Oracle Database Vault can be audited, including Database Vault administrator activities.

4.4 Modifying a Realm

You can use the `DBMS_MACADM.UPDATE_REALM` procedure to modify the definition of a realm.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Find the realm name and check its definition.

For example:

```
SELECT NAME, DESCRIPTION, ENABLED, AUDIT_OPTIONS, REALM_TYPE
FROM DBA_DV_REALM ORDER BY NAME;
```

If you want to change the `ENABLED` setting, then note the following: If the realm is managed by a policy, and if the policy status is set to partial, then you can modify the enablement status of the realm. If the policy is set to enabled, disabled, or simulation mode, then you cannot modify the enablement status of the realm.

3. Run the `DBMS_MACADM.UPDATE_REALM` statement.

For example:

```
BEGIN
  DBMS_MACADM.UPDATE_REALM(
    realm_name    => 'HR Realm',
    description   => 'Realm to protect the HR schema',
    enabled       => DBMS_MACUTL.G_YES,
    audit_options => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type    => 1);
END;
/
```

Related Topics

- [Oracle Database Vault Realm APIs](#)
The `DBMS_MACADM` PL/SQL package enables you to configure Oracle Database Vault realms.
- [About Auditing in Oracle Database Vault](#)
All activities in Oracle Database Vault can be audited, including Database Vault administrator activities.

4.5 Deleting a Realm

You can use the `DBMS_MACADM.DELETE_REALM` procedure to delete a realm.

When you delete a realm, all the associations that were created for the realm are dropped, too.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Find the names of the realms that you want to remove.

```
SELECT NAME FROM DBA_DV_REALM
ORDER BY NAME;
```

3. Optionally, check the realm's definitions before you decide to delete the realm.

- To check for any object references to realm, query the `DBA_DV_REALM_OBJECT` data dictionary view. For example:

```
SELECT OBJECT_OWNER, OBJECT_NAME, OBJECT_TYPE
FROM DBA_DV_REALM_OBJECT
WHERE REALM_NAME = 'HR Realm';
```

```
OBJECT_OWNER  OBJECT_NAME  OBJECT_TYPE
-----
HR            EMPLOYEES   TABLE
```

If you want to only remove objects from the realm, then you can run the `DBMS_MACADM.DELETE_OBJECT_FROM_REALM` procedure.

- To find the authorizations for the realm, query the `DBA_DV_REALM_AUTH` data dictionary view. For example:

```
SELECT GRANTEE, AUTH_OPTIONS
FROM DBA_DV_REALM_AUTH
WHERE REALM_NAME = 'HR Realm';
```

```
GRANTEE  AUTH_OPTIONS
-----  -
HR       DBMS_MACUTL.G_SCOPE_LOCAL
```

You can remove authorizations by running the `DBMS_MACADM.DELETE_AUTH_FROM_REALM` procedure.

- To find policies that are associated with the realm, query the `DBA_DV_POLICY_OBJECT` data dictionary view. For example:

```
SELECT POLICY_NAME, COMMAND_OBJ_NAME
FROM DBA_DV_POLICY_OBJECT
WHERE COMMAND_OBJ_NAME = 'HR Realm';
```

You can run the `DBMS_MACADM.DELETE_REALM_FROM_POLICY` to remove the realm from the policy.

4. Run the `DBMS_MACADM.DELETE_REALM` procedure to delete the realm.

For example:

```
EXEC DBMS_MACADM.DELETE_REALM('HR Realm');
```

Related Topics

- [Oracle Database Vault Realm APIs](#)
The `DBMS_MACADM` PL/SQL package enables you to configure Oracle Database Vault realms.

4.6 About Realm-Secured Objects

Realm-secured objects define the territory—a set of schema and database objects and roles—that a realm protects.

You can create the following types of protections:

- Objects from multiple database accounts or schemas can be under the same realm.
- One object can belong to multiple realms.

If an object belongs to multiple realms, then Oracle Database Vault checks the realms for the proper authorization. For `SELECT`, `DDL`, and `DML` statements, as long as a user is a participant in one of the realms, and if the command rules permit it, then the commands that the user enters are allowed. For `GRANT` and `REVOKE` operations of a database role in multiple realms, the person performing the `GRANT` or `REVOKE` operation must be the realm owner. Schema owners can perform `DML` operations on objects that are protected by multiple regular realms.

If one of the realms is a mandatory realm, then the user who wants to access the object must be a realm owner or participant in the mandatory realm. During the authorization checking process, the non-mandatory realms are ignored. If there are multiple mandatory

realms that protect the object, then the user who wants to access the object must be authorized in all of the mandatory realms.

- SYS-owned objects are already protected by data dictionary protection and are not protected separately by Oracle Database Vault.

4.7 About Realm Authorization

Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.

You can grant a realm authorization to an account or role to allow the use of its system privileges in the following situations:

- When the user must create or access realm-secured objects
- When a user must grant or revoke realm-secured roles

A user who has been granted realm authorization as either a realm owner or a realm participant can use its system privileges to access secured objects in the realm.

Note the following:

- Realm owners cannot add other users to their realms as owners or participants. Only users who have the `DV_OWNER` or `DV_ADMIN` role are allowed to add users as owners or participants to a realm.
- Users who have been granted the `DV_OWNER` role can add themselves to a realm authorization.
- A realm owner, but not a realm participant, can grant or revoke realm secured roles or grant or revoke object privileges on realm secured objects to anyone.
- A user can be granted either as a realm owner or a realm participant, but not both. However, you can update the authorization types of existing realm authorizations.

Related Topics

- [Realm Authorization Configuration Issues Report](#)
The Realm Authorization Configuration Issues Report displays Oracle Database Vault realm configuration issues.

4.8 Realm Authorizations in a Multitenant Environment

The rules and behavior for common realm authorizations are similar to the authorizations for other common objects.

Local Authorization for a Common Realm

The local authorization for a common realm refers to the authorization a user has for the PDB that this user is accessing.

The rules for the local authorization for a common realm are as follows:

- A user who has been commonly granted the `DV_OWNER` or `DV_ADMIN` role can grant local authorization to common users, common roles, local users, and local roles. The common `DV_OWNER` or `DV_ADMIN` user can also remove local authorization from a common realm in a PDB.
- A local Database Vault administrator can authorize locally (that is, grant local authorizations to both local and common users) within the PDB. A common Database Vault

administrator can also grant authorizations in each PDB. A common realm authorization can only be granted by a common Database Vault administrator in the application root.

- The common Database Vault administrator can both add or remove local authorization to and from a common realm from within the PDB.
- If a common user has only local authorization for a common realm, then this user cannot access the common realm in any other PDB than this local authorization.
- A common user or a common role can have both the local authorization and the common authorization to a common realm at the same time. Removing a common user's local authorization from a common realm does not affect the common user's common authorization. Removing a common user's common authorization from a common realm does not affect the common user's local authorization.

Common Authorization for a Common Realm

The common authorization for a common realm refers to the authorization a common user or a common role has in the application root while the authorization takes effect in every container that is Database Vault enabled.

The rules for the local authorization for a common realm are as follows:

- A user who has been commonly granted the `DV_OWNER` or `DV_ADMIN` role can grant common realm authorization to common users or roles in the application root. This common Database Vault administrator can perform the removal of common authorizations while in the application root.
- This common authorization applies to the containers that have been Database Vault enabled in the CDB.
- If a common user is authorized to a common realm in the application root, then this user has access to the objects protected by the common realm in the application root and any application PDBs.
- Any rule sets that are associated with a common realm must be common rule sets. The rules that are added to a common rule set that is associated with common authorization cannot involve any local objects.

How the Authorization of a Realm Works in Both the Application Root and in an Individual PDB

During the Database Vault enforcement in a container, a common realm performs the same enforcement behaviors as the same realm when it is used locally in a PDB.

4.9 How Realms Work

When an appropriately privileged database account issues a SQL statement that affects an object within a realm, a special set of activities occur.

These privileges include `DDL`, `DML`, `EXECUTE`, `GRANT`, `REVOKE`, or `SELECT` privileges.

1. Are the user's object privileges correct?
Oracle Database Vault first checks the user's privileges before allowing the user to continue. If the user does not have the correct privileges, then grant these to the user. If the user's privileges are correct, then go to Step 2. Realm authorization does not implicitly grant additional privileges to the user.
2. Does the SQL statement affect objects secured by a realm?

If yes, then go to Step 3. If no, then realms do not affect the SQL statement. Go to Step 8. If the object affected by the command is not secured in any realms, then realms do not affect the SQL statement being attempted.

3. Is the realm a mandatory realm or regular realm?

If yes, then go to Step 5. If it is regular realm, then go to Step 4.

4. Is the database account using a system privilege to run the SQL statement?

If yes, then go to Step 5. If no, then go to Step 7. If the session has object privileges on the object in question for `SELECT`, `EXECUTE`, and DML statements only, then the realm protection is not enforced. Realms protect against the use of any system privilege on objects or roles protected by the realm. Even users with object privileges for objects that are protected by regular realms are prevented from performing DDL operations.

5. Is the database account a realm owner or realm participant?

If yes, then go to Step 6. Otherwise, a realm violation occurs and the statement is not allowed to succeed. If the command is a `GRANT` or `REVOKE` of a role that is protected by the realm, or the `GRANT` or `REVOKE` of an object privilege on an object protected by the realm, then the session must be authorized as the realm owner directly or indirectly through roles.

6. Is the realm authorization for the database account conditionally based on a rule set?

If yes, then go to Step 7. If no, then go to Step 8.

7. Does the rule set evaluate to `TRUE`?

If yes, then go to Step 8. If no, then there is a realm violation, so the SQL statement is not allowed to succeed.

8. Does a command rule prevent the command from executing?

If yes, then there is a command rule violation and the SQL statement fails. If no, then there is no realm or command rule violation, so the command succeeds.

For example, the `HR` account may have the `DROP ANY TABLE` privilege and may be the owner of the `HR` realm, but a command rule can prevent `HR` from dropping any tables in the `HR` schema unless it is during its monthly maintenance window. Command rules apply to the use of the `ANY` system privileges and object privileges and are evaluated after the realm checks.

In addition, because a session is authorized in a realm, it does not mean the account has full control on objects protected by the realm. Realm authorization does *not* implicitly grant extra privileges to the account. The account still must have system privileges or object privileges to access the objects. For example, an account or role may have the `SELECT ANY table` privilege and be a participant in the `HR` realm. This means the account or the account granted the role could query the `HR.EMPLOYEES` table. Being a participant in the realm does not mean the account or role can `DROP` the `HR.EMPLOYEES` table. Oracle Database Vault does not replace the discretionary access control model in the existing Oracle database. It functions as a layer on top of this model for both realms and command rules.

Note the following:

- Protecting a table in a realm does not protect the view by default. Any view that must be protected should be added to the realm regardless of whether the view was created before or after the table was added to the realm.
- For invoker's right procedures that access realm protected objects, the invoker of the procedure must be authorized to the realm.
- Be aware that realm protection does not protect a table if access to the table has been granted to `PUBLIC`. For example, if `SELECT ON table_name` is granted to `PUBLIC`, then every

user has access to *table_name* (unless the table is protected by a mandatory realm), even if this table is protected by a realm. As a best practice, revoke unnecessary privileges from PUBLIC.

4.10 How Authorizations Work in a Realm

Realm authorizations prevent users from performing activities if the users do not have the correct privileges.

- [About Authorizations in a Realm](#)
Realms protect data from access through system privileges.
- [Examples of Realm Authorizations](#)
You can create realms that protect objects from users who have system privileges and other powerful privileges, for example.

4.10.1 About Authorizations in a Realm

Realms protect data from access through system privileges.

Realms do not give additional privileges to the data owner or participants.

The realm authorization provides a run-time mechanism to check logically if a user's command should be allowed or denied to access objects specified in the command and to proceed with its execution.

System privileges are sweeping database privileges such as `CREATE ANY TABLE` and `DELETE ANY TABLE`. These privileges typically apply across schemas and bypass the need for object privileges. Data dictionary views such as `DBA_SYS_PRIVS`, `USER_SYS_PRIVS`, and `ROLE_SYS_PRIVS` list the system privileges for database accounts and roles. Database authorizations work normally for objects not protected by a realm. However, a user must be authorized as a realm owner or participant to successfully use their system privileges on objects secured by the realm. A realm violation prevents the use of system privileges and can be audited.

Mandatory realms block both object privileged-based access and system privilege-based access. This means that even the object owner cannot have access if they are not authorized to access the realm. Users can access secured objects in the mandatory realm only if the user or role is authorized to do so.

4.10.2 Examples of Realm Authorizations

You can create realms that protect objects from users who have system privileges and other powerful privileges, for example.

- [Example: Unauthorized User Trying to Create a Table](#)
The `ORA-47401` error appears when unauthorized users try to create tables.
- [Example: Unauthorized User Trying to Use the DELETE ANY TABLE Privilege](#)
An `ORA-01031: insufficient privileges` error appears for unauthorized user access.
- [Example: Authorized User Performing DELETE Operation](#)
Authorized users are allowed to perform the activities for which they are authorized.

4.10.2.1 Example: Unauthorized User Trying to Create a Table

The `ORA-47401` error appears when unauthorized users try to create tables.

[Example 4-1](#) shows what happens when an unauthorized user who has the `CREATE ANY TABLE` system privilege tries to create a table in a realm where the `HR` schema is protected by a realm.

Example 4-1 Unauthorized User Trying to Create a Table

```
CREATE TABLE HR.demo2 (col1 NUMBER(1));
```

The following output should appear

```
ORA-47401: Realm violation for CREATE TABLE on HR.DEMO2
```

As you can see, the attempt by the unauthorized user fails. Unauthorized use of system privileges such as `SELECT ANY TABLE`, `CREATE ANY TABLE`, `DELETE ANY TABLE`, `UPDATE ANY TABLE`, `INSERT ANY TABLE`, `CREATE ANY INDEX`, and others results in failure.

4.10.2.2 Example: Unauthorized User Trying to Use the `DELETE ANY TABLE` Privilege

An `ORA-01031: insufficient privileges` error appears for unauthorized user access.

[Example 4-2](#) shows what happens when an unauthorized database account tries to use their `DELETE ANY TABLE` system privilege to delete an existing record, the database session returns the following error.

Example 4-2 Unauthorized User Trying to Use the `DELETE ANY TABLE` Privilege

```
DELETE FROM HR.EMPLOYEES WHERE EMPNO = 8002;
```

The following output should appear:

```
ERROR at line 1:  
ORA-01031: insufficient privileges
```

Realms do not affect direct privileges on objects. For example, a user granted delete privileges to the `HR.EMPLOYEES` table can successfully delete records without requiring realm authorizations. Therefore, realms should minimally affect normal business application usage for database accounts.

4.10.2.3 Example: Authorized User Performing `DELETE` Operation

Authorized users are allowed to perform the activities for which they are authorized.

[Example 4-3](#) shows how an authorized user can perform standard tasks allowed within the realm.

Example 4-3 Authorized User Performing `DELETE` Operation

```
DELETE FROM HR.EMPLOYEES WHERE EMPNO = 8002;
```

```
1 row deleted.
```

4.11 Access to Objects That Are Protected by a Realm

You can protect an object by a realm, but still enable access to objects that are part of this realm-protected object.

For example, suppose you create a realm around a specific table. However, you want users to be able to create an index on this table. You can accomplish this as follows, depending on the following scenarios.

- **The user does not have the CREATE ANY INDEX privilege.** As the realm owner of the table, grant the `CREATE INDEX ON table` privilege to the user who must create the index.
- **The user has the CREATE ANY INDEX privilege.** In this case, create another realm and make all index types as the secured objects and grant that user participant authorization to the realm. (Remember that having the `CREATE ANY INDEX` privilege alone is not sufficient for a non-realm participant to create an index in a realm-protected table.)
- **You want all of your database administrators to be able to create an index and they have the CREATE ANY INDEX privilege.** In your data protection realm, specify all object types to be protected *except* the index types. This permits all of your administrators to create indexes for the protected table.

4.12 Example of How Realms Work

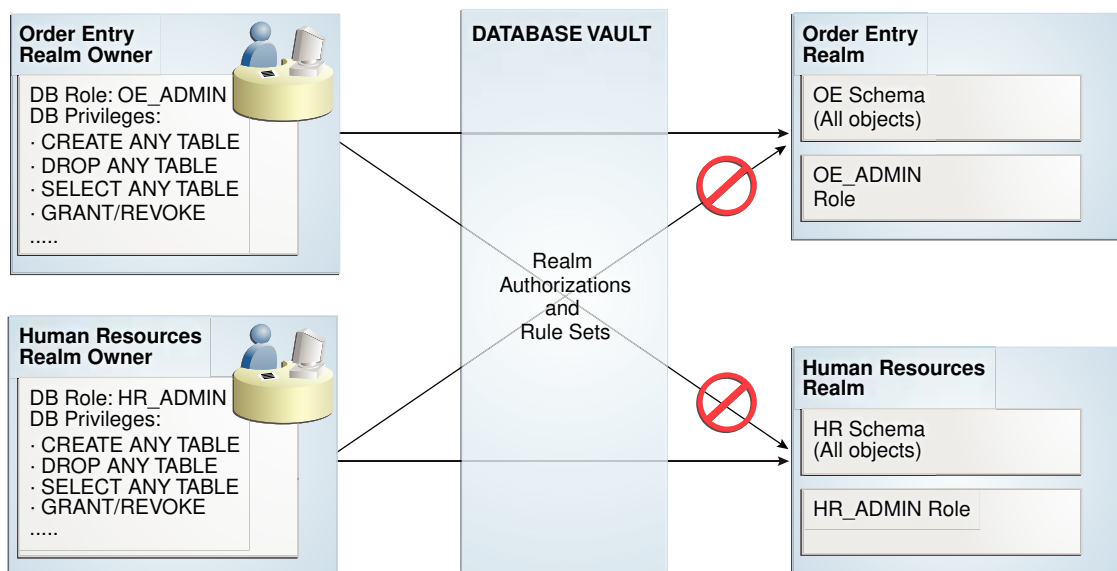
Realms can provide protection in which two users who each have the same privileges must have separate access levels for an object.

Figure 4-1 illustrates how data within a realm is protected.

In this scenario, two users, each in charge of a different realm, have the same system privileges. The owner of a realm can be either a database account or a database role. As such, each of the two roles, `OE_ADMIN` and `HR_ADMIN`, can be protected by a realm as a secured object *and* be configured as the owner of a realm.

Further, only a realm owner, such as `OE_ADMIN`, can grant or revoke database roles that are protected by the realm. The realm owner cannot manage roles protected by other realms such as the `DBA` role created by `SYS` in the Oracle System Privilege and Role Management realm. Any unauthorized attempt to use a system privilege to access realm-protected objects raises a realm violation, which can be audited. The powers of each realm owner are limited within the realm itself. For example, `OE_ADMIN` has no access to the Human Resources realm, and `HR_ADMIN` has no access to the Order Entry realm.

Figure 4-1 How Authorizations Work for Realms and Realm Owners



Related Topics

- [Quick Start Tutorial: Securing a Schema from DBA Access](#)
This tutorial shows how to create a realm around the `HR` schema.

4.13 How Realms Affect Other Oracle Database Vault Components

Realms have no effect on factors, identities, or rule sets, but they do affect command rules.

With command rules, Oracle Database Vault evaluates the realm authorization first when processing SQL statements.

[How Realms Work](#) explains the steps that Oracle Database Vault takes to process SQL statements that affect objects in a realm. [How Command Rules Work](#) describes how command rules are processed.

4.14 Guidelines for Designing Realms

Oracle provides a set of guidelines for designing realms.

- Create realms based on the schemas and roles that form a database application.
Define database roles with the minimum and specific roles and system privileges required to maintain the application objects and grant the role to named accounts. You then can add the role as an authorized member of the realm. For object-level privileges on objects protected by the realm and required by an application, create a role and grant these minimum and specific object-level privileges to the role, and then grant named accounts this role. In most cases, these types of roles do not need to be authorized in the realm unless `ANY`-style system privileges are already in use. A model using the principle of least privilege is ideal for any database application.
- A database object can belong to multiple realms and an account or role can be authorized in multiple realms.

To provide limited access to a subset of a database schema (for example, just the `EMPLOYEES` table in the `HR` schema), or roles protected by a realm, create a new realm with just the minimum required objects and authorizations.

- If you want to add a role to a realm as a grantee, create a realm to protect the role. Doing so prevents users who have been granted the `GRANT ANY ROLE` system privilege, such as the `SYSTEM` user account, from granting the role to themselves.
- If you want to add the `SYS` user account to a realm authorization, you must add user `SYS` explicitly and not through a role (such as the `DBA` role).
- Be mindful of the privileges currently allowed to a role that you plan to add as a realm authorization.

Realm authorization of a role can be accidentally granted and not readily apparent if an account such as `SYS` or `SYSTEM` creates a role for the first time and the Oracle Database Vault administrator adds this role as a realm authorization. This is because the account that creates a role is implicitly granted the role when it is created.

- Sometimes you must temporarily relax realm protections for an administrative task. Rather than disabling the realm, have the Security Manager (`DV_ADMIN` or `DV_OWNER`) log in, add the named account to the authorized accounts for the realm, and set the authorization rule

set to Enabled. Then in the enabled rule set, turn on all auditing for the rule set. You can remove the realm authorization when the administrative task is complete.

- If you want to grant `ANY` privileges to new users, Oracle recommends that you add a database administrative user to the Oracle System Privilege and Role Management realm so that this user can grant other users `ANY` privileges, if they need them. For example, using a named account to perform the `GRANT` of the `ANY` operations enables you to audit these operations, which creates an audit trail for accountability.
- If you drop a table, index, or role that has been protected by a realm and then recreate it using the same name, the realm protection is not restored. You must re-create the realm protection for the new table, index, or role. However, you can automatically enforce protection for all future tables, indexes, and roles within a specified schema. For example, to enforce protection for all future tables:

```
BEGIN
  DBMS_MACADM.ADD_OBJECT_TO_REALM('realm_name', 'schema_name', '%', 'TABLE');
END;
/
```

- You can test the development phase of a realm by using simulation mode, which enables the realm without enforcing the restrictions. Simulation mode writes detailed information about violations, allowing you to see the activities that have been enforced. A user who has the `DV_OWNER` or `DV_ADMIN` role can view the simulation log by querying the `DBA_DV_SIMULATION_LOG` data dictionary view.

Related Topics

- [Using Simulation Mode for Logging Realm and Command Rule Activities](#)
Simulation mode writes violations to the simulation log instead of preventing SQL execution to quickly test new and modified Oracle Database Vault controls.

4.15 How Realms Affect Performance

Realms can affect database performance in a variety situations, such as with DDL and DML operations.

- **DDL and DML operations on realm-protected objects do not have a measurable effect on Oracle Database.** Oracle recommends that you create the realm around the entire schema, and then authorize specific users to perform only specific operations related to their assigned tasks. For finer-grained control, you can define realms around individual tables and authorize users to perform certain operations on them, and also have a realm around the entire schema to protect the entire application. Note that this type of configuration (that is, multiple realms protecting the same objects) does not result in significant performance degradation, and it does enable you to grant realm authorization to some of the objects in a schema.
- **Auditing affects performance.** To achieve the best performance, Oracle recommends that you use fine-grained auditing rather than auditing all operations.
- **Periodically check the system performance.** You can do so by running tools such as Oracle Enterprise Manager (including Oracle Enterprise Manager Cloud Control, which is installed by default with Oracle Database), Automatic Workload Repository (AWR), and `TKPROF`.

Related Topics

- *Oracle Database Performance Tuning Guide*
- *Oracle Database SQL Tuning Guide*

4.16 Realm Related Reports and Data Dictionary Views

Oracle Database Vault provides reports and data dictionary views that are useful for analyzing realms.

[Table 4-1](#) lists the Oracle Database Vault reports.

Table 4-1 Reports Related to Realms

| Report | Purpose |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Realm Audit Report | Audits records generated by the realm protection and realm authorization operations |
| Realm Authorization Configuration Issues Report | Lists authorization configuration information, such as incomplete or disabled rule sets, or nonexistent grantees or owners that may affect the realm |
| Rule Set Configuration Issues Report | Lists rule sets that do not have rules defined or enabled, which may affect the realms that use them |
| All object privilege reports | List object privileges that the realm affects |
| Privilege management summary reports | Provide information about grantees and owners for a realm |
| Sensitive objects reports | Lists objects that the command rule affects |

[Table 4-2](#) lists data dictionary views that provide information about existing realms.

Table 4-2 Data Dictionary Views Used for Realms

| Data Dictionary View | Description |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| DBA_DV_REALM | Lists the realms created in the current database instance. |
| DBA_DV_REALM_AUTH | lists the authorization of a named database user account or database role (<i>GRANTEE</i>) to access realm objects in a particular realm |
| DBA_DV_REALM_OBJECT | Lists the database schemas, or subsets of schemas with specific database objects contained therein, that are secured by the realms |

Related Topics

- [Oracle Database Vault Reports](#)
 Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.
- [Oracle Database Vault Data Dictionary Views](#)
 You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

5

Configuring Rule Sets

Rule sets group one or more rules together; the rules determine whether a user can perform an action on an object.

- [What Are Rule Sets?](#)
A rule set is a collection of one or more rules.
- [Rule Sets and Rules in a Multitenant Environment](#)
You can create a rule set and its associated rules in a PDB or an application root.
- [Default Rule Sets](#)
Oracle Database Vault provides a set of default rule sets that you can customize for your needs.
- [Creating a Rule Set](#)
To create a rule set, you first create the rule set itself, and then you can edit the rule set to associate it with one or more rules.
- [Creating a Rule to Add to a Rule Set](#)
A rule defines the behavior that you want to control; a rule set is a named collection of rules.
- [Modifying a Rule Set](#)
You can use the `DBMS_MACADM.UPDATE_RULE_SET` procedure to modify the definition of a rule set.
- [Deleting a Rule Set](#)
Before you delete a rule set, you must remove any rules from the rule set.
- [How Rule Sets Work](#)
Understanding how rule sets work helps to create more effective rule sets.
- [Tutorial: Configuring Two-Person Integrity, or Dual Key Security](#)
This tutorial demonstrates how to use Oracle Database Vault to control the authorization of two users.
- [Guidelines for Designing Rule Sets](#)
Oracle provides guidelines for designing rule sets.
- [How Rule Sets Affect Performance](#)
The number and complexity of rules can slow database performance.
- [Default Rules and Rule Sets from Releases Earlier Than Release 12.2](#)
Many default rules and rule sets from earlier releases are no longer supported, but may be in use in your current Oracle Database installation.
- [Rule Set and Rule Related Reports and Data Dictionary Views](#)
Oracle Database Vault provides reports and data dictionary views that are useful for analyzing rule sets and the rules within them.

5.1 What Are Rule Sets?

A rule set is a collection of one or more rules.

You can associate the rule set with a realm authorization, factor assignment, command rule, or secure application role.

The rule set evaluates to true or false based on the evaluation of each rule it contains and the evaluation type (*All True* or *Any True*). A rule within a rule set is a PL/SQL expression that evaluates to true or false. You can create a rule and add the rule to multiple rule sets.

You can use rule sets to accomplish the following activities:

- As a further restriction to realm authorization, to define the conditions under which realm authorization is active
- To define when to allow a command rule
- To enable a secure application role
- To define when to assign the identity of a factor

When you create a rule set, Oracle Database Vault makes it available for selection when you configure the authorization for a realm, command rule, factor, or secure application role.

Related Topics

- [Rule Set and Rule Related Reports and Data Dictionary Views](#)
Oracle Database Vault provides reports and data dictionary views that are useful for analyzing rule sets and the rules within them.
- [Oracle Database Vault Rule Set APIs](#)
You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.

5.2 Rule Sets and Rules in a Multitenant Environment

You can create a rule set and its associated rules in a PDB or an application root.

A common realm must use a common rule set when the associated realm or command rule is evaluated by Database Vault. The common rule set and its rules can only be created in the application root. After the common rule set is created, it exists in every container that is associated with the root where the common rule set is created. The common rule set can only include common rules.

To configure a common rule set and its rules, you must be commonly granted the `DV_OWNER` or `DV_ADMIN` role.

Related Topics

- [Command Rules in a Multitenant Environment](#)
You can create common and local command rules in either the CDB root or the application root.

5.3 Default Rule Sets

Oracle Database Vault provides a set of default rule sets that you can customize for your needs.

You can find a full list of rule sets by querying the `DBA_DV_RULE_SET` data dictionary view. To find rules that are associated with a rule set, query the `DBA_DV_RULE_SET_RULE` data dictionary view.

The default rule sets are as follows:

- `Allow Dumping Datafile Header` prevents the dumping of data blocks.
- `Allow Fine Grained Control for Alter System` enables you to control the ability of users to set initialization parameters using the `ALTER SYSTEM SQL` statement.
- `Allow Sessions` controls the ability to create a session in the database. This rule set enables you to add rules to control database logins using the `CONNECT` command rule. The `CONNECT` command rule is useful to control or limit `SYSDBA` access to programs that require its use. This rule set is not populated.
- `Can Grant VPD Administration` controls the ability to grant the `GRANT EXECUTE` or `REVOKE EXECUTE` privileges on the Oracle Virtual Private Database `DBMS_RLS` package, with the `GRANT` and `REVOKE` statements.
- `Can Maintain Accounts/Profiled` controls the roles that manage user accounts and profiles, through the `CREATE USER`, `DROP USER`, `CREATE PROFILE`, `ALTER PROFILE`, or `DROP PROFILE` statements.
- `Can Maintain Own Account` allows the accounts with the `DV_ACCTMGR` role to manage user accounts and profiles with the `ALTER USER` statement. Also allows individual accounts to change their own password using the `ALTER USER` statement. See [DV_ACCTMGR Database Vault Account Manager Role](#) for more information about the `DV_ACCTMGR` role.
- `Disabled` is a convenience rule set to quickly disable security configurations like realms, command rules, factors, and secure application roles.
- `Enabled` is a convenience rule set to quickly enable system features.
- `Not allow to set AUDIT_SYS_OPERATIONS to False` prevents the `AUDIT_SYS_OPERATIONS` initialization parameter from being set to `FALSE`. If unified auditing is enabled, then the `AUDIT_SYS_OPERATIONS` parameter has no effect.
- `Not allow to set OPTIMIZER_SECURE_VIEW_MERGING to True` prevents the `OPTIMIZER_SECURE_VIEW_MERGING` initialization parameter from being set to `TRUE`.
- `Not allow to set OS_ROLES to True` prevents the `OS_ROLES` initialization parameter from being set to `TRUE`.
- `Not allow to set PLSQL_DEBUG to True` prevents the `PLSQL_DEBUG` initialization parameter from being set to `TRUE`.
- `Not allow to set REMOTE_OS_ROLES to True` prevents the `REMOTE_OS_ROLES` initialization parameter from being set to `TRUE`.
- `Not allow to set SQL92_SECURITY to False` prevents the `SQL92_SECURITY` from being set to `FALSE`.
- `Not allow to turn off AUDIT_TRAIL` prevents the `AUDIT_TRAIL` initialization parameter from being turned off. If unified auditing is enabled, then the `AUDIT_TRAIL` parameter has no effect.

5.4 Creating a Rule Set

To create a rule set, you first create the rule set itself, and then you can edit the rule set to associate it with one or more rules.

You can associate a new rule with the rule set, add existing rules to the rule set, or delete a rule association from the rule set.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Run the `DBMS_MACADM.CREATE_RULE_SET` statement to create the rule set.

For example:

```
BEGIN
DBMS_MACADM.CREATE_RULE_SET(
  rule_set_name      => 'Limit_DBA_Access',
  description        => 'DBA access through predefined processes',
  enabled            => DBMS_MACUTL.G_YES,
  eval_options       => DBMS_MACUTL.G_RULESET_EVAL_ANY,
  audit_options      => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
  fail_options       => DBMS_MACUTL.G_RULESET_FAIL_SHOW,
  fail_message       => 'Evaluation failed',
  fail_code          => 20461,
  handler_options    => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
  handler            => '',
  is_static          => TRUE,
  scope              => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

In this specification:

- `rule_set_name` can be up to 128 characters in mixed-case. Spaces are allowed. Oracle suggests that you start the name with a verb and complete it with the realm or command rule name to which the rule set is attached. The `DBA_DV_RULE_SET` data dictionary view lists existing rule sets.
- `description` can be 1024 characters in mixed-case. You may want to document the business requirement of the rule set (for example, Rule set to limit access to SQL*Plus).
- `enabled` controls whether the rule set is enabled or disabled. `DBMS_MACUTL.G_YES` enables the rule set; `DBMS_MACUTL.G_NO` disables it. The default is `DBMS_MACUTL.G_YES`.
- `eval_options` is used if you plan to have multiple rules associated with the rule set. `DBMS_MACUTL.G_RULESET_EVAL_ALL` means all rules must evaluate to `TRUE`; `DBMS_MACUTL.G_RULESET_EVAL_ANY` means at least one rule must evaluate to `TRUE`.
- `audit_options` applies only to traditional auditing, not unified auditing environments. Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create unified audit policies instead of using `audit_options`. `audit_options` applies only to traditional auditing, not unified auditing environments. Valid `audit_options` settings are `DBMS_MACUTL.G_RULESET_AUDIT_OFF`, `DBMS_MACUTL.G_RULESET_AUDIT_FAIL`, `DBMS_MACUTL.G_RULESET_AUDIT_SUCCESS`, and `DBMS_MACUTL.G_REALM_AUDIT_FAIL + DBMS_MACUTL.G_REALM_AUDIT_SUCCESS`.
- `fail_options` designates whether to show (`DBMS_MACUTL.G_RULESET_FAIL_SHOW`) to not show (`DBMS_MACUTL.G_RULESET_FAIL_SILENT`) error messages. An advantage of selecting `DBMS_MACUTL.G_RULESET_FAIL_SILENT` and then enabling auditing is that you can track the activities of a potential intruder. The audit report reveals the activities of the intruder, yet the intruder is unaware that you are doing this because they do not see any error messages.

- `fail_message` is a text string error message up to 80 characters in mixed-case, to associate with the fail code you specify for `fail_code`. If you do not specify an error message, then Oracle Database Vault displays a generic error message.
- `fail_code` is a number in the range of -20000 to -20999 or 20000 to 20999 to associate with the `fail_message` parameter. If you omit this setting, then Oracle Database Vault displays a generic error code.
- `handler_options` enables you to include handler code to define custom event handler logic. `DBMS_MACUTL.G_RULESET_HANDLER_OFF` disables error handling (default), `DBMS_MACUTL.G_RULESET_HANDLER_FAIL` calls handler on rule set failure, and `DBMS_MACUTL.G_RULESET_HANDLER_SUCCESS` calls handler on rule set success.
- `handler` is a PL/SQL function or procedure that defines the custom event handler logic. You can create a custom event method to provide special processing outside the standard Oracle Database Vault rule set auditing features. For example, you can use an event handler to initiate a workflow process or send event information to an external system.

Write the expression as a fully qualified procedure (such as `schema.procedure_name`). Do not include any other form of SQL statements. If you are using application package procedures or standalone procedures, you must provide `DVSYS` with the `EXECUTE` privilege on the object. The procedure signature can be in one of the following two forms:

- `PROCEDURE my_ruleset_handler(p_ruleset_name IN VARCHAR2, p_ruleset_rules IN BOOLEAN):` Use this form when the name of the rule set and its return value are required in the handler processing.
- `PROCEDURE my_ruleset_handler:` Use this form when the name of the rule set and its return value are not required in the handler processing.

Be aware that you cannot use invoker's rights procedures as event handlers. Doing so can cause the rule set evaluation to fail unexpectedly. Only use definer's rights procedures as event handlers.

Use the following syntax:

```
myschema.my_ruleset_handler
```

- `is_static` determines how often a rule set is evaluated when it is accessed. `TRUE` evaluates the rule set once during the user session. After that, the value is re-used. `FALSE` evaluates the rule set each time the rule set is called. The default is `FALSE`.
- `scope` defines whether the rule set is created in a PDB (`DBMS_MACUTL.G_SCOPE_LOCAL`) or in an application root (`DBMS_MACUTL.G_SCOPE_COMMON`). If you create the common rule set in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:

```
ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;
```

At this stage the rule set creation is complete.

3. Optionally, add one or more rules to the rule set.

The `DBA_DV_RULE` data dictionary view lists existing rules.

For example:

```
BEGIN
DBMS_MACADM.ADD_RULE_TO_RULE_SET(
  rule_set_name => 'Limit_DBA_Access',
  rule_name      => 'Is Database Administrator',
  rule_order    => 1,
```

```
enabled => DBMS_MACUTL.G_YES);  
END;  
/
```

Related Topics

- [Creating a New Rule](#)
You can create a new rule or use the default Oracle Database Vault rules.
- [Oracle Database Vault Rule Set APIs](#)
You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.
- [Oracle Database Vault PL/SQL Rule Set Functions](#)
Oracle Database Vault provides functions to use in rule sets to inspect the SQL statement that the rule set protects.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

5.5 Creating a Rule to Add to a Rule Set

A rule defines the behavior that you want to control; a rule set is a named collection of rules.

- [What Are Rules?](#)
A rule is an expression that checks if a particular condition is true or false.
- [Default Rules](#)
Default rules are rules that have commonly used behavior, such as checking if an action evaluates to true or false.
- [Creating a New Rule](#)
You can create a new rule or use the default Oracle Database Vault rules.
- [Adding Existing Rules to a Rule Set](#)
After you have created one or more rules, you can add them to a rule set.
- [Modifying a Rule](#)
You can use the `DBMS_MACADM.UPDATE_RULE` procedure to modify the definition of a rule.
- [Removing a Rule from a Rule Set](#)
Before you remove a rule from a rule set, you must remove references to it from rule sets.

5.5.1 What Are Rules?

A rule is an expression that checks if a particular condition is true or false.

This expression enables Oracle Database Vault to perform an action based on the result of the rule evaluation during runtime. For example, the `Is Database Administrator` default rule checks if the session user is `SYS` or has the `DBA` role enabled or granted. You can create an Oracle Database Vault rule set that includes the rule to prevent users who fail this rule check from accessing a realm that should only be accessed by users with the `DBA` role. In addition, you can create Oracle Database Vault command rules that prevent users who fail a rule check from executing critical SQL commands that should only be used by users with the `DBA` role or `SYS`.

The expression that you use to define the rule must be a PL/SQL Boolean expression. You can use standard Oracle Database functions to build the expression, such as the `SYS_CONTEXT` function. An example of a rule expression using the `SYS_CONTEXT` function is as follows:

```
SYS_CONTEXT('USERENV',SESSION_USER') = 'RLAYTON'
```

This rule expression translates to "Check if the currently logged in user is user `RLAYTON`."

When you create a rule, you can define a scope for it, that is, whether the rule is created in a PDB or in an application root.

You can create rules during the rule set creation process, or independently of it. After you create the rule, you can associate a rule set with one or more additional rules.

If you create a new rule during the rule set creation process, the rule is automatically added to the current rule set. You also can add existing rules to the rule set. Alternatively, you can omit adding rules to the rule set and use it as a template for rule sets you may want to create in the future.

You can add as many rules that you want to a rule set, but for better design and performance, you should keep the rule sets simple. Oracle provides guidelines for designing rule sets.

The rule set evaluation depends on the evaluation of its rules using the Evaluation Options (**All True** or **Any True**). If a rule set is disabled, then Oracle Database Vault evaluates the rule set to true without evaluating its rules.

Related Topics

- [How Rule Sets Work](#)
Understanding how rule sets work helps to create more effective rule sets.
- [Guidelines for Designing Rule Sets](#)
Oracle provides guidelines for designing rule sets.

5.5.2 Default Rules

Default rules are rules that have commonly used behavior, such as checking if an action evaluates to true or false.

You can find a full list of rules by querying the `DBA_DV_RULE` data dictionary view. The following table lists the current default Oracle Database rules.

Table 5-1 Current Default Oracle Database Vault Rules

| Rule | Description |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Are Dest Parameters Allowed | Checks if the current SQL statement attempts to alter initialization parameters related to the size limit of a dump |
| Are Dump Parameters Allowed | Checks if the current SQL statement attempts to alter initialization parameters related to the destination of a dump |
| False | Evaluates to <code>FALSE</code> |
| Is Alter DVSYS Allowed | Note: This default rule has been deprecated. Checks if the logged-in user can run the <code>ALTER USER</code> statement on other users successfully |
| Is Database Administrator | Checks if a user has been granted the <code>DBA</code> role |
| Is Drop User Allowed | Checks if the logged in user can drop users |

Table 5-1 (Cont.) Current Default Oracle Database Vault Rules

| Rule | Description |
|------------------------------|------------------------------------------------------------------------------------------------------------|
| Is Dump of Block Allowed | Checks if the dumping of blocks is allowed |
| Is First Day of Month | Checks if the specified date is the first day of the month |
| Is Label Administrator | Checks if the user has been granted the <code>LBAC_DBA</code> role |
| Is Last Day of Month | Checks if the specified date is the last day of the month |
| Is Parameter Value False | Checks if a specified parameter value has been set to <code>FALSE</code> |
| Is Parameter Value None | Checks if a specified parameter value has been set to <code>NONE</code> |
| Is Parameter Value Not False | Checks if a specified parameter value has been set to <code><> FALSE</code> |
| Is Parameter Value Not None | Checks if a specified parameter value has been set to <code><> NONE</code> |
| Is Parameter Value Not Off | Checks if a specified parameter value has been set to <code><> OFF</code> |
| Is Parameter Value Not On | Checks if a specified parameter value has been set to <code><> ON</code> |
| Is Parameter Value Not True | Checks if a specified parameter value has been set to <code><> TRUE</code> |
| Is Parameter Value Off | Checks if a specified parameter value has been set to <code>OFF</code> |
| Is Parameter Value On | Checks if a specified parameter value has been set to <code>ON</code> |
| Is Parameter Value True | Checks if a specified parameter value has been set to <code>TRUE</code> |
| Is SYS or SYSTEM User | Checks if the user is <code>SYS</code> or <code>SYSTEM</code> |
| Is Security Administrator | Checks if a user has been granted the <code>DV_ADMIN</code> role |
| Is Security Owner | Checks if a user has been granted the <code>DV_OWNER</code> role |
| Is User Manager | Checks if a user has been granted the <code>DV_ACCTMGR</code> role |
| Login User Is Object User | Checks if the logged in user is the same as the user about to be altered by the current SQL statement |
| No Exempt Access Policy Role | Checks if the user has been granted the <code>EXEMPT ACCESS POLICY</code> role or is user <code>SYS</code> |
| Not Export Session | Obsolete |
| True | Evaluates to <code>TRUE</code> |

5.5.3 Creating a New Rule

You can create a new rule or use the default Oracle Database Vault rules.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Run the DBMS_MACADM.CREATE_RULE statement to create the rule.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Is SYSADM Administrator',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') = ''SYSADM'',
    scope     => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

In this specification:

- `rule_name` up to 90 characters in mixed-case. Spaces are allowed. The `DBA_DV_RULE` data dictionary view lists existing rules. The `DBA_DV_RULE_SET_RULE` lists rule sets that are associated with rules. Oracle suggests that you start the name with a verb and complete the name with the purpose of the rule. For example: Prevent non-admin access to SQL*Plus. Because rules do not have a `description` parameter, make the name explicit but be sure to not exceed over 90 characters.
- `rule_expr` is a PL/SQL Boolean expression. If the expression contains quotation marks, do not use double quotation marks. Instead, use two single quotation marks. Enclose the entire expression within single quotation marks. For example:

```
'TO_CHAR(SYSDATE, ''HH24'') = ''12'''
```

Enter a PL/SQL expression that fits the following requirements:

- It is valid in a SQL `WHERE` clause.
- It can be a freestanding and valid PL/SQL Boolean expression such as the following:


```
TO_CHAR(SYSDATE, 'HH24') = '12'
```
- It must evaluate to a Boolean (`TRUE` or `FALSE`) value.
- It must be no more than 1024 characters long.
- It can contain existing and compiled PL/SQL functions from the current database instance. Ensure that these are fully qualified functions (such as `schema.function_name`). Do not include any other form of SQL statements.

Be aware that you cannot use invoker's rights procedures with rule expressions. Doing so will cause the rule evaluation to fail unexpectedly. Only use definer's rights procedures with rule expressions.

If you want to use application package functions or standalone functions, you must grant the `DVSYSA` account the `EXECUTE` privilege on the function. Doing so reduces the chances of errors when you add new rules.

- Ensure that the rule works. You can test the syntax by running the following statement in SQL*Plus:

```
SELECT rule_expression FROM DUAL;
```

For example, suppose you have created the following the rule expression:

```
SYS_CONTEXT('USERENV', 'SESSION_USER') != 'TSMITH'
```

You could test this expression as follows:

```
SELECT SYS_CONTEXT('USERENV', 'SESSION_USER') FROM DUAL;
```

For the Boolean example listed earlier, you would enter the following:

```
SELECT TO_CHAR(SYSDATE, 'HH24') FROM DUAL;
```

- `scope` defines whether the rule is created in a PDB (`DBMS_MACUTL.G_SCOPE_LOCAL`) or in an application root (`DBMS_MACUTL.G_SCOPE_COMMON`).

After you create a rule, you can add it to a rule set.

Related Topics

- [Adding Existing Rules to a Rule Set](#)
After you have created one or more rules, you can add them to a rule set.
- [Oracle Database Vault Rule Set APIs](#)
You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.
- [Oracle Database Vault PL/SQL Rule Set Functions](#)
Oracle Database Vault provides functions to use in rule sets to inspect the SQL statement that the rule set protects.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

5.5.4 Adding Existing Rules to a Rule Set

After you have created one or more rules, you can add them to a rule set.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Query the `DBA_DV_RULE` data dictionary view to find the rule to add to a rule set.

```
SELECT NAME FROM DBA_DV_RULE
ORDER BY NAME;
```

3. Query the `DBA_DV_RULE_SET` data dictionary view to find the rule set to which you want to add the rule.

```
SELECT RULE_SET_NAME
FROM DBA_DV_RULE_SET
ORDER BY RULE_SET_NAME;
```

You can also query the `DBA_DV_RULE_SET_RULE` data dictionary view to find if the rule has already been associated with a rule set.

4. Run the `DBMS_MACADM.ADD_RULE_TO_RULE_SET` to add the rule to a rule set.

For example:

```
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'Limit_DBA_Access',
    rule_name      => 'Is SYSADM Administrator',
    rule_order    => 1,
    enabled       => DBMS_MACUTL.G_NO,
    scope        => );
END;
/
```

In this specification:

- `rule_order` does not apply to this release, but you must include a value for the `ADD_RULE_TO_RULE_SET` procedure to work. Enter 1.
- `enabled` determines whether the rule should be checked when the rule set is evaluated. `DBMS_MACUTL.G_YES` (default). Enables the rule to be checked during the rule set evaluation. `DBMS_MACUTL.G_NO` Prevents the rule from being checked during the rule set evaluation.
- `scope` defines whether the rule is created in a PDB (`DBMS_MACUTL.G_SCOPE_LOCAL`) or in an application root (`DBMS_MACUTL.G_SCOPE_COMMON`).

Related Topics

- [Oracle Database Vault Rule Set APIs](#)
You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.

5.5.5 Modifying a Rule

You can use the `DBMS_MACADM.UPDATE_RULE` procedure to modify the definition of a rule.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

2. Find the rule and check its definition.

For example:

```
SELECT * FROM DBA_DV_RULE ORDER BY NAME;
```

3. Run the `DBMS_MACADM.UPDATE_RULE` statement.

For example:

```
BEGIN
  DBMS_MACADM.UPDATE_RULE(
    rule_name => 'Check UPDATE operations',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') = ''SYSADM'' AND
      (
        UPPER(SYS_CONTEXT(''USERENV'', ''MODULE'')) LIKE ''APPSRV%' ' OR
        UPPER(SYS_CONTEXT(''USERENV'', ''MODULE'')) LIKE ''DBAPP%' ' )'
      );
END;
/
```

Related Topics

- [UPDATE_RULE Procedure](#)
The `UPDATE_RULE` procedure updates a rule.

5.5.6 Removing a Rule from a Rule Set

Before you remove a rule from a rule set, you must remove references to it from rule sets.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Query the `DBA_DV_RULE` data dictionary view to find the rule that you want to remove from a rule set.

```
SELECT NAME FROM DBA_DV_RULE
ORDER BY NAME;
```

3. Query the `DBA_DV_RULE_SET_RULE` data dictionary views to find rule sets that are associated with the rule.

For example:

```
SELECT RULE_SET_NAME
FROM DBA_DV_RULE_SET_RULE
WHERE RULE_NAME = 'Is SYSADM Administrator';
```

4. Execute the `DBMS_MACADM.DELETE_RULE_FROM_RULE_SET` procedure to remove the rule from the rule set.

For example:

```
BEGIN
  DBMS_MACADM.DELETE_RULE_FROM_RULE_SET(
    rule_set_name => 'Limit_DBA_Access',
    rule_name      => 'Is SYSADM Administrator');
END;
/
```

After you remove the rule from the rule set, the rule still exists. If you want, you can associate it with other rule sets. You can also delete the rule by executing the `DBMS_MACADM.DELETE_RULE`. For example:

```
EXEC DBMS_MACADM.DELETE_RULE('Is SYSADM Administrator');
```

Related Topics

- [Oracle Database Vault Rule Set APIs](#)
You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.

5.6 Modifying a Rule Set

You can use the `DBMS_MACADM.UPDATE_RULE_SET` procedure to modify the definition of a rule set.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Find the rule set and check its definition.

For example:

```
SELECT * FROM DBA_DV_RULE_SET ORDER BY RULE_SET_NAME;
```

3. Run the `DBMS_MACADM.UPDATE_RULE_SET` statement.

For example:

```
BEGIN
  DBMS_MACADM.UPDATE_RULE_SET(
    rule_set_name      => 'Limit_DBA_Access',
    description        => 'DBA access through predefined processes',
    enabled            => DBMS_MACUTL.G_NO,
    eval_options       => DBMS_MACUTL.G_RULESET_EVAL_ANY,
    audit_options      => DBMS_MACUTL.G_RULESET_AUDIT_FAIL,
    fail_options       => DBMS_MACUTL.G_RULESET_FAIL_SHOW,
    fail_message       => 'Access denied!',
    fail_code          => 20900,
    handler_options    => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
    handler            => '',
    is_static          =  TRUE);
END;
/
```

Related Topics

- [Oracle Database Vault Rule Set APIs](#)
You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.

5.7 Deleting a Rule Set

Before you delete a rule set, you must remove any rules from the rule set.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Query the `DBA_DV_RULE_SET` data dictionary view to find the rule set that you want to delete.

```
SELECT RULE_SET_NAME
FROM DBA_DV_RULE_SET
ORDER BY RULE_SET_NAME;
```

3. Query the `DBA_DV_RULE_SET_RULE` data dictionary view to ensure that no rules are associated with the rule set that you want to delete.

For example:

```
SELECT RULE_NAME
FROM DBA_DV_RULE_SET_RULE
WHERE RULE_SET_NAME = 'Limit_DBA_Access';
```

4. If necessary, run `DBMS_MACADM.DELETE_RULE_FROM_RULE_SET` to remove the rules that are associated with the rule set.

For example:

```
BEGIN
  DBMS_MACADM.DELETE_RULE_FROM_RULE_SET(
```

```
rule_set_name => 'Limit_DBA_Access',  
rule_name     => 'Is SYSADM Administrator');  
END;  
/
```

5. Run the `DBMS_MACADM.DELETE_RULE_SET` procedure to delete the rule set.

For example:

```
EXEC DBMS_MACADM.DELETE_RULE_SET('Limit_DBA_Access');
```

Related Topics

- [Oracle Database Vault Rule Set APIs](#)
You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.

5.8 How Rule Sets Work

Understanding how rule sets work helps to create more effective rule sets.

- [How Oracle Database Vault Evaluates Rules](#)
Oracle Database Vault evaluates the rules within a rule set as a collection of expressions.
- [Nested Rules within a Rule Set](#)
You can nest one or more rules within the rule set.
- [Creating Rules to Apply to Everyone Except One User](#)
You can also create rules to apply to everyone *except* one user (for example, a privileged user).

5.8.1 How Oracle Database Vault Evaluates Rules

Oracle Database Vault evaluates the rules within a rule set as a collection of expressions.

If you have set the `eval_options` parameter in the `DBMS_MACADM.CREATE_RULE_SET` or `DBMS_MACADM.UPDATE_RULE_SET` procedure to `DBMS_MACUTL.G_RULESET_EVAL_ALL` and if a rule evaluates to false, then the evaluation stops at that point, instead of attempting to evaluate the rest of the rules in the rule set. Similarly, if `eval_options` is set to `DBMS_MACUTL.G_RULESET_EVAL_ANY` and if a rule evaluates to true, the evaluation stops at that point. If a rule set is disabled, then Oracle Database Vault evaluates it to true without evaluating its rules.

5.8.2 Nested Rules within a Rule Set

You can nest one or more rules within the rule set.

For example, suppose you want to create a nested rule, `Is Corporate Network During Maintenance`, that performs the following two tasks:

- It limits table modifications only when the database session originates within the corporate network.
- It restricts table modifications during the system maintenance window scheduled between 10:00 p.m. and 10:59 p.m.

The rule definition would be as follows:

```
DVF.F$NETWORK = 'Corporate' AND TO_CHAR(SYSDATE,'HH24') between '22' AND '23'
```

Related Topics

- [Oracle Database Vault DVF PL/SQL Factor Functions](#)
Oracle Database Vault maintains the DVF schema functions when you use the DBMS_MACADM PL/SQL package to manage the various factors.
- [Configuring Factors](#)
Factors allow you to create and use complex attributes through PL/SQL to make Oracle Database Vault authorization decisions.

5.8.3 Creating Rules to Apply to Everyone Except One User

You can also create rules to apply to everyone *except* one user (for example, a privileged user).

- To create a rule that excludes specific users, use the SYS_CONTEXT function.

For example:

```
SYS_CONTEXT('USERENV','SESSION_USER') = 'SUPERADMIN_USER' OR additional_rule
```

If the current user is a privileged user, then the system evaluates the rule to true without evaluating *additional_rule*. If the current user is not a privileged user, then the evaluation of the rule depends on the evaluation of *additional_rule*.

5.9 Tutorial: Configuring Two-Person Integrity, or Dual Key Security

This tutorial demonstrates how to use Oracle Database Vault to control the authorization of two users.

- [About This Tutorial](#)
In this tutorial, you configure a rule set that defines two-person integrity (TPI).
- [Step 1: Create Users for This Tutorial](#)
You must create two users for this tutorial, `patch_boss` and `patch_user`.
- [Step 2: Create a Function to Check if User patch_boss Is Logged In](#)
The behavior of the Database Vault settings will be determined by the function.
- [Step 3: Create Rules, a Rule Set, and a Command Rule to Control User Access](#)
Next, you must create two rules, a rule set to which you will add them, and a command rule.
- [Step 4: Test the Users' Access](#)
After the rules have been created, they are ready to be tested.
- [Step 5: Remove the Components for This Tutorial](#)
You can remove the components that you created for this tutorial if you no longer need them.

5.9.1 About This Tutorial

In this tutorial, you configure a rule set that defines two-person integrity (TPI).

This feature is also called dual key security, dual key connection, and two-man rule security. In this type of security, two users are required to authorize an action instead of one user.

The idea is that one user provides a safety check for the other user before that user can proceed with a task. Two-person integrity provides an additional layer of security for actions that potentially can be dangerous. This type of scenario is often used for tasks such as database patch updates, which is what this tutorial will demonstrate. One user, `patch_user` must log in to perform a database patch upgrade, but the only way that they can do this is if their manager, `patch_boss` is already logged in. You will create a function, rules, a rule set, and a command rule to control `patch_user`'s ability to log in.

5.9.2 Step 1: Create Users for This Tutorial

You must create two users for this tutorial, `patch_boss` and `patch_user`.

- `patch_boss` acts in a supervisory role: If `patch_boss` is not logged in, then the `patch_user` user cannot log in.
- `patch_user` is the user who is assigned to perform the patch upgrade. However, for this tutorial, user `patch_user` does not actually perform a patch upgrade. This user can only attempt to log in.

To create the users:

1. Log in to a PDB as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
sqlplus accts_admin_ace@pdb_name
Enter password: password
```

To find the available PDBs, 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 users and grant them the `CREATE SESSION` privilege.

```
GRANT CREATE SESSION TO patch_boss IDENTIFIED BY password;
GRANT CREATE SESSION TO patch_user IDENTIFIED BY password;
```

Replace `password` with a password that meets the password complexity requirements of the user's profile.

3. Connect as user `SYS` with the `SYSDBA` administrative privilege.

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

4. Grant the following privileges to the `DV_OWNER` or `DV_ADMIN` user.

For example:

```
GRANT CREATE PROCEDURE TO sec_admin_owen;
GRANT SELECT ON V_$SESSION TO sec_admin_owen;
```

The `V_$SESSION` table is the underlying table for the `V$SESSION` dynamic view.

In a real-world scenario, you also would log in as the `DV_OWNER` user and grant the `DV_PATCH_ADMIN` role to user `patch_user` (but not to `patch_boss`). But because you are not really going to perform a database patch upgrade in this tutorial, you do not need to grant this role to user `patch_user`.

Related Topics

- *Oracle Database Security Guide*

5.9.3 Step 2: Create a Function to Check if User patch_boss Is Logged In

The behavior of the Database Vault settings will be determined by the function.

The function that you must create, `check_boss_logged_in`, does just that: When user `patch_user` tries to log in to the database instance, it checks if user `patch_boss` is already logged in by querying the `V$SESSION` data dictionary view.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Create the `check_boss_logged_in` function as follows:

```
CREATE OR REPLACE FUNCTION check_boss_logged_in
return varchar2
authid definer as

v_session_number number := 0;
v_allow varchar2(10)    := 'TRUE';
v_deny varchar2(10)    := 'FALSE';

BEGIN
  SELECT COUNT(*) INTO v_session_number
  FROM SYS.V_$SESSION
  WHERE USERNAME = 'PATCH_BOSS'; -- Enter the user name in capital letters.

  IF v_session_number > 0
  THEN RETURN v_allow;
  ELSE
  RETURN v_deny;
  END IF;
END check_boss_logged_in;
/
```

3. Grant the `EXECUTE` privilege on the `check_boss_logged_in` function to the `DVSYS` schema.

```
GRANT EXECUTE ON check_boss_logged_in to DVSYS;
```

5.9.4 Step 3: Create Rules, a Rule Set, and a Command Rule to Control User Access

Next, you must create two rules, a rule set to which you will add them, and a command rule.

The rule set triggers the `check_boss_logged_in` function when user `patch_user` tries to logs in to the database.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Create the Check if Boss Is Logged In rule, which checks that the `patch_user` user is logged in to the database. In the definition, replace `sec_admin_owen` with the name of the `DVOWNER` or `DV_ADMIN` user who created the `check_boss_logged_in` function.

If the `check_boss_logged_in` function returns `TRUE` (that is, `patch_boss` is logged in to another session), then `patch_user` can log in.

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check if Boss Is Logged In',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') = ''PATCH_USER'' and
sec_admin_owen.check_boss_logged_in = ''TRUE'' ');
END;
/
```

Enter the user name, `PATCH_USER`, in upper-case letters, which is how the `SESSION_USER` parameter stores it.

3. Create the Allow Connect for Other Database Users rule, which ensures that the user logged in (`patch_user`) is not user `patch_boss`. It also enables all other valid users to log in.

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Allow Connect for Other Database Users',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') != ''PATCH_USER''');
END;
/
COMMIT;
```

4. Create the Dual Connect for Boss and Patch rule set, and then add the two rules to it.

```
BEGIN
  DBMS_MACADM.CREATE_RULE_SET(
    rule_set_name => 'Dual Connect for Boss and Patch',
    description => 'Checks if both boss and patch users are logged in.',
    enabled => DBMS_MACUTL.G_YES,
    eval_options => 2,
    audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
    fail_options => DBMS_MACUTL.G_RULESET_FAIL_SILENT,
    fail_message => '',
    fail_code => NULL,
    handler_options => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
    handler => ''
  );
END;
/
```

```
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'Dual Connect for Boss and Patch',
    rule_name => 'Check if Boss Is Logged In'
  );
END;
/
```

```
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'Dual Connect for Boss and Patch',
    rule_name => 'Allow Connect for Other Database Users'
  );
END;
/
```

5. Create the following `CONNECT` command rule, which permits user `patch_user` to connect to the database only if `patch_boss` is already logged in.

```

BEGIN
  DBMS_MACADM.CREATE_COMMAND_RULE (
    command          => 'CONNECT',
    rule_set_name    => 'Dual Connect for Boss and Patch',
    object_owner     => '%',
    object_name      => '%',
    enabled          => DBMS_MACUTL.G_YES);
END;
/
COMMIT;

```

5.9.5 Step 4: Test the Users' Access

After the rules have been created, they are ready to be tested.

1. Exit SQL*Plus.

```
EXIT
```

2. Create a second shell, for example:

```
xterm &
```

3. In the first shell, try to log in as user `patch_user`.

```
sqlplus patch_user@pdb_name
Enter password: password
```

```
ERROR:
ORA-47400: Command Rule violation for CONNECT on LOGON
```

```
Enter user-name:
```

User `patch_user` cannot log in until user `patch_boss` is already logged in. (Do not try the Enter user-name prompt yet.)

4. In the second shell and then log in as user `patch_boss`.

```
sqlplus patch_boss@pdb_name
Enter password: password
Connected.
```

User `patch_boss` can log in.

5. Go back to the first shell, and then try logging in as user `patch_user` again.

```
Enter user_name: patch_user
Enter password: password
```

This time, user `patch_user` is deemed a valid user, so now `patch_user` can log in.

5.9.6 Step 5: Remove the Components for This Tutorial

You can remove the components that you created for this tutorial if you no longer need them.

1. In the session for the user `patch_boss`, exit SQL*Plus and then close the shell.

```
EXIT
```

2. In the first shell, connect the `DV_ACCTMGR` user and remove the users you created.

```
CONNECT accts_admin_ace@pdb_name
Enter password: password
```

```
DROP USER patch_boss;
DROP USER patch_user;
```

3. Connect as a user SYS with the SYSDBA administrative privilege and revoke the privileges that you had granted to the DV_OWNER or DV_ADMIN user.

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

```
REVOKE CREATE PROCEDURE FROM sec_admin_owen;
REVOKE SELECT ON V_$SESSION FROM sec_admin_owen;
```

4. Connect as the DV_OWNER or DV_ADMIN user and drop the rules, rule set, and command rule, in the order shown.

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

```
DROP FUNCTION check_boss_logged_in;
EXEC DBMS_MACADM.DELETE_COMMAND_RULE('CONNECT', '%', '%');
EXEC DBMS_MACADM.DELETE_RULE_FROM_RULE_SET('Dual Connect for Boss and Patch', 'Check
if Boss Is Logged In');
EXEC DBMS_MACADM.DELETE_RULE_FROM_RULE_SET('Dual Connect for Boss and Patch', 'Allow
Connect for Other Database Users');
EXEC DBMS_MACADM.DELETE_RULE('Check if Boss Is Logged In');
EXEC DBMS_MACADM.DELETE_RULE('Allow Connect for Other Database Users');
EXEC DBMS_MACADM.DELETE_RULE_SET('Dual Connect for Boss and Patch');
COMMIT;
```

5.10 Guidelines for Designing Rule Sets

Oracle provides guidelines for designing rule sets.

- You can share rules among multiple rule sets. This lets you develop a library of reusable rule expressions. Oracle recommends that you design such rules to be discrete, single-purpose expressions.
- You can design a rule set so that its evaluation is static, that is, it is evaluated only once during a user session. Alternatively, it can be evaluated each time the rule set is accessed. If the rule set is evaluated only once, then the evaluated value is reused throughout the user session each time the rule set is accessed. Using static evaluation is useful in cases where the rule set must be accessed multiple times but the conditions on which the rule set depend do not change during that session. An example would be a `SELECT` command rule associated with a rule set when the same `SELECT` statement occurs multiple times and if the evaluated value is acceptable to use again, rather than evaluating the rule set each time the `SELECT` occurs.

To control the static evaluation of the rule set, set the `is_static` parameter of the `CREATE_RULE_SET` or `UPDATE_RULE_SET` procedures of the `DBMS_MACADM` PL/SQL package. See [DBMS_MACADM Rule Set Procedures](#) for more information.

- Use Oracle Database Vault factors in your rule expressions to provide reusability and trust in the values used by your rule expressions. Factors can provide contextual information to use in your rules expressions.
- You can use custom event handlers to extend Oracle Database Vault security policies to integrate external systems for error handling or alerting. Using Oracle utility packages such as `UTL_TCP`, `UTL_HTTP`, `UTL_MAIL`, `UTL_SMTP`, or `DBMS_AQ` can help you to achieve this type of integration.

- Test rule sets thoroughly for various accounts and scenarios either on a test database or on a test realm or command rule for nonsensitive data before you apply them to realms and command rules that protect sensitive data. You can test rule expressions directly with the following SQL statement:

```
SQL> SELECT SYSDATE from DUAL where rule expression
```

- You can nest rule expressions inside a single rule. This helps to achieve more complex situations where you would need a logical **AND** for a subset of rules and a logical **OR** with the rest of the rules. For example, suppose you want to create a nested rule that performs the following two tasks:
 - Limits table modifications only when the database session originates within the corporate network
 - Restricts table modifications during the system maintenance window scheduled between 10:00 p.m. and 10:59 p.m.

A rule definition for this scenario could be as follows:

```
DVF.F$NETWORK = 'Corporate' AND TO_CHAR(SYSDATE, 'HH24') between '22' AND '23'
```

- You cannot use invoker's rights procedures with rule expressions. Only use definer's rights procedures with rule expressions.

5.11 How Rule Sets Affect Performance

The number and complexity of rules can slow database performance.

Rule sets govern the performance for execution of certain operations. For example, if you have a very large number of rules in a rule set governing a **SELECT** statement, performance could degrade significantly.

If you have rule sets that require many rules, performance improves if you move all the rules to logic defined in a single PL/SQL standalone or package function. However, if a rule is used by other rule sets, there is little performance effect on your system.

If possible, consider setting the rule set to use static evaluation, assuming this is compatible with the associated command rule's usage. See [Guidelines for Designing Rule Sets](#) for more information.

You can check system performance by running tools such as Oracle Enterprise Manager (including Oracle Enterprise Manager Cloud Control, which is installed by default with Oracle Database), Automatic Workload Repository (AWR), and **TKPROF**.

Related Topics

- *Oracle Database Performance Tuning Guide*
- *Oracle Database SQL Tuning Guide*

5.12 Default Rules and Rule Sets from Releases Earlier Than Release 12.2

Many default rules and rule sets from earlier releases are no longer supported, but may be in use in your current Oracle Database installation.

If you use default rules and rule sets from releases earlier than Oracle Database release 12.2, Oracle Database does not remove them during an upgrade in case you have customized them for your own use. If you customized these rules and rule sets, or use these older default rule

sets, Oracle recommends that you re-implement the customized rules and rule sets by using the `ALTER SYSTEM` and `ALTER SESSION` command rules, and then disable and drop the old rules and rule sets. If you have not customized these rules and rule sets, or otherwise use them, you should drop these earlier rules and rule sets because the same functionality is available in later default command rules.

 **Note:**

See the release 12.2 version of *Oracle Database Vault Administrator's Guide* for a full listing of the rules and rule sets that may be affected.

5.13 Rule Set and Rule Related Reports and Data Dictionary Views

Oracle Database Vault provides reports and data dictionary views that are useful for analyzing rule sets and the rules within them.

[Table 5-2](#) lists the Oracle Database Vault reports.

Table 5-2 Reports Related to Rule Sets

| Report | Description |
|------------------------------------------------|---------------------------------------------------------------------------|
| Rule Set Configuration Issues Report | Lists rule sets that have no rules defined or enabled |
| Secure Application Configuration Issues Report | Lists secure application roles that have incomplete or disabled rule sets |
| Command Rule Configuration Issues Report | Lists rule sets that are incomplete or disabled |

[Table 5-3](#) lists data dictionary views that provide information about existing rules and rule sets.

Table 5-3 Data Dictionary Views Used for Rules and Rule Sets

| Data Dictionary View | Description |
|----------------------|---------------------------------------------------------|
| DBA_DV_RULE | Lists the rules that have been defined |
| DBA_DV_RULE_SET | Lists the rule sets that have been created |
| DBA_DV_RULE_SET_RULE | Lists rules that are associated with existing rule sets |

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.
- [Oracle Database Vault Data Dictionary Views](#)
You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

6

Configuring Command Rules

You can create command rules or use the default command rules to protect DDL and DML statements.

- [What Are Command Rules?](#)
A command rule applies Oracle Database Vault protections with an Oracle Database SQL statement, such as `ALTER SESSION`.
- [Default Command Rules](#)
Oracle Database Vault provides default command rules, based on commonly used SQL statements.
- [SQL Statements That Can Be Protected by Command Rules](#)
You can protect a large number of SQL statements by using command rules.
- [Creating a Command Rule](#)
You can create a different types of command rules using different command rule APIs.
- [Modifying a Command Rule](#)
You can use the `DBMS_MACADM.UPDATE_COMMAND_RULE`, `DBMS_MACADM.UPDATE_CONNECT_COMMAND_RULE`, `DBMS_MACADM.UPDATE_SESSION_EVENT_CMD_RULE`, and `DBMS_MACADM.UPDATE_SYSTEM_EVENT_CMD_RULE` procedures to modify the definition of a command rule.
- [Deleting a Command Rule](#)
Before you delete a command rule, you can locate the various references to it by querying the command rule-related Oracle Database Vault views.
- [How Command Rules Work](#)
Command rules follow a set of steps to check their associated components.
- [Tutorial: Using a Command Rule to Control Table Creations by a User](#)
In this tutorial, you create a simple local command rule to control whether users can create tables in the `SCOTT` schema.
- [Guidelines for Designing Command Rules](#)
Oracle provides guidelines for designing command rules.
- [How Command Rules Affect Performance](#)
The performance of a command rule depends on the complexity of the rules in the rule set associated with the command rule.
- [Command Rule Related Reports and Data Dictionary View](#)
Oracle Database Vault provides reports and a data dictionary view that are useful for analyzing command rules.

6.1 What Are Command Rules?

A command rule applies Oracle Database Vault protections with an Oracle Database SQL statement, such as `ALTER SESSION`.

- [About Command Rules](#)
A command rule protects Oracle Database SQL statements that affect one or more database objects.
- [Command Rules in a Multitenant Environment](#)
You can create common and local command rules in either the CDB root or the application root.
- [Types of Command Rules](#)
In addition to command rules for many SQL statements, you can create command rules specifically for the `CONNECT`, `ALTER SYSTEM`, and `ALTER SESSION` SQL statements.

6.1.1 About Command Rules

A command rule protects Oracle Database SQL statements that affect one or more database objects.

These statements can include `SELECT`, `ALTER SYSTEM`, database definition language (DDL), and data manipulation language (DML) statements.

To customize and enforce the command rule, you associate it with a rule set, which is a collection of one or more rules. The command rule is enforced at run time. Command rules affect anyone who tries to use the SQL statements it protects, regardless of the realm in which the object exists.

You can use command rules to protect a wide range of SQL statements, in addition to basic Oracle Database DDL and DML statements. For example, you can protect statements that are used with Oracle Flashback Technology.

A command rule has the following attributes, in addition to associating a command rule to a command:

- SQL statement the command rule protects
- Owner of the object the command rule affects
- Database object the command rule affects
- Whether the command rule is enabled
- An associated rule set

Command rules can be categorized as follows:

- **Command rules that have a system-wide scope.** With this type, in most cases, you can only create one command rule for each database instance. For example, `CONNECT` or `ALTER SYSTEM` command rules are enforced system-wide.
- **Command rules that are schema specific.** An example of a schema-specific command rule is a command rule for the `DROP TABLE` statement. You can create only one `CONNECT` command rule for each schema.
- **Command rules that are object specific.** An example is creating a command rule for the `DROP TABLE` statement with a specific table included in the command rule definition.

When a user runs a statement affected by a command rule, Oracle Database Vault checks the realm authorization first. If it finds no realm violation and if the associated command rules are enabled, then Database Vault evaluates the associated rule sets. If all the rule sets evaluate to `TRUE`, then the statement is authorized for further processing. If any of the rule sets evaluate to `FALSE`, then the statement is not allowed to be run and a command rule violation is raised.

You can define a command rule that uses factors for the `CONNECT` event to permit or deny sessions after the usual steps—user authentication process, factor initialization, and Oracle Label Security integration—are complete. In addition, you can configure a command rule that allows DDL statements such as `CREATE TABLE`, `DROP TABLE`, and `ALTER TABLE` in the `BIZAPP` schema to be authorized after business hours, but not during business hours.

You can run reports on the command rules by using the data dictionary views or the reports included in Oracle Enterprise Manager.

You cannot create command rules that block `SYS` from executing `SYS`-owned procedures. Instead, you should minimize your use of the `SYS` database user and, instead, create named accounts with the appropriate privileges. The `SYS` account should be reserved for installation, database creation, and database patching..

Related Topics

- [Oracle Database Vault Command Rule APIs](#)
The `DBMS_MACADM` PL/SQL package provides procedures for configuring command rules. .
- [Configuring Rule Sets](#)
Rule sets group one or more rules together; the rules determine whether a user can perform an action on an object.
- [SQL Statements That Can Be Protected by Command Rules](#)
You can protect a large number of SQL statements by using command rules.

6.1.2 Command Rules in a Multitenant Environment

You can create common and local command rules in either the CDB root or the application root.

Common command rules can be associated only with common realms, rule sets, and rules. Local command rules can be associated only with local realm, rule sets, and rules.

To apply these command rules to the entire multitenant environment, you must run the command rule procedures from the CDB root or application root as a common user who has been granted the `DVADM` or `DVOWNER` role. A common command rule that is created in the CDB root will be applied to all PDBs in that CDB environment. A common command rule that is created in the application root will only be applied to the PDBs that are associated with this application root. To propagate the command rule to the PDBs that are associated with the CDB root or application root, you must synchronize the PDB. For example, to synchronize an application root called `saas_sales_app` to its application PDBs:

```
ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;
```

To synchronize a common command rule in the CDB root to a PDB:

```
ALTER PLUGGABLE DATABASE APPLICATION APP$CDB$SYSTEM SYNC;
```

You can check a user's roles by querying the `USER_ROLE_PRIVS` data dictionary view. To find information about command rules, query the `DBA_DV_COMMAND_RULE` data dictionary view.

6.1.3 Types of Command Rules

In addition to command rules for many SQL statements, you can create command rules specifically for the `CONNECT`, `ALTER SYSTEM`, and `ALTER SESSION` SQL statements.

- [CONNECT Command Rule](#)
The `DBMS_MACADM.CREATE_CONNECT_CMD_RULE` procedure creates a user-specific `CONNECT` command rule.
- [ALTER SESSION and ALTER SYSTEM Command Rules](#)
You can create different kinds of `ALTER SESSION` and `ALTER SYSTEM` command rules that provide fine-grained control for these SQL statements.

6.1.3.1 CONNECT Command Rule

The `DBMS_MACADM.CREATE_CONNECT_CMD_RULE` procedure creates a user-specific `CONNECT` command rule.

This type of command rule specifies a user, an associated rule set, an enablement status, and where to run the `CONNECT` command rule. You can enable or disable the `CONNECT` command rule, or you can set it to use simulation mode. In simulation mode, violations to the command rule are logged in a designated log table with sufficient information to describe the error, such as the user name or SQL statement used.

You can create the `CONNECT` command rule in either the application root or in a specific PDB. The associated rule set must be consistent with the `CONNECT` command rule: if the `CONNECT` command rule is in the application root, then the rule set and rules must also be in the application root. You run the `CONNECT` command rule procedures from the CDB root as a common user. If the `CONNECT` command rule is local to a pluggable database (PDB), then you must run the `CONNECT` command rule creation command in that PDB, and the rule set and rules must be local.

The following example shows a `CONNECT` command rule definition that creates a local, enabled `CONNECT` command rule for the `HR` user. The rule set that is associated with this command rule is local to the current PDB.

```
BEGIN
DBMS_MACADM.CREATE_CONNECT_COMMAND_RULE (
  rule_set_name => 'Enabled',
  user_name     => 'HR',
  enabled       => DBMS_MACUTL.G_YES,
  scope        => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

Related Topics

- [CREATE_COMMAND_RULE Procedure](#)
The `CREATE_COMMAND_RULE` procedure creates both command and local command rules, which can be added to a rule set.
- [Using Simulation Mode for Logging Realm and Command Rule Activities](#)
Simulation mode writes violations to the simulation log instead of preventing SQL execution to quickly test new and modified Oracle Database Vault controls.

6.1.3.2 ALTER SESSION and ALTER SYSTEM Command Rules

You can create different kinds of `ALTER SESSION` and `ALTER SYSTEM` command rules that provide fine-grained control for these SQL statements.

The procedures to create these types of command rules are as follows:

- `DBMS_MACADM.CREATE_COMMAND_RULE` creates `ALTER SESSION` and `ALTER SYSTEM` command rules that use clauses from the corresponding SQL statement, such as `ADVISE`, `CLOSE`

DATABASE LINK, COMMIT IN PROCEDURE, and SET for ALTER SESSION, or ARCHIVE_LOG, CHECK DATAFILES, CHECKPOINT, and SET for ALTER SYSTEM.

- DBMS_MACADM.CREATE_SESSION_EVENT creates a command rule that is specific to the ALTER SESSION SET EVENTS SQL statement
- DBMS_MACADM.CREATE_SYSTEM_EVENT creates a command rule that is specific to the ALTER SYSTEM SET EVENTS SQL statement.

To create these command rules, you use the appropriate Database Vault procedure to specify the clause and if applicable, the parameter of the clause, in the creation statement. If the ALTER SESSION or ALTER SYSTEM command rule use the SET EVENTS setting, then you can use special parameters to specify events, components, and actions.

For example, for an ALTER SYSTEM command rule, you could specify the SECURITY clause and its RESTRICTED SESSION parameter from the ALTER SYSTEM SQL statement. To specify whether RESTRICTED SESSION is TRUE or FALSE, you must create a Database Vault rule and rule set, which can test for the validity of this sequence number.

To understand how this concept works, first create the following rule and rule set, which are designed to check if the RESTRICTED SESSION parameter is set to TRUE:

```
EXEC DBMS_MACADM.CREATE_RULE('RESTRICTED SESSION TRUE', 'UPPER(PARAMETER_VALUE) =
''TRUE'');

BEGIN
  DBMS_MACADM.CREATE_RULE_SET(
    rule_set_name => 'Check RESTRICTED SESSION for TRUE',
    description   => 'Checks if restricted session is true',
    enabled       => DBMS_MACUTL.G_YES,
    eval_options  => DBMS_MACUTL.G_RULESET_EVAL_ALL,
    audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
    fail_options  => DBMS_MACUTL.G_RULESET_FAIL_SILENT,
    fail_message  => 'RESTRICTED SESSION is not TRUE',
    fail_code     => 20461,
    handler_options => DBMS_MACUTL.G_RULESET_HANDLER_FAIL,
    handler       => '',
    is_static     => false);
END;
/
EXEC DBMS_MACADM.ADD_RULE_TO_RULE_SET('Check RESTRICTED SESSION for TRUE', 'RESTRICTED
SESSION TRUE');
```

With the rule and rule set in place, you are ready to create an ALTER SYSTEM command rule that will check if the RESTRICTED SESSION parameter:

```
BEGIN
  DBMS_MACADM.CREATE_COMMAND_RULE(
    command       => 'ALTER SYSTEM',
    rule_set_name => 'Check RESTRICTED SESSION for TRUE',
    object_owner  => '%',
    object_name   => '%',
    enabled       => DBMS_MACUTL.G_YES,
    clause_name   => 'SECURITY',
    parameter_name => 'RESTRICTED SESSION',
    scope        => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

In this example:

- `rule_set_name` checks whether `RESTRICTED SESSION` is set to `TRUE` or `FALSE`. You must create the rule set and rule in the same location as the command rule: either in the application root or locally in a PDB.
- `object_owner` and `object_name` must always be set to `%` for this kind of `ALTER SESSION` or `ALTER SYSTEM` command rule.
- `enabled` enables you to enable or disable the command rule, or to use simulation mode to log violations to the command rule to a designated log table. The log data describes the error, such as the user name or SQL statement used.
- `clause_name` specifies the `SECURITY` clause of the `ALTER SYSTEM SQL` statement
- `parameter_name` specifies the `RESTRICTED SESSION` parameter from the `SECURITY` clause
- `scope` sets the command rule to be local to the current PDB. The associated rule set and rule must also be local to the current PDB. If you want to create the command rule in the application root, then as a common user, you would set `scope` to `DBMS_MACUTL.G_SCOPE_COMMON` and run the procedure (and its accompanying rule set and rule creation procedures) from the application root.

See Also:

- [CREATE_COMMAND_RULE Procedure](#) about the `DBMS_MACADM.CREATE_COMMAND_RULE` procedure
- [CREATE_SESSION_EVENT_CMD_RULE Procedure](#) about the `DVS.DBMS_MACADM.CREATE_SESSION_EVENT_CMD_RULE` procedure
- [CREATE_SYSTEM_EVENT_CMD_RULE Procedure](#) for more information about the `DBMS_MACADM.CREATE_SYSTEM_EVENT_CMD_RULE` procedure
- [DBA_DV_COMMAND_RULE View](#) for information about the `DBA_DV_COMMAND_RULE` data dictionary view
- *Oracle Database SQL Language Reference* for information about the `ALTER SESSION SQL` statement
- *Oracle Database SQL Language Reference* for information about the `ALTER SYSTEM SQL` statement

6.2 Default Command Rules

Oracle Database Vault provides default command rules, based on commonly used SQL statements.

[Table 6-1](#) lists the default Database Vault command rules.

Table 6-1 Default Command Rules

| SQL Statement | Rule Set Name |
|---------------|--------------------------------|
| CREATE USER | Can Maintain Accounts/Profiles |
| ALTER USER | Can Maintain Own Account |
| DROP USER | Can Maintain Accounts/Profiles |

Table 6-1 (Cont.) Default Command Rules

| SQL Statement | Rule Set Name |
|-----------------|-------------------------------------------------|
| CREATE PROFILE | Can Maintain Accounts/Profiles |
| ALTER PROFILE | Can Maintain Accounts/Profiles |
| DROP PROFILE | Can Maintain Accounts/Profiles |
| ALTER SYSTEM | Allow Fine Grained Control of System Parameters |
| CHANGE PASSWORD | Can Maintain Own Account ¹ |

¹ The actual SQL statement that the Can Maintain Own Account rule refers to is PASSWORD.

The following set of command rules helps you to achieve separation of duty for user management:

- ALTER PROFILE
- ALTER USER
- CREATE PROFILE
- CREATE USER
- DROP PROFILE
- DROP USER

To grant a user the ability to use these commands, you can grant the user the role that the rule set checks. For example, the CREATE USER command rule ensures that a user who tries to run a CREATE USER statement has the DV_ACCTMGR role.



Note:

To find information about the default command rules, query the DBA_DV_COMMAND_RULE data dictionary view.

6.3 SQL Statements That Can Be Protected by Command Rules

You can protect a large number of SQL statements by using command rules.

The SQL statements that you can protect are as follows:

SQL Statements A-A

ADMINISTER KEY MANAGEMENT
ALTER CLUSTER
ALTER DIMENSION
ALTER FLASHBACK ARCHIVE
ALTER FUNCTION
ALTER INDEX

SQL Statements A-D

ANALYZE TABLE
ASSOCIATE STATISTICS
AUDIT
AUDIT POLICY (for enabling audit unified audit policies)
CHANGE PASSWORD
COMMENT

SQL Statements C-U

CREATE SYNONYM
CREATE TABLE
CREATE TABLESPACE
CREATE TRIGGER
CREATE TYPE
CREATE TYPE BODY

SQL Statements A-A

ALTER INDEXTYPE
 ALTER JAVA
 ALTER LIBRARY
 ALTER OPERATOR
 ALTER OUTLINE
 ALTER MATERIALIZED VIEW
 ALTER MATERIALIZED VIEW LOG
 ALTER PACKAGE
 ALTER PACKAGE BODY
 ALTER PLUGGABLE DATABASE
 ALTER PROCEDURE
 ALTER PROFILE
 ALTER RESOURCE COST
 ALTER ROLE
 ALTER ROLLBACK SEGMENT
 ALTER SEQUENCE
 ALTER SESSION

 ALTER SYNONYM
 ALTER SYSTEM
 ALTER TABLE
 ALTER TABLESPACE
 ALTER TRIGGER
 ALTER TYPE
 ALTER TYPE BODY
 ALTER USER
 ALTER VIEW
 ANALYZE CLUSTER
 ANALYZE INDEX

SQL Statements A-D

CONNECT
 CREATE AUDIT POLICY
 CREATE EDITION
 CREATE FLASHBACK ARCHIVE
 CREATE USER
 CREATE CLUSTER
 CREATE CONTEXT
 CREATE DATABASE LINK
 CREATE DIMENSION
 CREATE DIRECTORY
 CREATE FUNCTION
 CREATE INDEX
 CREATE INDEXTYPE
 CREATE JAVA
 CREATE LIBRARY
 CREATE OPERATOR
 CREATE OUTLINE

 CREATE PACKAGE
 CREATE PACKAGE BODY
 CREATE PLUGGABLE DATABASE
 CREATE PROCEDURE
 CREATE PROFILE
 CREATE ROLE
 CREATE ROLLBACK SEGMENT
 CREATE SCHEMA
 CREATE SEQUENCE
 CREATE MATERIALIZED VIEW
 CREATE MATERIALIZED VIEW LOG

SQL Statements C-U

CREATE VIEW
 DELETE
 DISASSOCIATE STATISTICS
 DROP CLUSTER
 DROP CONTEXT
 DROP DATABASE LINK
 DROP EDITION
 DROP DIMENSION
 DROP DIRECTORY
 DROP FLASHBACK ARCHIVE
 DROP FUNCTION
 FLASHBACK TABLE
 EXECUTE
 GRANT
 INSERT
 NOAUDIT
 NOAUDIT POLICY (for disabling unified
 audit policies only)
 PURGE DBA_RECYCLEBIN
 PURGE INDEX
 RENAME
 PURGE RECYCLEBIN
 PURGE TABLE
 PURGE TABLESPACE
 REVOKE
 SELECT
 TRUNCATE CLUSTER
 TRUNCATE TABLE
 UPDATE

Related Topics

- [Command Rules in a Multitenant Environment](#)
 You can create common and local command rules in either the CDB root or the application root.

6.4 Creating a Command Rule

You can create a different types of command rules using different command rule APIs.

Depending on the command rule that you want to create, you can use one of the following command rule APIs to create the command rule: `DBMS_MACADM.CREATE_COMMAND_RULE`, `DBMS_MACADM.CREATE_CONNECT_COMMAND_RULE`, `DBMS_MACADM.CREATE_SYSTEM_EVENT_CMD_RULE`.

The `DBMS_MACADM.CREATE_COMMAND_RULE` procedure enables you to create complex command rules for `ALTER SYSTEM` and `ALTER SESSION` statements. This topic describes how to create a command rule using the `DBMS_MACADM.CREATE_COMMAND_RULE` procedure.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. If necessary, create a rule set that the command rule will use.

The `DBA_DV_RULE_SET` data dictionary view lists existing rule sets.

3. Run the `DBMS_MACADM.CREATE_COMMAND_RULE` to create the command rule.

For example, to create a simple command rule:

```
BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'GRANT',
  rule_set_name => 'Can Grant VPD Administration',
  object_owner  => 'HR',
  object_name   => 'EMPLOYEES',
  enabled       => DBMS_MACUTL.G_YES,
  scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

In this specification:

- `command` is the SQL statement that you want to protect. The `DBA_DV_COMMAND_RULE` data dictionary view lists the SQL statements that are protected by command rules. If you plan to create a command rule for a unified audit policy object, then ensure that you specify `AUDIT POLICY` or `NOAUDIT POLICY`, not `AUDIT` or `NOAUDIT`, as the command. If you want to create a command rule for the `ALTER SYSTEM` or `ALTER SESSION` statements, then you must include a set of special parameters to define the details of these statements: `clause_name`, `parameter_name`, `event_name`, `component_name`, and `action_name`. These parameters, as well as examples of how to use them, are described in the `CREATE_COMMAND_RULE` reference. See [Related Topics](#).
- `rule_set_name` is the rule set to associate with this command rule. If the rule set evaluates to true, then the SQL statement succeeds. If it evaluates to false, the statement fails, and then Oracle Database Vault raises a command rule violation. The `DBA_DV_RULE_SET` data dictionary view lists existing rule sets. This parameter is mandatory.
- `object_owner` is the schema to which this command rule will apply. This attribute is mandatory for all SQL statements that operate on objects within a specific schema. To find the available schema users, query the `DBA_USERS` view. You can use wildcard character `%` to select all owners. However, you cannot use wildcard characters with text, such as `EM%` to select all owners whose names begin in `EM`. The wildcard `%` is not allowed for the command rules for the `SELECT`, `INSERT`, `UPDATE`, `DELETE`, and `EXECUTE` statements. Nor is `%` allowed for `SELECT`, `INSERT`, `UPDATE`, `DELETE`, and `EXECUTE` statements to do a selection of all (`%`) or the `SYS` and `DVSYS` schemas.

- `object_name` is the name of the database object that the command rule affects. Specify `%` to select all database objects, which can include tables, procedures, views, unified audit policies, and so on. This attribute is mandatory if you specified `object_owner`.
- `enabled` controls the status of the command rule. Valid settings are `DBMS_MACUTL.G_YES 'y'` to enable the command rule (default), `DBMS_MACUTL.G_NO` or `'n'` to disable the command rule, including the capture of violations in the simulation log, or `DBMS_MACUTL.G_SIMULATION` or `'s'` to enable SQL statements to run but capture violations in the simulation log.
- `scope` defines whether the command rule is authorized locally in the current PDB (`DBMS_MACUTL.G_SCOPE_LOCAL`) or in an application root (`DBMS_MACUTL.G_SCOPE_COMMON`). If you create the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:

```
ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;
```

Related Topics

- [Configuring Rule Sets](#)
Rule sets group one or more rules together; the rules determine whether a user can perform an action on an object.
- [CREATE_COMMAND_RULE Procedure](#)
The `CREATE_COMMAND_RULE` procedure creates both command and local command rules, which can be added to a rule set.
- [SQL Statements That Can Be Protected by Command Rules](#)
You can protect a large number of SQL statements by using command rules.
- [Oracle Database Vault Command Rule APIs](#)
The `DBMS_MACADM` PL/SQL package provides procedures for configuring command rules. .

6.5 Modifying a Command Rule

You can use the `DBMS_MACADM.UPDATE_COMMAND_RULE`, `DBMS_MACADM.UPDATE_CONNECT_COMMAND_RULE`, `DBMS_MACADM.UPDATE_SESSION_EVENT_CMD_RULE`, and `DBMS_MACADM.UPDATE_SYSTEM_EVENT_CMD_RULE` procedures to modify the definition of a command rule.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Find the command rule and check its definition.

For example:

```
SELECT COMMAND, ENABLED FROM DBA_DV_COMMAND_RULE ORDER BY COMMAND;
```

The `DBA_DV_COMMAND_RULE` view also shows the definition of the command rule.

3. Run the appropriate procedure to modify the command rule.
 - `DBMS_MACADM.UPDATE_COMMAND_RULE` updates a command rule declaration that was created with the `DBMS_MACADM.CREATE_COMMAND_RULE` procedure. For example:

```
BEGIN
  DBMS_MACADM.UPDATE_COMMAND_RULE (
```



```

command          => 'GRANT',
rule_set_name    => 'Can Grant VPD Administration',
object_owner     => 'HR',
object_name      => 'EMPLOYEES',
enabled          => DBMS_MACUTL.G_NO,
scope           => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/

```

- `DBMS_MACADM.UPDATE_CONNECT_COMMAND_RULE` updates command rules that were created with `DBMS_MACADM.CREATE_CONNECT_COMMAND_RULE`.
- `DBMS_MACADM.UPDATE_SESSION_EVENT_CMD_RULE` updates command rules that were created with `DBMS_MACADM.CREATE_SESSION_EVENT_CMD_RULE`.
- `DBMS_MACADM.UPDATE_SYSTEM_EVENT_CMD_RULE` updates command rules that were created with `DBMS_MACADM.CREATE_SYSTEM_EVENT_CMD_RULE`.

Related Topics

- [Oracle Database Vault Command Rule APIs](#)

The `DBMS_MACADM` PL/SQL package provides procedures for configuring command rules. .

6.6 Deleting a Command Rule

Before you delete a command rule, you can locate the various references to it by querying the command rule-related Oracle Database Vault views.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```

CONNECT c##sec_admin_owen@pdb_name
Enter password: password

```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Query the `DBA_DV_COMMAND_RULE` data dictionary to find the command rule to delete.

For example:

```

SELECT COMMAND FROM DBA_DV_COMMAND_RULE ORDER BY COMMAND;

```

The `DBA_DV_COMMAND_RULE` view also shows the definition of the command rule.

3. Query the `DBA_DV_COMMAND_RULE` data dictionary to find the definition of the command rule.

When you drop a command rule, you must omit the `rule_set_name` and `enabled` parameters, and ensure that the rest of the parameters match the settings that were used the last time the command rule was updated.

For example:

```

SELECT OBJECT_OWNER, OBJECT_NAME, COMMON
FROM DBA_DV_COMMAND_RULE
WHERE COMMAND = 'GRANT';

```

4. Run the appropriate procedure to delete the command rule.

- `DBMS_MACADM.DELETE_COMMAND_RULE` deletes a command rule that was created with the `DBMS_MACADM.CREATE_COMMAND_RULE` procedure. For example:

```

BEGIN
  DBMS_MACADM.DELETE_COMMAND_RULE (
    command      => 'GRANT',
    object_owner => 'HR',
    object_name  => 'EMPLOYEES',
    scope       => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/

```

- `DBMS_MACADM.DELETE_CONNECT_COMMAND_RULE` deletes command rules that were created with `DBMS_MACADM.CREATE_CONNECT_COMMAND_RULE`.
- `DBMS_MACADM.DELETE_SESSION_EVENT_CMD_RULE` deletes command rules that were created with `DBMS_MACADM.CREATE_SESSION_EVENT_CMD_RULE`.
- `DBMS_MACADM.DELETES_SYSTEM_EVENT_CMD_RULE` deletes command rules that were created with `DBMS_MACADM.CREATE_SYSTEM_EVENT_CMD_RULE`.

Related Topics

- [Oracle Database Vault Command Rule APIs](#)
The `DBMS_MACADM` PL/SQL package provides procedures for configuring command rules. .

6.7 How Command Rules Work

Command rules follow a set of steps to check their associated components.

[How Realms Work](#) describes what happens when a database account issues a `SELECT`, `DDL`, or `DML` statement that affects objects within a realm.

The following actions take place when `SELECT`, `DDL`, or `DML` statement is issued:

1. Oracle Database Vault queries all the command rules that need to be applied.
For `SELECT`, `DDL`, and `DML` statements, multiple command rules may apply because the object owner and object name support wildcard notation.
You can associate rule sets with both command rules and realm authorizations. Oracle Database Vault evaluates the realm authorization rule set first, and then it evaluates the rule sets that apply to the command type being evaluated.
2. For each command rule that applies, Oracle Database Vault evaluates its associated rule set.
3. If the associated rule set of any of the applicable command rules returns false or errors, Oracle Database Vault prevents the command from executing. Otherwise, the command is authorized for further processing. The configuration of the rule set with respect to auditing and event handlers dictates the auditing or custom processing that occurs.

Command rules override object privileges. That is, even the owner of an object cannot access the object if the object is protected by a command rule. You can disable either a command rule or the rule set of a command. If you disable a command rule, then the command rule does not perform the check it is designed to handle. If you disable a rule set, then the rule set always evaluates to `TRUE`. However, if you want to disable a command rule for a particular command, then you should disable the command rule because the rule set may be associated with other command rules or realm authorizations.

6.8 Tutorial: Using a Command Rule to Control Table Creations by a User

In this tutorial, you create a simple local command rule to control whether users can create tables in the `SCOTT` schema.

- **Step 1: Create a Table**
First, user `SCOTT` must create a table.
- **Step 2: Create a Command Rule**
After the table has been created in the `SCOTT` schema, you can create a command rule.
- **Step 3: Test the Command Rule**
Next, you are ready to test the `CREATE TABLE` local command rule.
- **Step 4: Remove the Components for This Tutorial**
You can remove the components that you created for this tutorial if you no longer need them.

6.8.1 Step 1: Create a Table

First, user `SCOTT` must create a table.

1. Log in to a PDB as user `SCOTT`.

```
sqlplus scott@pdb_name  
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

If the `SCOTT` account is locked and expired, then log in as the Database Vault Account Manager and unlock `SCOTT` and create a new password. For example:

```
sqlplus accts_admin_ace@pdb_name  
Enter password: password
```

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

Replace `password` with a password that meets the password complexity requirements of the user's profile.

```
CONNECT SCOTT@pdb_name  
Enter password: password
```

2. As user `SCOTT`, create a table.

```
CREATE TABLE t1 (num NUMBER);
```

3. Now drop the table.

```
DROP TABLE t1;
```

At this stage, user `SCOTT` can create and drop tables. Do not exit SQL*Plus yet, and remain connected as `SCOTT`. You must use it later on when `SCOTT` tries to create another table.

Related Topics

- [Oracle Database Security Guide](#)

6.8.2 Step 2: Create a Command Rule

After the table has been created in the `SCOTT` schema, you can create a command rule.

1. Connect to a PDB as a user who has been granted the `DV_OWNER` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

2. Create a `CREATE TABLE` command rule with user `SCOTT` as the owner.

```
BEGIN
  DBMS_MACADM.CREATE_COMMAND_RULE (
    command      => 'CREATE TABLE',
    rule_set_name => 'Disabled',
    object_owner  => 'SCOTT',
    object_name   => '%',
    enabled       => DBMS_MACUTL.G_YES);
END;
/
```

This command rule will prevent user `SCOTT` from creating tables in their schema, even though he is the schema owner. The `object_name` will apply the command rule to all objects in the `SCOTT` schema.

Command rules take effect immediately. Right away, user `SCOTT` is prevented from creating tables, even though he is still in the same user session that he was in a moment ago, before you created the `CREATE TABLE` command rule.

6.8.3 Step 3: Test the Command Rule

Next, you are ready to test the `CREATE TABLE` local command rule.

1. In `SQL*Plus`, ensure that you are logged in to the PDB as user `SCOTT`.

```
CONNECT SCOTT@pdb_name
Enter password: password
```

2. Try to create a table.

```
CREATE TABLE t1 (num NUMBER);
```

The following output should appear:

```
ORA-47400: Command Rule violation for create table on SCOTT.T1
```

As you can see, `SCOTT` is no longer allowed to create tables, even in their own schema.

3. Now enable user `SCOTT` to create tables again.
 - a. Connect to the PDB as the user who created the command rule.
 - b. Update the `CREATE TABLE` command rule to now enable table creations.

```
BEGIN
  DBMS_MACADM.UPDATE_COMMAND_RULE (
    command      => 'CREATE TABLE',
    rule_set_name => 'Enabled',
    object_owner  => 'SCOTT',
    object_name   => '%',
```

```

        enabled          => DBMS_MACUTL.G_YES);
    END;
/

```

4. Connect as user SCOTT, and then try creating the table again.

```

CONNECT scott@hrpdb
Enter password: password

CREATE TABLE t1 (num NUMBER);

Table created.

```

5. User SCOTT does not really need this table, so drop the table.

```
DROP TABLE t1;
```

Now that the `CREATE TABLE` command rule is set to Enabled, user SCOTT is once again permitted to create tables. (Do not exit SQL*Plus.)

6.8.4 Step 4: Remove the Components for This Tutorial

You can remove the components that you created for this tutorial if you no longer need them.

1. Connect to the PDB as the user who created the `CREATE TABLE` command rule.

For example:

```

CONNECT c##sec_admin_owen@hrpdb
Enter password: password

```

2. Drop the `CREATE TABLE` command rule.

Remember that the `command`, `object_owner`, and `object_name` arguments must match exactly the arguments that were used the last time the command rule was updated. You can check a command rule's definition by querying the `DBA_DV_COMMAND_RULE` data dictionary view.

```

BEGIN
  DBMS_MACADM.DELETE_COMMAND_RULE (
    command          => 'CREATE TABLE',
    object_owner     => 'SCOTT',
    object_name      => '%');
END;
/

```

3. If you no longer need the SCOTT account to be available, then connect to the PDB as the Database Vault Account Manager and enter the following `ALTER USER` statement:

```

CONNECT accts_admin_ace@pdb_name
Enter password: password

ALTER USER SCOTT ACCOUNT LOCK PASSWORD EXPIRE;

```

6.9 Guidelines for Designing Command Rules

Oracle provides guidelines for designing command rules.

- Create finer-grained command rules, because they are far easier to maintain.

For example, if you want to prevent `SELECT` statements from occurring on specific schema objects, then design multiple command rules to stop the `SELECT` statements on those specific schema objects, rather than creating a general command rule to prevent `SELECT` statements in the schema level.

- When designing rules for the `CONNECT` event, be careful to include logic that does not inadvertently lock out any required user connections. If any account has been locked out accidentally, ask a user who has been granted the `DV_ADMIN` or `DV_OWNER` role to log in and correct the rule that is causing the lock-out problem. The `CONNECT` command rule does not apply to users with the `DV_OWNER` and `DV_ADMIN` roles. This prevents improperly configured `CONNECT` command rules from causing a complete lock-out.

If the account has been locked out, you can disable Oracle Database Vault, correct the rule that is causing the lock-out problem, and then reenable Oracle Database Vault. Even when Oracle Database Vault is disabled, you still can use Database Vault Administrator and the Database Vault PL/SQL packages.

- If you must temporarily relax an enabled command rule for an administrative task, then consider switching the command rule to simulation mode. Note that this will not capture activity that meets the rule set criteria, only activity that would have violated it.
- When designing command rules, be careful to consider automated processes such as backup where these procedures may be inadvertently disabled. You can account for these tasks by creating rules that allow the command when a series of Oracle Database Vault factors is known to be true (for example, the program being used), and the account being used or the computer or network on which the client program is running.
- You can test the development phase of a command rule by using simulation mode, which enables the command rule but writes detailed information about it to a log file.

Related Topics

- [Using Simulation Mode for Logging Realm and Command Rule Activities](#)
Simulation mode writes violations to the simulation log instead of preventing SQL execution to quickly test new and modified Oracle Database Vault controls.

6.10 How Command Rules Affect Performance

The performance of a command rule depends on the complexity of the rules in the rule set associated with the command rule.

For example, suppose a rule set invokes a PL/SQL function that takes 5 seconds to run. In this case, a command rule that uses that rule set would take 5 seconds to grant access for the command statement to run.

You can check the system performance by running tools such as Oracle Enterprise Manager (including Oracle Enterprise Manager Cloud Control, which is installed by default with Oracle Database), Automatic Workload Repository (AWR), and `TKPROF`.

Related Topics

- *Oracle Database Performance Tuning Guide*
- *Oracle Database SQL Tuning Guide*

6.11 Command Rule Related Reports and Data Dictionary View

Oracle Database Vault provides reports and a data dictionary view that are useful for analyzing command rules.

[Table 6-2](#) lists the Oracle Database Vault report.

Table 6-2 Reports Related to Command Rules

| Report | Description |
|------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Command Rule Audit Report | Lists audit records generated by command rule processing operations |
| Command Rule Configuration Issues Report | Tracks rule violations, in addition to other configuration issues the command rule may have |
| Object privilege reports | List object privileges that the command rule affects |
| Sensitive object reports | List objects that the command rule affects |
| Rule Set Configuration Issues Report | Lists rules sets that have no rules defined or enabled, which may affect the command rules that use them |

You can use the `DBA_DV_COMMAND_RULE` data dictionary view to find the SQL statements that are protected by command rules.

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.
- [Oracle Database Vault Data Dictionary Views](#)
You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

7

Configuring Factors

Factors allow you to create and use complex attributes through PL/SQL to make Oracle Database Vault authorization decisions.

- [What Are Factors?](#)
A factor is a named variable or attribute, such as a database IP address, that Oracle Database Vault can recognize.
- [Default Factors](#)
Oracle Database Vault provides a set of default factors.
- [Creating a Factor](#)
In general, to create a factor, you first create the factor itself, and then you edit the factor to include its identity.
- [Adding an Identity to a Factor](#)
After you create a new factor, you optionally can add an identity to it.
- [Modifying a Factor](#)
You can use the `DBMS_MACADM.UPDATE_FACTOR` procedure to modify the definition of a factor.
- [Deleting a Factor](#)
Before you delete a factor, you must remove references to the factor.
- [How Factors Work](#)
Oracle Database Vault processes factors when a session is established.
- [Tutorial: Preventing Ad Hoc Tool Access to the Database](#)
This tutorial demonstrates how to use factors to prevent ad hoc tools (such as SQL*Plus) from accessing the database.
- [Guidelines for Designing Factors](#)
Oracle provides guidelines for designing factors.
- [How Factors Affect Performance](#)
The complexity of factors affects the performance of your Oracle database instance.
- [Factor Related Reports and Data Dictionary Views](#)
Oracle Database Vault provides reports and data dictionary views that display information about factors and their identities.

7.1 What Are Factors?

A factor is a named variable or attribute, such as a database IP address, that Oracle Database Vault can recognize.

You can use factors for activities such as authorizing database accounts to connect to the database or creating filtering logic to restrict the visibility and manageability of data.

Oracle Database Vault provides a selection of factors that lets you set controls on such components as the domain for your site, IP addresses, databases, and so on. You also can create custom factors, using your own PL/SQL retrieval methods. However, for the vast majority of cases, you can use the `SYS_CONTEXT` PL/SQL function to create rules on the most commonly used factors that are readily available in the database. Such factors as

`Session_User`, `Proxy_User`, `Network_Protocol`, and `Module` are available through the `SYS_CONTEXT` function.

Factors have powerful capabilities that are used in conjunction with Oracle Label Security and for other database attributes that are not already available through context parameters. Commonly available factors are listed in this section, but Oracle recommends that you use the `SYS_CONTEXT` function in the rule definitions for these factors. Only create and use factors that are not already available through `SYS_CONTEXT`.

Note the following:

- You can use factors in combination with rules in rule sets. The `DVF` factor functions are factor-specific functions that you can use in rule expressions.
- Factors have values (identities) and are further categorized by their factor types.
- You also can integrate factors with Oracle Label Security labels.
- You can run reports on the factors that you create in Oracle Database Vault.
- You only can create factors in a PDB, not in the CDB root or the application root.

Related Topics

- [Creating a Rule to Add to a Rule Set](#)
A rule defines the behavior that you want to control; a rule set is a named collection of rules.
- [Oracle Database SQL Language Reference](#)
- [Oracle Database Vault DVF PL/SQL Factor Functions](#)
Oracle Database Vault maintains the `DVF` schema functions when you use the `DBMS_MACADM` PL/SQL package to manage the various factors.
- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.2 Default Factors

Oracle Database Vault provides a set of default factors.

For each of these factors, there is an associated function that retrieves the value of the factor.

You can create custom factors by using your own PL/SQL retrieval methods. A useful PL/SQL function you can use (which is used for many of the default factors) is the `SYS_CONTEXT` SQL function, which retrieves data about the user session. For example, you can use the `CLIENT_PROGRAM_NAME` attribute of `SYS_CONTEXT` to find the name of the program used for the database session. After you create the custom factor, you can query its values similar to the functions used to query the default factors.

The default factors are as follows:

- `Authentication_Method` is the method of authentication. In the list that follows, the type of user is followed by the method returned:
 - Password-authenticated enterprise user, local database user, user with the `SYSDBA` or `SYSOPER` administrative privilege using the password file; proxy with user name using password: `PASSWORD`
 - Kerberos-authenticated enterprise user or external user (with no administrative privileges): `KERBEROS`

- Kerberos-authenticated enterprise user (with administrative privileges):
KERBEROS_GLOBAL
- Kerberos-authenticated external user (with administrative privileges):
KERBEROS_EXTERNAL
- Transport Layer Security (TLS)-authenticated enterprise or external user (with no administrative privileges): SSL (Transport Layer Security replaces Secure Sockets Layer, but SSL-related settings will work with Transport Layer Security.)
- Transport Layer Security-authenticated enterprise user (with administrative privileges):
SSL_GLOBAL
- Transport Layer Security-authenticated external user (with administrative privileges):
SSL_EXTERNAL
- Radius-authenticated external user: RADIUS
- OS-authenticated external user, or user with the SYSDBA or SYSOPER administrative privilege: OS
- Proxy with certificate, DN, or username without using password: NONE
- Background process (job queue secondary process): JOB
- Parallel Query Slave (secondary) process: PQ_SLAVE

For non-administrative connections, you can use the `Identification_Type` factor to distinguish between external and enterprise users when the authentication method is `PASSWORD`, `KERBEROS`, or `SSL`. For administrative connections, the `Authentication_Method` factor is sufficient for the `PASSWORD`, `SSL_EXTERNAL`, and `SSL_GLOBAL` authentication methods.

- `Client_Identifier` is an identifier that is set by the application through the `DBMS_SESSION.SET_IDENTIFIER` procedure, the Oracle Call Interface (OCI) attribute `OCI_ATTR_CLIENT_IDENTIFIER`, or Oracle Dynamic Monitoring Service (DMS). Various Oracle Database components use this attribute to identify lightweight application users who authenticate as the same database user.
- `Client_IP` is the IP address of the machine from which the client is connected.
- `Database_Domain` is the domain of the database as specified in the `DB_DOMAIN` initialization parameter.
- `Database_Hostname` is the host name of the computer on which the instance is running.
- `Database_Instance` is the instance identification number of the current instance.
- `Database_IP` is the IP address of the computer on which the instance is running.
- `Database_Name` is the name of the database as specified in the `DB_NAME` initialization parameter.
- `DBlink_Info` is the source of a database link session. The string has this form:

```
SOURCE_GLOBAL_NAME=dblink_src_global_name,  
DBLINK_NAME=dblink_name,SOURCE_AUDIT_SESSIONID=dblink_src_audit_sessionid
```

In this specification:

- `dblink_src_global_name` is the unique global name of the source database
- `dblink_name` is the name of the database link on the source database
- `dblink_src_audit_sessionid` source database that initiated source database that initiated the connection to the remote database using `dblink_name`

- `Domain` is a named collection of physical, configuration, or implementation-specific factors in the run-time environment (for example, a networked IT environment or subset of it) that operates at a specific sensitivity level. You can identify a domain using factors such as host name, IP address, and database instance names of the Database Vault nodes in a secure access path to the database. Each domain can be uniquely determined using a combination of the factor identifiers that identify the domain. You can use these identifying factors and possibly additional factors to define the Maximum Security Label within the domain. This restricts data access and commands, depending on the physical factors about the Database Vault session. Example domains of interest may be Corporate Sensitive, Internal Public, Partners, and Customers.
- `Enterprise_Identity` is the enterprise-wide identity for the user:
 - For enterprise users: the Oracle Internet Directory-distinguished name (DN).
 - For external users: the external identity (Kerberos principal name, Radius and DCE schema names, operating system user name, certificate DN).
 - For local users and `SYSDBA` and `SYSOPER` logins: NULL.

The value of the attribute differs by proxy method:

- For a proxy with DN: the Oracle Internet Directory DN of the client.
 - For a proxy with certificate: the certificate DN of the client for external users; the Oracle Internet Directory DN for global users.
 - For a proxy with user names: the Oracle Internet Directory DN if the client is an enterprise user; NULL if the client is a local database user.
- `Identification_Type` is the way the user schema was created in the database. Specifically, it reflects the `IDENTIFIED` clause in the `CREATE USER` and `ALTER USER` syntax. In the list that follows, the syntax used during schema creation is followed by the identification type returned:
 - `IDENTIFIED BY password`: LOCAL
 - `IDENTIFIED EXTERNALLY`: EXTERNAL
 - `IDENTIFIED GLOBALLY`: GLOBAL SHARED
 - `IDENTIFIED GLOBALLY AS DN`: GLOBAL PRIVATE
 - `GLOBAL EXCLUSIVE` for exclusive global user mapping
 - `GLOBAL SHARED` for shared user mapping
 - `NONE` when the schema is created with no authentication
 - `Lang` is the ISO abbreviation for the language name, a shorter form than the existing `LANGUAGE` parameter.
 - `Language` is the language and territory your session currently uses, along with the database character set, in the following form:

language_territory.characterset

For example:

AMERICAN_AMERICA.WE8MSWIN1252

- `Machine` is the host name for the database client that established the current session. If you must find out whether the computer was used for a client or server session, then you can compare this setting with the `Database_Hostname` factor to make the determination.

- `Module` is the application name (module) that is set through the `DBMS_APPLICATION_INFO` PL/SQL package or OCI.
- `Network_Protocol` is the network protocol being used for communication, as specified in the `PROTOCOL=protocol` portion of the connect string.
- `Proxy_Enterprise_Identity` is the Oracle Internet Directory DN when the proxy user is an enterprise user.
- `Proxy_User` is the name of the database user who opened the current session on behalf of `SESSION_USER`.
- `Session_User` is the database user name by which the current user is authenticated. This value remains the same throughout the session.

Related Topics

- [Oracle Database Vault DVF PL/SQL Factor Functions](#)
Oracle Database Vault maintains the DVF schema functions when you use the `DBMS_MACADM` PL/SQL package to manage the various factors.
- [Oracle Database SQL Language Reference](#)
- [Oracle Database Globalization Support Guide](#)

7.3 Creating a Factor

In general, to create a factor, you first create the factor itself, and then you edit the factor to include its identity.

This procedure explains how to create the factor only, not how to configure an identity for it.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. If necessary, create a rule set that the factor will use.

The `DBA_DV_RULE_SET` data dictionary view lists existing rule sets.

3. Run the `DBMS_MACADM.CREATE_FACTOR` procedure to create the factor.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_FACTOR(
    factor_name       => 'Sector2_DB',
    factor_type_name => 'Instance',
    description      => 'Factor to restrict DBA access',
    rule_set_name    => 'Limit_DBA_Access',
    get_expr         => 'UPPER(SYS_CONTEXT(''USERENV'', ''DB_NAME''))',
    validate_expr    => 'dbavowner.check_db_access',
    identify_by     => DBMS_MACUTL.G_IDENTIFY_BY_METHOD,
    labeled_by      => DBMS_MACUTL.G_LABELED_BY_SELF,
    eval_options    => DBMS_MACUTL.G_EVAL_ON_SESSION,
    audit_options   => DBMS_MACUTL.G_AUDIT_OFF,
    fail_options    => DBMS_MACUTL.G_FAIL_SILENTLY);
```

```
END;
/
```

In this specification:

- `factor_name` can be up to 128 characters in mixed-case, without spaces. The `DBA_DV_FACTOR` data dictionary view lists existing factors. This parameter is mandatory.
- `factor_type_name` can be up to 128 characters in mixed-case, without spaces. The `DBA_DV_FACTOR_TYPE` data dictionary view lists existing factor types. This parameter is mandatory. The

Factor types have a name and description and are used only to help classify factors. A factor type is the category name used to classify the factor. The default physical factor types include authentication method, host name, host IP address, instance identifiers, database account information, and others. You can create user-defined factor types, such as application name, certificate information, and so on in addition to the installed factor types, such as time and authentication method. If you want to find factors that are associated with a particular factor type, query the `DBA_DV_FACTOR` view. For example:

```
SELECT NAME FROM DBA_DV_FACTOR
WHERE FACTOR_TYPE_NAME='Authentication Method';
```

- `description` can have up to 1024 characters in mixed-case. This parameter is mandatory.
- `rule_set_name` is the rule set name if you want to use a rule set to control when and how a factor identity is set. The `DBA_DV_RULE_SET` data dictionary view lists rules sets. This parameter is mandatory.

This setting is particularly useful for situations where database applications, such as a Web application using a JDBC connection pool, must dynamically set a factor identity for the current database session. For example, a Web application may want to assign the geographic location for a database account logging in to the Web application. To do so, the Web application can use the JDBC Callable Statement, or Oracle Data Provider for .NET (ODP.NET) to run the PL/SQL function `SET_FACTOR`, for example:

```
BEGIN
  SET_FACTOR('GEO_STATE', 'VIRGINIA');
END;
```

Then you can create an assignment rule for the `GEO_STATE` factor to allow or disallow the setting of the `GEO_STATE` factor based on other factors or rule expressions.

- `get_expr` is a valid PL/SQL expression that retrieves the identity of a factor. It can use up to 255 characters in mixed-case. The following retrieval method sets a value of the `DB_NAME` factor by retrieving the database name (`DB_NAME`) from the `USERENV` namespace in a user's session:

```
UPPER(SYS_CONTEXT('USERENV', 'DB_NAME'))
```

- `validate_expr` is a valid PL/SQL expression that returns a Boolean value (`TRUE` or `FALSE`) to validate the identity of the factor being retrieved (with the `GET_FACTOR` function) or the value to be assigned to a factor (with the `SET_FACTOR` function). It can have up to 255 characters and be in mixed case. This parameter is mandatory. If the method is evaluated to false for the value being retrieved or to be assigned, then the factor identity is set to null. This feature provides an additional level of assurance that the factor is properly retrieved and set. You can include any package function or standalone function in the expression. Ensure that the expression is a fully qualified function, such as `schema.function_name`. Do not include complete SQL statements. If

you are using application packages or functions, then you must provide `DVSYS` with the `EXECUTE` privilege on the object.

The PL/SQL expression can use either of these formats:

- `FUNCTION IS_VALID RETURN BOOLEAN`
In this form, you can use the `DVF.F$factor_name` function inside the function logic. This is more appropriate for factors that are evaluated by session.
- `FUNCTION IS_VALID(p_factor_value VARCHAR2) RETURN BOOLEAN`
In this form, the factor value is passed to the validation function directly. This is more appropriate for factors that are evaluated by access. It is also valid for factors evaluated by session.
- `identify_by` can be one of the following options for determining the identity of a factor, based on the expression set for the `get_expr` parameter:
 - `DBMS_MACUTL.G_IDENTIFY_BY_CONSTANT`: By constant
 - `DBMS_MACUTL.G_IDENTIFY_BY_METHOD`: By method. For example, suppose the expression retrieves the system date: `to_char(sysdate, 'yyyy-mm-dd')`. On December 15, 2020, the following value would be returned: `2020-12-15`
 - `DBMS_MACUTL.G_IDENTIFY_BY_FACTOR`: By factor. This setting determines the factor identity by mapping the identities of the child factor to its parent factor. A parent factor is a factor whose values are resolved based on a second factor, called a child factor. To establish their relationship, you map their identities. (You do not need to specify the `get_expr` parameter for this option.)
 - `DBMS_MACUTL.G_IDENTIFY_BY_CONTEXT`: By context
- `labeled_by` controls how the factor identity retrieves an Oracle Label Security (OLS) label. This parameter is mandatory if you are using the Oracle Label Security integration.
 - `DBMS_MACUTL.G_LABELED_BY_SELF` labels the identities for the factor directly from the labels associated with an Oracle Label Security policy (default)
 - `DBMS_MACUTL.G_LABELED_BY_FACTORS` derives the factor identity label from the labels of its child factor identities.
- `eval_options` evaluate the factor when the user logs on. This parameter is mandatory.
 - `DBMS_MACUTL.G_EVAL_ON_SESSION` evaluates the factor when the database session is created (default). Be aware that this setting may affect performance of the factor.
 - `DBMS_MACUTL.G_EVAL_ON_ACCESS` evaluates the factor each time the factor is accessed.
 - `DBMS_MACUTL.G_EVAL_ON_STARTUP` evaluates the factor on start-up.
- `audit_options` applies only to traditional auditing, not unified auditing environments. Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create unified audit policies instead of using `audit_options`. Valid options for `audit_options` are as follows:
 - `DBMS_MACUTL.G_AUDIT_OFF` disables auditing
 - `DBMS_MACUTL.G_AUDIT_ALWAYS` always audits.
 - `DBMS_MACUTL.G_AUDIT_ON_GET_ERROR` audits if `get_expr` returns an error.
 - `DBMS_MACUTL.G_AUDIT_ON_GET_NULL` audits if `get_expr` is null.

- `DBMS_MACUTL.G_AUDIT_ON_VALIDATE_ERROR` audits if the validation procedure returns an error.
- `DBMS_MACUTL.G_AUDIT_ON_VALIDATE_FALSE` audits if the validation procedure is false.
- `DBMS_MACUTL.G_AUDIT_ON_TRUST_LEVEL_NULL` audits if there is no trust level set.
- `DBMS_MACUTL.G_AUDIT_ON_TRUST_LEVEL_NEG` audits if the trust level is negative.
- `fail_options` sets options for reporting factor errors.
 - `DBMS_MACUTL.G_FAIL_WITH_MESSAGE` shows an error message (default).
 - `DBMS_MACUTL.G_FAIL_SILENTLY` does not show an error message.

At this stage, the factor is complete and can be used. For more detailed and customized processing, you can configure an identity for the factor.

Related Topics

- [Configuring Rule Sets](#)
Rule sets group one or more rules together; the rules determine whether a user can perform an action on an object.
- [Adding an Identity to a Factor](#)
After you create a new factor, you optionally can add an identity to it.
- [About Identity Mapping](#)
While you are creating a factory identity, you can map it.
- [How Factors Affect Performance](#)
The complexity of factors affects the performance of your Oracle database instance.
- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.4 Adding an Identity to a Factor

After you create a new factor, you optionally can add an identity to it.

- [About Factor Identities](#)
An identity is the actual value of a factor, such an `IP_Address` factor identity being `192.0.2.4`.
- [How Factor Identities Work](#)
A factor identity is the actual value of a factor (for example, the IP address for a factor that uses the `IP_Address` type).
- [About Trust Levels](#)
Trust levels enable you to assign a numeric value to indicate the measure of trust allowed.
- [About Label Identities](#)
You can assign You Oracle Label Security (OLS) labels to factor identities.
- [Creating and Configuring a Factor Identity](#)
You can create and configure a factor identity for an existing factor.
- [Using Identity Mapping to Configure an Identity to Use Other Factors](#)
You can use identity mapping to use a group of factors to manage identity values.
- [Modifying a Factor Identity](#)
You can use the `DBMS_MACADM.UPDATE_IDENTITY` procedure to modify a factor identity.

- [Deleting a Factor Identity](#)
Before delete a factor identity, you must remove references to it.

7.4.1 About Factor Identities

An identity is the actual value of a factor, such an IP_Address factor identity being 192.0.2.4.

A factor identity for a given database session is assigned at run time using the `get_expr` parameter (to retrieve the identity of a factor) and the `identify_by` parameter (to determine the identify of the factor) in the `DBMS_MACADM.CREATE_FACTOR` procedure. You can further configure the identity for the following reasons:

- To define the known identities for a factor
- To add a trust level to a factor identity
- To add an Oracle Label Security label to a factor identity
- To resolve a factor identity through its child factors, by using identity mapping

7.4.2 How Factor Identities Work

A factor identity is the actual value of a factor (for example, the IP address for a factor that uses the IP_Address type).

A factor can have several identities depending on its retrieval method or its identity mapping logic. For example, a factor such as `Database_Hostname` could have multiple identities in an Oracle Real Application Clusters environment; a factor such as `Client_IP` can have multiple identities in any database environment. The retrieval method for these types of factors may return different values because the retrieval method is based on the database session. Several reports allow you to track the factor identity configuration.

You can configure the assignment of a factor in the following ways:

- Assign the factor at the time a database session is established.
- Configure individual requests to retrieve the identity of the factor.

With the Oracle Label Security integration, you can label identities with an Oracle Label Security label. You can also assign an identity *trust levels*, which are numbers that indicate the magnitude of trust relative to other identities for the same factor. In general, the higher the trust level number is set, the greater the trust. Negative trust levels are not trusted.

Within a database session, a factor assigned identity is available to Oracle Database Vault and any application with a publicly accessible PL/SQL function that exists in the `DVF` schema (which contains functions that retrieve factor values) as follows:

```
dvf.f$factor_name
```

This allows the identifier for a factor to be accessed globally from within the Oracle database (using PL/SQL, SQL, Oracle Virtual Private Database, triggers, and so on). For example, in SQL*Plus:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password

SELECT DVF.F$DATABASE_IP FROM DUAL;
```

Output similar to the following appears:


```
SELECT DVF.F$DATABASE_IP FROM DUAL;
```

```
F$DATABASE_IP
```

```
-----  
192.0.2.1
```

You can also use the `GET_FACTOR` function to find the identity of a factor that is made available for public access. For example:

```
SELECT GET_FACTOR('DATABASE_IP') FROM DUAL;
```

The following output appears:

```
GET_FACTOR('DATABASE_IP')
```

```
-----  
192.0.2.1
```

Related Topics

- [Adding an Identity to a Factor](#)
After you create a new factor, you optionally can add an identity to it.
- [Factor Related Reports and Data Dictionary Views](#)
Oracle Database Vault provides reports and data dictionary views that display information about factors and their identities.

7.4.3 About Trust Levels

Trust levels enable you to assign a numeric value to indicate the measure of trust allowed.

A trust value of 1 signifies some trust. A higher value indicates a higher level of trust. A negative value or zero indicates distrust. When the factor identity returned from a factor retrieval method is not defined in the identity, Oracle Database Vault automatically assigns the identity a negative trust level.

To determine the trust level of a factor identity at run time, you can use the `GET_TRUST_LEVEL` and `GET_TRUST_LEVEL_FOR_IDENTITY` functions in the `DVSYSTEM` schema.

For example, suppose you have created a factor named `Network`. You can create the following identities for the `Network` factor:

- Intranet, with a trust level of 10
- VPN (virtual private network), with a trust level of 5
- Public, with a trust level of 1

You then can create rule expressions (or custom application code) that base policy decisions on the trust level. For example, you can use the `GET_TRUST_LEVEL` function to find trust levels greater than 5:

```
GET_TRUST_LEVEL('Network') > 5
```

Or, you can use a `SELECT` statement on the `DBA_DV_IDENTITY` data dictionary view to find trust levels for the `Network` factor greater than or equal to 5:

```
SELECT VALUE, TRUST_LEVEL FROM DBA_DV_IDENTITY  
WHERE TRUST_LEVEL >= 5  
AND FACTOR_NAME='Network'
```

Output similar to the following appears:

```
F$NETWORK GET_TRUST_LEVEL('NETWORK')
-----
VPN                    5
INTRANET              10
```

In the preceding example, the `Network` factor identity for `VPN` is trusted (value equals 5), and the identity for the `INTRANET` domain is 10, which implies a greater trust.

Related Topics

- [Oracle Database Vault Realm APIs](#)
The `DBMS_MACADM` PL/SQL package enables you to configure Oracle Database Vault realms.

7.4.4 About Label Identities

You can assign You Oracle Label Security (OLS) labels to factor identities.

In brief, a label acts as an identifier for a database table row to assign privileges to the row. In the `DBMS_MACADM.CREATE_FACTOR` or `DBMS_MACADM.UPDATE_FACTOR` procedure, the `labeled_by` parameter setting determines whether a factor is labeled `DBMS_MACUTL.G_LABELLED_BY_SELF` or `DBMS_MACUTL.G_LABELLED_BY_FACTORS`. If you set `labeled_by` to `DBMS_MACUTL.G_LABELLED_BY_SELF`, then you can associate OLS labels with the factor identities. If you set `labeled_by` to `DBMS_MACUTL.G_LABELLED_BY_FACTORS`, then Oracle Database Vault derives the factor identity labels from the labeling of child factor identities. When there are multiple child factor identities with labels, Oracle Database Vault merges the labels using the OLS algorithm associated with the applicable factor Oracle Label Security policy.

Related Topics

- [Oracle Label Security Administrator's Guide](#)

7.4.5 Creating and Configuring a Factor Identity

You can create and configure a factor identity for an existing factor.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Run the `DBMS_MACADM.CREATE_IDENTITY` procedure.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_IDENTITY(
    factor_name => 'Sector2_ClientID',
    value       => 'intranet',
    trust_level => 5);
END;
/
```

In this specification:

- `factor_name` is the name of the existing factor. The `DBA_DV_FACTOR` data dictionary view lists factors.
- `value` is the value of the factor, up to 1024 characters in mixed-case. For example, the identity of an `IP_Address` factor could be the IP address of 192.0.2.12.
- `trust_level` indicates the magnitude of trust relative to other identities for the same factor. In general, the higher the trust level number is set, the greater the trust. A trust level of 10 indicates "very trusted." Negative trust levels are not trusted.

- 10 is very trusted.
- 5 is trusted.
- 1 is somewhat trusted.
- -1 is untrusted.
- NULL is for a trust level that is not defined (default)

After you create a factor identity, you can use it in an identity map with two existing factors.

Related Topics

- [Creating a Factor](#)
In general, to create a factor, you first create the factor itself, and then you edit the factor to include its identity.
- [Mapping an Identity to a Factor](#)
You can map an identity to a factor by creating a parent-child relationship with two factors.
- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.4.6 Using Identity Mapping to Configure an Identity to Use Other Factors

You can use identity mapping to use a group of factors to manage identity values.

- [About Identity Mapping](#)
While you are creating a factory identity, you can map it.
- [Mapping an Identity to a Factor](#)
You can map an identity to a factor by creating a parent-child relationship with two factors.
- [Deleting an Identity Map](#)
To remove the parent-child relationship between two factors, you must delete the identity map.

7.4.6.1 About Identity Mapping

While you are creating a factory identity, you can map it.

Identity mapping is the process of identifying a factor by using other (child) factors. This is a way to transform combinations of factors into logical identities for a factor or to transform continuous identity values (for example, temperature) or large discrete identity values (for example, IP address ranges) into logical sets. To check configuration issues in the mapping for an identity, you can run the Identity Configuration Issues report.

You can map different identities of a parent factor to different identities of the contributing factor. For example, an `INTRANET` identity maps to an IP address range of 192.0.2.1 to 192.0.2.24. A `REMOTE` identity can map to an IP address range that excludes the address range 192.0.2.1 to 192.0.2.24.

Based on identity mapping, you can create a security policy. For example, you can define a reduced set of privileges for an employee connecting over VPN (with `REMOTE`), as opposed to an employee connecting from within the corporate network (with `INTRANET`).

If you need to change the identity mapping, you must delete and then recreate the identity map.

7.4.6.2 Mapping an Identity to a Factor

You can map an identity to a factor by creating a parent-child relationship with two factors.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Ensure that you have created the factors and factor identities that you that you plan to use for the mapping.

The `DBA_DV_FACTOR` data dictionary view lists the existing factors. The `DBA_DV_IDENTITY` data dictionary view lists the existing factor identities.

3. Run the `DBMS_MACADM.CREATE_IDENTITY_MAP` procedure to create the identity map.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_IDENTITY_MAP (
    identity_factor_name => 'Sector2_ClientID',
    identity_factor_value => 'intranet',
    parent_factor_name   => 'HQ_ClientID',
    child_factor_name    => 'Div1_ClientID',
    operation            => '<',
    operand1             => '192.0.2.50',
    operand2             => '192.0.2.100');
END;
/
```

In this specification:

- `identity_factor_name` is the factor to be used for the identity map.
- `identity_factor_value` is value the factor assumes if the identity map evaluates to `TRUE`.
- `parent_factor_name` is the parent factor link to which the map is related. The `DBA_DV_IDENTITY_MAP` data dictionary view lists existing parent-child factor mappings.
- `child_factor_name` is the child factor link to which the map is related.
- `operation` is a relational operator for the identity map (for example, `<`, `>`, `=`, `between`, and so on).
- `operand1` is the left operand for the relational operator and refers to the low value you enter.
- `operand2` is the right operand for the relational operator and refers to the high value you enter.

For example, consider a scenario where the child factor is set to `Client_IP`, `operation` is set to `between`, `operand1` is set to `192.0.2.1`, and `operand2` is set to `192.0.2.24`. This means that whenever the client IP address lies in the specified address range of `192.0.2.1` to `192.0.2.24`, the parent factor evaluates to a predefined identity (for example, `INTRANET`).

4. Repeat this process to add more contributing factors for a parent factor identity.

For example, you can configure the `Network` factor to resolve to a value `ACCOUNTING-SENSITIVE`, when the `Program` factor resolves to `Oracle General Ledger` and the `Client_IP` is in between `192.0.2.1` and `192.0.2.24`. So, if an authorized accounting financial application program, running on a client with IP address `192.0.2.12` accesses the database, then the `Network` factor is resolved to `ACCOUNTING-SENSITIVE`. A database

session with the `ACCOUNTING-SENSITIVE` Network value would have more access privileges than one with the `INTRANET` Network value.

Related Topics

- [Creating a Factor](#)
In general, to create a factor, you first create the factor itself, and then you edit the factor to include its identity.
- [Creating and Configuring a Factor Identity](#)
You can create and configure a factor identity for an existing factor.
- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.4.6.3 Deleting an Identity Map

To remove the parent-child relationship between two factors, you must delete the identity map.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Query the `DBA_DV_FACTOR_LINK` data dictionary view to find the factors that have been used in parent-child mappings.

For example:

```
SELECT PARENT_FACTOR_NAME, CHILD_FACTOR_NAME FROM DBA_DV_FACTOR_LINK;
```

| PARENT_FACTOR_NAME | CHILD_FACTOR_NAME |
|--------------------|-------------------|
| Domain | Database_Instance |
| Domain | Database_IP |
| Domain | Database_Hostname |

3. Query the `DBA_DV_IDENTITY_MAP` data dictionary view to find the definition of the mapping that you want to remove.
4. Based on the definition of the mapping, run the `DBMS_MACADM.DELETE_IDENTITY_MAP` procedure.

For example:

```
BEGIN
  DBMS_MACADM.DELETE_IDENTITY_MAP (
    identity_factor_name => 'intranet-factor',
    identity_factor_value => 'intranet',
    parent_factor_name   => 'Domain',
    child_factor_name    => 'Database_IP',
    operation             => 'between',
    operand1              => '192.0.2.22',
    operand2              => '192.0.2.99');
END;
/
```

Related Topics

- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.4.7 Modifying a Factor Identity

You can use the `DBMS_MACADM.UPDATE_IDENTITY` procedure to modify a factor identity.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Find the factor identity and check its definition.

For example:

```
SELECT * FROM DBA_DV_IDENTITY ORDER BY FACTOR_NAME;
```

3. Run the `DBMS_MACADM.UPDATE_IDENTITY` statement.

For example:

```
BEGIN
  DBMS_MACADM.UPDATE_IDENTITY(
    factor_name => 'Sector2_ClientID',
    value       => 'intranet',
    trust_level => 7);
END;
/
```

Related Topics

- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.4.8 Deleting a Factor Identity

Before delete a factor identity, you must remove references to it.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Query the `DBA_DV_IDENTITY` data dictionary view to find the factor identity to remove.

For example:

```
SELECT * FROM DBA_DV_IDENTITY ORDER BY FACTOR_NAME;
```

3. Run the `DBMS_MACADM.DELETE_IDENTITY` procedure.

You must include the `factor_name` and `value` parameters. For example:

```
BEGIN
  DBMS_MACADM.DELETE_IDENTITY(
    factor_name => 'Sector2_ClientID',
    value       => 'intranet');
END;
/
```

Related Topics

- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.5 Modifying a Factor

You can use the `DBMS_MACADM.UPDATE_FACTOR` procedure to modify the definition of a factor.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Find the factor and check its definition.

For example:

```
SELECT * FROM DBA_DV_FACTOR ORDER BY NAME;
```

3. Run the `DBMS_MACADM.UPDATE_FACTOR` statement.

For example:

```
BEGIN
DBMS_MACADM.UPDATE_FACTOR(
  factor_name      => 'Sector2_DB',
  factor_type_name => 'Instance',
  description      => 'Factor to restrict DBA access in Sector2_DB',
  rule_set_name    => 'Limit_DBA_Access',
  get_expr         => 'UPPER(SYS_CONTEXT(''USERENV'', ''DB_NAME''))',
  validate_expr    => 'dbavowner.check_db_access',
  identify_by      => DBMS_MACUTL.G_IDENTIFY_BY_METHOD,
  labeled_by       => DBMS_MACUTL.G_LABELED_BY_SELF,
  eval_options     => DBMS_MACUTL.G_EVAL_ON_ACCESS,
  audit_options    => DBMS_MACUTL.G_AUDIT_ALWAYS,
  fail_options     => DBMS_MACUTL.G_FAIL_WITH_MESSAGE);
END;
/
```

Related Topics

- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.6 Deleting a Factor

Before you delete a factor, you must remove references to the factor.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Query the `DBA_DV_FACTOR` data dictionary to find the name of the factor to delete.

For example:

```
SELECT NAME FROM DBA_DV_FACTOR ORDER BY NAME;
```

3. Query the `DBA_DV_FACTOR_LINK` data dictionary to find if the factor is a parent or a child factor.

For example, assuming the factor is named `Sector2_DB`:

```
SELECT PARENT_FACTOR_NAME, CHILD_FACTOR_NAME
FROM DBA_DV_FACTOR_LINK
WHERE PARENT_FACTOR_NAME = 'Sector2_DB'
OR CHILD_FACTOR_NAME = 'Sector2_DB';
```

4. If the factor is a parent or child factor, then delete the factor link.

For example:

```
BEGIN
  DBMS_MACADM.DELETE_FACTOR_LINK(
    parent_factor_name => 'Sector2_DB',
    child_factor_name  => 'Div1_ClientID');
END;
/
```

5. Query the `DBA_DV_IDENTITY_MAP` data dictionary view to find the definition for any identity maps that may use the factor.

For example:

```
SELECT * FROM DBA_DV_IDENTITY_MAP
WHERE FACTOR_NAME = 'Sector2_DB';
```

6. Run the `DBMS_MACADM.DELETE_IDENTITY_MAP` to delete the identity map.

For example:

```
BEGIN
  DBMS_MACADM.DELETE_IDENTITY_MAP(
    identity_factor_name => 'Sector2_DB',
    identity_factor_value => 'intranet',
    parent_factor_name  => 'HQ_ClientID',
    child_factor_name   => 'Div1_ClientID',
    operation           => '<',
    operand1            => '192.0.2.10',
    operand2            => '192.0.2.15');
END;
/
```

7. Query the `DBA_DV_IDENTITY` data dictionary view to find if the factor has a reference to any factor identities.

Query for the factor name and the value. For example:

```
SELECT VALUE FROM DBA_DV_IDENTITY
WHERE FACTOR_NAME = 'Sector2_DB'
```

8. Run the `DBMS_MACADM.DELETE_IDENTITY` procedure to remove the factor reference.

You must include both the `factor_name` and `value` parameters. For example:

```
BEGIN
  DBMS_MACADM.DELETE_IDENTITY(
    factor_name => 'Sector2_DB',
    value      => 'intranet');
END;
/
```

9. Run the `DBMS_MACADM.DELETE_FACTOR` to delete the factor.

For example:

```
EXEC DBMS_MACADM.DELETE_FACTOR('Sector2_DB');
```


Related Topics

- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

7.7 How Factors Work

Oracle Database Vault processes factors when a session is established.

- [How Factors Are Processed When a Session Is Established](#)
Oracle Database Vault evaluates the factors based on when a session begins.
- [How Retrieval Methods Work](#)
The Retrieval Method identifies factors where the factor identification is by method or constant.
- [How Factors Are Retrieved](#)
You can retrieve a factor in a database session at any time by using the `DVF` factor function or the `GET_FACTOR` function.
- [How Factors Are Set](#)
You can assign a factor identity at any time during a database session, but only if the factor assignment rule set evaluates to true.
- [How Factor Auditing Works](#)
Whether you have unified auditing enabled affects how auditing is handled for factors.

7.7.1 How Factors Are Processed When a Session Is Established

Oracle Database Vault evaluates the factors based on when a session begins.

When a database session is established, the following actions occur:

1. At the start of each database session, Oracle Database Vault begins to evaluate all default and user-created factors in the database instance.

This evaluation occurs after the normal database authentication of the session and the initialization of the Oracle Label Security session information, if applicable.
2. In the factor evaluation stage, the factor initialization process executes the retrieval method for all factors that are identified by methods or constants, to resolve the factor identity for the session.

The factor error options setting has no effect on the factor initialization process.
3. If a factor has a validation method defined, Oracle Database Vault validates the identity (value) of the factor by executing this validation method. If the validation method fails or returns false, the identity of the factor is undefined (`NULL`).
4. If a factor has any identities defined for it, Oracle Database Vault resolves the trust level of the factor based on the identities defined. If an identity of the factor is defined in this list of defined identities, then Oracle Database Vault assigns the trust level as configured; otherwise it sets it to `-1`. If there are no identities defined for the factor, the trust level is undefined (`NULL`).
5. Depending on the outcome of this factor evaluation, factor validation, and trust level resolution, Database Vault audits the details of the evaluation as dictated by the factor audit configuration.

- When the evaluation of all factors that are identified by method or constant completes, Oracle Database Vault resolves the factors that are identified by other factors by using the identity maps that are defined for the factor configured identities.

The evaluation order of the factor-configured identities is by ASCII sort on the identity values: Oracle Database Vault uses the first alphabetically sorted identity mapping that it evaluates. For example, suppose factor `TEST` has identities `X` and `Y`. Furthermore, identities `X` and `Y` have identity maps that are dependent on identities for factors `A`, `B`, and `C`. The following mapping occurs:

- `X` is mapped when `A=1` and `B=1`.
- `Y` is mapped when `A=1`, `B=1`, and `C=2`.

In this case, the first one evaluated is `X`. `Y` is not evaluated, but what if its `C` mapping meets the criteria that is needed for the `TEST` factor's success? You would need to reverse the mapping, that is, map `Y` before `X` so that `A`, `B`, and `C` can be evaluated first. To reverse the mapping, rename `Y` to `V` (or some alphabetic value that sorts before `X`) so that it can be correctly resolved.

This algorithm works if the ASCII sort ordering is correct and the identities map the same number factors at some level.

- When the factor initialization completes, the Oracle Database Vault integration with Oracle Label Security occurs.

After this process completes, Oracle Database Vault checks to see if a command rule is associated with the `CONNECT` event. If a rule set associated with the `CONNECT` event, then Oracle Database Vault evaluates the rule set. If the rule set evaluates to false or results in an error, then the session is terminated. Oracle Database Vault executes any auditing or call handlers associated with the rule set before the session is terminated.

 **Note:**

Be careful about associating command rules with the `CONNECT` event, because you can inadvertently lock out other users from of the database. In general, if you create a command rule for `CONNECT`, set its evaluation option of the associated rule set to `Any True`.

If you do inadvertently lock out users, then you should temporarily disable Oracle Database Vault, disable the `CONNECT` command rule, re-enable Oracle Database Vault, and then fix the factor code that is causing the problem. [If the Test Fails](#) provides an example of how to accomplish this.

7.7.2 How Retrieval Methods Work

The Retrieval Method identifies factors where the factor identification is by method or constant.

If the factor identification is by factors, Oracle Database Vault identifies it by its identity mappings. You can create your own PL/SQL retrieval methods, or use the functions supplied with Oracle Database Vault. Oracle Database Vault provides factor-specific and general utility functions that you can use to build the retrieval method.

See also the default factors provided with Oracle Database Vault for examples of retrieval methods.

The `get_expr` parameter is mandatory if you have selected the following `DBMS_MACADM.CREATE_FACTOR` or `DBMS_MACADM.CREATE_UPDATE` settings for the `identify_by` parameter:

- `DBMS_MACUTL.G_IDENTIFY_BY_METHOD`: Enter a method for the `get_expr` parameter.
- `DBMS_MACUTL.G_IDENTIFY_BY_CONSTANT`: Enter a constant for the `get_expr` parameter.

The value returned as the factor identity must be a `VARCHAR2` string or otherwise convertible to one.

You can include any package function or standalone function in the expression. Ensure that the expression is a fully qualified function, such as `schema.function_name`. Do not include complete SQL statements. If you are using application packages or functions, you must provide `DVSYS` with the `EXECUTE` privilege on the object.

Write the function signature using the following format:

```
FUNCTION GET_FACTOR RETURN VARCHAR2
```

Related Topics

- [Default Factors](#)
Oracle Database Vault provides a set of default factors.
- [Oracle Database Vault DVF PL/SQL Factor Functions](#)
Oracle Database Vault maintains the `DVF` schema functions when you use the `DBMS_MACADM` PL/SQL package to manage the various factors.
- [DBMS_MACADM Factor Procedures and Functions](#)
The `DBMS_MACADM` PL/SQL package provides procedures and functions to configure factors.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

7.7.3 How Factors Are Retrieved

You can retrieve a factor in a database session at any time by using the `DVF` factor function or the `GET_FACTOR` function.

To find a listing of available factors, query the `DBA_DV_FACTOR` data dictionary view, described in .

[Example 7-1](#) shows an example of using the `GET_FACTOR` function.

Example 7-1 Using GET_FACTOR to Retrieve a Factor

```
SELECT GET_FACTOR('client_ip') FROM DUAL;
```

You can use the factor values retrieved from the `DVF` factor function or the `GET_FACTOR` in the following ways:

- Oracle Database Vault rule expressions
- Custom application code that is available to all database sessions in an Oracle Database Vault environment

If you had set the `DBMS_MACADM.CREATE_FACTOR` or `DBMS_MACADM.UPDATE_FACTOR` `eval_options` parameter to factor evaluation to `DBMS_MACUTL.G_EVAL_ON_SESSION`, then Oracle Database Vault retrieves the value from the session context established, as described under [How Factors Are Processed When a Session Is Established](#).

If you had set the factor evaluation to `DBMS_MACUTL.G_EVAL_ON_ACCESS`, then Oracle Database Vault performs Step 2 through Step 5 (or Step 6), as described under [How Factors Are Processed When a Session Is Established](#), whenever the factor is retrieved.

If you had defined error options for the factor and if an error occurs, then Oracle Database Vault displays the error message.

7.7.4 How Factors Are Set

You can assign a factor identity at any time during a database session, but only if the factor assignment rule set evaluates to true.

You can do this in the application code by using the `SET_FACTOR` function. In Java code, you can use the JDBC class `java.sql.CallableStatement` to set this value. For example:

```
java.sql.Connection connection ;
...
java.sql.CallableStatement statement =
    connection.prepareCall("{call SET_FACTOR('FACTOR_X', ?)}");
statement.setString(1, "MyValue");
boolean result = statement.execute();
...
```

Applications that can execute Oracle PL/SQL functions can use this procedure (for example, applications written using Oracle Data Provider for .NET (ODP.NET)).

This concept is similar to the standard Oracle `DBMS_SESSION.SET_IDENTIFIER` procedure with an added feature that a rule set controls when a factor value can be set. If the rule set evaluates to true, Steps 2 through 5 under [How Factors Are Processed When a Session Is Established](#) occur.

If you have not associated a assignment rule set for the factor or if the rule set returns false (or returns errors), then Oracle Database Vault sends an error message if you attempt to set the factor using the `SET_FACTOR` function.

7.7.5 How Factor Auditing Works

Whether you have unified auditing enabled affects how auditing is handled for factors.

In a traditional, non-unified auditing environment, Oracle Database Vault writes the audit trail to the `DVSYS.AUDIT_TRAIL$` table. Be aware that traditional auditing is deprecated starting with Oracle Database release 21c.

If you have enabled unified auditing, then this setting does not capture audit records. Instead, you can create unified audit policies to capture this information.

You can use the Factor Audit Report to display the generated audit records. In addition, you can select multiple audit options at a time. Each option is converted to a bit mask and added to determine the aggregate behavior. Note that there is little performance impact in auditing, unless the factor has errors.

Related Topics

- *Oracle Database Security Guide*

7.8 Tutorial: Preventing Ad Hoc Tool Access to the Database

This tutorial demonstrates how to use factors to prevent ad hoc tools (such as SQL*Plus) from accessing the database.

- [About This Tutorial](#)
Many database applications contain features to explicitly control the actions of a user.
- [Step 1: Enable the HR and OE User Accounts](#)
You must use the `HR` and `OE` accounts later on when you test the Oracle Database Vault components for this tutorial.
- [Step 2: Create the Factor](#)
After you have ensured that the `HR` and `OE` accounts are active, you can create a factor.
- [Step 3: Create the Rule Set and Rules](#)
After you have created the factor, you can create a rule set and rules to work with the factor.
- [Step 4: Create the CONNECT Command Rule](#)
The `CONNECT` command rule controls the `CONNECT` SQL statement.
- [Step 5: Test the Ad Hoc Tool Access Restriction](#)
You do not need to restart your SQL*Plus session for the Oracle Database Vault changes to take effect.
- [Step 6: Remove the Components for This Tutorial](#)
You can remove the components that you created for this tutorial if you no longer need them.

7.8.1 About This Tutorial

Many database applications contain features to explicitly control the actions of a user.

However, an ad hoc query tool, such as SQL*Plus, may not have these controls. As a result, a user could use an ad hoc tool to perform actions in the database that they would normally be prevented from performing in a database application. You can use a combination of Oracle Database Vault factors, rule sets, and command rules to prevent unauthorized access to the database by ad hoc query tools.

In the following tutorial, you prevent users `HR` and `OE` from using SQL*Plus. To accomplish this, you must create a factor to find the applications on your system and a rule and rule set to limit SQL*Plus to these four users. Then you create a command rule for the `CONNECT` SQL statement, which is associated with the rule set. This factor, `Client_Prog_Name`, uses the `CLIENT_PROGRAM_NAME` attribute of the `SYS_CONTEXT` SQL function `USERENV` namespace to find the names of the applications that are used to access the current instance of Oracle Database. The `SYS_CONTEXT` SQL function provides many useful methods for finding the state of a user session. `SYS_CONTEXT` is a valuable tool for creating custom factors.

Related Topics

- [Oracle Database SQL Language Reference](#)

7.8.2 Step 1: Enable the HR and OE User Accounts

You must use the `HR` and `OE` accounts later on when you test the Oracle Database Vault components for this tutorial.

1. Log into the PDB as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
sqlplus accts_admin_ace@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Check the status of the `HR` account.

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

3. If the `HR` account is expired and locked, then enter the following statement to make it active:

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

Replace `password` with a password that meets the password complexity requirements of the user's profile.

4. Repeat these steps for the `OE` account.

Related Topics

- *Oracle Database Security Guide*

7.8.3 Step 2: Create the Factor

After you have ensured that the `HR` and `OE` accounts are active, you can create a factor.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Create the factor.

```
BEGIN
  DBMS_MACADM.CREATE_FACTOR(
    factor_name      => 'Client_Prog_Name',
    factor_type_name => 'Application',
    description      => 'Stores client program name that connects to database',
    rule_set_name    => NULL,
    validate_expr    => NULL,
    get_expr         => 'UPPER(SYS_CONTEXT(''USERENV'', ''CLIENT_PROGRAM_NAME''))',
    identify_by      => DBMS_MACUTL.G_IDENTIFY_BY_METHOD,
    labeled_by       => DBMS_MACUTL.G_LABELED_BY_SELF,
    eval_options     => DBMS_MACUTL.G_EVAL_ON_SESSION,
    audit_options    => DBMS_MACUTL.G_AUDIT_OFF,
    fail_options     => DBMS_MACUTL.G_FAIL_SILENTLY);
END;
/
```

In this specification:

- `factor_type_name` specifies that this is an application-based factor.
- `get_expr` defines the expression for the factor. This expression calls the `SYS_CONTEXT` function, using the `USERENV` namespace and `CLIENT_PROGRAM_NAME` attribute, to find the programs that are logged into the Oracle database.

- `identify_by` identifies the factor by method.
- `labeled_by` labels the identities for the factor directly from the labels associated with an Oracle Label Security policy (default).
- `eval_options` evaluates the factor when the database session is created.
- `audit_options` audits if `get_expr` returns an error.
- `fail_silently` does not show any error messages for the factor.

7.8.4 Step 3: Create the Rule Set and Rules

After you have created the factor, you can create a rule set and rules to work with the factor.

1. Create the Limit SQL*Plus Access rule set as follows:

```
BEGIN
  DBMS_MACADM.CREATE_RULE_SET(
    rule_set_name => 'Limit SQL*Plus Access',
    description   => 'Limits access to SQL*Plus for Apps Schemas',
    enabled       => DBMS_MACUTL.G_YES,
    eval_options  => DBMS_MACUTL.G_RULESET_EVAL_ANY,
    audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
    fail_options  => DBMS_MACUTL.G_RULESET_FAIL_SHOW,
    fail_message  => 'SQL*Plus access not allowed for Apps Schemas',
    fail_code     => 20461,
    handler_options => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
    handler       => NULL,
    is_static     => FALSE);
END;
/
```

In this specification:

- `fail_options` enables an error message, set by `fail_message`, and error code, set by `fail_code`, to appear if there are errors.
 - `is_static` evaluates the rule set once during the user session. After that, the value is re-used.
2. Find the exact settings for the computer on which you want to apply the policy, based on what the `CLIENT_PROGRAM_NAME` attribute will return.

```
SELECT SYS_CONTEXT('USERENV', 'CLIENT_PROGRAM_NAME') FROM DUAL;
```

The output should be similar to the following:

```
SYS_CONTEXT('USERENV', 'CLIENT_PROGRAM_NAME')
-----
sqlplus@nemosity (TNS V1-V3)
```

3. Create the following rules.

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Prevent Apps Schemas Access to SQL*Plus',
    rule_expr => 'UPPER (DVF.F$CLIENT_PROG_NAME) != ''SQLPLUS@NEMOSITY (TNS V1-V3)''
  AND DVF.F$SESSION_USER IN (''HR'', ''OE'')');
END;
/
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Allow Non-Apps Schemas Access to SQL*Plus',
```

```

    rule_expr =>'DVF.F$$SESSION_USER NOT IN ('HR', 'OE')');
END;
/

```

4. Add the rules to the Limit SQL*Plus Access rule set.

```

BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'Limit SQL*Plus Access',
    rule_name      => 'Prevent Apps Schemas Access to SQL*Plus',
    rule_order    => 1);
END;
/
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'Limit SQL*Plus Access',
    rule_name      => 'Allow Non-Apps Schemas Access to SQL*Plus',
    rule_order    => 1);
END;
/

```

The `rule_order` setting is required to enable the procedure to work.

7.8.5 Step 4: Create the CONNECT Command Rule

The `CONNECT` command rule controls the `CONNECT` SQL statement.

This command rule also applies to logging into SQL*Plus from the command line or other tools your site may use to access SQL*Plus.

- Create the `CONNECT` command rule as follows:

```

BEGIN
  DBMS_MACADM.CREATE_COMMAND_RULE(
    command      => 'CONNECT',
    rule_set_name => 'Limit SQL*Plus Access',
    object_owner => '%',
    object_name  => '%',
    enabled      => DBMS_MACUTL.G_YES);
END;
/

```

In this specification:

- `rule_set_name` associates the Limit SQL*Plus Access rule set with the `CONNECT` command rule.
- `object_owner` is set to `%` so that the command rule applies to all users.
- `object_name` is set to `%` so that the command rule applies to all objects.
- `enabled` enables the command rule so that it can be used right away.

7.8.6 Step 5: Test the Ad Hoc Tool Access Restriction

You do not need to restart your SQL*Plus session for the Oracle Database Vault changes to take effect.

1. In SQL*Plus, try to connect to the PDB as user `HR`:

```

CONNECT HR@pdb_name
Enter password: password

```


The following output should appear:

```
ERROR:  
ORA-47306: 20461: Limit SQL*Plus Access rule set failed
```

User HR should be prevented from using SQL*Plus.

2. Next, try to connect as user OE:

```
CONNECT OE@pdb_name  
Enter password: password
```

The following output should appear:

```
ERROR:  
ORA-47306: 20461: Limit SQL*Plus Access rule set failed
```

User OE also should be prevented from using SQL*Plus.

3. Now try to connect as user SYSTEM:

```
CONNECT SYSTEM@pdb_name  
Enter password: password  
Connected.
```

User SYSTEM should be able to log in to the database instance. So should SYS, the Database Vault Owner account, and the Database Vault Account Manager account.

If the Test Fails

If you cannot log in to the database instance as SYSTEM (or as any of the other administrative users listed in your rule expression), then you are prevented from using SQL*Plus.

You can remedy the problem as follows:

1. Log in to the database instance as a user who has been granted the DV_OWNER or DV_ADMIN role.

For example:

```
CONNECT sec_admin_owen@pdb_name  
Enter password: password
```

2. Enter the following statement to drop the CONNECT command rule.

```
EXEC DBMS_MACADM.DELETE_COMMAND_RULE ('CONNECT', '%', '%');
```

Even though you have disabled Oracle Database Vault, you still can use its PL/SQL packages and Database Vault Administrator.

3. Check the policy components for any errors and then correct them. Recreate the CONNECT command rule, and then test it.

7.8.7 Step 6: Remove the Components for This Tutorial

You can remove the components that you created for this tutorial if you no longer need them.

1. Remove the CONNECT command rule.

```
EXEC DBMS_MACADM.DELETE_COMMAND_RULE ('CONNECT', '%', '%');
```

2. Remove the Client_Prog_Name factor.

```
EXEC DBMS_MACADM.DELETE_FACTOR('Client_Prog_Name');
```

3. Remove the Limit SQL*Plus Access rule set.

```
EXEC DBMS_MACADM.DELETE_RULE_SET('Limit SQL*Plus Access');
```

4. Remove the rules.

```
EXEC DBMS_MACADM.DELETE_RULE('Prevent Apps Schemas Access to SQL*Plus');
EXEC DBMS_MACADM.DELETE_RULE('Allow Non-Apps Schemas Access to SQL*Plus');
```

5. If necessary, as a user who has been granted the DBV_ACCTMGR role, lock the HR and OE accounts.

```
CONNECT accts_admin_ace@pdb_name
Enter password: password
```

```
ALTER USER HR ACCOUNT LOCK;
ALTER USER OE ACCOUNT LOCK;
```

7.9 Guidelines for Designing Factors

Oracle provides guidelines for designing factors.

- You can use the Oracle utility packages such as UTL_TCP, UTL_HTTP, DBMS_LDAP, and DBMS_PIPE to integrate security or other contextual information about the session from external systems.
- Do not specify a retrieval method (using the `get_expr` parameter in `DBMS_MACADM.CREATE_FACTOR` or `DBMS_MACADM.UPDATE_FACTOR`) if the `identify_by` parameter is set to `DBMS_MACUTL.G_IDENTIFY_BY_FACTOR`. Retrieval methods are only needed if you set the factor to `DBMS_MACUTL.G_IDENTIFY_BY_CONSTANT` or `DBMS_MACUTL.G_IDENTIFY_BY_METHOD`.
- Consider using a validation method if a factor has an assignment rule set. Doing so helps to verify that invalid identities are not submitted.
- Use the client-supplied factors such as Program, OS User, and others with caution, because the values that are supplied can only be trusted when the client software is trusted and the communications channel from the client software is known to be secure.
- Only specify an evaluation option (`eval_options`) of `DBMS_MACUTL.G_EVAL_ON_ACCESS` if the value returned by the retrieval method could change from one invocation to the next in the same session (for example, time-based factors).
- Optimize the internal logic of a function used for the factor retrieval method using traditional SQL and PL/SQL optimization techniques.
- If the discrete values returned by the retrieval method are known, be sure to define identities for each value so that you can assign trust levels for them. Trust levels add value to factors as you also can use the trust level in application logic based on factors.
- A security policy based on more factors is generally considered stronger than one based on fewer factors. You can create a new factor that is identified by other factors to store combinations of factors into logical grouping using identity maps. This also makes it easier to label the parent factor when you integrate the factors with the Oracle Label Security labels.
- It is generally easier to configure and debug a factor whose `labeled_by` parameter is set to `DBMS_MACUTL.G_LABELED_BY_SELF` than one labeled `DBMS_MACUTL.G_LABELED_BY_FACTORS` when integrating the Oracle Label Security.
- You can design a database client application to pass one or more security, end-user, or environmental attributes so that they are available to an associated database session. To

do this, create a single factor for each attribute and then use an assignment rule set to control when these attributes can be assigned (for example only when using a specific Web application on specified named application server computers). Oracle Database Vault factors used in this fashion are very much like the Oracle procedure `DBMS_SESSION.SET_IDENTIFIER` but also include a capability to control when they can be set.

Related Topics

- [Integrating Oracle Database Vault with Oracle Label Security](#)
You can integrate Oracle Database Vault with Oracle Label Security, and check the integration with reports and data dictionary views.

7.10 How Factors Affect Performance

The complexity of factors affects the performance of your Oracle database instance.

Each factor has elements that are processed, such as its validation method, trust level, and so on. For factors that are evaluated by the session, such as `Database_Hostname` and `Proxy_User`, Oracle Database Vault performs this processing during session initialization, and then caches the results for subsequent requests for that value.

The default factors are cached because they are likely candidates for a typical security policy. However, if you only use five factors (for example, in rule sets or other components), then the other factors consume resources that could otherwise be used elsewhere. In this case, you should remove the unnecessary factors by deleting them. (Oracle Database Vault does not use any of these factors internally, so you can remove them if you do not need them.)

If you have a large number of users or if your application server frequently must create and destroy connections, the resources used can affect system performance. You can delete the unnecessary factors.

You can check system performance by running tools such as Oracle Enterprise Manager (including Oracle Enterprise Manager Cloud Control, which is installed by default with Oracle Database), Automatic Workload Repository (AWR), and `TKPROF`.

Related Topics

- [Default Factors](#)
Oracle Database Vault provides a set of default factors.
- [Oracle Database Performance Tuning Guide](#)
- [Oracle Database SQL Tuning Guide](#)

7.11 Factor Related Reports and Data Dictionary Views

Oracle Database Vault provides reports and data dictionary views that display information about factors and their identities.

[Table 7-1](#) lists the Oracle Database Vault reports.

Table 7-1 Reports Related to Factors and Their Identities

| Report | Description |
|---------------------|---------------------------------------------------------------------------|
| Factor Audit Report | Audits factors (for example, to find factors that failed to be evaluated) |

Table 7-1 (Cont.) Reports Related to Factors and Their Identities

| Report | Description |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Factor Configuration Issues Report | Lists configuration issues, such as disabled or incomplete rule sets, or to audit issues that may affect the factor |
| Factor Without Identities Report | Lists factors that have had no identities assigned yet |
| Identity Configuration Issues Report | Lists factors that have invalid label identities or no map for the identity |
| Rule Set Configuration Issues Report | Lists rule sets that have no rules defined or enabled, which may affect the factors that use them |

[Table 7-2](#) lists data dictionary views that provide information about existing factors and factor identities.

Table 7-2 Data Dictionary Views Used for Factors and Factor Identities

| Data Dictionary View | Description |
|----------------------|---------------------------------------------------------------------------------------------------------|
| DBA_DV_FACTOR | Lists the existing factors in the current database instance |
| DBA_DV_FACTOR_LINK | Shows the relationships of each factor whose identity is determined by the association of child factors |
| DBA_DV_FACTOR_TYPE | Lists the names and descriptions of factor types used in the system |
| DBA_DV_IDENTITY | Lists the identities for each factor |
| DBA_DV_IDENTITY_MAP | Lists the mappings for each factor identity |

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.
- [Oracle Database Vault Data Dictionary Views](#)
You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

8

Configuring Secure Application Roles for Oracle Database Vault

Secure application roles enable you to control how much access users have to an application.

- [What Are Secure Application Roles in Oracle Database Vault?](#)
In Oracle Database Vault, you can create a secure application role that you enable with an Oracle Database Vault rule set.
- [Security for Oracle Database Vault Secure Application Roles](#)
Users who have database administrative privileges may try to use the `DROP ROLE` statement to delete Oracle Database Vault secure application roles.
- [Creating an Oracle Database Vault Secure Application Role](#)
When you create a secure application role, you associate it with a rule set to determine when the role is enabled or disabled.
- [Enabling Oracle Database Secure Application Roles to Work with Oracle Database Vault](#)
You can modify an existing secure application role only if it has been created in Oracle Database Vault.
- [Modifying a Secure Application Role](#)
You can modify the definition of an Oracle Database Vault secure application role.
- [Deleting an Oracle Database Vault Secure Application Role](#)
You can delete Oracle Database Vault secure application roles if no applications are using them.
- [How Oracle Database Vault Secure Application Roles Work](#)
The process flow for an Oracle Database Vault secure application role begins after you create and set the secure application role.
- [Tutorial: Granting Access with Database Vault Secure Application Roles](#)
This tutorial demonstrates how to create a secure application role to control user access to the `OE.ORDERS` table during work hours.
- [How Secure Application Roles Affect Performance](#)
You can check system performance by using Oracle Database tools, including Oracle Enterprise Manager Cloud Control.
- [Secure Application Role Related Reports and Data Dictionary View](#)
Oracle Database Vault provides reports and a data dictionary view that you can use to analyze Oracle Database Vault secure application roles.

8.1 What Are Secure Application Roles in Oracle Database Vault?

In Oracle Database Vault, you can create a secure application role that you enable with an Oracle Database Vault rule set.

Regular Oracle Database secure application roles are enabled by custom PL/SQL procedures. You use secure application roles to prevent users from accessing data from outside an

application. This forces users to work within the framework of the application privileges that have been granted to the role.

You only can create a secure application role in a PDB, not in the CDB root or the application root.

The advantage of basing database access for a role on a rule set is that you can store database security policies in one central place, as opposed to storing them in all your applications. Basing the role on a rule set provides a consistent and flexible method to enforce the security policies that the role provides. In this way, if you must update the security policy for the application role, you do it in one place, the rule set. Furthermore, no matter how the user connects to the database, the result is the same, because the rule set is bound to the role. All you need to do is to create the role and then associate it with a rule set. The associated rule set validates the user who is trying to enable the role.

Related Topics

- [Oracle Database Vault Secure Application Role APIs](#)
The `DBMS_MACADM` and `DBMS_MACSEC_ROLES` PL/SQL packages manage Database Vault secure application roles.

8.2 Security for Oracle Database Vault Secure Application Roles

Users who have database administrative privileges may try to use the `DROP ROLE` statement to delete Oracle Database Vault secure application roles.

Whenever an Oracle Database Vault secure application role has been created, Database Vault adds the secure application role to the Oracle Database Vault realm. This prevents database administrator from deleting the secure application role using the `DROP ROLE` statement.

8.3 Creating an Oracle Database Vault Secure Application Role

When you create a secure application role, you associate it with a rule set to determine when the role is enabled or disabled.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. If necessary, create a rule set that the secure application role will use.
The `DBA_DV_RULE_SET` data dictionary view lists existing rule sets.
3. Run the `DBMS_MACADM.CREATE_ROLE` procedure to create the security role.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_ROLE(
    role_name      => 'access_hr_employees',
    enabled        => DBMS_MACUTL.G_YES,
    rule_set_name  => 'Can Access HR.EMPLOYEES');
END;
/
```

In this specification:

- `role_name` can be up to 128 characters in mixed-case, without spaces. Ensure that this name follows the standard Oracle naming conventions for role creation using the `CREATE ROLE` statement. The `DBA_DV_FACTOR` data dictionary view lists existing factors. This parameter is mandatory. The `DBA_DV_ROLE` data dictionary view lists existing security roles.

- `enabled` enables or disables the role to be available for use. This parameter is mandatory. `DBMS_MACUTL.G_YES` makes the role available for enabling; `DBMS_MACUTL.G_NO` prevents the role from being enabled. The default is `DBMS_MACUTL.G_YES`. That is, users are allowed to call the `DBMS_MACSEC_ROLES.SET_ROLE` function to try to enable the role. Note that whether or not the role will be enabled depends on the evaluation result of the associated rule set.
 - `rule_set_name` is a mandatory rule set that the `DBMS_MACSEC_ROLES.SET_ROLE` procedure will use to determine if the role should be enabled or disabled. If the rule set evaluates to true, then Oracle Database Vault enables the role for the database session. If the rule set evaluates to false, then the role is not enabled. The `DBA_DV_RULE_SET` data dictionary view lists existing rule sets.
4. As the owner of the schema that will be affected by the secure application role, grant the appropriate privileges to the secure application role.

These privileges should be the same privileges that the secure application role will control. For example, suppose you created a role that enabled users to select or update the `HR.EMPLOYEES` table. The `HR` user would need to grant the `SELECT` and `UPDATE` privileges to the secure application role.

For example:

```
CONNECT HR@pdb_name
Enter password: password

GRANT SELECT, UPDATE ON EMPLOYEES TO ACCESS_HR_EMPLOYEES;
```

5. Test the secure application role.
- a. Connect as the user who will be granted or denied the secure application role.
 - b. Run the `DBMS_MACSEC_ROLES.SET_ROLE` procedure on the role. For example:

```
EXEC DBMS_MACSEC_ROLES.SET_ROLE('ACCESS_HR_EMPLOYEES');
```

- c. Attempt to perform an action that is controlled by the secure application role. For example:

```
SELECT COUNT(*) FROM HR.EMPLOYEES;
```

If the user should be granted the privileges, then the user can perform the action. Otherwise, the action will fail.

Related Topics

- [Configuring Rule Sets](#)
 Rule sets group one or more rules together; the rules determine whether a user can perform an action on an object.
- [SET_ROLE Procedure](#)
 The `SET_ROLE` procedure issues the `SET ROLE` PL/SQL statement for specified roles.
- [Oracle Database Vault Secure Application Role APIs](#)
 The `DBMS_MACADM` and `DBMS_MACSEC_ROLES` PL/SQL packages manage Database Vault secure application roles.

8.4 Enabling Oracle Database Secure Application Roles to Work with Oracle Database Vault

You can modify an existing secure application role only if it has been created in Oracle Database Vault.

You cannot modify secure application roles or database roles that have been created outside of Oracle Database Vault. However, you can enable non-Oracle Database Vault roles to work with Oracle Database Vault.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

For example:

```
CONNECT c##sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, 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 a new secure application role in Oracle Database Vault and then grant the existing role to the secure application role.

For example:

```
GRANT myExistingDBrole TO myDVrole;
```

3. Modify your code to use this new role.

You can use `DBMS_MACSEC_ROLES.SET_ROLE` in your application code to accomplish this.

Related Topics

- [SET_ROLE Procedure](#)
The `SET_ROLE` procedure issues the `SET ROLE` PL/SQL statement for specified roles.

8.5 Modifying a Secure Application Role

You can modify the definition of an Oracle Database Vault secure application role.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Find the secure application role and check its definition.

For example:

```
SELECT * FROM DBA_DV_ROLE ORDER BY ROLE;
```

3. Run the `DBMS_MACADM.UPDATE_ROLE` statement.

For example:

```
BEGIN
  DBMS_MACADM.UPDATE_ROLE(
    role_name      => 'access_hr_employees',
    enabled        => DBMS_MACUTL.G_NO,
    rule_set_name  => 'System Access Controls');
END;
/
```


Related Topics

- [Oracle Database Vault Secure Application Role APIs](#)
The `DBMS_MACADM` and `DBMS_MACSEC_ROLES` PL/SQL packages manage Database Vault secure application roles.

8.6 Deleting an Oracle Database Vault Secure Application Role

You can delete Oracle Database Vault secure application roles if no applications are using them.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Query the `DBA_DV_ROLE` data dictionary view to find the secure application roles that you want to delete.

For example:

```
SELECT ROLE FROM DBA_DV_ROLE ORDER BY ROLE;
```

3. Check and modify any applications that may be using the secure application role that you want to delete.
4. Run the `DBMS_MACADM.DELETE_ROLE` procedure to delete the role.

For example:

```
EXEC DBMS_MACADM.DELETE_ROLE('access_hr_employees');
```

Related Topics

- [Oracle Database Vault Secure Application Role APIs](#)
The `DBMS_MACADM` and `DBMS_MACSEC_ROLES` PL/SQL packages manage Database Vault secure application roles.

8.7 How Oracle Database Vault Secure Application Roles Work

The process flow for an Oracle Database Vault secure application role begins after you create and set the secure application role.

1. Create or update the role either in Oracle Database Vault Administrator or by using the secure application role-specific functions in the `DBMS_MACADM` package.
2. Modify your application to call the role, by using the `DBMS_MACSEC_ROLES.SET_ROLE` function.
3. Oracle Database Vault then evaluates the rule set associated with the secure application role.

If the rule set evaluates to true, then Oracle Database Vault enables the role for the current session. If the rule set evaluates to false, the role is not enabled. In either case, Oracle Database Vault processes the associated auditing and custom event handlers for the rule set associated with the secure application role.

Related Topics

- [DBMS_MACADM Secure Application Role Procedures](#)
The `DBMS_MACADM` package creates, renames, assigns, unassigns, updates, and deletes Oracle Database Vault secure application roles.
- [SET_ROLE Procedure](#)
The `SET_ROLE` procedure issues the `SET ROLE` PL/SQL statement for specified roles.

8.8 Tutorial: Granting Access with Database Vault Secure Application Roles

This tutorial demonstrates how to create a secure application role to control user access to the `OE.ORDERS` table during work hours.

- [About This Tutorial](#)
In this tutorial, you restrict the `SELECT` statement on the `ORDERS` table in the `OE` schema to a specific set of users.
- [Step 1: Create Users for This Tutorial](#)
First, you must create users for the tutorial.
- [Step 2: Enable the OE User Account](#)
The `OE` schema will be used for this tutorial.
- [Step 3: Create the Rule Set and Its Rules](#)
The rule set and rules will restrict who can modify orders in the `OE.ORDERS` table.
- [Step 4: Create the Database Vault Secure Application Role](#)
The Database Vault secure application role will be set when the rule set conditions are satisfied.
- [Step 5: Grant the SELECT Privilege to the Secure Application Role](#)
The secure application role must be granted the `SELECT` privilege.
- [Step 6: Test the Database Vault Secure Application Role](#)
With all the components in place, you can test the Database Vault secure application role.
- [Step 7: Remove the Components for This Tutorial](#)
You can remove the components that you created for this tutorial if you no longer need them.

8.8.1 About This Tutorial

In this tutorial, you restrict the `SELECT` statement on the `ORDERS` table in the `OE` schema to a specific set of users.

Furthermore, these users can only perform these statements on the `OE.ORDERS` table from within the office, not from a remote connection. To accomplish this, you create an Oracle Database Vault secure application role that is enabled for the user only if the user passes the checks enforced by the rule set that you associate with the secure application role.

8.8.2 Step 1: Create Users for This Tutorial

First, you must create users for the tutorial.

1. Log in to a PDB as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
sqlplus accts_admin_ace@pdb_name  
Enter password: password
```

To find the available PDBs, 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 user accounts:

```
GRANT CREATE SESSION TO eabel IDENTIFIED BY password;
GRANT CREATE SESSION TO ahutton IDENTIFIED BY password;
GRANT CREATE SESSION TO ldoran IDENTIFIED BY password;
```

Replace *password* with a password that meets the password complexity requirements of the user's profile.

Related Topics

- *Oracle Database Security Guide*

8.8.3 Step 2: Enable the OE User Account

The OE schema will be used for this tutorial.

1. In SQL*Plus, connect as the DV_ACCTMGR user.

For example:

```
CONNECT accts_admin_ace@pdb_name
Enter password: password
```

2. Check the account status of the OE account.

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

3. If the OE account is locked and expired, unlock it and assign it a new password.

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

Replace *password* with a password that meets the password complexity requirements of the user's profile.

Related Topics

- *Oracle Database Security Guide*

8.8.4 Step 3: Create the Rule Set and Its Rules

The rule set and rules will restrict who can modify orders in the OE.ORDERS table.

1. Connect as a user who has been granted the DV_OWNER role.

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Create the following rule set.

```
BEGIN
  DBMS_MACADM.CREATE_RULE_SET(
    rule_set_name    => 'Can Modify Orders',
    description      => 'Rule set to control who can modify orders in the OE.ORDERS
table',
    enabled          => DBMS_MACUTL.G_YES,
    eval_options     => DBMS_MACUTL.G_RULESET_EVAL_ALL,
    audit_options    => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
    fail_options     => DBMS_MACUTL.G_RULESET_FAIL_SHOW,
    fail_message     => 'Failure',
    fail_code        => 20461,
    handler_options  => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
    handler          => '',
    is_static        => FALSE,
    scope            => DBMS_MACUTL.G_SCOPE_LOCAL);
```

```
END;  
/
```

3. Create the following rule.

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Session User',  
    rule_expr => 'DVF.F$SESSION_USER IN (''EABEL'', ''AHUTTON'')');  
END;  
/
```

4. Add the Check Session User rule to the Can Modify Orders rule set.

```
BEGIN  
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(  
    rule_set_name => 'Can Modify Orders',  
    rule_name     => 'Check Session User',  
    rule_order    => 1);  
END;  
/
```

8.8.5 Step 4: Create the Database Vault Secure Application Role

The Database Vault secure application role will be set when the rule set conditions are satisfied.

1. If necessary, connect as the user who was granted the DV_OWNER role.

```
CONNECT sec_admin_owen@pdb_name  
Enter password: password
```

2. Create and enable the secure application role, and associate it with the Can Modify Orders rule set.

```
BEGIN  
  DBMS_MACADM.CREATE_ROLE(  
    role_name     => 'ORDERS_MGMT',  
    enabled       => DBMS_MACUTL.G_YES,  
    rule_set_name => 'Can Modify Orders');  
END;  
/
```

At this stage, the Database Vault secure application role and its associated rule set are created, though the role does not yet have any privileges.

8.8.6 Step 5: Grant the SELECT Privilege to the Secure Application Role

The secure application role must be granted the SELECT privilege.

1. In SQL*Plus, connect as user OE.

```
CONNECT OE@pdb_name  
Enter password: password
```

2. Grant the SELECT privilege to the ORDERS_MGMT secure application role.

```
GRANT SELECT ON ORDERS TO ORDERS_MGMT;
```

8.8.7 Step 6: Test the Database Vault Secure Application Role

With all the components in place, you can test the Database Vault secure application role.

1. Connect as user `eabel`.
2. Set the `ORDERS_MGMT` role.

```
EXEC DBMS_MACSEC_ROLES.SET_ROLE('ORDERS_MGMT');
```

Typically, you would embed this call in the application to which the user logs in.

3. Select from the `OE.ORDERS` table.

```
SELECT COUNT(*) FROM OE.ORDERS;
```

The following output should appear:

```

COUNT(*)
-----
          105

```

Because user `eabel` is configured as a valid session user, she can select from the `OE.ORDERS` table. If user `ahutton` logs in to SQL*Plus in the same manner, she also can select from the `OE.ORDERS` table.

4. Connect as user `ldoran`.
5. Enter the following statements:

```
EXEC DBMS_MACSEC_ROLES.SET_ROLE('ORDERS_MGMT');
SELECT COUNT(*) FROM OE.ORDERS;
```

Because user `ldoran` is not a valid user, she cannot enable the `ORDERS_MGMT` role. Therefore, she cannot select from the `OE.ORDERS` table.

8.8.8 Step 7: Remove the Components for This Tutorial

You can remove the components that you created for this tutorial if you no longer need them.

1. Connect as a user who was granted the `DV_OWNER` role.

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Drop the `ORDERS_MGMT` secure application role.

```
EXEC DBMS_MACADM.DELETE_ROLE('ORDERS_MGMT');
```

3. Remove the Check Session User rule from the Can Modify Orders rule set.

```
BEGIN
  DBMS_MACADM.DELETE_RULE_FROM_RULE_SET(
    rule_set_name => 'Can Modify Orders',
    rule_name      => 'Check Session User');
END;
/
```

4. Drop the rule and rule set.

```
EXEC DBMS_MACADM.DELETE_RULE('Check Session User');
EXEC DBMS_MACADM.DELETE_RULE_SET('Can Modify Orders');
```

5. Connect as a user who has been granted the `DV_ACCTMGR` role.

```
CONNECT accts_admin_ace@pdb_name
Enter password: password
```

6. Drop the users.

```
DROP USER eabel;
DROP USER ahutton;
DROP USER ldoran;
```

7. If unnecessary, lock and expire the OE user account.

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

8.9 How Secure Application Roles Affect Performance

You can check system performance by using Oracle Database tools, including Oracle Enterprise Manager Cloud Control.

Other tools that you can use are Automatic Workload Repository (AWR) and `TKPROF`.

Related Topics

- [Oracle Database Performance Tuning Guide](#)
- [Oracle Database SQL Tuning Guide](#)

8.10 Secure Application Role Related Reports and Data Dictionary View

Oracle Database Vault provides reports and a data dictionary view that you can use to analyze Oracle Database Vault secure application roles.

[Table 8-1](#) lists the Oracle Database Vault reports.

Table 8-1 Reports Related to Secure Application Roles

| Report | Description |
|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Secure Application Role Audit Report | Lists audit records generated by the Oracle Database Vault secure application role-enabling operation. To generate this type of audit record, enable auditing for the rule set associated with the role. |
| Secure Application Configuration Issues Report | Lists secure application roles that have nonexistent database roles, or incomplete or disabled rule sets |
| Rule Set Configuration Issues Report | Lists rule sets that have no rules defined or enabled, which may affect the secure application roles that use them |
| Powerful database accounts and roles reports | Provide information about powerful database accounts and roles |

The `DBA_DV_ROLE` data dictionary view lists the Oracle Database Vault secure application roles used in privilege management.

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.

- [Oracle Database Vault Data Dictionary Views](#)
You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

9

Configuring Oracle Database Vault Policies

You can use Oracle Database Vault policies to implement frequently used realm and command rule settings.

- [What Are Database Vault Policies?](#)
An Oracle Database Vault policy groups local realms and command rules into a named policy that you can enable or disable as necessary.
- [Default Oracle Database Vault Policies](#)
Oracle Database Vault provides two default policies that you can use to better secure user accounts and system privileges.
- [Creating an Oracle Database Policy](#)
To create an Oracle Database Vault policy, you create a container policy that specifies the realms and command rules that encompass the policy.
- [Modifying an Oracle Database Vault Policy](#)
You can use the modify an Oracle Database Vault policy.
- [Deleting an Oracle Database Vault Policy](#)
You can use Enterprise Manager Cloud Control to delete Oracle Database Vault policies.
- [Related Data Dictionary Views](#)
Oracle Database Vault provides data dictionary views that are useful for analyzing Database Vault policies.

9.1 What Are Database Vault Policies?

An Oracle Database Vault policy groups local realms and command rules into a named policy that you can enable or disable as necessary.

- [About Oracle Database Vault Policies](#)
Oracle Database Vault policies can group realm and command rule definitions into one policy, which then can be collectively enabled or disabled.
- [Oracle Database Vault Policies in a Multitenant Environment](#)
Oracle Database Vault policies are only local to the pluggable database (PDB) in which they were created.

9.1.1 About Oracle Database Vault Policies

Oracle Database Vault policies can group realm and command rule definitions into one policy, which then can be collectively enabled or disabled.

Database Vault policies enable you to delegate limited realm administration privileges to database users without giving them the powerful privileges that the `DVADM` and `DVOWNER` roles provide. Oracle Database Vault provides default policies.

For example, suppose you have a set of Oracle Database Vault objects that are related to a particular application, such as a realm and several command rules. You can use a Database Vault policy to group these objects into one policy. You then can designate a policy administrator to manage adding users to a realm for this application and for enabling or disabling the policy. If there is only one primary application, then it can be used for

manageability where a user can enable, disable, or simulate (use simulation mode) all related objects with one command rather than issuing a command for each included Database Vault object.

How the enablement of the individual realms and command rules works depends on how you set the policy state of the policy, as follows:

- Full enabled mode (`DBMS_MACADM.G_ENABLED`) sets the policy to take precedence over the individual enablement settings of the associated realms and command rules. For example, if the associated objects of a policy are individually disabled, then they will be enabled if the policy is enabled. (Conversely, you can set `DBMS_MACADM.G_PARTIAL` to allow the embedded security objects to set their own enabled, disabled, or simulation mode.)
- Partial enabled mode (`DBMS_MACADM.G_PARTIAL`) enables the associated realms and command rules to have different status settings (`ENABLED`, `DISABLED`, and `SIMULATION`). The other policy status choices force all associated controls to the same status dictated by the policy. Setting the policy status to partial allows each realm and command rule to change status as required.
- Simulation mode (`DBMS_MACADM.G_SIMULATION`) enables the policy but writes violations to realms or command rules to a designated log table with information about the type of violation, such as a user name or the SQL statement that was used. Simulation forces every security object in the policy to be in simulation mode.
- Disabled mode (`DBMS_MACADM.G_DISABLED`) disables the policy after you create it.

In general, to create a Database Vault policy, you perform the following steps:

1. Create the necessary realms and command rules to use in the policy.
2. Create the Database Vault policy.
You can use the `DBMS_MACADM.CREATE_POLICY` procedure to create the policy.
3. Add one or more realms to the policy.
You can use the `DBMS_MACADM.ADD_REALM_TO_POLICY` procedure to add realms to the policy.
4. Add one or more command rules to the policy.
You can use the `DBMS_MACADM.ADD_CMD_TO_POLICY` procedure to add command rules to the policy.
5. Add one or more database users as owners of the policy.
You can use the `DBMS_MACADM.ADD_OWNER_TO_POLICY` procedure to add users to the policy. Afterward, grant this user the `DV_POLICY_OWNER` role. This user will be able to perform a limited set of tasks: changing the policy state, adding or removing authorization from a realm, and having the `SELECT` privilege for a set of the `DVSYS.POLICY_OWNER*` data dictionary views. By default, the `DVOWNER` user owns the policy.

After the policy is created, it can be used right away.

Related Topics

- [Default Oracle Database Vault Policies](#)
Oracle Database Vault provides two default policies that you can use to better secure user accounts and system privileges.
- [Oracle Database Vault Policy APIs](#)
You can use the `DBMS_MACADM` PL/SQL package to manage Oracle Database Vault policies.

- [DV_POLICY_OWNER Database Vault Owner Role](#)
The `DV_POLICY_OWNER` role enables database users to manage to a limited degree Oracle Database Vault policies.

9.1.2 Oracle Database Vault Policies in a Multitenant Environment

Oracle Database Vault policies are only local to the pluggable database (PDB) in which they were created.

That is, if you created the policy in a PDB, then only local realms and command rules can be added to it.

9.2 Default Oracle Database Vault Policies

Oracle Database Vault provides two default policies that you can use to better secure user accounts and system privileges.

You can use the default policies in your own security configurations. If you do not need them, then you can remove them because they are not needed for internal use by Oracle Database Vault.

The default policies are as follows:

- `Oracle Account Management Controls` enforces controls over user-related operations within Oracle Database Vault. It is used to prevent ad hoc user account creation, user deletions, and other user account-related operations by unauthorized privileged users. It includes the `Database Vault Account Management` realm and user account management command rules for SQL statements such as `CREATE USER`.
- `Oracle System Protection Controls` enforces controls on important database schemas, privileges, and roles that are associated with the default Oracle Database environment. It includes the realms such as `Oracle Default Schema Protection Realm` and command rules for the system management SQL statement `ALTER SYSTEM`.

Related Topics

- [DBA_DV_POLICY_OBJECT View](#)
The `DBA_DV_POLICY_OBJECT` data dictionary view lists information about the objects that are protected by Oracle Database Vault policies in the current database instance.

9.3 Creating an Oracle Database Policy

To create an Oracle Database Vault policy, you create a container policy that specifies the realms and command rules that encompass the policy.

You can enable the policy during creation time, or enable it later on by executing the .

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Run the `DBMS_MACADM.CREATE_POLICY` procedure to create the policy

For example:

```
BEGIN
  DBMS_MACADM.CREATE_POLICY(
    policy_name => 'OE Policy',
    description => 'Policy to protect the OE schema',
    policy_state => DBMS_MACADM.G_ENABLED,
    pl_sql_stack => TRUE);
```

```
END;
/
```

In this specification:

- `policy_name` can be up to 128 characters in mixed case. The `DBA_DV_POLICY` data dictionary view lists existing policies.
 - `description` can be up to 4000 characters in mixed-case.
 - `policy_state` enables or disables the policy, using one of the following settings:
 - `DBMS_MACADM.G_ENABLED` (or 1) enables the policy after you create it.
 - `DBMS_MACADM.G_DISABLED` (or 0) disables the policy after you create it.
 - `DBMS_MACADM.G_SIMULATION` (or 2) sets the policy to simulation mode. In simulation mode, any violations to realms or command rules used in the policy are logged in a designated log table with sufficient information to describe the error, such as the user name or SQL statement used.
 - `DBMS_MACADM.G_PARTIAL` (or 3) sets the policy to partial mode. In partial mode, the enforcement state of realms or command rules associated with the policy can be changed individually.
 - `pl_sql_stack` is used when simulation mode is enabled and specifies whether to record the PL/SQL stack for failed operations. Enter `TRUE` to record the PL/SQL stack, `FALSE` to not record.
3. So that the Database Vault policy owner can query policy related views and run the allowed procedures, grant this user the `DV_POLICY_OWNER` role.

You can grant this role to multiple users.

For example:

```
GRANT DV_POLICY_OWNER TO psmith, pfitch;
```

4. To add a database user as the owner of the policy, run the `DBMS_MACADM.ADD_OWNER_TO_POLICY` procedure.

The policy owner will be able to modify the policy.

For example:

```
BEGIN
  DBMS_MACADM.ADD_OWNER_TO_POLICY(
    policy_name => 'OE Policy',
    owner_name  => 'PSMITH');
END;
/
```

5. To add a command rule to the policy, run the `DBMS_MACADM.ADD_CMD_RULE_TO_POLICY` procedure.

If you created the policy in a PDB, then the command rule must be local to this PDB.

For example, for a simple command rule:

```
BEGIN
  DBMS_MACADM.ADD_CMD_RULE_TO_POLICY(
    policy_name => 'OE Policy',
    command     => 'SELECT',
    object_owner => 'OE',
    object_name  => 'ORDERS',
    scope       => DBMS_MACUTL.G_SCOPE_LOCAL);
```

```
END;
/
```

In this specification, the command rule must exist and match the parameters included. To fine the command rule definition, query the `DBA_DV_COMMAND_RULE`.

If you want to add an `ALTER SYSTEM` or `ALTER SESSION` command rule, then you must include the parameters specific to those command rules. For example:

```
BEGIN
  DBMS_MACADM.ADD_CMD_RULE_TO_POLICY(
    policy_name => 'OE Policy',
    command     => 'ALTER SESSION',
    object_owner => '%',
    object_name  => '%',
    clause_name  => 'PARALLEL DDL',
    parameter_name => '',
    event_name   => '',
    action_name  => '',
    scope        => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

6. To add a realm to the policy, run the `DBMS_MACADM.ADD_REALM_TO_POLICY` procedure. If you created the policy in a PDB, then the command rule must be local to this PDB.

For example:

```
BEGIN
  DBMS_MACADM.ADD_REALM_TO_POLICY(
    policy_name => 'OE Policy',
    realm_name  => 'Database Vault Account Management');
END;
/
```

In this specification:

- `policy_name` is a name of the policy. The `DBA_DV_POLICY` view lists existing policies.
- `realm_name` is the name of the realm. The `DBA_DV_REALM` view lists existing realms.

Related Topics

- [About Simulation Mode](#)
Simulation mode enables you to capture violations in a simulation log instead of blocking SQL execution by Oracle Database Vault realms and command rules.
- [Oracle Database Vault Policy APIs](#)
You can use the `DBMS_MACADM` PL/SQL package to manage Oracle Database Vault policies.

9.4 Modifying an Oracle Database Vault Policy

You can use the modify an Oracle Database Vault policy.

You can modify only the description and state of a policy. If you want to make other modifications, such as changing the realm that is associated with the policy, then you must delete the object from the policy (for example, with the `DBMS_MACADM.DELETE_REALM_FROM_POLICY` procedure) and then add the replacement object (for example, with `DBMS_MACADM.ADD_REALM_TO_POLICY`) to the policy.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Find policy and check its definition.

For example:

```
SELECT * FROM DBA_DV_POLICY ORDER BY NAME;
```

3. To change the policy description, run the `DBMS_MACADM.UPDATE_POLICY_DESCRIPTION` procedure.

For example:

```
BEGIN
  DBMS_MACADM.UPDATE_POLICY_DESCRIPTION(
    policy_name => 'OE Policy',
    description => 'Policy to protect the OE schema from external intruders');
END;
/
```

4. To change the policy state, run the `DBMS_MACADM.UPDATE_POLICY_STATE` procedure.

For example:

```
BEGIN
  DBMS_MACADM.UPDATE_POLICY_STATE(
    policy_name => 'OE Policy',
    policy_state => DBMS_MACADM.G_SIMULATION,
    pl_sql_stack => TRUE);
END;
/
```

Related Topics

- [Oracle Database Vault Policy APIs](#)
You can use the `DBMS_MACADM` PL/SQL package to manage Oracle Database Vault policies.

9.5 Deleting an Oracle Database Vault Policy

You can use Enterprise Manager Cloud Control to delete Oracle Database Vault policies.

When you delete an Oracle Database Vault policy, the underlying realms and command rules are preserved, and they retain their individual enablement status. You do not need to remove any objects (such as realms) that are associated with the policy before deleting it.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Query the `DBA_DV_POLICY_OBJECT` data dictionary view to find the policy to delete.

For example:

```
SELECT POLICY_NAME FROM DBA_DV_POLICY ORDER BY POLICY_NAME;
```

3. Run the `DBMS_MACADM.DROP_POLICY` procedure to drop the policy.

For example:

```
EXEC DBMS_MACADM.DROP_POLICY ('OE Policy');
```

9.6 Related Data Dictionary Views

Oracle Database Vault provides data dictionary views that are useful for analyzing Database Vault policies.

[Table 9-1](#) lists data dictionary views that provide information about existing Oracle Database Vault policies.

Table 9-1 Data Dictionary Views Used for Oracle Database Vault Policies

| Data Dictionary View | Description |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DBA_DV_POLICY | Lists the Database Vault policies, a description, and their state |
| DBA_DV_POLICY_OBJECT | Provides detailed information about the policies, such as the associated realms and command rules |
| DBA_DV_POLICY_OWNER | Lists the owners of Database Vault policies |
| DBA_DV_REALM_AUTH | Enables users who have been granted the DV_POLICY_OWNER role to find information about the authorization that was granted to realms that have been associated with Database Vault policies, such as the realm name, grantee, and associated rule set. |
| DVSYS.POLICY_OWNER_COMMAND_RULE | Enables users who have been granted the DV_POLICY_OWNER role to find information about the command rules that have been associated with Database Vault policies, such as the command rule name. |
| DVSYS.POLICY_OWNER_POLICY | Enables users who have been granted the DV_POLICY_OWNER role to find information such as the names, descriptions, and states of existing policies in the current database instance, including policies created by other policy owners |
| DVSYS.POLICY_OWNER_REALM | Enables users who have been granted the DV_POLICY_OWNER role to find information about the realms that have been associated with Database Vault policies, such as the realm name, audit options, or type |
| DVSYS.POLICY_OWNER_REALM_OBJECT | Enables users who have been granted the DV_POLICY_OWNER role to find information about the objects that have been added to realms that are associated with Database Vault policies, such as the realm name, grantee, and associated rule set |
| DVSYS.POLICY_OWNER_RULE | Enables users who have been granted the DV_POLICY_OWNER role to find information about the rules that have been associated with rule sets in Database Vault policies, such as the rule name and its expression |
| DVSYS.POLICY_OWNER_RULE_SET | Enables users who have been granted the DV_POLICY_OWNER role to find information about the rule sets that have been associated with Database Vault policies, such as the rule set name, its handler information, and whether it is enabled |
| DVSYS.POLICY_OWNER_RULE_SET_RULE | Enables users who have been granted the DV_POLICY_OWNER role to find information about the rule sets that contain rules used in Database Vault policies, such as the rule set name and whether it is enabled |

Related Topics

- [Oracle Database Vault Data Dictionary Views](#)
You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

10

Using Simulation Mode for Logging Realm and Command Rule Activities

Simulation mode writes violations to the simulation log instead of preventing SQL execution to quickly test new and modified Oracle Database Vault controls.

- [About Simulation Mode](#)
Simulation mode enables you to capture violations in a simulation log instead of blocking SQL execution by Oracle Database Vault realms and command rules.
- [Simulation Mode Use Cases](#)
Simulation mode is useful for testing a development configuration of new realms and command rules.
- [Logging Realms in Simulation Mode](#)
You can set both regular and mandatory realms in simulation mode.
- [Tutorial: Tracking Violations to a Realm Using Simulation Mode](#)
This tutorial shows how to create a realm that uses simulation mode and then test violations to the realm.

10.1 About Simulation Mode

Simulation mode enables you to capture violations in a simulation log instead of blocking SQL execution by Oracle Database Vault realms and command rules.

Simulation mode stores the errors that are captured in one location for easy analysis. To use simulation mode, when you create or update a realm or command rule, instead of enabling or disabling the realm or command rule, you can set it to simulation mode. The realm or command rule is still enabled, but because violations are not blocked and are instead recorded to the simulation log file, you can test it for any potential errors before you enable it for a production environment. When simulation mode is enabled, the report may include violations for multiple realms or command rules. For more detailed reports that can help you better identify the source of user SQL statements, you can configure simulation mode to include the PL/SQL call stack. The call stack captures the calling procedures and functions recursively to better troubleshoot the Database Vault audit records. Call stack information is stored in the `PL_SQL_STACK` column in the `DVSYSDBA.DV_SIMULATION_LOG` data dictionary view.

For example, the following creation statement for a realm enables simulation mode and generates the PL/SQL call stack:

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name      => 'HR Apps',
    description     => 'Realm to protect the HR realm',
    enabled         => DBMS_MACUTL.G_SIMULATION,
    audit_options   => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type      => 1,
    realm_scope     => DBMS_MACUTL.G_SCOPE_LOCAL,
    pl_sql_stack    => TRUE);
END;
/
```

At this stage, SQL statements that violate realms or command rules are still able to execute, but these activities are recorded to the `DBA_DV_SIMULATION_LOG` data dictionary view. For example, the following query finds violations against the HR Apps realm and any other realms or command rules that have been configured for simulation mode:

```
SELECT USERNAME, COMMAND, SQLTEXT, VIOLATION_TYPE
FROM DBA_DV_SIMULATION_LOG
WHERE REALM_NAME = "HR APPS";
```

| USERNAME | COMMAND | SQLTEXT | VIOLATION_TYPE |
|----------|---------|----------------------------------|-----------------|
| ----- | ----- | ----- | ----- |
| DGRANT | SELECT | SELECT SALARY FROM HR.EMPLOYEES; | Realm Violation |

After you have completed testing the realm or command rule, a user who has been granted the `DV_ADMIN` or `DV_OWNER` role can clear the `DBA_DV_SIMULATION_LOG` data dictionary view by deleting the contents of the underlying table of this view, `DVSYS.SIMULATION_LOG$`.

For example:

```
DELETE FROM DVSYS.SIMULATION_LOG$;
```

Or:

```
DELETE FROM DVSYS.SIMULATION_LOG$ WHERE COMMAND = 'SELECT';
```

10.2 Simulation Mode Use Cases

Simulation mode is useful for testing a development configuration of new realms and command rules.

Use cases are as follows:

- Application certification

When you are certifying applications, you can use simulation mode as follows in an application test environment:

1. Put all schemas for the application into mandatory realms with simulation mode enabled.
2. Run a full regression test.
3. Analyze the simulation mode log by querying the `DBA_DV_SIMULATION_LOG` data dictionary view to find who can access these schemas.
4. Update the realms with new authorizations, and then enable the realms (that is, not using simulation mode).
5. Re-run the regression test.

- Introduction of a new command rule

You can use simulation mode on a production database that has Oracle Database Vault enabled.

1. Put the new command rule into production in simulation mode for however many weeks that are necessary.
2. Analyze the simulation mode log by querying `DBA_DV_SIMULATION_LOG` to determine if the command rule is working correctly.
3. Make changes to the command rule as necessary.

4. Enable the command rule.
- Putting a new realm into a production database in simulation mode.
This method can help to find the system context information needed to set the trusted path rules in rule sets and find authorized users for realms.
 1. Create the new realm in mandatory mode and add the protected objects
 2. Do not add any authorized users.
 3. Run applications and development operations from the normal IP addresses that will be used.
 4. Check the simulation log file for both authorized users and system context information that you can use to create trusted paths.
 5. Create the trusted paths, and then add the authorized users.
 6. Clear the simulation log and run the application and development operation tasks again.
 7. After a period of time, review the simulation log. If all the controls were updated correctly, then the simulation log is empty. Log entries in the simulation mode indicate additional changes that you need to make to the realm and rule sets or the log entries may indicate a malicious use.

10.3 Logging Realms in Simulation Mode

You can set both regular and mandatory realms in simulation mode.

- [Considerations When Logging Realms in Simulation Mode](#)
There are several use cases to consider if you want to use realms in simulation mode.
- [Use Case: All New Realms in Simulation Mode](#)
In this use case, all realms are either mandatory or regular and all user-created realms are in simulation mode.
- [Use Case: New Realms Introduced to Existing Realms](#)
In this use case, you add a set of new realms to a database that has an existing set of realms.
- [Use Case: Testing the Addition of New Objects in a Realm](#)
In this use case, you add new objects to an existing realm and then test it using simulation mode without removing the current realm protections.
- [Use Case: Testing the Removal of Objects from a Realm](#)
In this use case, you test the removal of objects to an existing realm.
- [Use Case: Testing the Addition of an Authorized User to a Realm](#)
In this use case, you loosen security controls by adding more users. You do not need to simulate anything if you are simply adding more authorized users.
- [Use Case: Testing the Removal of an Authorized User from a Realm](#)
In this use case, you want to drop an authorized user and use simulation mode to check if the user still needs to access the realm.
- [Use Case: Testing New Factors with Realms](#)
In this use case, you want to test changes to factors.
- [Use Case: Testing Changes to an Existing Command Rule](#)
In this use case, you test changes to an existing command rule while keeping the original command rule enabled.

10.3.1 Considerations When Logging Realms in Simulation Mode

There are several use cases to consider if you want to use realms in simulation mode.

- Testing an application with all new Database Vault controls: all realms are in simulation mode
- Adding a realm to existing working Database Vault controls: only a subset of realms are in simulation mode
- Adding new objects to an existing enabled realm and then testing the difference with simulation mode and not disabling existing controls
- Dropping one or more existing objects from an existing enabled realm and then testing the difference with simulation mode and not disabling existing controls
- Adding new authorized users to an existing enabled realm and then testing the difference with simulation mode and not disabling existing controls
- Dropping one or more existing authorized users from an existing enabled realm and then testing the difference with simulation mode and not disabling existing controls
- Adding or changing factors in an existing enabled realm and then testing the difference with simulation mode and not disabling existing controls
- Testing changes to a command rule in production while keeping the original command rule enabled

When a user runs a SQL statement and it fails, it may fail for realms that are enabled, fail for realms that are simulated, or it could fail for both of these reasons. There could be mandatory realms, regular realms, or both. These conditions determine the data that is captured in the simulation log.

After you create the use cases that are described in the next sections, regular realms are completely overpowered by mandatory realms when an object has both types of realms protecting it. In all cases where mandatory and regular realms protect the same object, regular realms can be ignored with regard to simulation logs. Only mandatory realm failures are captured in the simulation logs. The only time regular realm failures are entered into the simulation log is when all realms for an object are regular realms. And then, the following must happen for regular realms to be written to the simulation log:

- All regular realms in simulation mode fails and
- All regular realms that are enabled also fail

If at least one enabled or simulation regular realm succeeds, then no simulation regular realms are logged.

10.3.2 Use Case: All New Realms in Simulation Mode

In this use case, all realms are either mandatory or regular and all user-created realms are in simulation mode.

Examples are as follows:

- Mandatory realms only, which are all in simulation mode
 - The user is authorized to execute the SQL statement in all mandatory realms. Nothing is captured in the simulation log table.

- The user fails one or more mandatory realm checks. All realm check failures are logged to the simulation log. Mandatory realm checks where the user's SQL statement succeeded is not logged.

In this example, there are three mandatory realms. The user SQL statement succeeds with one realm and fails with the other two. Only the two failed realm checks are recorded in the simulation log.
- Regular realms only, which are all in simulation mode
 - The user is authorized to execute the SQL statement in at least one regular realm. The user should have access to the data so nothing is logged to the simulation log.
 - The user is not authorized to execute the SQL statement in all regular realms. The simulation log captures all the failed realm authorization failures. This enables the user to select which realm to which the user should be authorized. The SQL only needs to be authorized in one regular realm to work and not all regular realms need to be updated to authorize the SQL.
- Mix of mandatory and regular realms, which are all in simulation mode
 - In this case, you capture the key realms when a user is rejected. In the case with mandatory and regular realms, the mandatory realms are the key realms. All mandatory realms must pass the authorization check for the user to gain access. In fact, regular realms could be considered superfluous when mandatory realms are protecting an object. So in cases where there are both mandatory and regular realms protecting the same object, it is only the mandatory realms that control if the SQL statement is blocked or allowed to execute. It does not matter whether the user was authorized to the regular realm or not. This example follows the rules for the first scenario, for mandatory realms in simulation mode.
 - The user is authorized to execute the SQL statement in all mandatory realms. Nothing is captured in the simulation log table. Even though the user may succeed or fail in one or more regular realms, nothing about regular realm failure is captured.
 - The user fails one or more mandatory realm checks. All realm check failures are logged to the simulation log. Mandatory realm checks where the user SQL statement succeeded are not be logged.

For example, there are three mandatory realms. The user SQL statement succeeds with one realm and fails with the other two. Only the two failed realm checks are recorded in the simulation log.

No regular realms need to be captured, because only the mandatory realms need to be captured in the simulation log.

10.3.3 Use Case: New Realms Introduced to Existing Realms

In this use case, you add a set of new realms to a database that has an existing set of realms.

The existing realms are enabled and working. The new realms are in simulation mode. This use case applies only if both simulation and enabled realms are protecting the same object.

Examples:

- New mandatory realms in simulation mode with existing enabled mandatory realms. This use case shows some additional mandatory realms for an object: adding more security to an existing object.
 - Enabled mandatory realms and mandatory realms in simulation mode all successful with user SQL statement: in this case, the SQL executes normally and nothing is captured

- Enabled mandatory realms (at least one) fails and mandatory realms in simulation mode all successful: SQL is blocked and nothing is written to the simulation log
- Enabled mandatory realms (at least one) fails and mandatory realms in simulation mode has one or more failures: SQL is blocked and all failing mandatory realms in simulation mode are entered into simulation log
- Enabled mandatory realms all successful and mandatory realms in simulation mode have at least one failure: SQL is not blocked, all failed mandatory realms in simulation mode entered into simulation log
- New regular realms in simulation mode with existing enabled regular realms: More regular realms are added to a security object, providing new ways for users to access sensitive data
 - Enabled regular realms (at least one) and regular realms in simulation mode (at least one) successful: the user SQL executes normally with nothing written to simulation log
 - Enabled regular realms (at least one) is successful, and regular realms in simulation mode all fail: user SQL executes normally, nothing is entered into the simulation log
 - Enabled regular realms all fail and regular realms in simulation mode all fail: the user SQL is blocked and all regular realms in simulation mode are entered into simulation log. The user must evaluate which regular realm to authorize to if needed. The current implementation blocks the SQL and does not add the regular realms in simulation mode into the simulation log because the enabled regular realm would have blocked it anyway. This must change because the user may have added a new realm to authorize the SQL in this use case. There is no way to tell what happened if the new SQL should have worked, but is blocked by all regular realms in simulation mode as well (when one of the regular realms in simulation mode was designed to allow it to work). This would simulate an entry into the audit log for this situation.
 - Enabled regular realms all fail and regular realms in simulation mode (at least one) successful: the user SQL is blocked and nothing is written to the simulation log.
- New regular realms with existing enabled mandatory realms: You do not need to do anything in this situation. The enabled mandatory realms will continue to control the objects and the new regular realms in simulation mode will have no impact if they are enabled or not. No simulation logs should be generated in this case.
- New mandatory realms in simulation mode with existing enabled regular realm: While the enabled regular realm controls the objects for now, when the new mandatory realms in simulation mode are enabled, then they will have full control over the objects with no control by the older enabled regular realms. So, simulation logs will be created for all mandatory realms. This is the same as the scenario for new mandatory realms with existing enabled mandatory realms.
- New regular realms in simulation mode with existing enabled mandatory and regular realms: The enabled mandatory realms will be the deciding realms whether the new regular realms in simulation mode are added to the existing enabled regular realms in the system. This is the same as the scenario as a mix of mandatory and regular realms, all in simulation mode. Nothing is written to the simulation logs.
- New mandatory realms in simulation mode with enabled mandatory and regular realms: The enabled regular realms can be ignored. This is the same as the scenario for new mandatory realms with existing enabled mandatory realms.
- Mix of new mandatory and regular realms in simulation mode with existing enabled mandatory and regular realms: Ignore all enabled and mandatory regular realms. This is simply adding more mandatory realms to an existing object. This is the same scenario as new mandatory realms with existing enabled mandatory realms.

10.3.4 Use Case: Testing the Addition of New Objects in a Realm

In this use case, you add new objects to an existing realm and then test it using simulation mode without removing the current realm protections.

Oracle recommends that you create a duplicate realm in simulation mode for the new objects with the same authorized users and rule sets. This way, the existing realm can continue to provide protection to the existing objects while testing the new object.

10.3.5 Use Case: Testing the Removal of Objects from a Realm

In this use case, you test the removal of objects to an existing realm.

Because you are removing security controls for an existing object, there is no need to use simulation mode. Simply remove the object from the realm.

10.3.6 Use Case: Testing the Addition of an Authorized User to a Realm

In this use case, you loosen security controls by adding more users. You do not need to simulate anything if you are simply adding more authorized users.

If you are adding new functionality that is accessing data in a realm, but are not sure which new database users to authorize to the realm, then simply run the new functionality as a test (which will be blocked if not already authorized). Review the Database Vault audit logs to see the user name that attempted to access the realm data and add any new database users that are now authorized.

10.3.7 Use Case: Testing the Removal of an Authorized User from a Realm

In this use case, you want to drop an authorized user and use simulation mode to check if the user still needs to access the realm.

You may not be sure about dropping this user because you must check if the authorized user is accessing the realm for authorized activities.

If the data is only protected by a regular realm, then you can clone the realm with authorized users as the only difference. Remove the user to be dropped from the original realm and then add this user to the cloned realm. Then the cloned realm's audit setting is changed to capture `audit on success`. This enables the dropped user to be visible in the audit records if they accessed the realm over a period of time. Audit policies can also be used in this case. For data that is protected by a mandatory realm, the best solution is to create an audit policy.

10.3.8 Use Case: Testing New Factors with Realms

In this use case, you want to test changes to factors.

There are two scenarios where the factors can change:

- Changes to an application or the infrastructure that force a change to the factors

In this case, you do not need to keep the original factors in place. However, objects and authorized users should be able to remain enabled during the testing of the new factors. With an enabled realm, you can remove the factors from the authorized users. At the same time, create a mandatory realm for the same protected objects in simulation mode with no authorized users. The regular realm will protect the objects from unauthorized users while the simulation realm will capture all access along with the factor information. The

simulation log can then be mined for each user to come up with the new factors which can then be added to the mandatory realm in simulation mode to make sure it's clean before being migrated to the original regular realm.

- No changes to the application or the infrastructure but changes such as new factors being added or factors being removed take place

When factors are being added, you must clone a second simulation realm from the original, but with the new factors added in. If the simulation logs shows that the usage is clean, then you can safely introduce the new factors into the original realm.

Dropping factors lowers the security profile, so you can simply drop the factor from the rule set. No testing needs to be done.

10.3.9 Use Case: Testing Changes to an Existing Command Rule

In this use case, you test changes to an existing command rule while keeping the original command rule enabled.

Command rules may need to be updated and ideally tested before the changes are enabled in production. For a new command rule that will be added to a set of already existing command rules, put the new command rule into simulation mode when you create it. The other pre-existing command rules are already enabled and offer protection.

If you want to modify an existing command rule, there is no way to maintain the existing protection and test the new modification. Oracle recommends that you create an audit policy to capture what the original command rule was doing and then set an alert for it. The audit will not prevent the SQL as a command rule would do, but at least you can be alerted about the action. Then you can put the new updated command rule into simulation mode and test it.

10.4 Tutorial: Tracking Violations to a Realm Using Simulation Mode

This tutorial shows how to create a realm that uses simulation mode and then test violations to the realm.

- [About This Tutorial](#)
In this tutorial, you will create a realm around the `HR.EMPLOYEES` table and test violations against it.
- [Step 1: Create Users for This Tutorial](#)
You must create three users for this tutorial.
- [Step 2: Create a Realm and an Oracle Database Vault Policy](#)
Next, you create a realm around the `HR.EMPLOYEES` table, and then add this realm to an Oracle Database Vault policy.
- [Step 3: Test the Realm and Policy](#)
User `tjones_dba` will commit a violation on the realm to test the realm and policy.
- [Step 4: Query the DBA_DV_SIMULATION_LOG View for Violations](#)
Now you can check the simulation mode log for the violations that user `tjones_dba` committed.
- [Step 5: Enable and Re-test the Realm](#)
Now that you have captured the violations, user `psmith` can update the `HR.EMPLOYEES_pol` policy.

- **Step 6: Remove the Components for This Tutorial**
You can remove the components that you created for this tutorial if you no longer need them.

10.4.1 About This Tutorial

In this tutorial, you will create a realm around the `HR.EMPLOYEES` table and test violations against it.

The `HR.EMPLOYEES` table contains confidential data such as employee salaries. To test the realm, an administrator, `tjones_dba`, will look up and modify the salary of another employee, `smavris`. The Database Vault administrator, `sec_admin_owen`, will use simulation mode to track the violations to the `HR.EMPLOYEES` table. To accomplish this, user `sec_admin_owen` will create a Database Vault policy, which a delegated administrator, user `psmith`, will own. User `psmith` will then be able to make limited changes to the policy without needing the `DV_OWNER` or `DV_ADMIN` role.

10.4.2 Step 1: Create Users for This Tutorial

You must create three users for this tutorial.

The users are: `psmith`, who is the Database Vault policy owner; `tjones_dba`, who commits violations on the `HR.EMPLOYEES` table; and `smavris`, whose salary is the recipient of `tjones_dba`'s violations.

1. Log in to a PDB as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
sqlplus accts_admin_ace@pdb_name
Enter password: password
```

To find the available PDBs, 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 users and grant them the `CREATE SESSION` privilege.

```
GRANT CREATE SESSION TO psmith IDENTIFIED BY password;
GRANT CREATE SESSION TO tjones_dba IDENTIFIED BY password;
GRANT CREATE SESSION TO smavris IDENTIFIED BY password;
```

Replace `password` with a password that meets the password complexity requirements of the user's profile.

3. Connect as a user who has been granted the `DV_OWNER` role.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

4. Grant user `psmith` the `DV_POLICY_OWNER` role, which enables `psmith` to manage Database Vault policies.

```
GRANT DV_POLICY_OWNER TO psmith;
```

5. Connect as user `SYS` with the `SYSDBA` administrative privilege.

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

6. Grant the `DBA` role to user `tjones_dba`

```
GRANT DBA TO tjones_dba;
```

7. Connect as the HR schema owner.

```
CONNECT HR@pdb_name
Enter password: password
```

8. Grant the SELECT privilege on the HR.EMPLOYEES table to user smavris

```
GRANT SELECT ON HR.EMPLOYEES TO smavris;
```

At this stage, the users have all been created and granted the appropriate privileges.

Related Topics

- *Oracle Database Security Guide*

10.4.3 Step 2: Create a Realm and an Oracle Database Vault Policy

Next, you create a realm around the HR.EMPLOYEES table, and then add this realm to an Oracle Database Vault policy.

1. Connect to the PDB as a user who has been granted the DV_OWNER role.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Create the realm around HR.EMPLOYEES table as follows.

These procedures create the HR.EMPLOYEES_realm realm, add the HR.EMPLOYEES table to this realm, authenticate HR as an owner, authenticate user psmith as a participant, and set the realm in simulation mode.

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name    => 'HR.EMPLOYEES_realm',
    description   => 'Realm to protect HR.EMPLOYEES',
    enabled       => DBMS_MACUTL.G_SIMULATION,
    audit_options => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type    => 0);
END;
/
```

```
BEGIN
  DBMS_MACADM.ADD_OBJECT_TO_REALM(
    realm_name    => 'HR.EMPLOYEES_realm',
    object_owner  => 'HR',
    object_name   => 'EMPLOYEES',
    object_type   => 'TABLE');
END;
/
```

3. Create the HR.EMPLOYEES_pol Database Vault policy and set it to be in simulation mode.

These procedures create the HR.EMPLOYEES_pol policy, add the realm that was just created to the policy, and then add user psmith as the owner of the policy.

```
BEGIN
  DBMS_MACADM.CREATE_POLICY(
    policy_name   => 'HR.EMPLOYEES_pol',
    description   => 'Policy to protect HR.EMPLOYEES',
    policy_state  => DBMS_MACADM.G_SIMULATION);
```



```

END;
/

BEGIN
  DBMS_MACADM.ADD_REALM_TO_POLICY(
    policy_name => 'HR.EMPLOYEES_pol',
    realm_name  => 'HR.EMPLOYEES_realm');
END;
/

BEGIN
  DBMS_MACADM.ADD_OWNER_TO_POLICY(
    policy_name => 'HR.EMPLOYEES_pol',
    owner_name  => 'PSMITH');
END;
/

```

At this point, the realm and policy are ready to be tested.

10.4.4 Step 3: Test the Realm and Policy

User `tjones_dba` will commit a violation on the realm to test the realm and policy.

1. Connect to the PDB as user `tjones_dba`.

```

CONNECT tjones_dba@pdb_name
Enter password: password

```

2. Query the `HR.EMPLOYEES` table for the salary of `smavris`.

```

SELECT SALARY FROM HR.EMPLOYEES WHERE EMAIL = 'SMAVRIS';

```

Output similar to the following should appear:

```

      SALARY
-----
          6500

```

3. Cut `smavris`'s salary in half.

```

UPDATE HR.EMPLOYEES
SET SALARY = SALARY / 2
WHERE EMAIL = 'SMAVRIS';

```

1 row updated.

4. Connect as user `smavris`.

```

CONNECT smavris@pdb_name

```

5. Query the salary of `smavris`.

```

SELECT SALARY FROM HR.EMPLOYEES WHERE EMAIL = 'SMAVRIS';

```

Output similar to the following should appear:

```

      SALARY
-----
          3250

```

At this point, `tjones_dba`'s violations have been recorded in the `DBA_DV_SIMULATION_LOG` data dictionary view.

10.4.5 Step 4: Query the DBA_DV_SIMULATION_LOG View for Violations

Now you can check the simulation mode log for the violations that user `tjones_dba` committed.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` role.
2. Query the `DBA_DV_SIMULATION_LOG` data dictionary view.

```
SELECT USERNAME, COMMAND, SQLTEXT, VIOLATION_TYPE
FROM DBA_DV_SIMULATION_LOG
WHERE REALM_NAME = 'HR.EMPLOYEES_realm';
```

Output similar to the following should appear:

```
USERNAME
-----
COMMAND
-----
SQLTEXT
-----
VIOLATION_TYPE
-----
TJONES_DBA
UPDATE
UPDATE HR.EMPLOYEES SET SALARY = SALARY / 2 WHERE EMAIL = 'SMAVRIS'
Realm Violation

USERNAME
-----
COMMAND
-----
SQLTEXT
-----
VIOLATION_TYPE
-----
TJONES_DBA
SELECT
SELECT SALARY FROM HR.EMPLOYEES WHERE EMAIL = 'SMAVRIS'
Realm Violation
```

The output indicates that user `tjones_dba` has committed two offences: first, `tjones_dba` looked at another employee's salary, and not only that, `tjones_dba` cut it in half. The violation type is a realm violation. The query by `smavris` was not captured because she legitimately can look at `smavris`'d salary.

10.4.6 Step 5: Enable and Re-test the Realm

Now that you have captured the violations, user `psmith` can update the `HR.EMPLOYEES_pol` policy.

This is so that the `HR.EMPLOYEES_realm` realm can be enabled. Then you can test the violations again.

1. Connect to the PDB as user `psmith`.

```
CONNECT psmith@pdb_name
Enter password: password
```

2. Update the policy so that it is enabled.

```
BEGIN
  DBMS_MACADM.UPDATE_POLICY_STATE (
    policy_name => 'HR.EMPLOYEES_pol',
    policy_state => 1);
END;
/
```

3. Connect as user `tjones_dba`.

```
CONNECT tjones_dba@pdb_name
```

4. Try lowering `smavris`'s salary to new depths.

```
UPDATE HR.EMPLOYEES
SET SALARY = SALARY / 2
WHERE EMAIL = 'SMAVRIS';
```

Output similar to the following should appear:

```
ERROR at line 1:
ORA-01031: insufficient privileges
```

The policy, now enabled, enables the realm to protect the `HR.EMPLOYEES` table. `smavris`'s salary can shrink no more.

10.4.7 Step 6: Remove the Components for This Tutorial

You can remove the components that you created for this tutorial if you no longer need them.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` role.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Remove the `HR.EMPLOYEES_pol` Database Vault policy.

```
EXEC DBMS_MACADM.DROP_POLICY('HR.EMPLOYEES_pol');
```

You first must remove the policy before you can drop its contents.

3. Remove the `HR.EMPLOYEES_realm` realm.

```
EXEC DBMS_MACADM.DELETE_REALM('HR.EMPLOYEES_realm');
```

4. Remove the simulation mode log data that was accumulated.

Because the simulation mode log only captured information about user `tjones_dba`, you can remove only the rows that relate to this user.

```
DELETE FROM DVSYS.SIMULATION_LOG$ WHERE USERNAME = 'TJONES_DBA';
```

5. Connect as user `HR`.

```
CONNECT HR@pdb_name
Enter password: password
```

6. Revert `smavris`'s salary back to its pre-violated state.

```
UPDATE HR.EMPLOYEES
SET SALARY = 6500
WHERE EMAIL = 'SMAVRIS';
```

7. Connect as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
CONNECT accts_admin_ace@pdb_name  
Enter password: password
```

8. Remove the users `psmith`, `smavris`, and `tjones_dba`.

```
DROP USER psmith;  
DROP USER smavris;  
DROP USER tjones_dba;
```

11

Integrating Oracle Database Vault with Other Oracle Products

You can integrate Oracle Database Vault with other Oracle products, such as Oracle Enterprise User Security.

- [Integrating Oracle Database Vault with Enterprise User Security](#)
You can integrate Oracle Database Vault with Oracle Enterprise User Security.
- [Integrating Oracle Database Vault with Transparent Data Encryption](#)
Transparent Data Encryption complements Oracle Database Vault in that it provides data protection when the data leaves the secure perimeter of the database.
- [Attaching Factors to an Oracle Virtual Private Database](#)
You can attach factors to an Oracle Virtual Private Database.
- [Integrating Oracle Database Vault with Oracle Label Security](#)
You can integrate Oracle Database Vault with Oracle Label Security, and check the integration with reports and data dictionary views.
- [Integrating Oracle Database Vault with Oracle Data Guard](#)
Oracle Database Vault can protect your Oracle Data Guard environments, providing additional security for your high availability and disaster recovery architecture.
- [Registering Oracle Internet Directory Using Oracle Database Configuration Assistant](#)
You can use Oracle Internet Directory in an Oracle Database Vault-enabled database.
- [Integrating Oracle Database Vault with Oracle APEX](#)
You can integrate Oracle Database Vault with Oracle APEX.

11.1 Integrating Oracle Database Vault with Enterprise User Security

You can integrate Oracle Database Vault with Oracle Enterprise User Security.

- [About Integrating Oracle Database Vault with Enterprise User Security](#)
Enterprise User Security centrally manages database users and authorizations in one place.
- [Configuring an Enterprise User Authorization](#)
To configure an Enterprise User authorization, you must create an Oracle Database Vault rule set to control the user access.
- [Configuring Oracle Database Vault Accounts as Enterprise User Accounts](#)
You can configure existing Oracle Database Vault user accounts as enterprise user accounts in a PDB.

11.1.1 About Integrating Oracle Database Vault with Enterprise User Security

Enterprise User Security centrally manages database users and authorizations in one place.

It is combined with Oracle Identity Management and is available in Oracle Database Enterprise Edition.

In general, to integrate Oracle Database Vault with Oracle Enterprise User Security, you configure the appropriate realms to protect the data that you want to protect in the database.

After you define the Oracle Database Vault realms as needed, you can create a rule set for the Enterprise users to allow or disallow their access.

Related Topics

- *Oracle Database Enterprise User Security Administrator's Guide*

11.1.2 Configuring an Enterprise User Authorization

To configure an Enterprise User authorization, you must create an Oracle Database Vault rule set to control the user access.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Run the `DBMS_MACADM.CREATE_RULE` procedure to create the rule that allows or disallows user access.

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Control User Access',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''AUTHENTICATED_IDENTITY'') =
''USER_DOMAIN_NAME'',
    scope => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

In this specification:

- `rule_name` specifies a rule name. Enter any valid name that is appropriate for your needs.
- `rule_expr` must use the rule expression given in this example. Replace `'user_domain_name'` with the domain. For example:

```
'SYS_CONTEXT(''USERENV'', ''AUTHENTICATED_IDENTITY'') =
'myserver.us.example.com''
```
- `scope` must be `DBMS_MACUTL.G_SCOPE_LOCAL`.

3. Run the `DBMS_MACADM.CREATE_RULE_SET` procedure to create a rule set to be used for the rule.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_RULE_SET(
    rule_set_name => 'EM User Authorization',
    description => 'Allows or disallows user access to EM',
    enabled => DBMS_MACUTL.G_YES,
    eval_options => DBMS_MACUTL.G_RULESET_EVAL_ANY,
    audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
    fail_options => DBMS_MACUTL.G_RULESET_FAIL_SILENT,
    fail_message => null,
    fail_code => null,
    handler_options => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
    handler => ' ',
    is_static => TRUE);
```

```
END;
/
```

4. Run the `DBMS_MACADM.ADD_RULE_TO_RULE_SET` procedure to add the rule to the rule set.

For example:

```
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'EM User Authorization',
    rule_name     => 'Control User Access',
    rule_order   => 1);
END;
/
```

5. Run the `DBMS_MACADM.ADD_AUTH_TO_REALM` procedure to add the rule set to the realm authorization for the data that you want to protect.

For example, for a realm called HR Realm:

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name   => 'HR Realm',
    grantee     => 'PFITCH',
    rule_set_name => 'EM User Authorization',
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER,
    auth_scope  => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

11.1.3 Configuring Oracle Database Vault Accounts as Enterprise User Accounts

You can configure existing Oracle Database Vault user accounts as enterprise user accounts in a PDB.

1. Log in to the PDB as a user who has been granted the `CREATE ROLE` system privilege.

For example:

```
sqlplus sec_admin@pdb_name
Enter password: password
```

To find the available PDBs, 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 a global role for the `DV_OWNER` role and a global role for the `DV_ACCTMGR` role.

For example:

```
CREATE ROLE g_dv_owner IDENTIFIED GLOBALLY;
CREATE ROLE g_dv_acctmgr IDENTIFIED GLOBALLY;
```

3. Connect as a user who has been granted the `DV_OWNER` role.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

4. Grant the `DV_OWNER` role to the global `DV_OWNER` role.

```
GRANT DV_OWNER TO g_dv_owner;
```

5. Connect as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
CONNECT dbv_acctmgr@pdb_name
Enter password: password
```

6. Grant the DV_ACCTMGR role to the global DV_ACCTMGR role.

```
GRANT DV_ACCTMGR TO g_dv_acctmgr;
```

7. Connect as user SYS with the SYSDBA administrative privilege.

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

8. Temporarily grant the DV_ACCTMGR user who will import the Database Vault users into OID the CREATE TABLE privilege and the SELECT_CATALOG_ROLE role.

```
GRANT CREATE TABLE, SELECT_CATALOG_ROLE TO dbv_acctmgr;
```

9. From the command line, run the User Migration Utility (UMU) to import the Database Vault accounts into Oracle Internet Directory (OID).

The following example imports the Database Vault accounts `sec_admin_owen` and `accts_admin_ace` into OID. The DV_ACCTMGR user is specified for the DBADMIN setting.

```
$ORACLE_HOME/rdbms/bin/umu PHASE=ONE
DBADMIN=dbv_acctmgr:password
ENTADMIN=cn=jane_ent_admin,dc=example,dc=com:password
USERS= LIST
DBLOCATION=example.com:7777:orcl
DIRLOCATION=example.com:636
USERSLIST=sec_admin_owen:accts_admin_ace
MAPSCHEMA=PRIVATE
CONTEXT=CONTEXT="c=Users, c=us"
KREALM=EXAMPLE.COM
```

```
$ORACLE_HOME/rdbms/bin/umu PHASE=TWO
DBADMIN=dbv_acctmgr:password
ENTADMIN=cn=jane_ent_admin,dc=example,dc=com:password
DBLOCATION=example.com:7777:orcl
DIRLOCATION=example.com:636
```

By default, errors are written to the `$ORACLE_HOME/network/log/umu.log` file.

Enterprise User Security (EUS) User Migration Utility (UMU) is deprecated in Oracle Database 21c. Use EUS Manager (EUSM) features instead.

10. From the Oracle Internet Directory Self Service Console (<http://hostname:port/oiddas/>), grant the global DV_OWNER and DV_ACCTMGR roles (for example, `g_dv_owner` and `g_dv_acctmgr`) to the enterprise user Database Vault accounts.

See the example of creating enterprise users in *Oracle Database Enterprise User Security Administrator's Guide* for a demonstration of creating an enterprise role from a global role and then granting this role to a user.

11. From SQL*Plus, as user SYS with the SYSDBA administrative privilege, revoke the CREATE TABLE and SELECT_CATALOG_ROLE role from the DV_ACCTMGR user.

```
REVOKE CREATE TABLE, SELECT_CATALOG_ROLE FROM dbv_acctmgr;
```

Related Topics

- *Oracle Database Enterprise User Security Administrator's Guide*

11.2 Integrating Oracle Database Vault with Transparent Data Encryption

Transparent Data Encryption complements Oracle Database Vault in that it provides data protection when the data leaves the secure perimeter of the database.

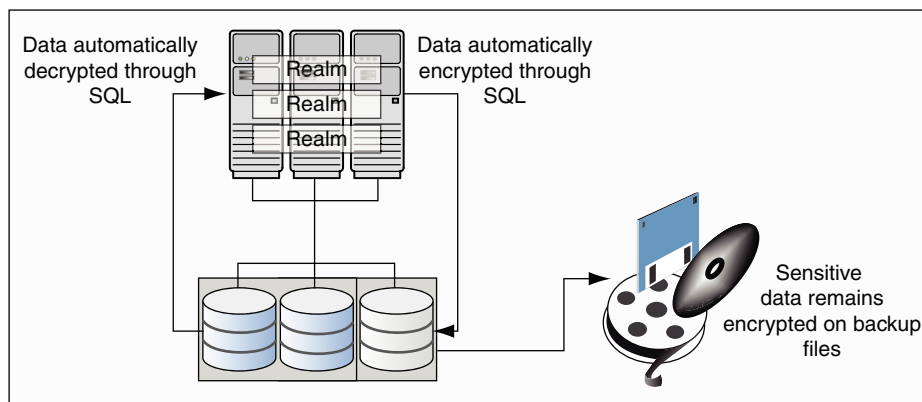
With Transparent Data Encryption, a database administrator or database security administrator can simply encrypt columns with sensitive content in application tables, or encrypt entire application tablespaces, without any modification to the application.

If a user passes the authentication and authorization checks, Transparent Data Encryption automatically encrypts and decrypts information for the user. This way, you can implement encryption without having to change your applications.

Once you have granted the Transparent Data Encryption user the appropriate privileges, then Transparent Data Encryption can be managed as usual and be used complimentary to Database Vault.

Figure 11-1 shows how Oracle Database Vault realms handle encrypted data.

Figure 11-1 Encrypted Data and Oracle Database Vault



Related Topics

- *Oracle Database Advanced Security Guide*

11.3 Attaching Factors to an Oracle Virtual Private Database

You can attach factors to an Oracle Virtual Private Database.

1. Define a Virtual Private Database policy predicate that is a PL/SQL function or expression.
2. For each function or expression, use the `DVF.F$` PL/SQL function that is created for each factor.

Related Topics

- *Oracle Database Security Guide*

11.4 Integrating Oracle Database Vault with Oracle Label Security

You can integrate Oracle Database Vault with Oracle Label Security, and check the integration with reports and data dictionary views.

- [How Oracle Database Vault Is Integrated with Oracle Label Security](#)
An Oracle Database Vault-Oracle Label Security integration enables you to assign an OLS label to a Database Vault factor identity.
- [Requirements for Using Oracle Database Vault with Oracle Label Security](#)
You must fulfill specific requirements in place before you use Oracle Database Vault with Oracle Label Security.
- [Using Oracle Database Vault Factors with Oracle Label Security Policies](#)
To enhance security, you can integrate Oracle Database Vault factors with Oracle Label Security policies.
- [Tutorial: Integrating Oracle Database Vault with Oracle Label Security](#)
An Oracle Database Vault-Oracle Label Security integration can grant different levels of access to two administrative users who have the same privileges.
- [Related Reports and Data Dictionary Views](#)
Oracle Database Vault provides reports and data dictionary views that list information about the Oracle Database Vault-Oracle Label Security integration.

11.4.1 How Oracle Database Vault Is Integrated with Oracle Label Security

An Oracle Database Vault-Oracle Label Security integration enables you to assign an OLS label to a Database Vault factor identity.

In Oracle Label Security, you can restrict access to rows in database tables or PL/SQL programs. For example, Mary may be able to see data protected by the `HIGHLY SENSITIVE` label, an Oracle Label Security label on the `EMPLOYEE` table that includes records that should have access limited to certain managers. Another label can be `PUBLIC`, which allows more open access to this data.

In Oracle Database Vault, you can create a factor called `Network`, for the network on which the database session originates, with the following identities:

- **Intranet:** Used for when an employee is working on site within the intranet for your company.
- **Remote:** Used for when the employee is working at home from a VPN connection.

You then assign a maximum session label to both. For example:

- Assign the Intranet identity to the `HIGHLY SENSITIVE` Oracle Label Security label.
- Assign the Remote identity to the `PUBLIC` label.

This means that when Mary is working at home using their VPN connection, she have access only to the limited table data protected under the `PUBLIC` identity. But when she is in the office, she has access to the `HIGHLY SENSITIVE` data, because she is using the Intranet identity.

In a traditional auditing environment, you can audit the integration with Oracle Label Security by using the Label Security Integration Audit Report. Oracle Database Vault writes the audit trail to the `DVSYS.AUDIT_TRAIL$` table. If unified auditing is enabled, then you can create audit

policies to capture this information. Be aware that as of Oracle Database release 21c, traditional auditing is deprecated.

Related Topics

- [Tutorial: Integrating Oracle Database Vault with Oracle Label Security](#)
An Oracle Database Vault-Oracle Label Security integration can grant different levels of access to two administrative users who have the same privileges.
- [Oracle Database Vault Oracle Label Security APIs](#)
You can use the `DBMS_MACADM` PL/SQL package to manage Oracle Label Security labels and policies in Oracle Database Vault.
- *Oracle Label Security Administrator's Guide*

11.4.2 Requirements for Using Oracle Database Vault with Oracle Label Security

You must fulfill specific requirements in place before you use Oracle Database Vault with Oracle Label Security.

- Oracle Label Security is licensed separately. Ensure that you have purchased a license to use it.
- Before you install Oracle Database Vault, you must have already installed Oracle Label Security.
- The installation process for Oracle Label Security creates the `LBACSYS` user account. As a user who has been granted the `DV_ACCTMGR` role, unlock this account and grant it a new password. For example:

```
sqlplus accts_admin_ace@pdb_name
Enter password: password
```

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

- If you plan to use the `LBACSYS` user account in Oracle Enterprise Manager, then log in to Enterprise Manager as user `SYS` with the `SYSDBA` administrative privilege, and grant this user the `SELECT ANY DICTIONARY` and `SELECT_CATALOG_ROLE` system privileges.
- Ensure that you have the appropriate Oracle Label Security policies defined.
- If you plan to integrate an Oracle Label Security policy with a Database Vault policy, then ensure that the policy name for Oracle Label Security is less than 24 characters. You can check the names of Oracle Label Security policies by querying the `POLICY_NAME` column of the `ALL_SA_POLICIES` data dictionary view.

11.4.3 Using Oracle Database Vault Factors with Oracle Label Security Policies

To enhance security, you can integrate Oracle Database Vault factors with Oracle Label Security policies.

- [About Using Oracle Database Vault Factors with Oracle Label Security Policies](#)
And Oracle Database Vault-Oracle Label Security integration enables you to control the maximum security clearance for a database session.

- [Configuring Factors to Work with an Oracle Label Security Policy](#)
You can define factors that contribute to the maximum allowable data label of an Oracle Label Security policy.

11.4.3.1 About Using Oracle Database Vault Factors with Oracle Label Security Policies

And Oracle Database Vault-Oracle Label Security integration enables you to control the maximum security clearance for a database session.

Oracle Database Vault controls the maximum security clearance for a database session by merging the maximum allowable data for each label in a database session by merging the labels of Oracle Database Vault factors that are associated to an Oracle Label Security policy.

In brief, a label acts as an identifier for the access privileges of a database table row. A policy is a name associated with the labels, rules, and authorizations that govern access to table rows.

Related Topics

- [Oracle Label Security Administrator's Guide](#)

11.4.3.2 Configuring Factors to Work with an Oracle Label Security Policy

You can define factors that contribute to the maximum allowable data label of an Oracle Label Security policy.

1. Connect to the PDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Make the user `LBACSYS` account an owner of the realm that contains the schema to which a label security policy has been applied.

This enables the `LBACSYS` account to have access to all the protected data in the realm, so that it can properly classify the data.

For example, to make `LBACSYS` the owner of a realm called `HR Realm`:

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name => 'HR Realm',
    grantee    => 'LBACSYS',
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/
```

3. Authorize the schema owner (on which the label security policy has been applied) as either a realm participant or a realm owner.

For example:

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name => 'HR Realm',
    grantee    => 'HR',
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/
```

4. Configure a label security policy for the realm.

Optionally set the label-merging algorithm for cases when Oracle Label Security has merged two labels. In most cases, you may want to configure the label security policy to use LII (Minimum Level/Intersection/Intersection). This setting is the most commonly used method that Oracle Label Security administrators use when they want to merge two labels. This setting provides optimum flexibility when your applications must determine the resulting label that is required when combining two data sets that have different labels. It is also necessary for situations in which you must perform queries using joins on rows with different data labels.

- To create a new label security policy, run the `DBMS_MACADM.CREATE_MAC_POLICY` procedure. For example:

```
BEGIN
  DBMS_MACADM.CREATE_MAC_POLICY(
    policy_name => 'Access Locations',
    algorithm   => 'LII');
END;
/
```

- To modify an existing label security policy, run the `DBMS_MACADM.UPDATE_MAC_POLICY` procedure.

5. Run the `DBMS_MACADM.ADD_POLICY_FACTOR` factor to associate a factor with the label security policy.

For example:

```
BEGIN
  DBMS_MACADM.ADD_POLICY_FACTOR(
    policy_name => 'Access Locations',
    factor_name => 'Sector2_DB');
END;
/
```

6. Run the `DBMS_MACADM.CREATE_IDENTITY` procedure to create a factor identity.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_IDENTITY(
    factor_name => 'Sector2_DB',
    value       => 'intranet',
    trust_level => 5);
END;
/
```

7. Label the factor identities using the labels for the policy.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_POLICY_LABEL(
    identity_factor_name => 'Sector2_DB',
    identity_factor_value => 'intranet',
    policy_name          => 'Access Locations',
    label                => 'sensitive');
END;
/
```

**Note:**

If you do not associate an Oracle Label Security policy with factors, then Oracle Database Vault maintains the default Oracle Label Security behavior for the policy.

Related Topics

- [ADD_AUTH_TO_REALM Procedure](#)
The `ADD_AUTH_TO_REALM` procedure authorizes a user or role to access a realm as an owner or a participant. You can authenticate both common and local realms.
- [Oracle Database Vault Oracle Label Security APIs](#)
You can use the `DBMS_MACADM` PL/SQL package to manage Oracle Label Security labels and policies in Oracle Database Vault.
- [Oracle Database Vault Factor APIs](#)
The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

11.4.4 Tutorial: Integrating Oracle Database Vault with Oracle Label Security

An Oracle Database Vault-Oracle Label Security integration can grant different levels of access to two administrative users who have the same privileges.

- [About This Tutorial](#)
You can use Oracle Database Vault factors with Oracle Label Security and Oracle Virtual Private Database (VPD) to restrict sensitive data access.
- [Step 1: Create Users for This Tutorial](#)
You must create two administrative users for this tutorial.
- [Step 2: Create the Oracle Label Security Policy](#)
Next, you can create the Oracle Label Security policy and grant users the appropriate privileges for it.
- [Step 3: Create Oracle Database Vault Rules to Control the OLS Authorization](#)
After you create the Oracle Label Security policy, you can create Database Vault rules to work with it.
- [Step 4: Update the ALTER SYSTEM Command Rule to Use the Rule Set](#)
Before the rule set can be used, you must update the ALTER SYSTEM command rule, which is a default command rule.
- [Step 5: Test the Authorizations](#)
With all the components in place, you are ready to test the authorization.
- [Step 6: Remove the Components for This Tutorial](#)
You can remove the components that you created for this tutorial if you no longer need them.

11.4.4.1 About This Tutorial

You can use Oracle Database Vault factors with Oracle Label Security and Oracle Virtual Private Database (VPD) to restrict sensitive data access.

You can restrict this data so that it is only exposed to a database session when the correct combination of factors exists, defined by the security administrator, for any given database session.

11.4.4.2 Step 1: Create Users for This Tutorial

You must create two administrative users for this tutorial.

1. Log in to a PDB as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
sqlplus accts_admin_ace@pdb_name
Enter password: password
```

To find the available PDBs, 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 local users:

```
GRANT CREATE SESSION TO mdale IDENTIFIED BY password CONTAINER = CURRENT;
GRANT CREATE SESSION TO jsmith IDENTIFIED BY password CONTAINER = CURRENT;
```

Replace `password` with a password that meets the password complexity requirements of the user's profile.

3. Connect as a user who can grant system privileges and who has been granted the owner authorization for the Oracle System Privilege and Role Management realm, and then grant administrative privileges to users `mdale` and `jsmith`.

```
CONNECT dba_psmith@pdb_name
Enter password: password
```

```
GRANT DBA TO mdale, jsmith;
```

At this stage, users `mdale` and `jsmith` have identical administrative privileges.

Related Topics

- [Oracle Database Security Guide](#)

11.4.4.3 Step 2: Create the Oracle Label Security Policy

Next, you can create the Oracle Label Security policy and grant users the appropriate privileges for it.

1. In SQL*Plus, connect to the PDB as the Oracle Label Security administrator, `LBACSYS`.

```
CONNECT LBACSYS@pdb_name
Enter password: password
```

If user `LBACSYS` is locked and expired, connect as the Database Vault Account Manager, unlock and unexpire the `LBACSYS` account, and then log back in as `LBACSYS`.

For example:

```
CONNECT accts_admin_ace@pdb_name
Enter password: password
```

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

```
CONNECT LBACSYS
Enter password: password
```

2. Create a new Oracle Label Security policy:

```
EXEC SA_SYSDBA.CREATE_POLICY('PRIVACY', 'PRIVACY_COLUMN', 'NO_CONTROL');
```

3. Create the following levels for the PRIVACY policy:

```
EXEC SA_COMPONENTS.CREATE_LEVEL('PRIVACY',2000,'S','SENSITIVE');
EXEC SA_COMPONENTS.CREATE_LEVEL('PRIVACY',1000,'C','CONFIDENTIAL');
```

4. Create the PII compartment.

```
EXEC SA_COMPONENTS.CREATE_COMPARTMENT('PRIVACY',100,'PII','PERS_INFO');
```

5. Grant users mdale and jsmith the following labels:

```
EXEC SA_USER_ADMIN.SET_USER_LABELS('PRIVACY','mdale','S:PII');
EXEC SA_USER_ADMIN.SET_USER_LABELS('PRIVACY','jsmith','C');
```

User `mdale` is granted the more sensitive label, Sensitive, which includes the PII compartment. User `jsmith` gets the Confidential label, which is less sensitive.

11.4.4.4 Step 3: Create Oracle Database Vault Rules to Control the OLS Authorization

After you create the Oracle Label Security policy, you can create Database Vault rules to work with it.

1. Connect to the PDB as the Database Vault Owner.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

2. Create the following rule set:

```
EXEC DBMS_MACADM.CREATE_RULE_SET('PII Rule Set', 'Protect PII data from privileged users', 'Y', 1, 0, 2, NULL, NULL, 0, NULL);
```

3. Create a rule for the PII Rule Set.

```
EXEC DBMS_MACADM.CREATE_RULE('Check OLS Factor',
'dominates(sa_utl.numeric_label('PRIVACY'), char_to_label('PRIVACY','S:PII'))
= '1');
```

Ensure that you use single quotes, as shown in this example, and not double quotes.

4. Add the Check OLS Factor rule to the PII Rule Set.

```
EXEC DBMS_MACADM.ADD_RULE_TO_RULE_SET('PII Rule Set', 'Check OLS Factor');
```

11.4.4.5 Step 4: Update the ALTER SYSTEM Command Rule to Use the Rule Set

Before the rule set can be used, you must update the ALTER SYSTEM command rule, which is a default command rule.

1. As the Database Vault Owner, check the current value of the ALTER SYSTEM command rule, which is one of the default command rules when you install Oracle Database Vault.

```
SELECT * FROM DBA_DV_COMMAND_RULE WHERE COMMAND = 'ALTER SYSTEM';
```

2. Make a note of these settings so that you can revert them to their original values later on.

In a default installation, the ALTER SYSTEM command rule uses the Allow Fine Grained Control of System Parameters rule set, and is enabled.

3. Update the ALTER SYSTEM command rule to be associated with the PII Rule Set.

```
EXEC DBMS_MACADM.UPDATE_COMMAND_RULE('ALTER SYSTEM', 'PII Rule Set', '%', '%', 'Y');
```


This command adds the PII Rule Set to the ALTER SYSTEM command rule, applies it to all object owners and object names, and enables the command rule.

11.4.4.6 Step 5: Test the Authorizations

With all the components in place, you are ready to test the authorization.

1. In SQL*Plus, log in to the PDB as user `mdale`.

```
CONNECT mdale@pdb_name
Enter password: password
```

2. Check the current setting for the `AUDIT_TRAIL` initialization parameter.

```
SHOW PARAMETER AUDIT_TRAIL
```

| NAME | TYPE | VALUE |
|-------------|--------|-------|
| audit_trail | string | DB |

Make a note of this setting, so that you can revert it to its original setting later on.

3. As user `mdale`, use the `ALTER SYSTEM` statement to modify the `CPU_COUNT` parameter.

```
ALTER SYSTEM SET CPU_COUNT = 4;
System altered.
```

Because user `mdale` was assigned the Sensitive label with the PII compartment, he can use the `ALTER SYSTEM` statement to modify the `CPU_COUNT` system parameter.

4. Set the `CPU_COUNT` parameter back to its original value.

For example:

```
ALTER SYSTEM SET CPU_COUNT = 2;
```

5. Log in as user `jsmith` and then issue the same `ALTER SYSTEM` statement:

```
CONNECT jsmith@pdb_name
Enter password: password
```

```
ALTER SYSTEM SET CPU_COUNT = 14;
```

The following output should appear:

```
ERROR at line 1:
ORA-01031: insufficient privileges
```

Because user `jsmith` was assigned only the Confidential label, he cannot perform the `ALTER SYSTEM` statement.

11.4.4.7 Step 6: Remove the Components for This Tutorial

You can remove the components that you created for this tutorial if you no longer need them.

1. Connect to the PDB as the Oracle Label Security administrator and remove the label policy and its components.

```
CONNECT LBACSYS@pdb_name
Enter password: password
```

```
EXEC SA_SYSDBA.DROP_POLICY('PRIVACY', TRUE);
```

2. Connect as the Oracle Database Vault Owner and issue the following commands in the order shown, to set the ALTER SYSTEM command rule back to its previous setting and remove the rule set.

For example:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password

EXEC DBMS_MACADM.UPDATE_COMMAND_RULE('ALTER SYSTEM', 'Allow System Parameters','%','%', 'Y');
EXEC DBMS_MACADM.DELETE_RULE_FROM_RULE_SET('PII Rule Set', 'Check OLS Factor');
EXEC DBMS_MACADM.DELETE_RULE('Check OLS Factor');
EXEC DBMS_MACADM.DELETE_RULE_SET('PII Rule Set');
COMMIT;
```

3. Connect as the Database Vault Account Manager and remove users mdale and jsmith.

```
CONNECT accts_admin_ace@pdb_name
Enter password: password

DROP USER mdale;
DROP USER jsmith;
```

11.4.5 Related Reports and Data Dictionary Views

Oracle Database Vault provides reports and data dictionary views that list information about the Oracle Database Vault-Oracle Label Security integration.

[Table 11-1](#) lists the Oracle Database Vault reports.

Table 11-1 Reports Related to Database Vault and Oracle Label Security Integration

| Report | Description |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Factor Configuration Issues Report | Lists factors in which the Oracle Label Security policy does not exist. |
| Identity Configuration Issues Report | Lists invalid label identities (the Oracle Label Security label for this identity has been removed and no longer exists). |
| Security Policy Exemption Report | Lists accounts and roles that have the <code>EXEMPT ACCESS POLICY</code> system privilege granted to them. Accounts that have this privilege can bypass all Virtual Private Database policy filters and any Oracle Label Security policies that use Oracle Virtual Private Database indirectly. |

[Table 11-2](#) lists data dictionary views that provide information about existing Oracle Label Security policies used with Oracle Database Vault.

Table 11-2 Data Dictionary Views Used for Oracle Label Security

| Data Dictionary View | Description |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <code>DBA_DV_MAC_POLICY</code> | Lists the Oracle Label Security policies defined |
| <code>DBA_DV_MAC_POLICY</code> | Lists the factors that are associated with Oracle Label Security policies |
| <code>DBA_DV_POLICY_LABEL</code> | Lists the Oracle Label Security label for each factor identifier in the <code>DBA_DV_IDENTITY</code> view for each policy |

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.
- [Oracle Database Vault Data Dictionary Views](#)
You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

11.5 Integrating Oracle Database Vault with Oracle Data Guard

Oracle Database Vault can protect your Oracle Data Guard environments, providing additional security for your high availability and disaster recovery architecture.

- [Step 1: Configure the Primary Database](#)
An Oracle Database Vault-Oracle Data Guard integration requires first, the primary database configuration, then the standby database configuration.
- [Step 2: Configure the Standby Database](#)
You can perform the standby database configuration within the database to be used for the standby database.
- [How Auditing Works After an Oracle Database Vault-Oracle Active Data Guard Integration](#)
After you have integrated Oracle Database Vault with Oracle Active Data Guard, how auditing is configured affects how audit records are generated.
- [Disabling Oracle Database Vault in an Oracle Data Guard Environment](#)
If you want to disable Oracle Database Vault in an Oracle Data Guard environment, you must perform the procedures first on the primary database, and then on the standby database.

11.5.1 Step 1: Configure the Primary Database

An Oracle Database Vault-Oracle Data Guard integration requires first, the primary database configuration, then the standby database configuration.

1. For Linux and UNIX systems, ensure there is an `/etc/oratab` entry for the database on the node in which you are installing Oracle Database Vault.
2. If you are using Data Guard Broker, then from the command prompt, disable the configuration as follows:

```
dgmgrl sys
Enter password: password

DGMGRL> disable configuration;
```

3. Configure and enable Oracle Database Vault on the primary server.

By default, Oracle Database Vault is installed as part of Oracle Database. You can check the registration status by querying the `DBA_DV_STATUS` data dictionary view.

4. Log in to the PDB as user `SYS` with the `SYSDBA` administrative privilege.
5. Run the following `ALTER SYSTEM` statements:

```
ALTER SYSTEM SET AUDIT_SYS_OPERATIONS=TRUE SCOPE=SPFILE;
ALTER SYSTEM SET OS_ROLES=FALSE SCOPE=SPFILE;
ALTER SYSTEM SET RECYCLEBIN='OFF' SCOPE=SPFILE;
ALTER SYSTEM SET REMOTE_LOGIN_PASSWORDFILE='EXCLUSIVE' SCOPE=SPFILE;
```

```
ALTER SYSTEM SET SQL92_SECURITY=TRUE SCOPE=SPFILE;
ALTER SYSTEM SET REMOTE_OS_ROLES=FALSE SCOPE=SPFILE;
```

6. Run the `ALTER SYSTEM` statement on each database instance to set the parameters as shown in Step 5.
7. As user `SYS` with the `SYSDBA` administrative privilege, close and then reopen each PDB.

```
ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;
ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

Related Topics

- [Getting Started with Oracle Database Vault](#)
Before you can start using Oracle Database Vault, you must configure and enable it with the Oracle database.

11.5.2 Step 2: Configure the Standby Database

You can perform the standby database configuration within the database to be used for the standby database.

1. Log into the database instance as user `SYS` with the `SYSDBA` administrative privilege.

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

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. Mount a standby database instance.

```
ALTER DATABASE MOUNT STANDBY DATABASE;
```

3. Run the following `ALTER SYSTEM` statements:

```
ALTER SYSTEM SET AUDIT_SYS_OPERATIONS=TRUE SCOPE=SPFILE;
ALTER SYSTEM SET OS_ROLES=FALSE SCOPE=SPFILE;
ALTER SYSTEM SET RECYCLEBIN='OFF' SCOPE=SPFILE;
ALTER SYSTEM SET REMOTE_LOGIN_PASSWORDFILE='EXCLUSIVE' SCOPE=SPFILE;
ALTER SYSTEM SET SQL92_SECURITY=TRUE SCOPE=SPFILE;
ALTER SYSTEM SET REMOTE_OS_ROLES=FALSE SCOPE=SPFILE;
```

4. Close and then reopen the PDB.

For example:

```
ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;
ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

5. Mount the next standby instance.
6. Restart the managed recovery as follows:

```
ALTER DATABASE RECOVER MANAGED STANDBY DATABASE;
```

7. If you are using Data Guard Broker, then from the command line, re-enable the configuration.

```
dgmgrl sys
Enter password: password

DGMGRL> enable configuration;
```

This command applies the changes to the physical standby database made by the Oracle Database Vault installation on the primary database.

8. Repeat the physical standby installation process on each physical standby database. For example, if there are three physical standby databases, then run these procedures on each standby database.

11.5.3 How Auditing Works After an Oracle Database Vault-Oracle Active Data Guard Integration

After you have integrated Oracle Database Vault with Oracle Active Data Guard, how auditing is configured affects how audit records are generated.

If you want to use the Active Data Guard physical standby database for read-only queries, then you must use pure unified auditing, not mixed mode. If mixed mode is used, then any query in the Active Data Guard physical standby that generates Oracle Database Vault audit records will be blocked. Oracle Database Vault cannot write to the traditional Database Vault audit table (`DVSYSAUDIT_TRAILS$`). Unified auditing will ensure that the Database Vault audit data is written into the operating system log files in an Oracle Active Data Guard physical standby database. You can move the data in these log files to the unified audit trail. Remember that to audit Database Vault activities, you must create unified audit policies, because the Database Vault traditional audit settings do not apply to unified auditing.

11.5.4 Disabling Oracle Database Vault in an Oracle Data Guard Environment

If you want to disable Oracle Database Vault in an Oracle Data Guard environment, you must perform the procedures first on the primary database, and then on the standby database.

Perform the disablement of Oracle Database Vault on the primary and standby databases in the following order:

1. Disable Oracle Database Vault on the primary database.
2. Disable Oracle Database Vault on the secondary database.
3. Restart the primary database.
4. Restart each standby database.

Related Topics

- [Step 1: Disable Oracle Database Vault](#)
Be aware that after you disable Oracle Database Vault, Oracle Label Security, which is required to run Database Vault, is still enabled.

11.6 Registering Oracle Internet Directory Using Oracle Database Configuration Assistant

You can use Oracle Internet Directory in an Oracle Database Vault-enabled database.

However, if you want to register Oracle Internet Directory (OID) using Oracle Database Configuration Assistant (DBCA), then you must first disable Oracle Database Vault.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

11.7 Integrating Oracle Database Vault with Oracle APEX

You can integrate Oracle Database Vault with Oracle APEX.

- [About Integrating Oracle Database Vault with Oracle APEX](#)
Oracle APEX is Oracle's primary tool for developing Web applications with SQL and PL/SQL.
- [Installing or Upgrading Oracle APEX with Oracle Database Vault Enabled](#)
When Oracle Database Vault is enabled, additional privileges are required to install or upgrade Oracle APEX.
- [Authorizing the Oracle APEX Schema for Oracle Database Vault Activities](#)
You must add the Oracle APEX schema (for example, `APEX_SCHEMA`) to Oracle Database Vault realms and authorizations that are required by Oracle APEX.
- [Authorizing Oracle APEX to Use Oracle Scheduler](#)
Oracle APEX uses Oracle Scheduler and must be authorized to continue to do so.
- [Authorizing Oracle APEX to Perform DDL Tasks](#)
You must authorize the Oracle APEX schema to use its DDL privileges on objects that it has access to but may be subject to additional Oracle Database Vault controls
- [Authorizing Oracle APEX to Perform Information Lifecycle Maintenance Tasks](#)
You must authorize the Oracle APEX schema to perform maintenance tasks.
- [Authorizing Oracle APEX to Proxy Users for Oracle Rest Data Services](#)
If you use Oracle Rest Data Services (ORDS), then you must authorize proxy users.
- [Oracle APEX and Application Objects Protected by Oracle Database Vault](#)
Objects that are protected by Oracle Database Vault realms and command rules are still protected after you have integrated Oracle APEX.
- [Troubleshooting the Oracle APEX and Database Vault Integration](#)
If you have problems with the integration of Oracle APEX and Database Vault, then you can diagnose these problems using tracing and Oracle Database Vault simulation mode.

11.7.1 About Integrating Oracle Database Vault with Oracle APEX

Oracle APEX is Oracle's primary tool for developing Web applications with SQL and PL/SQL.

You can enable Oracle Database Vault to protect the applications that are developed on Oracle APEX. To use Oracle APEX in an Oracle Database Vault-enabled database, you must install Oracle APEX on the Oracle Database Vault-enabled server, and then perform the necessary authorizations in the appropriate pluggable databases (PDBs).

11.7.2 Installing or Upgrading Oracle APEX with Oracle Database Vault Enabled

When Oracle Database Vault is enabled, additional privileges are required to install or upgrade Oracle APEX.

1. Log in to the root of the Oracle Database Vault-enabled database as a user with the `DV_OWNER` role.

2. Grant the `DV_PATCH_ADMIN` role to `SYS` in all pluggable databases (PDBs).

```
GRANT DV_PATCH_ADMIN TO SYS CONTAINER=ALL;
```

3. Complete the installation of Oracle APEX as directed by *Oracle APEX Installation Guide*.
If this installation includes Oracle Rest Data Services (ORDS), then see [Authorizing Oracle APEX to Proxy Users for Oracle Rest Data Services](#).
4. As a user with the `DV_OWNER` role, in the container database revoke the `DV_PATCH_ADMIN` role from `SYS` from all PDBs.

```
REVOKE DV_PATCH_ADMIN FROM SYS CONTAINER=ALL;
```

11.7.3 Authorizing the Oracle APEX Schema for Oracle Database Vault Activities

You must add the Oracle APEX schema (for example, `APEX_SCHEMA`) to Oracle Database Vault realms and authorizations that are required by Oracle APEX.

1. Connect to the pluggable database (PDB) of the Oracle Database Vault-enabled database as a user with the `DV_OWNER` role.
2. Authorize the Oracle APEX schema for the following realms, policies, and rules.

For example, for an Oracle APEX schema called `APEX_SCHEMA`:

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    REALM_NAME      => 'Oracle Default Schema Protection Realm',
    GRANTEE         => 'APEX_SCHEMA',
    RULE_SET_NAME   => NULL,
    AUTH_OPTIONS    => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/
```

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    REALM_NAME      => 'Oracle System Privilege and Role Management Realm',
    GRANTEE         => 'APEX_SCHEMA',
    RULE_SET_NAME   => NULL,
    AUTH_OPTIONS    => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/
```

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    REALM_NAME      => 'Oracle Default Component Protection Realm',
    GRANTEE         => 'APEX_SCHEMA',
    RULE_SET_NAME   => NULL,
    AUTH_OPTIONS    => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/
```

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
```

```

REALM_NAME      => 'Database Vault Account Management',
GRANTEE         => 'APEX_SCHEMA',
RULE_SET_NAME   => NULL,
AUTH_OPTIONS    => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/

EXEC DBMS_MACADM.UPDATE_POLICY_STATE('Oracle Account Management
Controls',DBMS_MACADM.G_PARTIAL);
BEGIN
  DBMS_MACADM.UPDATE_RULE('Is User Manager'
, 'DVSYS.DBMS_MACUTL.USER_HAS_ROLE_VARCHAR(''DV_ACCTMGR'',SYS_CONTEXT(''user
env'', 'current_user')) = ''Y''');
END;
/

BEGIN
  DBMS_MACADM.UPDATE_RULE('Is Alter DVSYS Allowed'
, 'DVSYS.DBMS_MACADM.IS_ALTER_USER_ALLOW_VARCHAR(SYS_CONTEXT(''userenv'', 'c
urrent_user')) = ''Y''');
END;
/

```

11.7.4 Authorizing Oracle APEX to Use Oracle Scheduler

Oracle APEX uses Oracle Scheduler and must be authorized to continue to do so.

1. Connect the pluggable database (PDB) of the Oracle Database Vault-enabled database as a user with the `DV_OWNER` role.
2. Authorize the `SYS` user to use its scheduler privileges on the Oracle APEX schema.

For example, for an Oracle APEX schema named `APEX_SCHEMA`:

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('SYS', 'APEX_SCHEMA');
```

3. Authorize the Oracle APEX user to use its job scheduler privileges.

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('APEX_SCHEMA', '%');
```

Related Topics

- [Using Oracle Scheduler with Oracle Database Vault](#)
Users who are responsible for scheduling database jobs must have Oracle Database Vault-specific authorization.

11.7.5 Authorizing Oracle APEX to Perform DDL Tasks

You must authorize the Oracle APEX schema to use its DDL privileges on objects that it has access to but may be subject to additional Oracle Database Vault controls

1. Connect the pluggable database (PDB) of the Oracle Database Vault-enabled database as a user with the `DV_OWNER` role.
2. Authorize the Oracle APEX schema to use its DDL privileges

For example, for an Oracle APEX schema named `APEX_SCHEMA`:

```
EXEC DBMS_MACADM.AUTHORIZE_DDL('APEX_SCHEMA','%');
```

Related Topics

- [Performing DDL Operations in Oracle Database Vault](#)
Data Definition Language (DDL) operations in Oracle Database Vault can be affected by situations such as schema ownership and patch upgrades.

11.7.6 Authorizing Oracle APEX to Perform Information Lifecycle Maintenance Tasks

You must authorize the Oracle APEX schema to perform maintenance tasks.

1. Connect the pluggable database (PDB) of the Oracle Database Vault-enabled database as a user with the `DV_OWNER` role.
2. Authorize the Oracle APEX schema to use its DDL privileges.

For example, for an Oracle APEX schema named `APEX_SCHEMA`:

```
EXEC DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER('APEX_SCHEMA','%');
```

Related Topics

- [Using Information Lifecycle Management with Oracle Database Vault](#)
Users who perform Information Lifecycle Management operations on an Oracle Database Vault-enabled database must be granted authorization to perform these operations.

11.7.7 Authorizing Oracle APEX to Proxy Users for Oracle Rest Data Services

If you use Oracle Rest Data Services (ORDS), then you must authorize proxy users.

1. Connect the pluggable database (PDB) of the Oracle Database Vault-enabled database as a user with the `DV_OWNER` role.
2. Find the existing proxy users and database users that they can proxy as.

```
SELECT PROXY, CLIENT FROM PROXY_USERS;
```

3. Authorize the proxying of users.

```
EXEC DBMS_MACADM.AUTHORIZE_PROXY_USER('proxy','client');
```

4. Repeat this step for each of the combinations listed in the `PROXY_USERS` query that you performed.

Related Topics

- [Using Information Lifecycle Management with Oracle Database Vault](#)
Users who perform Information Lifecycle Management operations on an Oracle Database Vault-enabled database must be granted authorization to perform these operations.

11.7.8 Oracle APEX and Application Objects Protected by Oracle Database Vault

Objects that are protected by Oracle Database Vault realms and command rules are still protected after you have integrated Oracle APEX.

The same privileges and authorizations must be met before Oracle Database Vault will grant access to these objects. For example, if you create an Oracle APEX workspace that requires access to the HR schema objects, and there is an Oracle Database Vault realm protected the HR schema objects, then the workspace will be required to have authorization to access the realm.

Related Topics

- [Configuring Realms](#)
You can create a realm around database objects to protect them, and then set authorizations to control user access to this data.
- [Configuring Command Rules](#)
You can create command rules or use the default command rules to protect DDL and DML statements.

11.7.9 Troubleshooting the Oracle APEX and Database Vault Integration

If you have problems with the integration of Oracle APEX and Database Vault, then you can diagnose these problems using tracing and Oracle Database Vault simulation mode.

- **Tracing:** Trace files enable you to track the Oracle Database Vault database instance for server and background process events. Use trace file to find out if the Oracle Database Vault policy authorization succeeded or failed. They are also useful for resolving issues such as bugs and other unexpected behavior.
- **Simulation mode:** You can use simulation mode to capture violations in a simulation log instead of blocking SQL execution by Oracle Database Vault realms and command rules. Oracle Database Vault stores these errors in a central location so that you can easily analyze them.

Related Topics

- [Using Trace Files to Diagnose Oracle Database Vault Events](#)
Trace files, which the database generates, capture important information to help you debug errors.
- [Using Simulation Mode for Logging Realm and Command Rule Activities](#)
Simulation mode writes violations to the simulation log instead of preventing SQL execution to quickly test new and modified Oracle Database Vault controls.

DBA Operations in an Oracle Database Vault Environment

Database administrators can perform operations in an Oracle Database Vault environment, such as using Database Vault with products such as Oracle Data Pump.

- [Handling Role Grants in Oracle Database Vault](#)
Oracle Database Vault protects default roles such as `RESOURCE`, `DBA`, `AUDIT_ADMIN`, and `PDB_DBA`, which are created when you install Oracle Database. This feature protects the system and object privileges that are granted to these roles
- [Performing DDL Operations in Oracle Database Vault](#)
Data Definition Language (DDL) operations in Oracle Database Vault can be affected by situations such as schema ownership and patch upgrades.
- [Using Oracle Database Vault with Oracle Enterprise Manager](#)
Oracle Database Vault administrators can perform tasks in Oracle Enterprise Manager Cloud Control such as propagating policies to other databases.
- [Using Oracle Data Pump with Oracle Database Vault](#)
Database administrators can authorize Oracle Data Pump users to work in a Database Vault environment.
- [Using Oracle Scheduler with Oracle Database Vault](#)
Users who are responsible for scheduling database jobs must have Oracle Database Vault-specific authorization.
- [Using Information Lifecycle Management with Oracle Database Vault](#)
Users who perform Information Lifecycle Management operations on an Oracle Database Vault-enabled database must be granted authorization to perform these operations.
- [Using Oracle Database Replay with Oracle Database Vault](#)
Database administrators can authorize Oracle Database Replay users to work in a Database Vault environment.
- [Running Preprocessor Programs with Oracle Database Vault](#)
Users who run preprocessor programs through external tables must have Oracle Database Vault-specific authorization.
- [Using Database Vault Operations Control to Restrict Multitenant Common User Access to Local PDB Data](#)
You can control PDB access by CDB root common users, such as infrastructure database administrators.
- [Preventing Multitenant Local Users from Blocking Common Operations](#)
You can prevent multitenant local users from blocking common operations when they attempt to create Oracle Database Vault protections on common user objects.
- [Oracle Recovery Manager and Oracle Database Vault](#)
You can use Recovery Manager (RMAN) in an Oracle Database Vault environment.
- [Privileges for Using XStream with Oracle Database Vault](#)
If you want to use XStream in an Oracle Database Vault environment, then you must have the appropriate privileges.

- [Privileges for Using Oracle GoldenGate with Oracle Database Vault](#)
If you want to use Oracle GoldenGate in an Oracle Database Vault environment, then you must have the appropriate privileges.
- [Using Data Masking in an Oracle Database Vault Environment](#)
You must have the correct authorization to perform data masking in an Oracle Database Vault environment.
- [Converting a Standalone Oracle Database to a PDB and Plugging It into a CDB](#)
You can convert a standalone Oracle Database database from release 12c through 19c to a PDB, and then plug this PDB into a CDB.
- [Using the ORADEBUG Utility with Oracle Database Vault](#)
The ORADEBUG utility is used primarily by Oracle Support to diagnose problems that may arise with an Oracle database.
- [Performing Patch Operations in an Oracle Database Vault Environment](#)
User SYS must have the DV_PATCH_ADMIN role to perform a patch operations on an Oracle Database Vault-enabled database.

12.1 Handling Role Grants in Oracle Database Vault

Oracle Database Vault protects default roles such as RESOURCE, DBA, AUDIT_ADMIN, and PDB_DBA, which are created when you install Oracle Database. This feature protects the system and object privileges that are granted to these roles

- [Identifying Roles That Are Protected by a Realm](#)
As a user who has been granted the DV_OWNER or DV_ADMIN role, you can identify which roles are protected by which realm.
- [Identifying Roles That Are Not Protected by a Realm](#)
As a user who has been granted the DV_OWNER or DV_ADMIN role, you can identify which roles are *not* protected by realms.
- [Handling Protected Role Grants for Named Users](#)
If you are using named accounts, which Oracle recommends, and you must grant a protected role to another user, then you must authorize each named account by adding it to the appropriate realm as a realm owner.
- [Identifying Realms and Roles Protected by a Realm to Which SYS Has Authorization](#)
As a user who has been granted the DV_OWNER or DV_ADMIN role, you can identify the Oracle Database Vault realms and roles that are protected by a realm to which SYS has authorization.

12.1.1 Identifying Roles That Are Protected by a Realm

As a user who has been granted the DV_OWNER or DV_ADMIN role, you can identify which roles are protected by which realm.

Perform the following query:

```
COLUMN "ROLE PROTECTED BY A DV REALM" FORMAT A35
SELECT REALM_NAME, OBJECT_NAME
AS "ROLE PROTECTED BY A DV REALM"
FROM DBA_DV_REALM_OBJECT
WHERE OBJECT_TYPE = 'ROLE'
ORDER BY 1, 2;
```

12.1.2 Identifying Roles That Are Not Protected by a Realm

As a user who has been granted the `DV_OWNER` or `DV_ADMIN` role, you can identify which roles are *not* protected by realms.

Perform the following query:

```
COLUMN "ROLE NOT PROTECTED BY A DV REALM" FORMAT A40
SELECT ROLE AS "ROLE NOT PROTECTED BY A DV REALM"
FROM DBA_ROLES
WHERE ROLE NOT IN (SELECT OBJECT_NAME FROM DBA_DV_REALM_OBJECT WHERE
OBJECT_TYPE = 'ROLE')
ORDER BY 1;
```

12.1.3 Handling Protected Role Grants for Named Users

If you are using named accounts, which Oracle recommends, and you must grant a protected role to another user, then you must authorize each named account by adding it to the appropriate realm as a realm owner.

For example, if `dba_debra` wants to grant the `PDB_DBA` role to `dba_harvey`, then the following error will occur if the realm authorizations are not in place for `dba_debra`:

```
GRANT PDB_DBA TO DBA_HARVEY;

ERROR at line 1: ORA-47410: Insufficient realm privileges to GRANT on PDB_DBA.
```

As a user with the `DV_OWNER` or `DV_ADMIN` role, identify the Database Vault realm that is protecting the `PDB_DBA` role by performing the following query. This example uses the `PDB_DBA` role in its query.

```
SELECT REALM_NAME FROM DBA_DV_REALM_OBJECT
WHERE OBJECT_NAME = 'PDB_DBA' AND OBJECT_TYPE = 'ROLE';
```

Output similar to the following appears:

```
REALM_NAME
-----
Oracle System Privilege and Role Management Realm
```

As that same user, add `dba_debra` to the Oracle System Privilege and Role Management Realm as an owner.

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM (
    REALM_NAME => 'Oracle System Privilege and Role Management Realm',
    GRANTEE    => 'DBA_DEBRA',
    RULE_SET_NAME => NULL,
    AUTH_OPTIONS => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/
```

Now, when `dba_debra` attempts to grant the `PDB_DBA` role to another user, the role grant will succeed:

```
GRANT PDB_DBA TO DBA_HARVEY;
```

Grant succeeded.

To revoke the authorization from `dba_debra`:

```
BEGIN
  DBMS_MACADM.DELETE_AUTH_FROM_REALM (
    REALM_NAME => 'Oracle System Privilege and Role Management Realm',
    GRANTEE    => 'DBA_DEBRA');
END;
/
```

Note that `SYS` has been granted owner authorization on many of the default Database Vault realms. You can use `SYS` to perform the `GRANT` commands. Oracle recommends that you create named accounts (for example, `pfitch`, `cabramowitz`) for each user instead of relying on shared accounts such as `SYS` or `SYSTEM`. Named users will also make it easier to identify who performed an action in the Oracle database.

12.1.4 Identifying Realms and Roles Protected by a Realm to Which SYS Has Authorization

As a user who has been granted the `DV_OWNER` or `DV_ADMIN` role, you can identify the Oracle Database Vault realms and roles that are protected by a realm to which `SYS` has authorization.

Perform the following query:

```
SELECT REALM_NAME, OBJECT_NAME
FROM DBA_DV_REALM_OBJECT
WHERE OBJECT_TYPE = 'ROLE' AND REALM_NAME IN (SELECT REALM_NAME FROM
DBA_DV_REALM_AUTH WHERE GRANTEE = 'SYS')
ORDER BY 1,2;
```

To identify only the realms, you can perform a query similar to the following:

```
SELECT DISTINCT REALM_NAME
FROM DBA_DV_REALM_OBJECT
WHERE OBJECT_TYPE = 'ROLE' AND REALM_NAME IN (SELECT REALM_NAME FROM
DBA_DV_REALM_AUTH WHERE GRANTEE = 'SYS')
ORDER BY 1;
```

To identify the realms in that `SYS` does *not* have authorization for, you can perform a query similar to the following:

```
SELECT DISTINCT REALM_NAME
FROM DBA_DV_REALM_OBJECT
WHERE OBJECT_TYPE = 'ROLE' AND REALM_NAME NOT IN (SELECT REALM_NAME FROM
```

```
DBA_DV_REALM_AUTH WHERE GRANTEE = 'SYS')  
ORDER BY 1;
```

12.2 Performing DDL Operations in Oracle Database Vault

Data Definition Language (DDL) operations in Oracle Database Vault can be affected by situations such as schema ownership and patch upgrades.

- [Restrictions on Performing DDL Operations in Oracle Database Vault](#)
Depending on the Oracle Database Vault configuration, DDL operations may be restricted and require DDL authorizations in an Oracle Database Vault environment.
- [Impact of the DV_PATCH_ADMIN Role on DDL Operations](#)
Object owners and users who have been granted the DV_PATCH_ADMIN role are exempt from the DDL authorization requirement.
- [Impact of Upgrades from Releases 21c and Earlier on DDL Operations](#)
If you upgrade Oracle Database Vault from release 21c or earlier, you may need to change the DDL authorizations.
- [Impact of the Removal of the DDL Default Authorization of \('%', '%'\)](#)
The DDL default authorization of ('%', '%') enables a user to perform DDL operations on any schema without explicit DDL authorizations.

12.2.1 Restrictions on Performing DDL Operations in Oracle Database Vault

Depending on the Oracle Database Vault configuration, DDL operations may be restricted and require DDL authorizations in an Oracle Database Vault environment.

Specifically, a user is required to have DDL authorization to perform DDL operations on a schema that has any of the following characteristics:

- The schema is an owner of objects that are protected by enabled realms.
- The schema is authorized to any enabled realm directly or through roles.
- The schema is granted object privileges directly or through roles on objects that are protected by enabled realms.
- The schema is granted any Oracle Database Vault roles directly or through roles.

Object owners and users who have granted the DV_PATCH_ADMIN role are exempt from the DDL authorization requirement. You can authorize a user to perform DDL operations on a specific schema by using the DBMS_MACADM.AUTHORIZE_DDL procedure. Note, however, that DDL authorization does not enable the grantee to perform DDL operations on a realm protected object or schema. To enable such operations, you must authorize the user to the realm. To find information about users who have been granted this authorization, query the DBA_DV_DDL_AUTH data dictionary view.

If Oracle Database Vault is upgraded from a previous release older than Oracle Database 21c, then the default DDL authorization of (% , %) may exist, and it would enable users to perform DDL operations on any schema without explicit DDL authorizations. For better security, Oracle recommends that you remove the default DDL authorization by running DBMS_MACADM.UNAUTHORIZE_DDL ('%', '%') and grant required DDL authorizations only to users who need to perform DDL operations.

Related Topics

- [AUTHORIZE_DDL Procedure](#)
The `AUTHORIZE_DDL` procedure grants a user authorization to run Data Definition Language (DDL) statements on the specified schema.

12.2.2 Impact of the DV_PATCH_ADMIN Role on DDL Operations

Object owners and users who have been granted the `DV_PATCH_ADMIN` role are exempt from the DDL authorization requirement.

You can authorize a user to perform DDL operations on a specific schema by using the `DBMS_MACADM.AUTHORIZE_DDL` procedure. Note, however, that DDL authorization does not allow the grantee to perform DDL operations on a realm-protected object or schema. To allow such operations, you must authorize the user for the realm. To find information about users who have been granted this authorization, query the `DBA_DV_DDL_AUTH` data dictionary view.

Related Topics

- [AUTHORIZE_DDL Procedure](#)
The `AUTHORIZE_DDL` procedure grants a user authorization to run Data Definition Language (DDL) statements on the specified schema.

12.2.3 Impact of Upgrades from Releases 21c and Earlier on DDL Operations

If you upgrade Oracle Database Vault from release 21c or earlier, you may need to change the DDL authorizations.

The default DDL authorization of ('%', '%') may exist, which enables users to perform DDL operations on any schema without explicit DDL authorizations. For better security, Oracle recommends that you remove the default DDL authorization by running `DBMS_MACADM.UNAUTHORIZE_DDL('%', '%')` and then grant required DDL authorizations only to users who need to perform DDL operations.

Related Topics

- [UNAUTHORIZE_DDL Procedure](#)
The `UNAUTHORIZE_DDL` procedure revokes authorization from a user who was granted authorization to run DDL statements through the `DBMS_MACADM.AUTHORIZE_DDL` procedure.
- [AUTHORIZE_DDL Procedure](#)
The `AUTHORIZE_DDL` procedure grants a user authorization to run Data Definition Language (DDL) statements on the specified schema.

12.2.4 Impact of the Removal of the DDL Default Authorization of ('%', '%')

The DDL default authorization of ('%', '%') enables a user to perform DDL operations on any schema without explicit DDL authorizations.

This default DDL authorization, which has been in place since DDL authorization was introduced in Oracle Database release 12.1, was to prevent any undesirable disruption due to unexpected DDL failures in the Oracle Database Vault environment. From Database Vault release 21c, however, there is no default DDL authorization, and the existing default DDL authorization of ('%', '%') is removed when Database Vault is upgraded to 21c or later. To prevent any problems, you need to identify and authorize trusted database users for DDL operations or optionally re-authorize ('%', '%') so that every user is allowed to perform DDL

operations without explicit authorization. For better security, Oracle recommends that only trusted users are authorized for DDL operations.

Related Topics

- [UNAUTHORIZE_DDL Procedure](#)
The `UNAUTHORIZE_DDL` procedure revokes authorization from a user who was granted authorization to run DDL statements through the `DBMS_MACDM.AUTHORIZE_DDL` procedure.
- [AUTHORIZE_DDL Procedure](#)
The `AUTHORIZE_DDL` procedure grants a user authorization to run Data Definition Language (DDL) statements on the specified schema.

12.3 Using Oracle Database Vault with Oracle Enterprise Manager

Oracle Database Vault administrators can perform tasks in Oracle Enterprise Manager Cloud Control such as propagating policies to other databases.

- [Propagating Oracle Database Vault Configurations to Other Databases](#)
You can propagate Database Vault configurations (such as a realm configuration) to other Database Vault-protected databases.
- [Enterprise Manager Cloud Control Alerts for Oracle Database Vault Policies](#)
To view Oracle Database Vault alerts, you must be granted the `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role.
- [Oracle Database Vault-Specific Reports in Enterprise Manager Cloud Control](#)
From the Database Vault home page, you can find information about violations.

12.3.1 Propagating Oracle Database Vault Configurations to Other Databases

You can propagate Database Vault configurations (such as a realm configuration) to other Database Vault-protected databases.

1. Log in to Oracle Database Vault Administrator from Cloud Control as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role and the `SELECT ANY DICTIONARY` privilege. [Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#) explains how to log in.
2. In the Database Vault home page, under Database Vault Policy Propagation, select **Database Vault Policy Propagation**.

The Available Policies area in the Policy Propagation subpage lists a summary of the Oracle Database Vault configurations that were created for the current database: that is, configurations that were created for realms, command rules, rule sets, and secure application roles. It does not list the Oracle Database Vault policies that were introduced in Oracle Database release 12c (12.2). From here, you can propagate these configurations to another database.

3. Under Available Policies, select each configuration that you want to propagate to another database.

Database Vault Policy Propagation

This page enables the propagation of Database Vault policies like realms, command rules, secure application roles, factors and rule sets from a source database to multiple destination databases. You can also backup your Database Vault policies to a file by clicking on Show SQL then on Save SQL. Cancel Show SQL OK

Available Policies

The following is the list of all the available Database Vault policies. Select the policies that need to be propagated to the destination databases.

Select All | Select None | Expand All | Collapse All

| Select | Name | Status |
|--------|----------------------------|--------|
| | ▼ Policies | |
| | ▶ Realms | |
| | ▶ Command Rules | |
| | ▶ Secure Application Roles | |
| | ▶ Rule Sets | |

Destination Databases

Select the databases to which these policies need to be applied. Database vault administrator credentials are required for each of the destination databases to successfully propagate the policies.

The table below shows the list of database targets to which these database policies will be applied.

Add Remove

| Select | Database Name | Database Type | Database Vault Administrator User Name | Database Vault Administrator Password |
|--------|----------------------------|---------------|----------------------------------------|---------------------------------------|
| | Add destination databases. | | | |

Propagate Options

Restore on failure.
If policy propagation encounters errors, the original Database Vault policies on the destination are restored.

Skip propagation if user defined policies exist.
If there are already existing user defined policies, policy propagation would not be attempted.

Propagate Enterprise Manager metric thresholds for Database Vault metrics.
Database vault related metric thresholds, configured on this database will be propagated to destination databases.

Cancel Show SQL OK

4. Under Destination Databases, click the **Add** button.
5. Under Search and Select: Database Vault Enabled Destination Databases, search for the destination databases, and then select each database to which you want to propagate the configurations. Then click the **Select** button.
6. Under Destination Databases, do the following:
 - a. Under Apply credentials across destination database(s), enter the user name and password of the administrator of the Database Vault database that contains the configurations you want to propagate.

This feature applies the Database Vault administrator's user name and password to all of the selected destination databases.
 - b. Select each database to which you want to propagate the configurations.
 - c. Enter the Database Vault administrator user name and password for each database.
 - d. Click the **Apply** button.
7. In the Propagate Options page, select from the following options.

Any changes made to the seeded realms, command rules, rule sets, and so on will not be propagated to the destination databases. Only custom-created data are propagated.

- **Restore on failure:** If the propagation operations encounters errors, then the propagation is rolled back. That is, the original policies on the destination database are restored. If you do not select this option, then the policy propagation on the destination database continues and ignores any errors.
- **Skip propagation if user defined policies exist:** If the destination databases already have the user-defined configurations, then the propagation operation is not attempted. If you do not select this option, then regardless of whether user-defined policies exist on the destination database, all the existing configurations are cleared, and the configurations from the source database are applied to the destination database.

- **Propagate Enterprise Manager metric thresholds for database vault metrics:** If the source database has Oracle Database Vault metric thresholds set, then these thresholds are also propagated to the destination databases. If you do not select this option, then only configurations are propagated and not the Oracle Database Vault thresholds.
8. Click the **OK** button.
 9. In the Confirmation window, click **OK**.

A message indicating success or failure appears. If the propagation succeeds, then the configurations are active right away in their destination databases.

12.3.2 Enterprise Manager Cloud Control Alerts for Oracle Database Vault Policies

To view Oracle Database Vault alerts, you must be granted the `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role.

The alerts are as follows:

- **Database Vault Attempted Realm Violations.** This alert helps the Oracle Database Vault security analyst (`DV_SECANALYST` role) to monitor violation attempts on the Database Vault database. This user can select the realms to be affected by the alert and filter these realms based on the different types of attempts by using error codes. You can enable this metric from the Metrics and Policy Settings page. By default, the attempted realm violations are collected every 24 hours.
- **Database Vault Attempted Command Rule Violations.** The functionality for this alert is the same as for Database Vault Attempted Realm Violations, except that it focuses on violations on command rules.
- **Database Vault Realm Configuration Issues.** This metric tracks and raises an alert if users misconfigure realms. This metric is enabled when you install Oracle Database vault, and by default it collects data every one hour.
- **Database Vault Command Rule Configuration Issues.** This functionality for this alert is that same as Database Vault Realm Configuration Issues, except that it focuses on configuration changes to command rules.
- **Database Vault Policy Changes.** This metric raises an alert on any change to any Database Vault policy, such as policies for realms and command rules. It provides a detailed policy changes report.

12.3.3 Oracle Database Vault-Specific Reports in Enterprise Manager Cloud Control

From the Database Vault home page, you can find information about violations.

These violations are as follows:

- Top five attempted violations on realm and command rule
- Top five attempted violations by database users and client host
- Time series-based graphical reports on attempted violations for more detailed analysis

To have full access to the Database Vault reports, you must log into Database Vault Administrator as a user who has been granted the `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role.

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.

12.4 Using Oracle Data Pump with Oracle Database Vault

Database administrators can authorize Oracle Data Pump users to work in a Database Vault environment.

- [About Using Oracle Data Pump with Oracle Database Vault](#)
Oracle Data Pump is used to unload data and metadata into a set of operating system files and dump files. Oracle Database Vault enables you to control which privileged users are authorized to perform Data Pump imports or exports.
- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.
- [Authorizing Users or Roles for Data Pump Transportable Export and Import Operations](#)
You can grant authorization levels for users who must perform Oracle Data Pump transportable operations, either directly or through a role.
- [Guidelines for Exporting or Importing Data in a Database Vault Environment](#)
After you grant the Oracle Data Pump database administrator the proper authorization, this user can perform any export or import operations that are necessary.

12.4.1 About Using Oracle Data Pump with Oracle Database Vault

Oracle Data Pump is used to unload data and metadata into a set of operating system files and dump files. Oracle Database Vault enables you to control which privileged users are authorized to perform Data Pump imports or exports.

This type of user must have Database Vault privileges in addition to the standard Oracle Data Pump privileges. If these users want to perform Oracle Data Pump transportable tablespace operations, then they must have special authorization. You can check a user's authorizations for using Data Pump in an Oracle Database Vault environment by querying the `DBA_DV_DATAPUMP_AUTH` data dictionary view. You can grant this authorization to either individual users or to database roles.

12.4.2 Authorizing Users or Roles for Data Pump Regular Export and Import Operations

You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

- [About Authorizing Users or Roles for Oracle Data Pump Regular Operations](#)
Users who have Oracle Data Pump authorization can perform regular Oracle Data Pump operations in a Database Vault environment.
- [Levels of Database Vault Authorization for Oracle Data Pump Regular Operations](#)
Oracle Database Vault provides several levels of authorization required for Oracle Data Pump regular operations in a Database Vault environment.
- [Authorizing Users or Roles for Oracle Data Pump Regular Operations in Database Vault](#)
You can authorize a database administrator or a role to use Data Pump for regular operations in an Oracle Database Vault environment.

- [Revoking Oracle Data Pump Authorization from Users or Roles](#)
You can revoke authorization from the database administrator or role who is using Oracle Data Pump for regular operations.

12.4.2.1 About Authorizing Users or Roles for Oracle Data Pump Regular Operations

Users who have Oracle Data Pump authorization can perform regular Oracle Data Pump operations in a Database Vault environment.

You can perform the following types of Oracle Data Pump authorizations:

- Authorizing the user or role to be able to import protected schemas and objects
- Authorizing the user or role to be able to perform following activities that can take place during the import operation: the creation of users, the grant of Oracle Database Vault-protected roles and system privileges, the grant of specific Oracle Database roles, and the grant of Oracle Database system privileges



Note:

Full level Data Pump authorization enables these users to perform transportable export and import operations as well.

Related Topics

- [Authorizing Users or Roles for Data Pump Transportable Export and Import Operations](#)
You can grant authorization levels for users who must perform Oracle Data Pump transportable operations, either directly or through a role.

12.4.2.2 Levels of Database Vault Authorization for Oracle Data Pump Regular Operations

Oracle Database Vault provides several levels of authorization required for Oracle Data Pump regular operations in a Database Vault environment.

[Table 12-1](#) describes these levels.

Table 12-1 Levels of Authorization for Oracle Data Pump Regular Operations

| Scenario | Authorization Required |
|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A database administrator wants to import data into another schema. | You must grant this user (or a role) the <code>BECOME USER</code> system privilege and the <code>IMP_FULL_DATABASE</code> role. ¹ To find the privileges a user has been granted, query the <code>USER_SYS_PRIVS</code> data dictionary view. |
| A database administrator wants to export or import data in a schema that has no Database Vault protection. | You only need to grant this user (or a role) the standard Oracle Data Pump privileges, which are the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles. If the user wants to import data, grant this user the <code>BECOME USER</code> system privilege. |

Table 12-1 (Cont.) Levels of Authorization for Oracle Data Pump Regular Operations

| Scenario | Authorization Required |
|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A database administrator wants to export or import data in a protected schema. | In addition to the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles, you must grant this user (or a role) Database Vault-specific authorization by using the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure. This authorization applies to both the <code>expdp</code> and <code>impdp</code> utilities. Later on, you can revoke this authorization by using the <code>DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER</code> procedure. If the user wants to import data, also grant this user the <code>BECOME USER</code> system privilege. |
| A database administrator wants to export or import the contents of an entire database. | In addition to the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles and the authorization granted by the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure, you must grant this user (or a role) the <code>DV_OWNER</code> role. If the user wants to import data, grant this user the <code>BECOME USER</code> system privilege. |

¹ The `BECOME USER` privilege is part of the `IMP_FULL_DATABASE` role by default, but in an Oracle Database Vault environment, this privilege is revoked.

12.4.2.3 Authorizing Users or Roles for Oracle Data Pump Regular Operations in Database Vault

You can authorize a database administrator or a role to use Data Pump for regular operations in an Oracle Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Ensure that the user or role to whom you want to grant authorization has been granted the `EXP_FULL_DATABASE` and `IMP_FULL_DATABASE` roles, which are required for using Oracle Data Pump.

```
SELECT GRANTEE, GRANTED_ROLE FROM DBA_ROLE_PRIVS WHERE GRANTED_ROLE LIKE '%FULL%';
```

3. Grant this user or role Oracle Database Vault authorization to import protected schemas and objects.

For example, to authorize the Data Pump user `DP_MGR` to export and import objects for the database table `EMPLOYEES`:

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR', 'HR', 'EMPLOYEES');
```

To restrict `DP_MGR`'s activities to a specific schema, you would enter the following procedure:

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR', 'HR');
```

To authorize users who have been granted the `DP_MGR_ROLE` role to export and import objects for the entire database, enter the following:

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR_ROLE');
```

After you run the `DBMS_MACADM.AUTHORIZE_DATAPUMP_USER` procedure, you can check the authorization of the user or role by querying the `DBA_DV_DATAPUMP_AUTH` data dictionary view.

If you granted the user or role full authorization (using % for the schema, object, type, and action parameters), then you can bypass the next step. However, if the authorization is only for a specific schema (for example, schema is set to HR and the remaining parameters are still set to %), then you must perform the next step.

4. If necessary, grant the user or role authorization to perform the following activities during the import operation:

- a. Creating users during the import. For example:

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_CREATE_USER('DP_MGR');
```

- b. Granting Oracle Database Vault-protected roles and system privileges during the import. For example:

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_GRANT('DP_MGR');
```

- c. Granting a specific role during the import. For example:

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_GRANT_ROLE('DP_MGR', 'DBA');
```

- d. Granting system privileges during the import. For example:

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_GRANT_SYSPRIV('DP_MGR');
```

5. If the user or role must export the entire database, then grant them the DV_OWNER role.

For example, for a role:

```
GRANT DV_OWNER TO DP_MGR_ROLE;
```

Related Topics

- [About Authorizing Users or Roles for Oracle Data Pump Regular Operations](#)
Users who have Oracle Data Pump authorization can perform regular Oracle Data Pump operations in a Database Vault environment.
- [AUTHORIZE_DATAPUMP_USER Procedure](#)
The AUTHORIZE_DATAPUMP_USER procedure authorizes a user to perform Oracle Data Pump operations when Oracle Database Vault is enabled.
- [DBA_DV_DATAPUMP_AUTH View](#)
The DBA_DV_DATAPUMP_AUTH data dictionary view lists the authorizations for using Oracle Data Pump in an Oracle Database Vault environment.

12.4.2.4 Revoking Oracle Data Pump Authorization from Users or Roles

You can revoke authorization from the database administrator or role who is using Oracle Data Pump for regular operations.

1. If you granted the user or role the DV_OWNER role, then optionally revoke the DV_OWNER role.

```
REVOKE DV_OWNER FROM DP_MGR_ROLE;
```

2. Query the DBA_DV_DATAPUMP_AUTH data dictionary view to find the users or roles that have been granted Oracle Data Pump authorizations.

```
SELECT GRANTEE, SCHEMA, OBJECT FROM DBA_DV_DATAPUMP_AUTH;
```

3. Use the information you gathered from the preceding step to build the DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER command.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('DP_MGR', 'HR', 'EMPLOYEES');
```

Ensure that this unauthorization complements the original authorization action. In other words, if you originally gave DP_MGR authorization over the entire database, then the following commands will not work:

```
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('DP_MGR', 'HR');  
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('DP_MGR', 'HR', 'EMPLOYEES');
```

4. If you authorized the user or role to perform user creation or other activities during the import operation, then revoke these.

For example:

```
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_CREATE_USER('DP_MGR');  
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_GRANT('DP_MGR');  
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_GRANT_ROLE('DP_MGR', 'DBA');  
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_GRANT_SYSPRIV('DP_MGR');
```

You can find the user's authorizations by querying the DBA_DV_DATAPUMP_AUTH data dictionary view.

Related Topics

- [UNAUTHORIZE_DATAPUMP_USER Procedure](#)
The UNAUTHORIZE_DATAPUMP_USER procedure revokes the authorization that was granted by the AUTHORIZE_DATAPUMP_USER procedure.
- [DBA_DV_DATAPUMP_AUTH View](#)
The DBA_DV_DATAPUMP_AUTH data dictionary view lists the authorizations for using Oracle Data Pump in an Oracle Database Vault environment.

12.4.3 Authorizing Users or Roles for Data Pump Transportable Export and Import Operations

You can grant authorization levels for users who must perform Oracle Data Pump transportable operations, either directly or through a role.

- [About Authorizing Users for Oracle Data Pump Transportable Operations](#)
You can grant users (either directly or through a role) different levels of transportable operation authorization.
- [Levels of Database Vault Authorization for Data Pump Transportable Operations](#)
Oracle Database Vault provides levels of authorization required for users who must perform export and import transportable operations in a Database Vault environment.
- [Authorizing Users or Roles for Data Pump Transportable Operations in Database Vault](#)
You can authorize users or roles to perform Oracle Data Pump transportable export or import operations in a Database Vault environment.
- [Revoking Transportable Tablespace Authorization from Users or Roles](#)
You can revoke authorization from the database administrator who is using Data Pump.

12.4.3.1 About Authorizing Users for Oracle Data Pump Transportable Operations

You can grant users (either directly or through a role) different levels of transportable operation authorization.

If you want users to only have the authorization to perform transportable export and import operations, then you must grant users or roles the correct authorization, based on their tasks.

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

12.4.3.2 Levels of Database Vault Authorization for Data Pump Transportable Operations

Oracle Database Vault provides levels of authorization required for users who must perform export and import transportable operations in a Database Vault environment.

[Table 12-2](#) describes these levels.

Table 12-2 Levels of Authorization for Oracle Data Pump Transportable Operations

| Scenario | Authorization Required |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A database administrator wants to transportable export a tablespace or table that has no Database Vault protection. | You only need to grant this user (or a role) the standard Oracle Data Pump privileges, which are the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles. |
| A database administrator wants to transportable export a tablespace where there is Database Vault protection (for example, a realm or command rule for a table object residing on that tablespace). | In addition to the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles, you must grant this user (or a role) Database Vault-specific transportable tablespace authorization by using the <code>DBMS_MACADM.AUTHORIZE_TTS_USER</code> procedure. Later on, you can revoke this authorization by using the <code>DBMS_MACADM.UNAUTHORIZE_TTS_USER</code> procedure. Remember that users who have been granted full database level Oracle Data Pump authorization (through the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure) can perform these operations as well. |
| A database administrator wants to transportable export a table within a tablespace where there is Database Vault protection (for example, a realm or command rule for a table object residing on the tablespace that contains the table to be exported). | In addition to the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles, you must grant this user (or a role) Database Vault-specific transportable tablespace authorization for the tablespace that contains the table to be exported by using the <code>DBMS_MACADM.AUTHORIZE_TTS_USER</code> procedure. Remember that users who have been granted full database level Oracle Data Pump authorization (from the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure) can perform these operations as well. |
| A database administrator wants to transportable export the contents of an entire database. | In addition to the <code>DV_OWNER</code> , <code>EXP_FULL_DATABASE</code> , and <code>IMP_FULL_DATABASE</code> roles, you must grant this user (or a role) Database Vault-specific full database level Oracle Data Pump authorization by using the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure. You do not need to run the <code>DBMS_MACADM.AUTHORIZE_TTS_USER</code> procedure for this user. |
| A database administrator wants to use a network link to transportable import a tablespace or a table that has no Database Vault protection. | In addition to the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles for both the database administrator and the connecting user, you must grant the connecting user (or a role) specified in the network link the <code>DV_DATAPUMP_NETWORK_LINK</code> role. |

Table 12-2 (Cont.) Levels of Authorization for Oracle Data Pump Transportable Operations

| Scenario | Authorization Required |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A database administrator wants to use a network link to transportable import a tablespace where there is Database Vault protection (for example, realm or command rule for a table object residing on that tablespace) | In addition to the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles, you must grant the connecting user (or a role) specified in the network link the Database Vault-specific transportable tablespace authorization for that tablespace by using the <code>DBMS_MACADM.AUTHORIZE_TTS_USER</code> procedure. You must also grant the connecting user the <code>DV_DATAPUMP_NETWORK_LINK</code> role. Remember that users that have been granted Database Vault-specific full database level Oracle Data Pump authorization (through the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure) can perform these operations. |
| A database administrator wants to use a network link to import a table within a transportable tablespace where there is Database Vault protection (for example, realm or command rule for a table object residing on the tablespace that contains the table to be exported) | In addition to the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles, you must grant the connecting user (or a role) the Database Vault-specific transportable tablespace authorization for the tablespace that contains the table to be exported by using the <code>DBMS_MACADM.AUTHORIZE_TTS_USER</code> procedure. You also must grant the connecting user (or a role) specified in the network link the <code>DV_DATAPUMP_NETWORK_LINK</code> role. Remember that users who have been granted Database Vault-specific full database level Oracle Data Pump authorization (through the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure) can perform the operations. |
| A database administrator wants to use a network link to transportable import the contents of an entire database. | In addition to the <code>DV_OWNER</code> role, you must grant the connecting user (or a role) Database Vault-specific full database level Oracle Data Pump authorization by using the <code>DBMS_MACADM.AUTHORIZE_DATAPUMP_USER</code> procedure. You do not need to run the <code>DBMS_MACADM.AUTHORIZE_TTS_USER</code> procedure for this user. You must also grant the connecting user (or a role) who is specified in the network link the <code>DV_DATAPUMP_NETWORK_LINK</code> role. |

12.4.3.3 Authorizing Users or Roles for Data Pump Transportable Operations in Database Vault

You can authorize users or roles to perform Oracle Data Pump transportable export or import operations in a Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Ensure that the user or role to whom you want to grant authorization has been granted the `EXP_FULL_DATABASE` and `IMP_FULL_DATABASE` roles, which are required for using Oracle Data Pump.

```
SELECT GRANTEE, GRANTED_ROLE FROM DBA_ROLE_PRIVS
WHERE GRANTED_ROLE LIKE '%FULL%';
```

3. If the user wants to transportable export or use a network link to transportable import the contents of an entire database, then grant the full database level Oracle Data Pump authorization to the user or role by using the `DBMS_MACADM.AUTHORIZE_DATAPUMP_USER` procedure. Otherwise, bypass this step.

For example:

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR');
```

4. If the user must have Database Vault-specific transportable tablespace authorization only, then grant this user or role this authorization.

For example:

```
EXEC DBMS_MACADM.AUTHORIZE_TTS_USER('DP_MGR', 'HR_TS');
```

5. If the user who wants to perform a transportable import operation wants to use a network link to perform the operation, then grant this user or role the `DV_DATAPUMP_NETWORK_LINK` role.

For example:

```
GRANT DV_DATAPUMP_NETWORK_LINK TO DP_MGR;
```

6. If the user wants to perform a transportable export or use a network link to transportable import the entire database, then grant this user or role the `DV_OWNER` role.

```
GRANT DV_OWNER TO DP_MGR;
```

Related Topics

- [AUTHORIZE_TTS_USER Procedure](#)
The `AUTHORIZE_TTS_USER` procedure authorizes a user to perform Oracle Data Pump transportable tablespace operations for a tablespace when Oracle Database Vault is enabled.
- [AUTHORIZE_DATAPUMP_USER Procedure](#)
The `AUTHORIZE_DATAPUMP_USER` procedure authorizes a user to perform Oracle Data Pump operations when Oracle Database Vault is enabled.
- [DV_DATAPUMP_NETWORK_LINK Data Pump Network Link Role](#)
The `DV_DATAPUMP_NETWORK_LINK` role is used for Data Pump import operations.

12.4.3.4 Revoking Transportable Tablespace Authorization from Users or Roles

You can revoke authorization from the database administrator who is using Data Pump.

1. If you granted the user or role the `DV_OWNER` role, then optionally revoke this role.

```
REVOKE DV_OWNER FROM DP_MGR;
```

2. Query the `DBA_DV_TTS_AUTH` data dictionary view to find the users and roles that have been granted Oracle Data Pump authorizations.

```
SELECT GRANTEE, TSNAME FROM DBA_DV_TTS_AUTH;
```

3. Use the information you gathered from the preceding step to build the `DBMS_MACADM.UNAUTHORIZE_TTS_USER` statement.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_TTS_USER('DP_MGR', 'HR_TS');
```

4. If the user had transportable exported or used a network link to transportable import the contents of an entire database, then revoke the full database level Oracle Data Pump authorization from the user or role.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('DP_MGR');
```

5. If the user who had performed a transportable import operation used a network link to perform the operation, then revoke the `DV_DATAPUMP_NETWORK_LINK` role from the user or role.

For example:

```
REVOKE DV_DATAPUMP_NETWORK_LINK FROM DP_MGR;
```

Related Topics

- [UNAUTHORIZE_TTS_USER Procedure](#)
The `UNAUTHORIZE_TTS_USER` procedure removes from authorization users who had previously been granted the authorization to perform Oracle Data Pump transportable tablespace operations.
- [UNAUTHORIZE_DATAPUMP_USER Procedure](#)
The `UNAUTHORIZE_DATAPUMP_USER` procedure revokes the authorization that was granted by the `AUTHORIZE_DATAPUMP_USER` procedure.
- [DV_DATAPUMP_NETWORK_LINK Data Pump Network Link Role](#)
The `DV_DATAPUMP_NETWORK_LINK` role is used for Data Pump import operations.

12.4.4 Guidelines for Exporting or Importing Data in a Database Vault Environment

After you grant the Oracle Data Pump database administrator the proper authorization, this user can perform any export or import operations that are necessary.

Before this user begins work, they should follow these guidelines:

- **Create a full backup of the database datafiles.** This way, if you or other users do not like the newly-imported data, then you easily can revert the database to its previous state. This guideline is especially useful if an intruder had managed to modify Oracle Data Pump exported data to use their own policies.
- **Decide how to handle exporting and importing multiple schemas or tables.** You cannot specify multiple schemas or tables in the `DBMS_MACADM.AUTHORIZE_DATAPUMP_USER` procedure, but you can use either of the following methods to accomplish this task:
 - Run the `DBMS_MACADM.AUTHORIZE_DATAPUMP_USER` procedure for each schema or table, and then specify the list of these objects in the `SCHEMAS` or `TABLES` parameter of the `EXPDP` and `IMPDP` utilities.
 - Perform a full database export or import operation. If so, see the next guideline.
- **When performing an export or import operation for an entire database, set the `EXPDP` or `IMPDP FULL` option to `Y`.** Remember that this setting will capture the `DVSYS` schema, so ensure that the user or role has that you have authorized been granted the `DV_OWNER` role.

Note the following:

- You cannot use the legacy `EXP` and `IMP` utilities with the direct path option (`direct=y`) if Oracle Database Vault is enabled.
- Users, either through a direct grant or a role grant, that have been granted Database Vault-specific Oracle Data Pump authorization through the `DBMS_MACADM.AUTHORIZE_DATAPUMP_USER` procedure or transportable tablespace authorization through the `DBMS_MACADM.AUTHORIZE_TTS_USER` procedure can export and import database objects, but they cannot perform other activities, such as `SELECT` queries on schema tables to which they normally do not have access. Similarly, users are not permitted to perform Data Pump operations on objects outside the designated data objects.
- You must grant the `DV_OWNER` role to users who must export or import an entire database, because a full database export requires access to the `DVSYS` schema, which stores the Oracle Database Vault policies. However, you cannot export the `DVSYS` schema itself. Data Pump only exports the protection definitions. The target database must have the `DVSYS`

schema in it and Database Vault enabled before you can begin the import process.) Conversely, for a Data Pump import operation to apply the imported policies to the target database, it internally uses the `DBMS_MACADM` PL/SQL package, which in turn requires the Data Pump user to have the `DV_OWNER` role.

12.5 Using Oracle Scheduler with Oracle Database Vault

Users who are responsible for scheduling database jobs must have Oracle Database Vault-specific authorization.

- [About Using Oracle Scheduler with Oracle Database Vault](#)
The level of authorization that you must grant depends on the schema in which the administrator wants to perform a task.
- [Granting a Job Scheduling Administrator Authorization for Database Vault](#)
You can authorize a user to schedule database jobs in a Database Vault environment.
- [Revoking Authorization from Job Scheduling Administrators](#)
You can revoke authorization from a user for scheduling database jobs.

12.5.1 About Using Oracle Scheduler with Oracle Database Vault

The level of authorization that you must grant depends on the schema in which the administrator wants to perform a task.

Possible scenarios are as follows:

- **An administrator wants to schedule a job in their own schema.** An administrator who has been granted privileges to schedule database jobs can continue to do so without any Oracle Database Vault-specific authorizations, unless this schema is protected by a realm. In that case, ensure that this user is authorized to access the realm.
- **An administrator wants to run a job in another schema, but this job does not access any Oracle Database Vault realm or command rule protected object.** In this case, this user only needs job related system privileges, not the Oracle Database Vault privileges.
- **An administrator wants to run a job under the schema of another user, including any schema in the database or a remote database.** If this job accesses an Oracle Database Vault realm or command rule protected object, then you must grant this user Database Vault-specific authorization by using the `DBMS_MACADM.AUTHORIZE_SCHEDULER_USER` procedure. This authorization applies to both background and foreground jobs. For background jobs, the authorization applies to the last user who created or modified the job. In addition, ensure that the schema owner (the protected schema in which the job is created) authorized to the realm.

Later on, you can revoke this authorization by using the `DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER` procedure. If the schema is not protected by a realm, then you do not need to run the `DBMS_MACADM.AUTHORIZE_SCHEDULER_USER` procedure for the user.

Before you can enable or disable an Oracle Scheduler job that is protected by a realm, you must be authorized for that realm (using `DBMS_MACADM.ADD_AUTH_TO_REALM`), or you should have Oracle Scheduler authorization for the job owner schema (using `DBMS_MACADM.AUTHORIZE_SCHEDULER_USER`).

Related Topics

- [About Realm Authorization](#)
Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.

12.5.2 Granting a Job Scheduling Administrator Authorization for Database Vault

You can authorize a user to schedule database jobs in a Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

Only a user who has been granted either of these roles can grant the necessary authorization.

2. Ensure that the user to whom you want to grant authorization has been granted system privileges to schedule database jobs.

These privileges include any of the following: `CREATE JOB`, `CREATE ANY JOB`, `CREATE EXTERNAL JOB`, `EXECUTE ANY PROGRAM`, `EXECUTE ANY CLASS`, `MANAGE SCHEDULER`. The `DBA` and `SCHEDULER_ADMIN` roles provide these privileges; however, when Oracle Database Vault is enabled, the privileges are revoked from these roles.

For example:

```
SELECT GRANTEE, PRIVILEGE FROM DBA_SYS_PRIVS
WHERE PRIVILEGE IN ('CREATE JOB', 'CREATE ANY JOB');
```

3. Grant this user Oracle Database Vault authorization.

For example, to authorize the user `job_mgr` to schedule jobs for any schema in the database:

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('JOB_MGR');
```

Optionally, you can restrict `job_mgr`'s activities to a specific schema, as follows:

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('JOB_MGR', 'HR');
```

4. Ensure that the user has been authorized by querying the `DBA_DV_JOB_AUTH` data dictionary view as follows:

```
SELECT GRANTEE, SCHEMA FROM DBA_DV_JOB_AUTH WHERE GRANTEE = 'user_name';
```

Related Topics

- [AUTHORIZE_SCHEDULER_USER Procedure](#)
The `AUTHORIZE_SCHEDULER_USER` procedure grants a user authorization to schedule database jobs when Oracle Database Vault is enabled.
- [DBA_DV_JOB_AUTH View](#)
The `DBA_DV_JOB_AUTH` data dictionary view lists the authorizations for using Oracle Scheduler in an Oracle Database Vault environment.

12.5.3 Revoking Authorization from Job Scheduling Administrators

You can revoke authorization from a user for scheduling database jobs.

1. Query the `DBA_DV_JOB_AUTH` data dictionary view to find the user's authorization.

```
SELECT GRANTEE, SCHEMA FROM DBA_DV_JOB_AUTH WHERE GRANTEE='username';
```

2. Use the information you gathered from the preceding step to build the `DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER` command.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER('JOB_MGR');
```

Ensure that this unauthorization complements the original authorization action. In other words, if you originally gave `job_mgr` authorization over the entire database, then the following command will not work:

```
EXEC DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER('JOB_MGR', 'HR');
```

Related Topics

- [UNAUTHORIZE_SCHEDULER_USER Procedure](#)
The `UNAUTHORIZE_SCHEDULER_USER` procedure revokes the authorization that was granted by the `AUTHORIZE_SCHEDULER_USER` procedure.

12.6 Using Information Lifecycle Management with Oracle Database Vault

Users who perform Information Lifecycle Management operations on an Oracle Database Vault-enabled database must be granted authorization to perform these operations.

- [About Using Information Lifecycle Management with Oracle Database Vault](#)
You can grant authorization to and from users who are responsible for performing Information Lifecycle Management (ILM) operations on Oracle Database Vault realm- and command rule-protected objects.
- [Authorizing Users for ILM Operations in Database Vault](#)
You can authorize a user to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.
- [Revoking Information Lifecycle Management Authorization from Users](#)
You can revoke authorization from users so that they cannot perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.

12.6.1 About Using Information Lifecycle Management with Oracle Database Vault

You can grant authorization to and from users who are responsible for performing Information Lifecycle Management (ILM) operations on Oracle Database Vault realm- and command rule-protected objects.

You must first authorize users before they can perform the following SQL statements for ILM operations in a Database Vault-enabled database:

- `ALTER TABLE`
 - `ILM`
 - `FLASHBACK ARCHIVE`
 - `NO FLASHBACK ARCHIVE`
- `ALTER TABLESPACE`
 - `FLASHBACK MODE`

12.6.2 Authorizing Users for ILM Operations in Database Vault

You can authorize a user to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

Only a user who has been granted either of these roles can grant the necessary authorization.

2. Use the `DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER` to authorize the user.

For example, to grant a user authorization to perform ILM operations on the `HR.EMPLOYEES` table:

```
EXEC DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER ('PSMITH', 'HR', 'EMPLOYEES', 'TABLE', 'ILM');
```

If you wanted to grant user `psmith` ILM authorizations for the entire database, you would enter a procedure similar to the following:

```
EXEC DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER ('PSMITH', '%', '%', '%', '%');
```

3. Ensure that the user has been authorized by querying the `DBA_DV_MAINTENANCE_AUTH` data dictionary view.

Related Topics

- [AUTHORIZE_MAINTENANCE_USER Procedure](#)
The `AUTHORIZE_MAINTENANCE_USER` procedure grants a user authorization to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.
- [DBA_DV_MAINTENANCE_AUTH View](#)
The `DBA_DV_MAINTENANCE_AUTH` data dictionary view provides information about the configuration of Oracle Database Vault authorizations to use Information Life Management (ILM) features.

12.6.3 Revoking Information Lifecycle Management Authorization from Users

You can revoke authorization from users so that they cannot perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.

1. Log into the database instance as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

Only a user who has been granted either of these roles can grant the necessary authorization.

2. Query the `DBA_DV_MAINTENANCE_AUTH` data dictionary view to find the kind of authorization that was granted to the ILM user.

3. Use the `DBMS_MACADM.UNAUTHORIZE_MAINTENANCE_USER` to revoke the authorization from the user.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_MAINTENANCE_USER ('PSMITH', 'HR', '%', 'TABLE', 'ILM');
```


Related Topics

- [DBA_DV_MAINTENANCE_AUTH View](#)
The `DBA_DV_MAINTENANCE_AUTH` data dictionary view provides information about the configuration of Oracle Database Vault authorizations to use Information Life Management (ILM) features.
- [UNAUTHORIZE_MAINTENANCE_USER Procedure](#)
The `UNAUTHORIZE_MAINTENANCE_USER` procedure revokes privileges from users who have been granted authorization to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.

12.7 Using Oracle Database Replay with Oracle Database Vault

Database administrators can authorize Oracle Database Replay users to work in a Database Vault environment.

- [About Using Database Replay with Oracle Database Vault](#)
You can grant Oracle Database Vault authorizations for users to perform both workload capture and workload replay operations with Oracle Database Replay.
- [Authorizing Users for Database Replay Operations](#)
You can authorize Oracle Database Replay users for both workload capture and workload replay operations.
- [Revoking Database Replay Authorization from Users](#)
You can remove authorization for both Oracle Database Replay workload capture and workload replay operations.

12.7.1 About Using Database Replay with Oracle Database Vault

You can grant Oracle Database Vault authorizations for users to perform both workload capture and workload replay operations with Oracle Database Replay.

Oracle Database Replay can capture a workload on the production system and replay it on a test system with the exact timing, concurrency, and transaction characteristics of the original workload. Because the workload may contain sensitive information, Oracle Database Vault enables you to control which privileged users can perform replay and capture operations.

12.7.2 Authorizing Users for Database Replay Operations

You can authorize Oracle Database Replay users for both workload capture and workload replay operations.

- [Authorizing Users for Workload Capture Operations](#)
You can authorize a user to perform Oracle Database Replay workload capture operations in an Oracle Database Vault environment.
- [Authorizing Users for Workload Replay Operations](#)
You can authorize a user to perform Oracle Database Replay workload replay operations in an Oracle Database Vault environment.

12.7.2.1 Authorizing Users for Workload Capture Operations

You can authorize a user to perform Oracle Database Replay workload capture operations in an Oracle Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

Only a user who has been granted either of these roles can grant this authorization.

2. Use the `DBMS_MACADM.AUTHORIZE_DBCAPTURE` procedure to authorize the user.

For example:

```
EXEC DBMS_MACADM.AUTHORIZE_DBCAPTURE ('PFITCH');
```

3. Ensure that the user has been authorized by querying the `DBA_DV_DBCAPTURE_AUTH` data dictionary view.

Related Topics

- [AUTHORIZE_DBCAPTURE Procedure](#)
The `AUTHORIZE_DBCAPTURE` procedure grants a user authorization to perform Oracle Database Replay workload capture operations.
- [DBA_DV_DBCAPTURE_AUTH View](#)
The `DBA_DV_DBCAPTURE_AUTH` data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload capture operations.

12.7.2.2 Authorizing Users for Workload Replay Operations

You can authorize a user to perform Oracle Database Replay workload replay operations in an Oracle Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.

Only a user who has been granted either of these roles can grant this authorization.

2. Use the `DBMS_MACADM.AUTHORIZE_DBREPLAY` procedure to authorize the user.

For example:

```
EXEC DBMS_MACADM.AUTHORIZE_DBREPLAY ('PFITCH');
```

3. Ensure that the user has been authorized by querying the `DBA_DV_DBREPLAY_AUTH` data dictionary view.

Related Topics

- [AUTHORIZE_DBREPLAY Procedure](#)
The `AUTHORIZE_DBREPLAY` procedure grants a user authorization to perform Oracle Database Replay workload replay operations.
- [DBA_DV_DBREPLAY View](#)
The `DBA_DV_DBREPLAY_AUTH` data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload replay operations.

12.7.3 Revoking Database Replay Authorization from Users

You can remove authorization for both Oracle Database Replay workload capture and workload replay operations.

- [Revoking Workload Capture Privileges](#)
You can revoke authorization from users so that they cannot perform Oracle Database Replay workload capture operations in an Oracle Database Vault environment.
- [Revoking Workload Replay Privileges](#)
You can revoke authorization from users so that they cannot perform Oracle Database Replay workload replay operations in an Oracle Database Vault environment.

12.7.3.1 Revoking Workload Capture Privileges

You can revoke authorization from users so that they cannot perform Oracle Database Replay workload capture operations in an Oracle Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
Only a user who has been granted either of these roles can grant this authorization.
2. Query the `DBA_DV_DBCAPTURE_AUTH` data dictionary view to find users whose workload capture authorization you want to revoke.
3. Use the `DBMS_MACADM.UNAUTHORIZE_DBCAPTURE` procedure to revoke authorization from the user.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_DBCAPTURE ('PFITCH');
```

Related Topics

- [DBA_DV_DBCAPTURE_AUTH View](#)
The `DBA_DV_DBCAPTURE_AUTH` data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload capture operations.
- [UNAUTHORIZE_DBCAPTURE Procedure](#)
The `UNAUTHORIZE_DBCAPTURE` procedure revokes authorization from users to perform Oracle Database Replay workload capture operations.

12.7.3.2 Revoking Workload Replay Privileges

You can revoke authorization from users so that they cannot perform Oracle Database Replay workload replay operations in an Oracle Database Vault environment.

1. Log into the database instance as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
Only a user who has been granted either of these roles can grant this authorization.
2. Query the `DBA_DV_DBREPLAY_AUTH` data dictionary view to find users whose workload replay authorization you want to revoke.
3. Use the `DBMS_MACADM.UNAUTHORIZE_DBDBREPLAY` procedure to revoke authorization from the user.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_DBREPLAY ('PFITCH');
```

Related Topics

- [DBA_DV_DBREPLAY View](#)
The `DBA_DV_DBREPLAY_AUTH` data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload replay operations.
- [UNAUTHORIZE_DBREPLAY Procedure](#)
The `UNAUTHORIZE_DBREPLAY` procedure revokes authorization from users to perform Oracle Database Replay workload replay operations.

12.8 Running Preprocessor Programs with Oracle Database Vault

Users who run preprocessor programs through external tables must have Oracle Database Vault-specific authorization.

- [About Running Preprocessor Programs with Oracle Database Vault](#)
You can grant and revoke Database Vault authorizations for users to run preprocessor programs through external tables.
- [Authorizing Users to Run Preprocessor Programs](#)
The `DBMS_MACADM.AUTHORIZE_PREPROCESSOR` procedure grants users authorization to run preprocessor programs through external tables.
- [Revoking Authorization to Run Execute Preprocessor Programs from Users](#)
The `DBMS_MACADM.UNAUTHORIZE_PREPROCESSOR` procedure revokes authorization from users so that they cannot run preprocessor programs through external tables in an Oracle Database Vault environment.

12.8.1 About Running Preprocessor Programs with Oracle Database Vault

You can grant and revoke Database Vault authorizations for users to run preprocessor programs through external tables.

12.8.2 Authorizing Users to Run Preprocessor Programs

The `DBMS_MACADM.AUTHORIZE_PREPROCESSOR` procedure grants users authorization to run preprocessor programs through external tables.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
Only a user who has been granted either of these roles can grant this authorization.
2. Use the `DBMS_MACADM.AUTHORIZE_PREPROCESSOR` procedure to authorize the user.

For example:

```
EXEC DBMS_MACADM.AUTHORIZE_PREPROCESSOR ('PFITCH');
```

3. Ensure that the user has been authorized by querying the `DBA_DV_PREPROCESSOR_AUTH` data dictionary view.

12.8.3 Revoking Authorization to Run Execute Preprocessor Programs from Users

The `DBMS_MACADM.UNAUTHORIZE_PREPROCESSOR` procedure revokes authorization from users so that they cannot run preprocessor programs through external tables in an Oracle Database Vault environment.

1. Log into the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
Only a user who has been granted either of these roles can grant this authorization.
2. Use the `DBMS_MACADM.UNAUTHORIZE_PREPROCESSOR` procedure to revoke the authorization from the user.

For example:

```
EXEC DBMS_MACADM.UNAUTHORIZE_PREPROCESSOR ('PFITCH');
```

3. Query the `DBA_DV_PREPROCESSOR_AUTH` data dictionary view to ensure that the user is no longer authorized.

12.9 Using Database Vault Operations Control to Restrict Multitenant Common User Access to Local PDB Data

You can control PDB access by CDB root common users, such as infrastructure database administrators.

- [About Using Database Vault Operations Control](#)
You can automatically restrict common users from accessing pluggable database (PDB) local data in autonomous, regular Cloud, or on-premises environments.
- [How the Addition of Common Users and Packages to an Exception List Works](#)
Before you add a common user or package to an exception list, they must fulfill special requirements.
- [Enabling Database Vault Operations Control](#)
To enable Database Vault operations control, use the `DBMS_MACADM.ENABLE_APP_PROTECTION` PL/SQL procedure.
- [Adding Common Users and Packages to an Exception List](#)
Common users and applications that must access PDB local data can be added to an exception list.
- [Deleting Common Users and Packages from an Exception List](#)
Users and applications that no longer need to access PDB local data can be removed from the exception list.
- [Disabling Database Vault Operations Control](#)
To disable Database Vault operations control, use the `DBMS_MACADM.DISABLE_APP_PROTECTION` PL/SQL procedure.

12.9.1 About Using Database Vault Operations Control

You can automatically restrict common users from accessing pluggable database (PDB) local data in autonomous, regular Cloud, or on-premises environments.

To accomplish this, you can use Oracle Database Vault operations control, which applies to common users such as infrastructure database administrators and applications.

Database Vault operations control is useful for situations where a database administrator must log in to the CDB root as a highly privileged user, but still not be able to access PDB customer data. Database operations control does not block PDB database administrators. To block these users, enable Oracle Database Vault in the PDB and then use the Database Vault features such as realm control to block these users. (Note that when operations control is enabled, common users cannot proxy as local users into the PDB.)

You can create an exception list for Database Vault operations control of common users and packages for situations where a common user or application must perform tasks that must access local data on a PDB. An example of the type of common user that you would specify for the exception list is the `CTXSYS` application account, which is responsible for Oracle Text. Specifying a package in an exception list enables you to apply more fine-grained control instead of providing full access to a user in an exception list.

The general process for using Database Vault operations control is as follows:

1. Enable Database Vault operations control and keep it enabled for the production environment.
2. At this stage Database Vault operations control applies to all PDBs in the environment, regardless of whether the PDB has enabled Database Vault or not.
3. To enable specific users and packages to have access to the local schemas of the PDBs, add them to an exception list. When the user or package no longer needs access, then you can remove them from the exception list. For example, if the database is using Oracle Text, then you can add the `CTXSYS` administrative user account and the package to the exception list.

12.9.2 How the Addition of Common Users and Packages to an Exception List Works

Before you add a common user or package to an exception list, they must fulfill special requirements.

You can add a user package to the exception list if the package is the only object in the user account that needs access to the PDB local data. This allows for fine grained control over what is put into the exception list. The kinds of common users and packages that you would add to the exception list are ones that are necessary for the functioning of the PDB. For example, if you are using Oracle Spatial, then you should add the `MDSYS` account to the exception list. `MDSYS` requires access to customer PDB data for Oracle Spatial functions.

A PL/SQL procedure on the Ops Control exception list can be run by any common user, as long as the common user has system or direct object privileges to run the PL/SQL procedure. (Only definer's rights procedures can be added to the exception list, not invoker's rights.)

Only users on the operations control exception list (user, % exception) can modify PL/SQL procedures on an exception list and only if they have the privileges to modify the PL/SQL procedures. For example, User X cannot modify their own User X PL/SQL procedure if the procedure is on the operations control exception list, but User X is not on the exception list. User Y can modify User X procedures if User Y is on the exception list (Y, %) and if User Y has privileges to modify User X procedures.

To add a common user and a package to the Database Vault operations control exception list, you can use the `DBMS_MACADM.ADD_APP_EXCEPTION` PL/SQL procedure. To find existing exceptions, you can query the `DBA_DV_APP_EXCEPTION` data dictionary view.

12.9.3 Enabling Database Vault Operations Control

To enable Database Vault operations control, use the `DBMS_MACADM.ENABLE_APP_PROTECTION` PL/SQL procedure.

Oracle recommends that if you elect to use Database Vault operations control for your multitenant production server, then you should keep Database Vault operations control enabled full time.

In most cases, you will enable Database Operations control for the entire CDB, not just a specific PDB. If you need to disable it for a specific PDB (for example, for troubleshooting purposes), then you can run the `DBMS_MACADM.DISABLE_APP_PROTECTION` procedure on the PDB. When you are finished troubleshooting the PDB, re-enable it for Database Vault operations control, as shown in the example in this topic.

Before you enable Database Vault operations control, Database Vault must be enabled and configured in the CDB root. However, Database Vault does not need to be enabled in the PDBs.

1. Log in to the CDB root as a common user who has been granted the `DV_OWNER` role.
2. Run the `DBMS_MACADM.ENABLE_APP_PROTECTION` procedure.
 - To enable Database Vault operations control for all PDBs in the CDB environment:

```
EXEC DBMS_MACADM.ENABLE_APP_PROTECTION;
```

- The operations control for a specific PDB may have been disabled for troubleshooting reasons. To re-enable Database Vault operations control for a specific PDB (for example, `HRPDB`):

```
EXEC DBMS_MACADM.ENABLE_APP_PROTECTION ('HRPDB');
```

At this stage, one or all of the PDBs are enabled for Database Vault operations control. You can confirm by connecting as user `SYS` with the `SYSDBA` administrative privilege and then executing the `SELECT * FROM DBA_DV_STATUS;` query. If specific trusted common users or packages must have access to the local schemas of these PDBs to perform special operations, then you can use the `DBMS_MACADM.ADD_APP_EXCEPTION` procedure to add the user or package to an exception list for Database Vault operations control.

Related Topics

- [Adding Common Users and Packages to an Exception List](#)
Common users and applications that must access PDB local data can be added to an exception list.

12.9.4 Adding Common Users and Packages to an Exception List

Common users and applications that must access PDB local data can be added to an exception list.

1. Log in to the CDB root as a common user who has been granted the `DV_OWNER` role.

For example:

```
sqlplus c##sec_admin_owen_root
Enter password: password
```

2. Ensure that the package that you will specify for the common user meets the following requirements:
 - The package must be owned by the common user.
 - A user-created package must be created with definer's rights procedures.

You can find more information about user-created packages by querying the `DBA_OBJECTS` data dictionary view.

3. Execute the `DBMS_MACADM.ADD_APP_EXCEPTION` procedure.

For example:

```
DBMS_MACADM.ADD_APP_EXCEPTION ('MDSYS', 'PATCH_APP');
```

12.9.5 Deleting Common Users and Packages from an Exception List

Users and applications that no longer need to access PDB local data can be removed from the exception list.

To remove a common user and a package from the Database Vault operations control exception list, you can use the `DBMS_MACADM.DELETE_APP_PROTECTION` PL/SQL procedure. To find existing exceptions, you can query the `DBA_DV_APP_EXCEPTION` data dictionary view.

1. Log in to the CDB root as a common user who has been granted the `DV_OWNER` role.
2. Run the `DBMS_MACADM.DELETE_APP_EXCEPTION` procedure.

For example:

```
DBMS_MACADM.DELETE_APP_EXCEPTION ('MDSYS', 'PATCH_APP');
```

12.9.6 Disabling Database Vault Operations Control

To disable Database Vault operations control, use the `DBMS_MACADM.DISABLE_APP_PROTECTION` PL/SQL procedure.

In most cases, you should keep Database Vault operations control enabled. If troubleshooting requires that a PDB be dropped from Database Vault operations control, then Oracle recommends that you temporarily disable Database Vault operations control for the PDB (and maintain operations control for the rest of the PDBs). After the troubleshooting is complete, then you should re-enable Database Vault operations control.

1. Log in to the CDB root as a common user who has been granted the `DV_OWNER` role.
2. Run the `DBMS_MACADM.DISABLE_APP_PROTECTION` procedure.

- To disable Database Vault operations control for all PDBs in the CDB environment:

```
EXEC DBMS_MACADM.DISABLE_APP_PROTECTION;
```

- To disable Database Vault operations control for a specific PDB (for example, `HRPDB`):

```
EXEC DBMS_MACADM.DISABLE_APP_PROTECTION ('HRPDB');
```

12.10 Preventing Multitenant Local Users from Blocking Common Operations

You can prevent multitenant local users from blocking common operations when they attempt to create Oracle Database Vault protections on common user objects.

- [About Preventing Multitenant Local Users from Blocking Common Operations](#)
A user who has the `DV_OWNER` role in the root can control whether local PDB users can create Oracle Database Vault controls on a common user's local objects.
- [Preventing Local Users from Blocking Common Operations](#)
To prevent local users from blocking common operations, run the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure in the root.

12.10.1 About Preventing Multitenant Local Users from Blocking Common Operations

A user who has the `DV_OWNER` role in the root can control whether local PDB users can create Oracle Database Vault controls on a common user's local objects.

If a local user can apply Oracle Database Vault controls (such as realms or command rules) to a local object that is owned by a common user, or to an object owned by an application common user, then the common user or the application common user could be blocked from accessing local data in their own schema in the PDB. This may prevent them from running common operations necessary for the maintenance of the database or application. In addition, a local user could be able to create a `CONNECT` command rule on a common user that can prevent this common user from logging in to the PDB in which the common user's objects reside.

To prevent local users from being able to block common operations, a common user who has been granted the `DV_OWNER` role in the root can run the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure in the root.

To find the current status of how `DBMS_MACADM.ALLOW_COMMON_OPERATION` has been set, a user with the `DV_OWNER` or `DV_ADMIN` role can query the `DVSYS.DBA_DV_COMMON_OPERATION_STATUS` data dictionary view.

Related Topics

- [DVSYS.DBA_DV_COMMON_OPERATION_STATUS View](#)
The `DVSYS.DBA_DV_COMMON_OPERATION_STATUS` data dictionary view displays the status of the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure setting.

12.10.2 Preventing Local Users from Blocking Common Operations

To prevent local users from blocking common operations, run the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure in the root.

When you set `ALLOW_COMMON_OPERATION` to `TRUE`, then local users are restricted from creating Oracle Database Vault controls on common user objects. This setting applies to existing local PDB Database Vault controls that were created on common user objects, so that they will not be enforced on common users.

1. Log in to the root as a user who has been granted the `DV_OWNER` role for the root.
2. Run the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure as follows:

```
EXEC DBMS_MACADM.ALLOW_COMMON_OPERATION (TRUE);
```

In this specification:

- `TRUE` prevents local users from creating Oracle Database Vault controls on common user objects. Alternatively, you can run this procedure without including any parameter to achieve a `TRUE` result.
- `FALSE` enables local users to create Database Vault controls on common user objects. If you do not run `DBMS_MACADM.ALLOW_COMMON_OPERATION` at all, then the default `ALLOW_COMMON_OPERATION` status is `FALSE`, and the default behavior will be to allow local users to create Database Vault controls on common user objects.

If a realm or command rule was already created on a common object while `DBMS_MACADM.ALLOW_COMMON_OPERATION` is set to `FALSE`, and then subsequently,

`DBMS_MACADM.ALLOW_COMMON_OPERATION` is set to `TRUE`, then the realm and command rule on the common object are not enforced.

12.11 Oracle Recovery Manager and Oracle Database Vault

You can use Recovery Manager (RMAN) in an Oracle Database Vault environment.

The functionality of RMAN with Oracle Database Vault is almost the same as its functionality in a standard Oracle Database environment. However, be aware that the RMAN recover table and table partitions features do not work with realm-protected tables when you attempt an export operation. To perform an export operation, you must perform a full table recovery and then have a Database Vault authorized user perform the export of the real-protected protected table.

Be aware that the RMAN recover table and table partitions features do not work with realm-protected tables when you attempt to recover the table. To recover the table, you must perform a full database recovery and then have a Database Vault authorized user perform the export of the realm-protected table to import into the existing database.

Related Topics

- [Oracle Database Backup and Recovery User's Guide](#)
- [Oracle Database Backup and Recovery Reference](#)

12.12 Privileges for Using XStream with Oracle Database Vault

If you want to use XStream in an Oracle Database Vault environment, then you must have the appropriate privileges.

These privileges are as follows:

- You must be granted the `DV_XSTREAM_ADMIN` role in order to configure the XStream.
- Before you can apply changes to any tables that are protected by a realm, you must be authorized to have access to that realm. For example:

```
EXEC DBMS_MACADM.ADD_AUTH_TO_REALM('realm_name','username');
```
- Before you can run the `DBMS_XSTREAM_AUTH.GRANT_ADMIN_PRIVILEGE` procedure, you must be granted the `DV_ACCTMGR` role.

Related Topics

- [DV_XSTREAM_ADMIN XStream Administrative Role](#)
The `DV_XSTREAM_ADMIN` role is used for Oracle XStream.
- [ADD_AUTH_TO_REALM Procedure](#)
The `ADD_AUTH_TO_REALM` procedure authorizes a user or role to access a realm as an owner or a participant. You can authenticate both common and local realms.

12.13 Privileges for Using Oracle GoldenGate with Oracle Database Vault

If you want to use Oracle GoldenGate in an Oracle Database Vault environment, then you must have the appropriate privileges.

These privileges are as follows:

- The user must be granted the `DV_GOLDENGATE_ADMIN` role in order to configure the Oracle GoldenGate.
- The user must be granted the `DV_GOLDENGATE_REDO_ACCESS` role if the user must use the Oracle GoldenGate `TRANLOGOPTIONS DBLOGREADER` method to access redo logs.

For example, to grant the `DV_GOLDENGATE_ADMIN` and `DV_GOLDENGATE_REDO_ACCESS` roles to a user named `gg_admin`:

```
GRANT DV_GOLDENGATE_ADMIN, DV_GOLDENGATE_REDO_ACCESS TO gg_admin;
```

- The user must be granted the `DV_ACCTMGR` role before this user can create users on the replicated side.
- The user must perform extract operations in triggerless mode before attempting to perform procedural replication.
- Before users can apply changes to any tables that are protected by a realm, they must be authorized to have access to that realm. For example:

```
EXEC DBMS_MACADM.ADD_AUTH_TO_REALM('realm_name','username');
```

- The `SYS` user must be authorized to perform Data Definition Language (DDL) operations in the `SYSTEM` schema, as follows:

```
EXECUTE DVSYS.DBMS_MACADM.AUTHORIZE_DDL('SYS', 'SYSTEM');
```

- The user must be granted authorization to the Oracle Default Component Protection Realm. For example, to grant this realm authorization to a user named `gg_admin`:

```
BEGIN
  DVSYS.DBMS_MACADM.ADD_AUTH_TO_REALM(
    REALM_NAME => 'Oracle Default Component Protection Realm',
    GRANTEE    => 'gg_admin',
    AUTH_OPTIONS => 1);
END;
/
```

Note:

Oracle GoldenGate queries, updates, and manages objects in the `SYS`, `SYSTEM` and GoldenGate-related schemas. If any of the schemas are protected by an Oracle Database Vault realm, then the GoldenGate Extract operation can fail. Oracle Database Vault protects dictionary related objects with the Oracle Default Component Protection Realm and recommends that you do not protect default schemas, such as `SYS` and `SYSTEM`, with any custom Oracle Database Vault realms or custom Oracle Database Vault command rules.

Related Topics

- [DV_GOLDENGATE_ADMIN GoldenGate Administrative Role](#)
The `DV_GOLDENGATE_ADMIN` role is used with Oracle GoldenGate.
- [DV_GOLDENGATE_REDO_ACCESS GoldenGate Redo Log Role](#)
The `DV_GOLDENGATE_REDO_ACCESS` role is used with Oracle GoldenGate.
- [ADD_AUTH_TO_REALM Procedure](#)
The `ADD_AUTH_TO_REALM` procedure authorizes a user or role to access a realm as an owner or a participant. You can authenticate both common and local realms.

12.14 Using Data Masking in an Oracle Database Vault Environment

You must have the correct authorization to perform data masking in an Oracle Database Vault environment.

- [About Data Masking in an Oracle Database Vault Enabled Database](#)
In an Oracle Database Vault-enabled database, only users who have Database Vault authorizations can mask data in Database Vault-protected database objects.
- [Adding Data Masking Users to the Data Dictionary Realm Authorizations](#)
You can add data masking users to the Oracle Default Component Protection realm to give them data dictionary realm authorizations.
- [Giving Users Access to Tables or Schemas That They Want to Mask](#)
To give users access to tables or schemas that they want to mask, you must authorize them for the appropriate realm.
- [Creating a Command Rule to Control Data Masking Privileges](#)
You must have privileges to manage tables, packages, and triggers before you can use data masking in an Oracle Database Vault environment.

12.14.1 About Data Masking in an Oracle Database Vault Enabled Database

In an Oracle Database Vault-enabled database, only users who have Database Vault authorizations can mask data in Database Vault-protected database objects.

In a non-Database Vault environment, users who have been granted the `SELECT_CATALOG_ROLE` and `DBA` roles can perform data masking. However, with Database Vault, users must have additional privileges. This section describes three ways that you can use to enable users to mask data in Database Vault-protected objects.

If users do not have the correct privileges, then the following errors can occur while creating the masking definition or when the job is executing:

```
ORA-47400: Command Rule violation for string on string
```

```
ORA-47401: Realm violation for string on string.
```

```
ORA-47408: Realm violation for the EXECUTE command
```

```
ORA-47409: Command Rule violation for the EXECUTE command
```

```
ORA-01301: insufficient privileges
```

12.14.2 Adding Data Masking Users to the Data Dictionary Realm Authorizations

You can add data masking users to the Oracle Default Component Protection realm to give them data dictionary realm authorizations.

The Oracle Data Dictionary controls access to the Oracle Database catalog schemas, such as `SYS` and `SYSTEM`. (See [Default Realms](#) for a full list of these schemas.) It also controls the ability to grant system privileges and database administrator roles. If you add users to the Oracle

Default Component Protection realm, and assuming these users already have the privileges associated with the Oracle Data Dictionary, then these users will have these same privileges in a Database Vault environment. Therefore, if you do add a user to this realm, ensure that this user is a trusted user.

- To add a user to the Oracle Default Component Protection realm, use the `DBMS_MACADM.ADD_AUTH_TO_REALM` procedure.

For example:

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name => 'Oracle Default Component Protection Realm',
    grantee    => 'DBA_JSMITH',
    auth_options => DBMS_MACUTL.G_REALM_AUTH_PARTICIPANT);
END;
/
```

12.14.3 Giving Users Access to Tables or Schemas That They Want to Mask

To give users access to tables or schemas that they want to mask, you must authorize them for the appropriate realm.

If the table or schema of a table that is to be data masked is in a realm, then you must add the user responsible for data masking to the realm authorization as a participant or owner. If the table or schema has dependent objects that are in other realm-protected tables, then you must grant the user participant or owner authorization for those realms as well.

- To authorize users for data masking to a realm that protects the objects they want to data mask, use the `DBMS_MACADM.ADD_AUTH_TO_REALM` procedure.

The following example shows how to grant user `DBA_JSMITH` authorization for the `HR.EMPLOYEES` table, which is protected by a realm called `Business Apps Realm`:

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name => 'Business Apps Realm',
    grantee    => 'DBA_JSMITH',
    auth_options => DBMS_MACUTL.G_REALM_AUTH_PARTICIPANT);
END;
/
```

12.14.4 Creating a Command Rule to Control Data Masking Privileges

You must have privileges to manage tables, packages, and triggers before you can use data masking in an Oracle Database Vault environment.

For data masking, users must have the `CREATE TABLE`, `SELECT TABLE`, `ALTER TABLE`, and `DROP TABLE` privileges for the masking objects and if there are any dependent objects to be created, the user must have the appropriate privileges such as `CREATE PACKAGE`, `CREATE TRIGGER`, and so on.

You can create command rules to control data masking privileges at a granular level. To do so, create a command rule that can either prevent or allow the user access to objects that must have to be data masked. For example, you can create a command rule called `Allow Data Masking` that checks if the user is in a list of users who are responsible for data masking. If the user logging in is one of these users, then the command rule evaluates to true and the user is permitted to create the data mask for the protected object.

To create a command rule that controls data masking privileges:

1. Create the rule set rule.

For example:

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Is HDRISCOLL or DBA_JSMITH User',
    rule_expr => 'USER IN(''HDRISCOLL'', ''DBA_JSMITH'')';
END;
/
```

2. Create a rule set and then add the rule to it:

```
BEGIN
  DBMS_MACADM.CREATE_RULE_SET(
    rule_set_name => 'Allow Data Masking',
    description   => 'Allows users HDRISCOLL and DBA_JSMITH access',
    enabled       => 'DBMS_MACUTL.G_YES',
    eval_options  => DBMS_MACUTL.G_RULESET_EVAL_ALL,
    audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
    fail_options  => DBMS_MACUTL.G_RULESET_FAIL_SHOW,
    fail_message  => 'You do not have access to this object.',
    fail_code     => 20461,
    handler_options => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
    is_static     => TRUE);
END;
/
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'Allow Data Masking',
    rule_name     => 'Is HDRISCOLL or DBA_JSMITH User',
    rule_order    => 1);
END;
/
```

3. Create a command rule and then add this rule to it:

```
BEGIN
  DBMS_MACADM.CREATE_COMMAND_RULE(
    command       => 'CREATE TABLE',
    rule_set_name => 'Allow Data Masking',
    object_owner  => 'HR',
    object_name   => 'EMPLOYEES',
    enabled       => DBMS_MACUTL.G_YES);
END;
/
```

12.15 Converting a Standalone Oracle Database to a PDB and Plugging It into a CDB

You can convert a standalone Oracle Database database from release 12c through 19c to a PDB, and then plug this PDB into a CDB.

1. Connect to the root as a user who has been granted the `DV_OWNER` role.
2. Grant the `DV_PATCH_ADMIN` role to user `SYS` with `CONTAINER = CURRENT`.

```
GRANT DV_PATCH_ADMIN TO SYS CONTAINER = CURRENT;
```

3. In the root, connect as user `SYS` with the `SYSOPER` system privilege.
4. Restart the database in read-only mode.

For example:

```
SHUTDOWN IMMEDIATE
STARTUP MOUNT
ALTER DATABASE OPEN READ ONLY
```

5. Connect to the Database Vault-enabled PDB as a user who has the `DV_OWNER` role.
6. Grant the `DV_PATCH_ADMIN` role to user `SYS` in this PDB.

```
GRANT DV_PATCH_ADMIN TO SYS;
```

7. Optionally, run the `DBMS_PDB.CHECK_PLUG_COMPATIBILITY` function to determine whether the unplugged PDB is compatible with the CDB.

When you run the function, set the following parameters:

- `pdb_descr_file`: Set this parameter to the full path to the XML file that will contain a description of the PDB.
- `store_report`: Set this parameter to indicate whether you want to generate a report if the PDB is not compatible with the CDB. Set it to `TRUE` to generate a report or `FALSE` to not generate a report. A generated report is stored in the `PDB_PLUG_IN_VIOLATIONS` temporary table and is generated only if the PDB is not compatible with the CDB.

For example, to determine whether a PDB described by the `/disk1/usr/dv_db_pdb.xml` file is compatible with the current CDB, run the following PL/SQL block:

```
SET SERVEROUTPUT ON
DECLARE
  compatible CONSTANT VARCHAR2(3) :=
    CASE DBMS_PDB.CHECK_PLUG_COMPATIBILITY(
      pdb_descr_file => '/disk1/usr/dv_db_pdb.xml',
      store_report   => TRUE)
    WHEN TRUE THEN 'YES'
    ELSE 'NO'
END;
BEGIN
  DBMS_OUTPUT.PUT_LINE(compatible);
END;
/
```

If the output is `YES`, then the PDB is compatible, and you can continue with the next step.

If the output is `NO`, then the PDB is not compatible. You can check the `PDB_PLUG_IN_VIOLATIONS` temporary table to see why it is not compatible.

8. Create an XML file that describes the PDB.

For example:

```
BEGIN
  DBMS_PDB.DESCRIBE(
    pdb_descr_file => '/disk1/oracle/dv_db.xml');
```

```
END;  
/
```

9. Run the `CREATE PLUGGABLE DATABASE` statement, and specify the XML file in the `USING` clause. Specify other clauses when they are required.

For example:

```
CREATE PLUGGABLE DATABASE dv_db_pdb AS CLONE USING 'dv_db.xml' NOCOPY;
```

10. Connect to the PDB that you just created as user `SYS` with the `SYSDBA` administrative privilege.
11. Run the `noncdb_to_pdb.sql` script.

```
@$ORACLE_HOME/rdbms/admin/noncdb_to_pdb.sql
```

12. Open this PDB in a read/write restricted mode.

```
ALTER PLUGGABLE DATABASE pdb_name OPEN READ WRITE RESTRICTED;
```

13. Run the following procedure to synchronize the PDB:

```
EXECUTE DBMS_PDB.SYNC_PDB;
```

14. Connect to the root as a user who has been granted the `DV_OWNER` role.
15. Revoke the `DV_PATCH_ADMIN` role from user `SYS` with `CONTAINER = CURRENT`.

```
REVOKE DV_PATCH_ADMIN FROM SYS CONTAINER = CURRENT;
```

16. Connect to the legacy Database Vault-enabled PDB as user `SYS` with the `SYSOPER` system privilege.
17. Close and then reopen the PDB.

```
ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;  
ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

18. Revoke the `DV_PATCH_ADMIN` role from user `SYS`.

```
REVOKE DV_PATCH_ADMIN FROM SYS;
```

12.16 Using the ORADEBUG Utility with Oracle Database Vault

The `ORADEBUG` utility is used primarily by Oracle Support to diagnose problems that may arise with an Oracle database.

You can control whether users can run the `ORADEBUG` utility in an Oracle Database Vault-enabled environment. In a traditional auditing environment, you can audit the use of `ORADEBUG` by setting the `AUDIT_SYS_OPERATIONS` initialization parameter to `TRUE`. In a unified auditing environment, `ORADEBUG` commands are mandatorily audited. This control does not apply to a privileged OS user, which is the OS user with the same OS user ID as the Oracle server process. This exception is made because such a user can completely control and examine the Oracle process using other means (for example, with a debugger).

1. Log into the database instance as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. If necessary, find out if `ORADEBUG` is already disabled or enabled.

```
SELECT * FROM DBA_DV_ORADEBUG;
```

3. Run one of the following procedures:

- To disable the use of `ORADEBUG`:

```
EXEC DBMS_MACADM.DISABLE_ORADEBUG;
```

- To enable the use of `ORADEBUG`:

```
EXEC DBMS_MACADM.ENABLE_ORADEBUG;
```

Related Topics

- [DBA_DV_ORADEBUG View](#)
The `DBA_DV_ORADEBUG` data dictionary view indicates whether users can use the `ORADEBUG` utility in an Oracle Database Vault environment.
- [DISABLE_ORADEBUG Procedure](#)
The `DISABLE_ORADEBUG` procedure disables the use of the `ORADEBUG` utility in an Oracle Database Vault environment.
- [ENABLE_ORADEBUG Procedure](#)
The `ENABLE_ORADEBUG` procedure enables the use of the `ORADEBUG` utility in an Oracle Database Vault environment.

12.17 Performing Patch Operations in an Oracle Database Vault Environment

User `SYS` must have the `DV_PATCH_ADMIN` role to perform a patch operations on an Oracle Database Vault-enabled database.

Users who have been granted the `DV_PATCH_ADMIN` can also view data.

1. Connect to the CDB or the application root as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Temporarily grant the `SYS` user the `DV_PATCH_ADMIN` role.

```
GRANT DV_PATCH_ADMIN TO SYS CONTAINER=ALL;
```

If you are applying a patch to a single PDB, then you do not need to grant `DV_PATCH_ADMIN` to `SYS` on all containers.

3. After the `SYS` user has performed the patch operation, carefully following the instructions in the patch readme file, then revoke `DV_PATCH_ADMIN` from user `SYS`.

```
REVOKE DV_PATCH_ADMIN FROM SYS CONTAINER=ALL;
```

13

Oracle Database Vault Schemas, Roles, and Accounts

Oracle Database Vault provides schemas that contain Database Vault objects, roles that provide separation of duty for specific tasks, and default user accounts.

- [Oracle Database Vault Schemas](#)
The Oracle Database Vault schemas, `DVSY` and `DVF`, support the administration and run-time processing of Oracle Database Vault.
- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.
- [Oracle Database Vault Accounts Created During Registration](#)
The accounts that you create during registration enable Oracle Database Vault to adhere to separation of duty concepts and provide flexibility for users based on the tasks they perform.
- [Backup Oracle Database Vault Accounts](#)
As a best practice, you should maintain backup accounts for the `DV_OWNER` and `DV_ACCTMGR` roles.

13.1 Oracle Database Vault Schemas

The Oracle Database Vault schemas, `DVSY` and `DVF`, support the administration and run-time processing of Oracle Database Vault.

- [DVSYS Schema](#)
The `DVSY` schema contains Oracle Database Vault database objects.
- [DVF Schema](#)
The `DVF` schema is the owner of the Oracle Database Vault `DBMS_MACSEC_FUNCTION` PL/SQL package.

13.1.1 DVSYS Schema

The `DVSY` schema contains Oracle Database Vault database objects.

These objects store Oracle Database Vault configuration information and support the administration and run-time processing of Oracle Database Vault.

In a default installation, the `DVSY` schema is locked. The `DVSY` schema also owns the `AUDIT_TRAIL$` table.

The `DVSY` schema is considered a common schema, which means that the objects within `DVSY` (tables, views, PL/SQL packages, and so on) are automatically available to any child pluggable databases (PDBs). In addition, the `DVSY` schema account cannot switch to other containers using the `ALTER SESSION` statement.

Oracle Database Vault secures the `DVSYS` schema by using a protected schema design. A protected schema design guards the schema against improper use of system privileges (for example, `SELECT ANY TABLE`, `CREATE ANY VIEW`, or `DROP ANY`).

Oracle Database Vault protects and secures the `DVSYS` schema in the following ways:

- The `DVSYS` protected schema and its administrative roles cannot be dropped. By default, the `DVSYS` account is locked.
- By default, users cannot directly log into the `DVSYS` account. To control the ability of users to directly log into this account, you can run the `DBMS_MACADM.DISABLE_DV_DICTIONARY_ACCTS` procedure to prevent users from logging in and the `DBMS_MACADM.ENABLE_DV_DICTIONARY_ACCTS` procedure to allow users to log in.
- Statements such as `CREATE USER`, `ALTER USER`, `DROP USER`, `CREATE PROFILE`, `ALTER PROFILE`, and `DROP PROFILE` can only be issued by a user with the `DV_ACCTMGR` role. A user logged in with the `SYSDBA` administrative privilege can issue these statements only if it is allowed to do so by modifying the Can Maintain Accounts/Profiles rule set.
- The powerful `ANY` system privileges for database definition language (DDL) and data manipulation language (DML) commands are blocked in the protected schema. This means that the objects in the `DVSYS` schema must be created by the schema account itself. Also, access to the schema objects must be authorized through object privilege grants.
- Object privileges in the `DVSYS` schema can only be granted to Database Vault administrative roles in the schema. This means that users can access the protected schema only through predefined administrative roles.
- Only the protected schema account `DVSYS` can issue `ALTER ROLE` statements on Database Vault predefined administrative roles of the schema.
- The `SYS.DBMS_SYS_SQL.PARSE_AS_USER` procedure cannot be used to run SQL statements on behalf of the protected schema `DVSYS`.

**Note:**

Database users can grant additional object privileges and roles to the Oracle Database Vault administrative roles (`DV_ADMIN` and `DV_OWNER`, for example) provided they have sufficient privileges to do so.

Related Topics

- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.

13.1.2 DVF Schema

The `DVF` schema is the owner of the Oracle Database Vault `DBMS_MACSEC_FUNCTION` PL/SQL package.

This package contains the functions that retrieve factor identities. After you install Oracle Database Vault, the installation process locks the `DVF` account to better secure it. When you create a new factor, Oracle Database Vault creates a new retrieval function for the factor and saves it in this schema.

The `DVF` user cannot switch to other containers using the `ALTER SESSION` statement.

By default, users cannot directly log into the `DVF` account. To control the ability of users to directly log into this account, you can run the `DBMS_MACADM.DISABLE_DV_DICTIONARY_ACCTS` procedure to prevent users from logging in and the `DBMS_MACADM.ENABLE_DV_DICTIONARY_ACCTS` procedure to allow users to log in.

13.2 Oracle Database Vault Roles

Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.

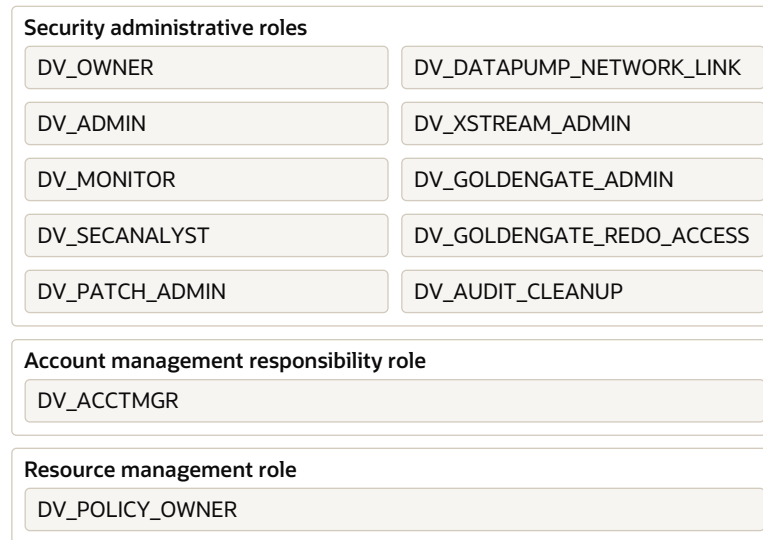
- [About Oracle Database Vault Roles](#)
Oracle Database Vault provides a set of roles that are required for managing Oracle Database Vault.
- [Privileges of Oracle Database Vault Roles](#)
The Oracle Database Vault roles are designed to provide the maximum benefits of separation of duty.
- [Granting Oracle Database Vault Roles to Users](#)
You can use Enterprise Manager Cloud Control to grant Oracle Database Vault roles to users.
- [DV_ACCTMGR Database Vault Account Manager Role](#)
The `DV_ACCTMGR` role is a powerful role, used for accounts management.
- [DV_ADMIN Database Vault Configuration Administrator Role](#)
The `DV_ADMIN` role controls the Oracle Database Vault PL/SQL packages.
- [DV_AUDIT_CLEANUP Audit Trail Cleanup Role](#)
The `DV_AUDIT_CLEANUP` role is used for purge operations.
- [DV_DATAPUMP_NETWORK_LINK Data Pump Network Link Role](#)
The `DV_DATAPUMP_NETWORK_LINK` role is used for Data Pump import operations.
- [DV_GOLDENGATE_ADMIN GoldenGate Administrative Role](#)
The `DV_GOLDENGATE_ADMIN` role is used with Oracle GoldenGate.
- [DV_GOLDENGATE_REDO_ACCESS GoldenGate Redo Log Role](#)
The `DV_GOLDENGATE_REDO_ACCESS` role is used with Oracle GoldenGate.
- [DV_MONITOR Database Vault Monitoring Role](#)
The `DV_MONITOR` role is used for monitoring Oracle Database Vault.
- [DV_OWNER Database Vault Owner Role](#)
The `DV_OWNER` role enables you to manage the Oracle Database Vault roles and its configuration.
- [DV_PATCH_ADMIN Database Vault Database Patch Role](#)
The `DV_PATCH_ADMIN` role is used for patching operations.
- [DV_POLICY_OWNER Database Vault Owner Role](#)
The `DV_POLICY_OWNER` role enables database users to manage to a limited degree Oracle Database Vault policies.
- [DV_SECANALYST Database Vault Security Analyst Role](#)
The `DV_SECANALYST` role enables users to analyze activities.
- [DV_XSTREAM_ADMIN XStream Administrative Role](#)
The `DV_XSTREAM_ADMIN` role is used for Oracle XStream.


13.2.1 About Oracle Database Vault Roles

Oracle Database Vault provides a set of roles that are required for managing Oracle Database Vault.

The following illustration shows how these roles are designed to implement the first level of separation of duties within the database. How you use these roles depends on the requirements that your company has in place.

Figure 13-1 How Oracle Database Vault Roles Are Categorized



 **Note:**

You can grant additional object privileges and roles to the Oracle Database Vault roles to extend their scope of privileges. For example, a user logged in with the `SYSDBA` administrative privilege can grant object privileges to an Oracle Database Vault role as long as the object is not in the `DVSYS` schema or realm.

Related Topics

- [Separation of Duty Guidelines](#)
Oracle Database Vault is designed to easily implement separation of duty guidelines.
- [Managing Oracle Database Administrative Accounts](#)
Oracle provides guidelines for managing security for administrative accounts such as `SYSTEM` or users who have the `SYSDBA` administrative privilege.

13.2.2 Privileges of Oracle Database Vault Roles

The Oracle Database Vault roles are designed to provide the maximum benefits of separation of duty.

The `DV_PATCH_ADMIN`, `DV_XSTREAM`, `DV_GOLDENGATE_ADMIN`, and `DV_GOLDENGATE_REDO_ACCESS` roles are not included in the following sections because they have no system privileges.

DVSYs Schema, EXECUTE Privilege

Roles that can use this privilege:

- DV_ADMIN (includes the EXECUTE privilege on all Oracle Database Vault PL/SQL packages)
- DV_OWNER (includes the EXECUTE privilege on all Oracle Database Vault PL/SQL packages)
- DV_POLICY_OWNER (on some DBMS_MACADM procedures)

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_AUDIT_CLEANUP
- DV_MONITOR
- DV_SECANALYST

DVSYs Schema, SELECT Privilege

Roles that can use this privilege:

- DV_ADMIN
- DV_AUDIT_CLEANUP (on some Database Vault tables and views; can perform SELECT statements on the AUDIT_TRAIL\$ table, and the DV\$ENFORCEMENT_AUDIT and DV\$CONFIGURATION_AUDIT views)
- DV_MONITOR
- DV_OWNER
- DV_POLICY_OWNER (on some DBMS_MACADM procedures and on POLICY_OWNER* views only)
- DV_SECANALYST (on some Database Vault views: DV_SECANALYST can query DVSYs schema objects through Oracle Database Vault-supplied views)

Roles that are denied this privilege:

- DV_ACCTMGR

DVSYs Schema, DELETE Privilege

Roles that can use this privilege:

- DV_AUDIT_CLEANUP (can perform DELETE on some Database Vault tables and views, on the AUDIT_TRAIL\$ table, and the DV\$ENFORCEMENT_AUDIT and DV\$CONFIGURATION_AUDIT views)
- DV_OWNER (can perform DELETE on some Database Vault tables and views, on the AUDIT_TRAIL\$ table, and the DV\$ENFORCEMENT_AUDIT and DV\$CONFIGURATION_AUDIT views)

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_ADMIN
- DV_MONITOR
- DV_POLICY_OWNER
- DV_SECANALYST

DVSYSS Schema, Grant Privileges on Objects

Roles that can use this privilege: None

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_ADMIN
- DV_AUDIT_CLEANUP
- DV_MONITOR
- DV_OWNER
- DV_POLICY_OWNER
- DV_SECANALYST

DVF Schema, EXECUTE Privilege

Roles that can use this privilege:

- DV_OWNER

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_ADMIN
- DV_AUDIT_CLEANUP
- DV_MONITOR
- DV_OWNER
- DV_POLICY_OWNER
- DV_SECANALYST

DVF Schema, SELECT Privilege

Roles that can use this privilege:

- DV_OWNER
- DV_SECANALYST

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_ADMIN
- DV_AUDIT_CLEANUP
- DV_MONITOR
- DV_POLICY_OWNER

Monitor Database Vault Privilege

Roles that can use this privilege:

- DV_ADMIN

- DV_OWNER
- DV_MONITOR
- DV_SECANALYST

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_AUDIT_CLEANUP
- DV_POLICY_OWNER

Run Database Vault Reports Privilege

Roles that can use this privilege:

- DV_ADMIN
- DV_OWNER
- DV_SECANALYST

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_AUDIT_CLEANUP
- DV_MONITOR
- DV_POLICY_OWNER

SYS Schema, SELECT Privilege

Roles that can use this privilege:

- DV_MONITOR
- DV_OWNER
- DV_SECANALYST (on the same system views as DV_OWNER and DV_ADMIN)

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_ADMIN
- DV_AUDIT_CLEANUP
- DV_POLICY_OWNER

SYSMAN Schema, SELECT Privilege

Roles that can use this privilege:

- DV_OWNER (portions of SYSMAN)
- DV_SECANALYST (portions of SYSMAN)

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_ADMIN

- DV_AUDIT_CLEANUP
- DV_MONITOR
- DV_POLICY_OWNER

CREATE , ALTER , DROP User Accounts and Profiles Privilege

This privilege does not include the ability to drop or alter the DVSYS account, nor change the DVSYS password.

Role that can use this privilege:

- DV_ACCTMGR

Roles that are denied this privilege:

- DV_ADMIN
- DV_AUDIT_CLEANUP
- DV_MONITOR
- DV_OWNER
- DV_POLICY_OWNER
- DV_SECANALYST

Manage Objects in Schemas that Define a Realm

This privilege includes ANY privileges, such as CREATE ANY , ALTER ANY , and DROP ANY.

Roles that can use this privilege: None

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_AUDIT_CLEANUP
- DV_ADMIN
- DV_MONITOR
- DV_OWNER (portions of SYSMAN)
- DV_POLICY_OWNER
- DV_SECANALYST (portions of SYSMAN)

RESOURCE Role Privileges

The RESOURCE role provides the following system privileges: CREATE CLUSTER , CREATE INDEXTYPE , CREATE OPERATOR , CREATE PROCEDURE , CREATE SEQUENCE , CREATE TABLE , CREATE TRIGGER, CREATE TYPE.

Roles that can use this privilege: None

Roles that are denied this privilege:

- DV_ACCTMGR
- DV_ADMIN
- DV_AUDIT_CLEANUP

- DV_MONITOR
- DV_OWNER (portions of SYSMAN)
- DV_POLICY_OWNER
- DV_SECANALYST (portions of SYSMAN)

13.2.3 Granting Oracle Database Vault Roles to Users

You can use Enterprise Manager Cloud Control to grant Oracle Database Vault roles to users.

1. From Cloud Control, log into Oracle Database Vault Administrator as a user who has been granted the DV_OWNER role and the SELECT ANY DICTIONARY privilege..

[Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#) explains how to log in.

Refer to the role descriptions to find the requirements for who can grant roles to other users.

2. In the Administration page, under Database Vault Components, click **Database Vault Role Management**.

The Database Vault Role Management page appears.

Database Vault Role Management

This page displays users or roles granted with Database Vault roles.

Search

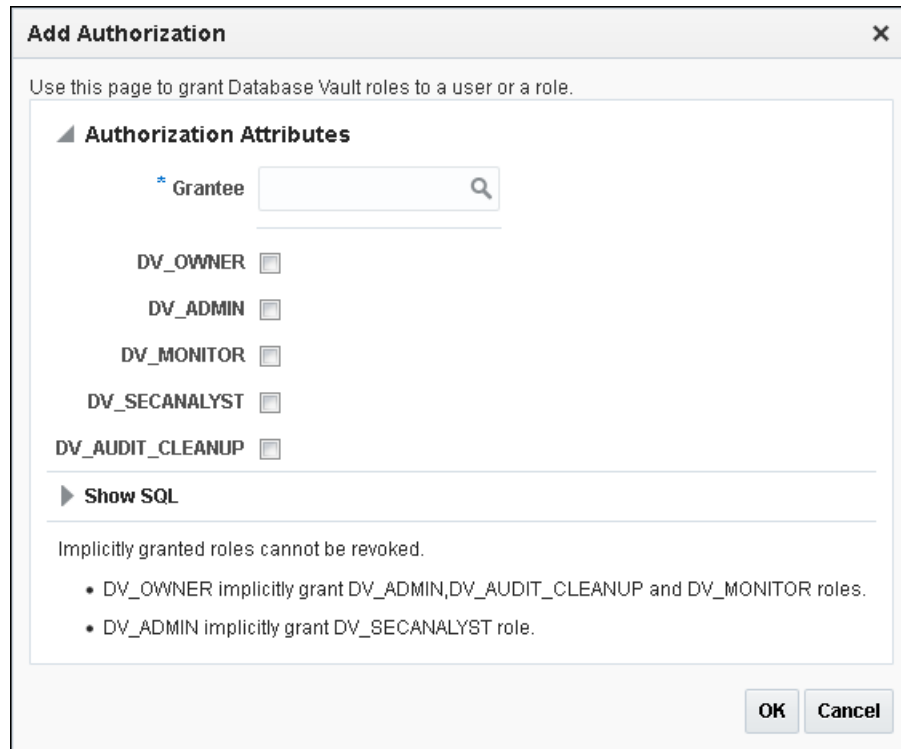
Grantee

The search returns all matches beginning with the string you enter. You can use the wildcard symbol (%) in the search string.

View ▾

| Grantee | Grantee Type | DV_OWNER | DV_ADMIN | DV_MONITOR | DV_S |
|---------|--------------|----------|----------|------------|------|
| DBSNMP | USER | | | ✓ | |
| MACAUTH | USER | | | | |
| MACSYS | USER | ✓ | ✓ | ✓ | |
| SYS | USER | | | | |

3. Do one of the following:
 - To add a new user or role for a grant, click the Add button to display the Add Authorization dialog box. Enter the grantee in the **Grantee** field, and then select the roles for the grant. Then click **OK**.



- To grant different roles or modify role grants for a user or role listed in the Database Vault Role Management page, select the user or role, click **Edit**, and then modify the role grants as necessary. Then click **OK**.

13.2.4 DV_ACCTMGR Database Vault Account Manager Role

The DV_ACCTMGR role is a powerful role, used for accounts management.

Use the DV_ACCTMGR role to create and maintain database accounts and database profiles. In this guide, the example DV_ACCTMGR role is assigned to a user named accts_admin_acer.

Privileges Associated with the DV_ACCTMGR Role

A user who has been granted this role can use the CREATE, ALTER, and DROP statements for user accounts or profiles, including users who have been granted the DV_SECANALYST, DV_AUDIT_CLEANUP, and DV_MONITOR roles.

This user also can grant the CREATE SESSION privilege to other users. However, a person who has been granted the DV_ACCTMGR role cannot perform the following operations:

- ALTER or DROP statements on the DVSYS account
- ALTER or DROP statements on users who have been granted the DV_ADMIN or DV_OWNER role
- Change passwords for users who have been granted the DV_ADMIN or DV_OWNER role

A common user who has been granted the DV_ACCTMGR role in the CDB root can alter a common user or a common profile in the CDB root even if the common DV_ACCTMGR user does not have the SET CONTAINER privilege or the DV_ACCTMGR role in any PDB.

To find the full list of system and object privileges associated with the DV_ACCTMGR role, log into the database instance with sufficient privileges and then enter the following queries:

```
SELECT TABLE_NAME, OWNER, PRIVILEGE FROM DBA_TAB_PRIVS WHERE GRANTEE = 'DV_ACCTMGR';  
SELECT PRIVILEGE FROM DBA_SYS_PRIVS WHERE GRANTEE = 'DV_ACCTMGR';
```

 **Tips:**

- If you want the `DV_ACCTMGR` user to be able to grant or revoke the `ANY` privileges for other users, then log in as user `SYS` with the `SYSDBA` privilege and grant this user the `GRANT ANY PRIVILEGE` and `REVOKE ANY PRIVILEGE` privileges. Then add this user to the Oracle System Privilege and Role Management Realm as an owner.
- Oracle strongly recommends that you create a separate, named account for the `DV_ACCTMGR` user. This way, if this user forgets their password, you can log in as the original `DV_ACCTMGR` account and reset the user's password. Otherwise, you must disable Oracle Database Vault, log in as `SYS` or `SYSTEM` to recreate the password, and then re-enable Database Vault.

How Are GRANT and REVOKE Operations Affected by DV_ACCTMGR?

Any account, such as `SYS` or `SYSTEM`, with the `GRANT ANY ROLE` system privilege alone does not have the rights to grant this role to or revoke this role from any other database account.

The account with the `DV_ACCTMGR` role and the `ADMIN OPTION` can grant this role to any given database account and revoke this role from another account.

DV_ACCTMGR Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.5 DV_ADMIN Database Vault Configuration Administrator Role

The `DV_ADMIN` role controls the Oracle Database Vault PL/SQL packages.

These packages are the underlying interface for the Database Vault Administrator user interface in Oracle Enterprise Manager Cloud Control.

Privileges Associated with the DV_ADMIN Role

The `DV_ADMIN` role has the `EXECUTE` privilege on the `DVSYS` packages (`DBMS_MACADM` and `DBMS_MACUTL`).

`DV_ADMIN` also has the capabilities provided by the `DV_SECANALYST` role, which allow the user to run Oracle Database Vault reports and monitor Oracle Database Vault. During installation, the `DV_ADMIN` role is granted to the `DV_OWNER` role with the `ADMIN OPTION`.

In addition, the `DV_ADMIN` role provides the `SELECT` privilege on the `DBA_DV_POLICY`, `DBA_DV_POLICY_OWNER`, and `DBA_DV_POLICY_OBJECT` data dictionary views.

To find the full list of system and object privileges associated with the `DV_ADMIN` role, log into the database instance with sufficient privileges and then enter the following queries:

```
SELECT TABLE_NAME, OWNER, PRIVILEGE FROM DBA_TAB_PRIVS WHERE GRANTEE = 'DV_ADMIN';  
SELECT PRIVILEGE FROM DBA_SYS_PRIVS WHERE GRANTEE = 'DV_ADMIN';
```

How Are GRANT and REVOKE Operations Affected by DV_ADMIN?

Accounts such as `SYS` or `SYSTEM`, with the `GRANT ANY ROLE` system privilege alone do not have the rights to grant or revoke `DV_ADMIN` from any other database account.

The user with the `DV_OWNER` role can grant or revoke this role to and from any database account.

Managing Password Changes for Users Who Have the DV_ADMIN Role

Before you can change the password for a user who has been granted the `DV_ADMIN` role, you must revoke the `DV_ADMIN` role from this account.

If you have been granted the `DV_ADMIN` role, then you can change your own password without having to revoke the role from yourself.

To change the `DV_ADMIN` user password:

1. Log into the root or the PDB using an account that has been granted the `DV_OWNER` role.
2. Revoke the `DV_ADMIN` role from the user account whose password needs to change.
3. Connect as a user who has been granted the `DV_ACCTMGR` role and then change the password for this user.
4. Connect as the `DV_OWNER` user and then grant the `DV_ADMIN` role back to the user whose password you changed.

DV_ADMIN Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database Vault roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.6 DV_AUDIT_CLEANUP Audit Trail Cleanup Role

The `DV_AUDIT_CLEANUP` role is used for purge operations.

Grant the `DV_AUDIT_CLEANUP` role to any user who is responsible for purging the Database Vault audit trail in a non-unified auditing environment.

[Archiving and Purging the Oracle Database Vault Audit Trail](#) explains how to use this role to complete a purge operation.

Privileges Associated with the DV_AUDIT_CLEANUP Role

The DV_AUDIT_CLEANUP role has SELECT and DELETE privileges for three Database Vault-related auditing views.

- SELECT and DELETE on the DVSYS.AUDIT_TRAIL\$ table
- SELECT and DELETE on the DVSYS.DV\$ENFORCEMENT_AUDIT view
- SELECT and DELETE on the DVSYS.DV\$CONFIGURATION_AUDIT view

How Are GRANT and REVOKE Operations Affected by DV_AUDIT_CLEANUP?

By default, this role is granted to the DV_OWNER role with the ADMIN OPTION.

Only a user who has been granted the DV_OWNER role can grant or revoke the DV_AUDIT_CLEANUP role to another user.

DV_AUDIT_CLEANUP Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database Vault roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the GRANT ANY ROLE system privilege can perform GRANT and REVOKE operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.7 DV_DATAPUMP_NETWORK_LINK Data Pump Network Link Role

The DV_DATAPUMP_NETWORK_LINK role is used for Data Pump import operations.

Grant the DV_DATAPUMP_NETWORK_LINK role to any user who is responsible for conducting the NETWORK_LINK transportable Data Pump import operation in an Oracle Database Vault environment.

This role enables the management of the Oracle Data Pump NETWORK_LINK transportable import processes to be tightly controlled by Database Vault, but does not change or restrict the way you would normally conduct Oracle Data Pump operations.

Privileges Associated with the DV_DATAPUMP_NETWORK_LINK Role

There are no system privileges associated with the DV_DATAPUMP_NETWORK_LINK role, but it does have the EXECUTE privilege on DVSYS objects.

To find the full list of DV_DATAPUMP_NETWORK_LINK object privileges, log into the database instance with sufficient privileges and then enter the following query:

```
SELECT TABLE_NAME, OWNER, PRIVILEGE FROM DBA_TAB_PRIVS WHERE GRANTEE =  
'DV_DATAPUMP_NETWORK_LINK';
```

Be aware that the DV_DATAPUMP_NETWORK_LINK role does not provide a sufficient set of database privileges to conduct NETWORK_LINK transportable Data Pump import operation. Rather, the DV_DATAPUMP_NETWORK_LINK role is an additional requirement (that is, in addition to the privileges that Oracle Data Pump currently requires) for database administrators to conduct

`NETWORK_LINK` transportable Data Pump import operations in an Oracle Database Vault environment.

How Are GRANT and REVOKE Operations Affected by DV_DATAPUMP_NETWORK_LINK?

Only users who have been granted the `DV_OWNER` role can grant or revoke the `DV_DATAPUMP_NETWORK_LINK` role to or from other users.

DV_DATAPUMP_NETWORK_LINK Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Using Oracle Data Pump with Oracle Database Vault](#)
Database administrators can authorize Oracle Data Pump users to work in a Database Vault environment.
- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.8 DV_GOLDENGATE_ADMIN GoldenGate Administrative Role

The `DV_GOLDENGATE_ADMIN` role is used with Oracle GoldenGate.

Grant this role to any user who is responsible for configuring Oracle GoldenGate in an Oracle Database Vault environment.

This enables the management of Oracle GoldenGate processes to be tightly controlled by Database Vault, but does not change or restrict the way an administrator would normally configure Oracle GoldenGate.

Privileges Associated with the DV_GOLDENGATE_ADMIN Role

There are no privileges associated with the `DV_GOLDENGATE_ADMIN` role.

Be aware that the `DV_GOLDENGATE_ADMIN` role does not provide a sufficient set of database privileges for configuring Oracle GoldenGate. Rather, the `DV_GOLDENGATE_ADMIN` role is an additional requirement (that is, in addition to the privileges that Oracle GoldenGate currently requires) for database administrators to configure Oracle GoldenGate in an Oracle Database Vault environment.

How Are GRANT and REVOKE Operations Affected by DV_GOLDENGATE_ADMIN?

Only users who have been granted the `DV_OWNER` role can grant or revoke the `DV_GOLDENGATE_ADMIN` role to or from other users.

DV_GOLDENGATE_ADMIN Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.
- [Privileges for Using Oracle GoldenGate with Oracle Database Vault](#)
If you want to use Oracle GoldenGate in an Oracle Database Vault environment, then you must have the appropriate privileges.

13.2.9 DV_GOLDENGATE_REDO_ACCESS GoldenGate Redo Log Role

The `DV_GOLDENGATE_REDO_ACCESS` role is used with Oracle GoldenGate.

Grant the `DV_GOLDENGATE_REDO_ACCESS` role to any user who is responsible for using the Oracle GoldenGate `TRANLOGOPTIONS DBLOGREADER` method to access redo logs in an Oracle Database Vault environment.

This enables the management of Oracle GoldenGate processes to be tightly controlled by Database Vault, but does not change or restrict the way an administrator would normally configure Oracle GoldenGate.

Privileges Associated with the DV_GOLDENGATE_REDO_ACCESS Role

There are no privileges associated with the `DV_GOLDENGATE_REDO_ACCESS` role.

Be aware that the `DV_GOLDENGATE_REDO_ACCESS` role does not provide a sufficient set of database privileges for configuring Oracle GoldenGate. Rather, the `DV_GOLDENGATE_REDO_ACCESS` role is an additional requirement (that is, in addition to the privileges that Oracle GoldenGate currently requires) for database administrators.

How Are GRANT and REVOKE Operations Affected by DV_GOLDENGATE_REDO_ACCESS?

You cannot grant the `DV_GOLDENGATE_REDO_ACCESS` role with `ADMIN OPTION`.

Only users who have been granted the `DV_OWNER` role can grant or revoke the `DV_GOLDENGATE_REDO_ACCESS` role to or from other users.

DV_GOLDENGATE_REDO_ACCESS Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.
- [Privileges for Using Oracle GoldenGate with Oracle Database Vault](#)
If you want to use Oracle GoldenGate in an Oracle Database Vault environment, then you must have the appropriate privileges.

13.2.10 DV_MONITOR Database Vault Monitoring Role

The `DV_MONITOR` role is used for monitoring Oracle Database Vault.

The `DV_MONITOR` role enables the Oracle Enterprise Manager Cloud Control agent to monitor Oracle Database Vault for attempted violations and configuration issues with realm or command rule definitions.

This role enables Cloud Control to read and propagate realm definitions and command rule definitions between databases.

Privileges Associated with the DV_MONITOR Role

There are no system privileges associated with the `DV_MONITOR` role, but it does have the `SELECT` privilege on `SYS` and `DVSYS` objects.

In addition, the `DV_MONITOR` role provides the `SELECT` privilege on the `DBA_DV_POLICY`, `DBA_DV_POLICY_OWNER`, and `DBA_DV_POLICY_OBJECT` data dictionary views.

To find the full list of `DV_MONITOR` object privileges, log into the database instance with sufficient (such as `DV_OWNER`) privileges and then enter the following query:

```
SELECT TABLE_NAME, OWNER, PRIVILEGE FROM DBA_TAB_PRIVS WHERE GRANTEE = 'DV_MONITOR';
```

How Are GRANT and REVOKE Operations Affected by DV_MONITOR?

By default, the `DV_MONITOR` role is granted to the `DV_OWNER` role and the `DBSNMP` user.

Only a user who has been granted the `DV_OWNER` role can grant or revoke the `DV_MONITOR` role to another user.

DV_MONITOR Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database Vault roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Monitoring Oracle Database Vault](#)
You can monitor Oracle Database Vault by checking for violations to the Database Vault configurations and by tracking changes to policies.
- [Auditing Oracle Database Vault](#)
You can audit activities in Oracle Database Vault, such as changes to policy configurations.
- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.11 DV_OWNER Database Vault Owner Role

The `DV_OWNER` role enables you to manage the Oracle Database Vault roles and its configuration.

In this guide, the example account that uses this role is `sec_admin_owen`.

Privileges Associated with the DV_OWNER Role

The DV_OWNER role has the administrative capabilities that the DV_ADMIN role provides, and the reporting capabilities the DV_SECANALYST role provides.

This role also provides privileges for monitoring Oracle Database Vault. It is created when you install Oracle Database Vault, and has the most privileges on the DVSYS schema. It also has the DV_ADMIN role.

To find the full list of system and object privileges associated with the DV_OWNER role, you can log into the database instance and enter the following queries:

```
SELECT TABLE_NAME, OWNER, PRIVILEGE FROM DBA_TAB_PRIVS WHERE GRANTEE = 'DV_OWNER';  
SELECT PRIVILEGE FROM DBA_SYS_PRIVS WHERE GRANTEE = 'DV_OWNER';
```

When you configure and enable Oracle Database Vault, the DV_OWNER account is created. The user who is granted this role is also granted the ADMIN option and can grant any Oracle Database Vault roles (except DV_ACCTMGR) to any account. Users granted this role also can run Oracle Database Vault reports and monitor Oracle Database Vault.

Tip:

Oracle strongly recommends that you create separate, named account for the DV_OWNER user. This way, if the user is no longer available (for example, they left the company), then you can easily recreate this user account and then grant this user the DV_OWNER role.

How Are GRANT and REVOKE Operations Affected by DV_OWNER?

Anyone with the DV_OWNER role can grant the DV_OWNER and DV_ADMIN roles to another user.

The account granted this role can revoke any granted Database Vault role from another account. Accounts such as SYS or SYSTEM, with the GRANT ANY ROLE system privilege alone (directly granted or indirectly granted using a role) do not have the right to grant or revoke the DV_OWNER role to or from any other database account. Note also that a user with the DV_OWNER role cannot grant or revoke the DV_ACCTMGR role.

Managing Password Changes for Users Who Have the DV_OWNER Role

Before you can change the password for another user who has been granted the DV_OWNER role, you must revoke the DV_OWNER role from that user account.

However, be cautious about revoking the DV_OWNER role. At least one user on your site must have this role granted. If another DV_OWNER user has been granted this role and needs to have their password changed, then you can temporarily revoke DV_OWNER from that user. Note also that if you have been granted the DV_OWNER role, then you can change your own password without having to revoke the role from yourself.

To change the DV_OWNER user password:

1. Log into the root or the PDB using an account that has been granted the DV_OWNER role.
2. Revoke the DV_OWNER role from the user account whose password needs to change.
3. Connect as a user who has been granted the DV_ACCTMGR role and then change the password for this user.

4. Connect as the `DV_OWNER` user and then grant the `DV_OWNER` role back to the user whose password you changed.

DV_OWNER Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database Vault roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.12 DV_PATCH_ADMIN Database Vault Database Patch Role

The `DV_PATCH_ADMIN` role is used for patching operations.

In order to generate all Database Vault-related audit records in accordance with the audit policies specified in the Database Vault metadata as well as Database Vault unified audit policies, run the `DBMS_MACADM.ENABLE_DV_PATCH_ADMIN_AUDIT` procedure as a user who has been granted the `DV_ADMIN` role before using the `DV_PATCH_ADMIN` role.

Temporarily grant the `DV_PATCH_ADMIN` role to any database administrator who is responsible for performing database patching. Before this administrator performs the patch operation, run the `DBMS_MACADM.ENABLE_DV_PATCH_ADMIN_AUDIT` procedure. This procedure enables realm, command rule, and rule set auditing of the actions by users who have been granted the `DV_PATCH_ADMIN` role, in accordance with the existing audit configuration. If you have mixed-mode auditing, then this user's actions are written to the `AUDIT_TRAIL$` table. If you have pure unified auditing enabled, then you should create a unified audit policy to capture this user's actions.

After the patch operation is complete, do not immediately disable the auditing of users who are responsible for performing database patch operations. This way, you can track the actions of the `DV_PATCH_ADMIN` role users. For backwards compatibility, this type of auditing is disabled by default.

Privileges Associated with the DV_PATCH_ADMIN Role

The `DV_PATCH_ADMIN` role does not provide access to any secured data. The common `DV_PATCH_ADMIN` grant is required for database upgrades, and Oracle recommends that this role not be used for any other database administration purpose.

The `DV_PATCH_ADMIN` role is a special Database Vault role that does not have any object or system privilege. It is designed to allow the database administrator or the user `SYS` to patch Database Vault enabled databases (for example, applying a database patch without disabling Database Vault). It also enables the database administrator to create users, because some patches may require the need to create new schemas.

Follow these guidelines for managing the `DV_PATCH_ADMIN` role:

- Do not grant the `DV_PATCH_ADMIN` role unless it is required (for example, for a database upgrade).
- Revoke the `DV_PATCH_ADMIN` role grant when the role is no longer needed.

- Review the audit records to monitor activities while the `DV_PATCH_ADMIN` role was granted.

How Are GRANT and REVOKE Operations Affected by DV_PATCH_ADMIN?

Only a user who has the `DV_OWNER` role can grant or revoke the `DV_PATCH_ADMIN` role to and from another user.

DV_PATCH_ADMIN Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Guidance for Configuring and Enabling Database Vault When Patching in Multitenant Environments

The `DV_OWNER` user can be configured locally or commonly to a common user in CDB root. When `DV_PATCH_ADMIN` must be granted to patch the database, there is no difference in what a locally granted `DV_OWNER` user has to do. By its structure, `DV_PATCH_ADMIN` acts as the user has `DV_PATCH_ADMIN` in every PDB to complete the patch, even if granted by a locally granted `DV_OWNER` common user in the CDB root.

Related Topics

- [Introduction to Auditing](#)
- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.13 DV_POLICY_OWNER Database Vault Owner Role

The `DV_POLICY_OWNER` role enables database users to manage to a limited degree Oracle Database Vault policies.

Privileges Associated with the DV_POLICY_OWNER Role

The `DV_POLICY_OWNER` role provides non-Database Vault administrative users the sufficient privileges to enable or disable a Database Vault policy, add or remove authorization to or from a realm, and use the `SELECT` privilege for the following database views:

- `DVSYS.POLICY_OWNER_COMMAND_RULE`
- `DVSYS.POLICY_OWNER_POLICY`
- `DVSYS.POLICY_OWNER_REALM`
- `DVSYS.POLICY_OWNER_REALM_AUTH`
- `DVSYS.POLICY_OWNER_REALM_OBJECT`
- `DVSYS.POLICY_OWNER_RULE_SET`
- `DVSYS.POLICY_OWNER_RULE`
- `DVSYS.POLICY_OWNER_RULE_SET_RULE`

Only the `DV_POLICY_OWNER` can query these views. Even users who have the `DV_OWNER` and `DV_ADMIN` roles cannot query these views.

The `DV_POLICY_OWNER` role does not have any system privileges. To find the full list of object privileges that are associated with the `DV_POLICY_OWNER` role, you can log into the database instance and enter the following query:

```
SELECT TABLE_NAME, OWNER, PRIVILEGE FROM DBA_TAB_PRIVS WHERE GRANTEE = 'DV_POLICY_OWNER';
```

How Are GRANT and REVOKE Operations Affected by DV_POLICY_OWNER?

Users who have been granted `DV_POLICY_OWNER` role cannot grant or revoke this role to or from other users.

DV_POLICY_OWNER Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database Vault roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.14 DV_SECANALYST Database Vault Security Analyst Role

The `DV_SECANALYST` role enables users to analyze activities.

Use the `DV_SECANALYST` role to run Oracle Database Vault reports and monitor Oracle Database Vault.

This role is also used for database-related reports. In addition, this role enables you to check the `DVSYS` configuration by querying the `DVSYS` views described in [Oracle Database Vault Data Dictionary Views](#).

Privileges Associated with the DV_SECANALYST Role

There are no system privileges associated with the `DV_SECANALYST` role, but it does have the `SELECT` privilege for some `DVSYS` schema objects and portions of the `SYS` and `SYSMAN` schema objects for reporting on `DVSYS`- and `DVF`-related entities.

In addition, the `DV_SECANALYST` role provides the `SELECT` privilege on the `DBA_DV_POLICY`, `DBA_DV_POLICY_OWNER`, and `DBA_DV_POLICY_OBJECT` data dictionary views.

To find the full list of `DV_SECANALYST` object privileges, log into the database instance with sufficient privileges and then enter the following query:

```
SELECT TABLE_NAME, OWNER, PRIVILEGE FROM DBA_TAB_PRIVS WHERE GRANTEE = 'DV_SECANALYST';
```

How Are GRANT and REVOKE Operations Affected by DV_SECANALYST?

Any account, such as `SYS` or `SYSTEM`, with the `GRANT ANY ROLE` system privilege alone does not have the rights to grant this role to or revoke this role from any other database account.

Only the user with the `DV_OWNER` role can grant or revoke this role to and from another user.

DV_SECANALYST Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database Vault roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

13.2.15 DV_XSTREAM_ADMIN XStream Administrative Role

The `DV_XSTREAM_ADMIN` role is used for Oracle XStream.

Grant the `DV_XSTREAM_ADMIN` role to any user who is responsible for configuring Oracle XStream in an Oracle Database Vault environment.

This enables the management of XStream processes to be tightly controlled by Database Vault, but does not change or restrict the way an administrator would normally configure XStream.

Privileges Associated with the DV_XSTREAM_ADMIN Role

There are no privileges associated with the `DV_XSTREAM_ADMIN` role.

Be aware that the `DV_XSTREAM_ADMIN` role does not provide a sufficient set of database privileges for configuring XStream. Rather, the `DV_XSTREAM_ADMIN` role is an additional requirement (that is, in addition to the privileges that XStream currently requires) for database administrators to configure XStream in an Oracle Database Vault environment.

How Are GRANT and REVOKE Operations Affected by DV_XSTREAM_ADMIN?

Only users who have been granted the `DV_OWNER` role can grant or revoke the `DV_XSTREAM_ADMIN` role to or from other users.

DV_XSTREAM_ADMIN Status When Oracle Database Vault Security Is Disabled

The protection of all Oracle Database roles is enforced only if Oracle Database Vault is enabled.

If Oracle Database Vault is disabled, then any account with the `GRANT ANY ROLE` system privilege can perform `GRANT` and `REVOKE` operations on protected Database Vault roles.

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.
- [Privileges for Using XStream with Oracle Database Vault](#)
If you want to use XStream in an Oracle Database Vault environment, then you must have the appropriate privileges.

13.3 Oracle Database Vault Accounts Created During Registration

The accounts that you create during registration enable Oracle Database Vault to adhere to separation of duty concepts and provide flexibility for users based on the tasks they perform.

- [About Oracle Database Vault Accounts Created During Registration](#)
You must create accounts for the Oracle Database Vault Owner and Oracle Database Vault Account Manager during the registration process.
- [Database Accounts Used by Oracle Database Vault](#)
Oracle Database Vault provides accounts that provide access to system and object privileges, and Oracle Label Security.
- [Model Oracle Database Vault Database Accounts](#)
You can create different database accounts to implement the separation of duties requirements for Oracle Database Vault.

13.3.1 About Oracle Database Vault Accounts Created During Registration

You must create accounts for the Oracle Database Vault Owner and Oracle Database Vault Account Manager during the registration process.

You must supply an account name and password for the Oracle Database Vault Owner accounts during installation. Creating an Oracle Database Vault Account Manager is optional but strongly recommended for better separation of duty.

The Oracle Database Vault Owner account is granted the `DV_OWNER` role. This account can manage Oracle Database Vault roles and configuration.

The Oracle Database Vault Account Manager account is granted the `DV_ACCTMGR` role. This account is used to manage database user accounts to facilitate separation of duties.

If you choose not to create the Oracle Database Vault Account Manager account during installation, then both the `DV_OWNER` and `DV_ACCTMGR` roles are granted to the Oracle Database Vault Owner user account.

13.3.2 Database Accounts Used by Oracle Database Vault

Oracle Database Vault provides accounts that provide access to system and object privileges, and Oracle Label Security.

The following table lists the Oracle Database Vault database accounts that are needed in addition to the accounts that you create during installation.

Table 13-1 Database Accounts Used by Oracle Database Vault

| Database Account | Roles and Privileges | Description |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| DVSYS | Several system and object privileges are provided to support Oracle Database Vault. The ability to create a session with this account is revoked at the end of the installation, and the account is locked. | Owner of Oracle Database Vault schema and related objects |

Table 13-1 (Cont.) Database Accounts Used by Oracle Database Vault

| Database Account | Roles and Privileges | Description |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| DVF | A limited set of system privileges are provided to support Oracle Database Vault. The ability to create a session with this account is revoked at the end of the installation, and the account is locked. | Owner of the Oracle Database Vault functions that are created to retrieve factor identities |
| LBACSYS | This account is created when you install Oracle Label Security by using the Oracle Universal Installer custom installation option. (It is not created when you install Oracle Database Vault.) Do not drop or re-create this account. If you plan to integrate a factor with an Oracle Label Security policy, you must assign this user as the owner of the realm that uses this factor. | Owner of the Oracle Label Security schema |

Related Topics

- [Using Oracle Database Vault Factors with Oracle Label Security Policies](#)
To enhance security, you can integrate Oracle Database Vault factors with Oracle Label Security policies.

13.3.3 Model Oracle Database Vault Database Accounts

You can create different database accounts to implement the separation of duties requirements for Oracle Database Vault.

The following table lists some model database accounts that can act as a guide. (The accounts listed in this table serve as a guide to implementing Oracle Database Vault roles. These are not actual accounts that are created during installation.)

Table 13-2 Model Oracle Database Vault Database Accounts

| Database Account | Roles and Privileges | Description |
|------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EBROWN | DV_OWNER (with DV_ADMIN and DV_SECANALYST) | Account that is the realm owner for the Oracle Database Vault realm. This account can: <ul style="list-style-type: none"> • Run DVSYS packages. • Grant privileges on the DVSYS schema objects. • Select objects in the DVSYS schema. • Monitor Oracle Database Vault activity. • Run reports on the Oracle Database Vault configuration. |

Table 13-2 (Cont.) Model Oracle Database Vault Database Accounts

| Database Account | Roles and Privileges | Description |
|------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| JGODFREY | DV_ACCTMGR | Account for administration of database accounts and profiles. This account can: <ul style="list-style-type: none"> • Create, alter, and drop users. • Create, alter, and drop profiles. • Grant and revoke the <code>CREATE SESSION</code> privilege. • Grant and revoke the <code>DV_ACCTMGR</code> role, but only if this account was created during the Database Vault installation (this account is created with the <code>ADMIN</code> option). • Grant and revoke the <code>CONNECT</code> role. Note: This account cannot create roles, or grant the <code>RESOURCE</code> or <code>DBA</code> roles. |
| RLAYTON | DV_ADMIN (with DV_SECANALYST) | Account to serve as the access control administrator. This account can: <ul style="list-style-type: none"> • Run <code>DVSYS</code> packages. • Monitor Oracle Database Vault activity. • Run reports on the Oracle Database Vault configuration. Note: This account cannot directly update the <code>DVSYS</code> tables. |
| PSMYTHE | DV_SECANALYST | Account for running Oracle Database Vault reports |

Related Topics

- [Configuring Oracle Database Vault Accounts as Enterprise User Accounts](#)
You can configure existing Oracle Database Vault user accounts as enterprise user accounts in a PDB.
- [Backup Oracle Database Vault Accounts](#)
As a best practice, you should maintain backup accounts for the `DV_OWNER` and `DV_ACCTMGR` roles.

13.4 Backup Oracle Database Vault Accounts

As a best practice, you should maintain backup accounts for the `DV_OWNER` and `DV_ACCTMGR` roles.

The Oracle Database Vault registration process entails creating both day-to-day and backup accounts for the `DV_OWNER` and `DV_ACCTMGR` roles. You should keep and maintain these accounts as a safety measure in case a user who has been granted one of these roles forgets their password or leaves the organization. Then you can log in to the backup account to recover the password or grant the role to a new account. These should be only used as a backup account kept safe in a privileged account management system or an organization break-glass (or emergency password recovery) system. When you grant a user one of these roles, include the `WITH ADMIN OPTION` clause in the `GRANT` statement.

Because of the strong separation of duty that Oracle Database Vault implements, loss of access to the `DV_OWNER` account will force you to rebuild the database. The `SYS` account cannot override the `DV_OWNER` account

Related Topics

- [Resetting Oracle Database Vault Account Passwords](#)
Backup accounts can help you reset lost passwords for users who have been granted the DV_OWNER and DV_ACCTMGR roles.

Oracle Database Vault Realm APIs

The `DBMS_MACADM` PL/SQL package enables you to configure Oracle Database Vault realms.

Only users who have been granted the `DV_OWNER` or `DV_ADMIN` role can use these procedures. For constants that you can use with these procedures, see [Table 20-1](#) for more information.

- [ADD_AUTH_TO_REALM Procedure](#)
The `ADD_AUTH_TO_REALM` procedure authorizes a user or role to access a realm as an owner or a participant. You can authenticate both common and local realms.
- [ADD_OBJECT_TO_REALM Procedure](#)
The `ADD_OBJECT_TO_REALM` procedure registers a set of objects for realm protection.
- [CREATE_REALM Procedure](#)
The `CREATE_REALM` procedure creates both common and local realms.
- [DELETE_AUTH_FROM_REALM Procedure](#)
The `DELETE_AUTH_FROM_REALM` procedure removes the authorization of a user or role to access a realm.
- [DELETE_OBJECT_FROM_REALM Procedure](#)
The `DELETE_OBJECT_FROM_REALM` procedure removes a set of objects from realm protection.
- [DELETE_REALM Procedure](#)
The `DELETE_REALM` procedure deletes a realm, including its related configuration information that specifies who is authorized and what objects are protected.
- [DELETE_REALM_CASCADE Procedure](#)
The `DELETE_REALM_CASCADE` procedure deletes a realm, including its related Database Vault configuration information that specifies who is authorized and the objects that are protected.
- [RENAME_REALM Procedure](#)
The `RENAME_REALM` procedure renames a realm; the name change takes effect everywhere the realm is used.
- [UPDATE_REALM Procedure](#)
The `UPDATE_REALM` procedure updates a realm.
- [UPDATE_REALM_AUTH Procedure](#)
The `UPDATE_REALM_AUTH` procedure updates the authorization of a user or role to access a realm.

14.1 ADD_AUTH_TO_REALM Procedure

The `ADD_AUTH_TO_REALM` procedure authorizes a user or role to access a realm as an owner or a participant. You can authenticate both common and local realms.

Optionally, you can specify a rule set that must be checked before allowing the authorization to be enabled.

Syntax

```
DBMS_MACADM.ADD_AUTH_TO_REALM(
  realm_name      IN VARCHAR2,
  grantee         IN VARCHAR2,
  rule_set_name   IN VARCHAR2,
  auth_options    IN NUMBER
  auth_scope      IN NUMBER DEFAULT);
```

Parameters

Table 14-1 ADD_AUTH_TO_REALM Parameters

| Parameter | Description |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| realm_name | <p>Realm name.</p> <p>To find the existing realms in the current database instance, query the DBA_DV_REALM view.</p> |
| grantee | <p>User or role name to authorize as an owner or a participant.</p> <p>To find the existing users and roles in the current database instance, query the DBA_USERS and DBA_ROLES views.</p> <p>To find the authorization of a particular user or role, query the DVA_DV_REALM_AUTH view.</p> <p>To find existing secure application roles used in privilege management, query the DBA_DV_ROLE view.</p> |
| rule_set_name | <p>Optional. The rule set to check during runtime. The realm authorization is enabled only if the rule set evaluates to TRUE.</p> <p>To find the available rule sets, query the DBA_DV_RULE_SET view.</p> |
| auth_options | <p>Optional. Specify one of the following options to authorize the realm:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_REALM_AUTH_PARTICIPANT: Participant. This account or role provides system or direct privileges to access, manipulate, and create objects protected by the realm, provided these rights have been granted using the standard Oracle Database privilege grant process. (Default) DBMS_MACUTL.G_REALM_AUTH_OWNER: Owner. This account or role has the same authorization as the realm participant, plus the authorization to grant or revoke realm-secured roles and privileges on realm-protected objects. <p>See Related Topics for more information about participants and owners.</p> |
| auth_scope | <p>Determines how to execute this procedure. The default is local. Options are as follows:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) to authorize the realm locally in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) to authorize the realm in the application root |

Examples

The following example authorizes user SYSADM as a participant in the Performance Statistics Realm. Because the default is to authorize the user as a participant, the auth_options parameter can be omitted.

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
    realm_name => 'Performance Statistics Realm',
    grantee    => 'SYSADM');
```

```
END;  
/
```

This example sets user SYSADM as the owner of the Performance Statistics Realm.

```
BEGIN  
  DBMS_MACADM.ADD_AUTH_TO_REALM(  
    realm_name  => 'Performance Statistics Realm',  
    grantee     => 'SYSADM',  
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER);  
END;  
/
```

The next example triggers the Check Conf Access rule set before allowing user SYSADM to act as the owner of the Performance Statistics Realm.

```
BEGIN  
  DBMS_MACADM.ADD_AUTH_TO_REALM(  
    realm_name  => 'Performance Statistics Realm',  
    grantee     => 'SYSADM',  
    rule_set_name => 'Check Conf Access',  
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER);  
END;  
/
```

This example shows how to commonly grant the common user C##HR_ADMIN access to the common realm HR Statistics Realm. The user running this procedure must be in the CDB root, and the rule set must be a common rule set residing in the application root.

```
BEGIN  
  DBMS_MACADM.ADD_AUTH_TO_REALM(  
    realm_name  => 'HR Statistics Realm',  
    grantee     => 'C##HR_ADMIN',  
    rule_set_name => 'Check Access',  
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER,  
    auth_scope  => DBMS_MACUTL.G_SCOPE_COMMON);  
END;  
/
```

This example shows how to locally grant the common user C##HR_CLERK access to the common realm HR Statistics Realm. The user running this procedure must be in the same PDB in which the authorization applies. To find the existing PDBs query the DBA_PDBS data dictionary view. The rule set must be a local rule set.

```
BEGIN  
  DBMS_MACADM.ADD_AUTH_TO_REALM(  
    realm_name  => 'HR Statistics Realm',  
    grantee     => 'C##HR_CLERK',  
    rule_set_name => 'Check Access',  
    auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER,  
    auth_scope  => DBMS_MACUTL.G_SCOPE_LOCAL);  
END;  
/
```

Related Topics

- [About Realm Authorization](#)
Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.

14.2 ADD_OBJECT_TO_REALM Procedure

The `ADD_OBJECT_TO_REALM` procedure registers a set of objects for realm protection.

Syntax

```
DBMS_MACADM.ADD_OBJECT_TO_REALM(
  realm_name   IN VARCHAR2,
  object_owner IN VARCHAR2,
  object_name  IN VARCHAR2,
  object_type  IN VARCHAR2);
```

Parameters

Table 14-2 ADD_OBJECT_TO_REALM Parameters

| Parameter | Description |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>realm_name</code> | <p>Realm name.</p> <p>To find the existing realms in the current database instance, query the <code>DBA_DV_REALM</code> view.</p> |
| <code>object_owner</code> | <p>The owner of the object that is being added to the realm. If you add a role to a realm, the object owner of the role is shown as <code>%</code> (for all), because roles do not have owners.</p> <p>To find the available users, query the <code>DBA_USERS</code> view.</p> <p>To find the authorization of a particular user or role, query the <code>DVA_DV_REALM_AUTH</code> view.</p> |
| <code>object_name</code> | <p>Object name. (The wildcard <code>%</code> is allowed.) You can also use the <code>DBMS_MACUTL.G_ALL_OBJECT</code> constant.</p> <p>To find the available objects, query the <code>ALL_OBJECTS</code> view.</p> <p>To find objects that are secured by existing realms, query the <code>DBA_DV_REALM_OBJECT</code> view.</p> |
| <code>object_type</code> | <p>Object type, such as <code>TABLE</code>, <code>INDEX</code>, or <code>ROLE</code>. (The wildcard <code>%</code> is allowed.) You can also use the <code>DBMS_MACUTL.G_ALL_OBJECT</code> constant.</p> |

Example

```
BEGIN
  DBMS_MACADM.ADD_OBJECT_TO_REALM(
    realm_name   => 'HR Apps',
    object_owner => '%',
    object_name  => 'HR_SELECT_ROLE',
    object_type  => 'ROLE');
END;
/
```

Related Topics

- [About Realm-Secured Objects](#)
Realm-secured objects define the territory—a set of schema and database objects and roles—that a realm protects.

14.3 CREATE_REALM Procedure

The `CREATE_REALM` procedure creates both common and local realms.

After you create the realm, use the following procedures to complete the realm definition:

- `ADD_OBJECT_TO_REALM` procedure registers one or more objects for the realm.
- `ADD_AUTH_TO_REALM` procedure authorizes users or roles for the realm.

Syntax

```
DBMS_MACADM.CREATE_REALM(
  realm_name      IN VARCHAR2,
  description     IN VARCHAR2,
  enabled         IN VARCHAR2,
  audit_options  IN NUMBER,
  realm_type     IN NUMBER DEFAULT,
  realm_scope    IN NUMBER DEFAULT
  pl_sql_stack   IN BOOLEAN DEFAULT);
```

Parameters

Table 14-3 CREATE_REALM Parameters

| Parameter | Description |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>realm_name</code> | <p>Realm name, up to 128 characters in mixed-case. Oracle suggests that you use the name of the protected application as the realm name (for example, <code>hr_app</code> for an human resources application). This parameter is mandatory.</p> <p>To find the existing realms in the current database instance, query the <code>DBA_DV_REALM</code> view.</p> |
| <code>description</code> | <p>Description of the purpose of the realm, up to 1024 characters in mixed-case. This parameter is optional.</p> <p>You may want to include a description for the business objective of the given application protection and document all other security policies that compliment the realm's protection. Also document who is authorized to the realm, for what purpose, and any possible emergency authorizations.</p> |
| <code>enabled</code> | <p>Specify one of the following mandatory options to set the status of the realm:</p> <ul style="list-style-type: none"> • <code>DBMS_MACUTL.G_YES</code> or <code>'y'</code> to enable realm checking (default) • <code>DBMS_MACUTL.G_NO</code> or <code>'n'</code> to disable all realm checking, including the capture of violations in the simulation log • <code>DBMS_MACUTL.G_SIMULATION</code> or <code>'s'</code> to enable SQL statements to execute but capture violations in the simulation log |

Table 14-3 (Cont.) CREATE_REALM Parameters

| Parameter | Description |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| audit_options | <p>Specify one of the following optional options to audit the realm:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_REALM_AUDIT_OFF: Disables auditing for the realm (default) DBMS_MACUTL.G_REALM_AUDIT_FAIL: Creates an audit record when a realm violation occurs (for example, when an unauthorized user tries to modify an object that is protected by the realm) DBMS_MACUTL.G_REALM_AUDIT_SUCCESS: Creates an audit record for authorized activities on objects protected by the realm DBMS_MACUTL.G_REALM_AUDIT_FAIL + DBMS_MACUTL.G_REALM_AUDIT_SUCCESS: Creates an audit record for both authorized and unauthorized activities on objects protected by the realm <p>Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create Oracle Database Vault unified audit policies instead of using the audit_options parameter.</p> |
| realm_type | <p>Specify one of the following options:</p> <ul style="list-style-type: none"> 0: Disables mandatory realm checking. 1: Enables mandatory realm checking for realm objects. Only realm owners or realm participants will have access to objects in a realm. Object owners and object-privileged users who are not realm owners or participants will have no access. <p>See also Related Topics.</p> |
| realm_scope | <p>Determines how to execute this procedure. The default is local. Options are as follows:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the realm must be local in the current PDB. DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the realm must be in the application root. This setting duplicates the realm in all of the associated PDBs. <p>If you create the common realm in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:</p> <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |
| pl_sql_stack | <p>When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter TRUE to record the PL/SQL stack, FALSE to not record. The default is FALSE.</p> |

Examples

The following example shows how to create a realm that is enabled, has auditing set to track both failed and successful access, uses mandatory realm checking, and records the PL/SQL stack.

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name      => 'HR Apps',
    description     => 'Realm to protect the HR schema',
    enabled         => DBMS_MACUTL.G_YES,
    audit_options   => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type      => 1,
    pl_sql_stack    => TRUE);
```



```
END;
/
```

This example shows how to create a variation of the preceding example, but as a common realm located in the application root. The user who creates this realm must be a common user and must run the procedure in the application root.

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name      => 'HR Apps',
    description     => 'Realm to protect the HR schema',
    enabled         => DBMS_MACUTL.G_YES,
    audit_options  => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type     => 1,
    realm_scope    => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

This example shows how to create a local version of the preceding example. The user who creates this realm must be in the PDB in which the realm will reside. To find existing PDBs, query the `DBA_PDBS` data dictionary view.

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name      => 'HR Apps',
    description     => 'Realm to protect the HR schema',
    enabled         => DBMS_MACUTL.G_YES,
    audit_options  => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type     => 1,
    realm_scope    => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

Related Topics

- [Mandatory Realms to Restrict User Access to Objects within a Realm](#)
By default, users who own or have object privileges are allowed to access realm-protected objects without explicit realm authorization.

14.4 DELETE_AUTH_FROM_REALM Procedure

The `DELETE_AUTH_FROM_REALM` procedure removes the authorization of a user or role to access a realm.

Syntax

```
DBMS_MACADM.DELETE_AUTH_FROM_REALM(
  realm_name      IN VARCHAR2,
  grantee        IN VARCHAR2,
  auth_scope     IN NUMBER DEFAULT);
```

Parameters

Table 14-4 DELETE_AUTH_FROM_REALM Parameters

| Parameter | Description |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| realm_name | <p>Realm name.</p> <p>To find the existing realms in the current database instance, query the DBA_DV_REALM view.</p> |
| grantee | <p>User or role name.</p> <p>To find the authorization of a particular user or role, query the DVA_DV_REALM_AUTH view.</p> |
| auth_scope | <p>Determines how to execute this procedure. The default is local. Options are as follows:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the realm was authorized locally in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the realm was authorized in the application root |

Example

```

BEGIN
DBMS_MACADM.DELETE_AUTH_FROM_REALM(
  realm_name    => 'HR Apps',
  grantee       => 'PSMITH',
  auth_scope    => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/

```

14.5 DELETE_OBJECT_FROM_REALM Procedure

The DELETE_OBJECT_FROM_REALM procedure removes a set of objects from realm protection.

Syntax

```

DBMS_MACADM.DELETE_OBJECT_FROM_REALM(
  realm_name    IN VARCHAR2,
  object_owner  IN VARCHAR2,
  object_name   IN VARCHAR2,
  object_type   IN VARCHAR2);

```

Parameters

Table 14-5 DELETE_OBJECT_FROM_REALM Parameters

| Parameter | Description |
|--------------|---------------------------------------------------------------------------------------------------------------------------|
| realm_name | <p>Realm name.</p> <p>To find the existing realms in the current database instance, query the DBA_DV_REALM view.</p> |
| object_owner | <p>The owner of the object that was added to the realm.</p> <p>To find the available users, query the DBA_USERS view.</p> |

Table 14-5 (Cont.) DELETE_OBJECT_FROM_REALM Parameters

| Parameter | Description |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| object_name | Object name. (The wildcard % is allowed.) You can also use the DBMS_MACUTL.G_ALL_OBJECT constant. To find objects that are secured by existing realms, query the DBA_DV_REALM_OBJECT view. See also Related Topics. |
| object_type | Object type, such as TABLE, INDEX, or ROLE. (The wildcard % is allowed.) You can also use the DBMS_MACUTL.G_ALL_OBJECT constant. See also Related Topics. |

Example

```
BEGIN
  DBMS_MACADM.DELETE_OBJECT_FROM_REALM(
    realm_name => 'Performance Statistics Realm',
    object_owner => 'SYS',
    object_name => 'GATHER_SYSTEM_STATISTICS',
    object_type => 'ROLE');
END;
/
```

Related Topics

- [About Realm-Secured Objects](#)
Realm-secured objects define the territory—a set of schema and database objects and roles—that a realm protects.

14.6 DELETE_REALM Procedure

The `DELETE_REALM` procedure deletes a realm, including its related configuration information that specifies who is authorized and what objects are protected.

This procedure does not delete the actual database objects or users.

To find users who are authorized for the realm, query the `DBA_DV_REALM_AUTH` view. To find the objects that are protected by the realm, query the `DBA_DV_REALM_OBJECT` view.

Syntax

```
DBMS_MACADM.DELETE_REALM(
  realm_name IN VARCHAR2);
```

Parameters**Table 14-6 DELETE_REALM Parameter**

| Parameter | Description |
|------------|----------------------------------------------------------------------------------------------------------------------------|
| realm_name | Realm name. To find the existing realms in the current database instance, query the <code>DBA_DV_REALM</code> view. |

Example

```
EXEC DBMS_MACADM.DELETE_REALM('Performance Statistics Realm');
```

14.7 DELETE_REALM_CASCADE Procedure

The `DELETE_REALM_CASCADE` procedure deletes a realm, including its related Database Vault configuration information that specifies who is authorized and the objects that are protected.

The `DBA_DV_REALM_AUTH` view lists who is authorized in the realm and the `DBA_DV_REALM_OBJECT` view lists the protected objects.

It does not delete the actual database objects or users. This procedure works the same as the `DELETE_REALM` procedure. (In previous releases, these procedures were different, but now they are the same. Both are retained for earlier compatibility.) To find a listing of the realm-related objects, query the `DBA_DV_REALM` view. To find its authorizations, query `DBA_DV_REALM_AUTH`.

Syntax

```
DBMS_MACADM.DELETE_REALM_CASCADE (
    realm_name IN VARCHAR2);
```

Parameters**Table 14-7** DELETE_REALM_CASCADE Parameter

| Parameter | Description |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <code>realm_name</code> | <p>Realm name.</p> <p>To find the existing realms in the current database instance, query the <code>DBA_DV_REALM</code> view.</p> |

Example

```
EXEC DBMS_MACADM.DELETE_REALM_CASCADE('Performance Statistics Realm');
```

14.8 RENAME_REALM Procedure

The `RENAME_REALM` procedure renames a realm; the name change takes effect everywhere the realm is used.

Syntax

```
DBMS_MACADM.RENAME_REALM (
    realm_name IN VARCHAR2,
    new_name   IN VARCHAR2);
```

Parameters

Table 14-8 RENAME_REALM Parameters

| Parameter | Description |
|------------|-------------------------------------------------------------------------------------------------------------------|
| realm_name | Current realm name. To find the existing realms in the current database instance, query the DBA_DV_REALM view. |
| new_name | New realm name, up to 128 characters in mixed-case. |

Example

```
BEGIN
  DBMS_MACADM.RENAME_REALM(
    realm_name => 'Performance Statistics Realm',
    new_name   => 'Sector 2 Performance Statistics Realm');
END;
/
```

14.9 UPDATE_REALM Procedure

The UPDATE_REALM procedure updates a realm.

To find information about the current settings for a realm, query the DVSYS.DV\$REALM view.

Syntax

```
DBMS_MACADM.UPDATE_REALM(
  realm_name      IN VARCHAR2,
  description     IN VARCHAR2,
  enabled        IN VARCHAR2,
  audit_options  IN NUMBER DEFAULT NULL,
  realm_type     IN NUMBER DEFAULT NULL,
  pl_sql_stack   IN BOOLEAN DEFAULT NULL);
```

Parameters

Table 14-9 UPDATE_REALM Parameters

| Parameter | Description |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| realm_name | Realm name. To find the existing realms in the current database instance, query the DBA_DV_REALM view. |
| description | Description of the purpose of the realm, up to 1024 characters in mixed-case. |
| enabled | Specify one of the following options to set the status of the realm: <ul style="list-style-type: none"> DBMS_MACUTL.G_YES or 'y' to enable realm checking DBMS_MACUTL.G_NO or 'n' to disable all realm checking, including the capture of violations in the simulation log DBMS_MACUTL.G_SIMULATION or 's' to enable SQL statements to execute but capture violations in the simulation log The default for enabled is the previously set value, which you can find by querying the DBA_DV_REALM data dictionary view. |

Table 14-9 (Cont.) UPDATE_REALM Parameters

| Parameter | Description |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| audit_options | <p>Specify one of the following options to audit the realm:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_REALM_AUDIT_OFF: Disables auditing for the realm DBMS_MACUTL.G_REALM_AUDIT_FAIL: Creates an audit record when a realm violation occurs (for example, when an unauthorized user tries to modify an object that is protected by the realm) DBMS_MACUTL.G_REALM_AUDIT_SUCCESS: Creates an audit record for authorized activities on objects protected by the realm. DBMS_MACUTL.G_REALM_AUDIT_FAIL + DBMS_MACUTL.G_REALM_AUDIT_SUCCESS: Creates an audit record for both authorized and unauthorized activities on objects protected by the realm <p>The default for audit_options is the previously set value, which you can find by querying the DBA_DV_REALM data dictionary view.</p> <p>Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create Oracle Database Vault unified audit policies instead of using the audit_options parameter.</p> |
| realm_type | <p>If you do not specify the realm_type parameter, then Oracle Database Vault does not update the current realm_type setting.</p> <p>Specify one of the following options:</p> <ul style="list-style-type: none"> 0: Sets the realm to be a regular realm, which does not have mandatory realm checking. 1: Enables mandatory realm checking for realm objects. Only realm owners or realm participants will have access to objects in a realm. Object owners and object-privileged users who are not realm owners or participants will have no access. <p>See also Related Topics.</p> |
| pl_sql_stack | <p>When simulation mode is enabled, indicates whether the PL/SQL stack has been recorded for failed operations. TRUE indicates that the PL/SQL stack has been recorded; FALSE indicates that the PL/SQL stack has not been recorded.</p> |

Example

```

BEGIN
  DBMS_MACADM.UPDATE_REALM(
    realm_name    => 'Sector 2 Performance Statistics Realm',
    description   => 'Realm to measure performance for Sector 2 applications',
    enabled       => DBMS_MACUTL.G_YES,
    audit_options => DBMS_MACUTL.G_REALM_AUDIT_OFF,
    realm_type    => 1);
END;
/

```

Related Topics

- [Mandatory Realms to Restrict User Access to Objects within a Realm](#)
 By default, users who own or have object privileges are allowed to access realm-protected objects without explicit realm authorization.

14.10 UPDATE_REALM_AUTH Procedure

The `UPDATE_REALM_AUTH` procedure updates the authorization of a user or role to access a realm.

Syntax

```
DBMS_MACADM.UPDATE_REALM_AUTH(
  realm_name      IN VARCHAR2,
  grantee         IN VARCHAR2,
  rule_set_name   IN VARCHAR2,
  auth_options    IN NUMBER,
  auth_scope      IN NUMBER DEFAULT);
```

Parameters

Table 14-10 UPDATE_REALM_AUTH Parameters

| Parameter | Description |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>realm_name</code> | <p>Realm name.</p> <p>To find the existing realms in the current database instance, query the <code>DBA_DV_REALM</code> view.</p> |
| <code>grantee</code> | <p>User or role name.</p> <p>To find the available users and roles in the current database instance, query the <code>DBA_USERS</code> and <code>DBA_ROLES</code> data dictionary views.</p> <p>To find the authorization of a particular user or role, query the <code>DVA_DV_REALM_AUTH</code> view.</p> <p>To find existing secure application roles used in privilege management, query the <code>DBA_DV_ROLE</code> view.</p> |
| <code>rule_set_name</code> | <p>Optional. A rule set to check during runtime. The realm authorization is enabled only if the rule set evaluates to <code>TRUE</code>.</p> <p>To find the available rule sets, query the <code>DBA_DV_RULE_SET</code> view. To find rules that are associated with the rule sets, query the <code>DBA_DB_RULE_SET_RULE</code> view.</p> |
| <code>auth_options</code> | <p>Optional. Specify one of the following options to authorize the realm:</p> <ul style="list-style-type: none"> <code>DBMS_MACUTL.G_REALM_AUTH_PARTICIPANT</code>: Participant. This account or role provides system or direct privileges to access, manipulate, and create objects protected by the realm, provided these rights have been granted using the standard Oracle Database privilege grant process. <code>DBMS_MACUTL.G_REALM_AUTH_OWNER</code>: Owner. This account or role has the same authorization as the realm participant, plus the authorization to grant or revoke realm-secured roles and privileges on realm-protected objects. A realm can have multiple owners. <p>The default for <code>auth_options</code> value is the previously set value, which you can find by querying the <code>DBA_DV_REALM_AUTH</code> data dictionary view.</p> |
| <code>realm_auth</code> | <p>Determines how to execute this procedure. The default is local. Options are as follows:</p> <ul style="list-style-type: none"> <code>DBMS_MACUTL.G_SCOPE_LOCAL</code> (or 1) if the realm is authorized locally in the current PDB <code>DBMS_MACUTL.G_SCOPE_COMMON</code> (or 2) if the realm is authorized in the application root |

Example

```
BEGIN
  DBMS_MACADM.UPDATE_REALM_AUTH(
    realm_name    => 'Sector 2 Performance Statistics Realm',
    grantee       => 'SYSADM',
    rule_set_name => 'Check Conf Access',
    auth_options  => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/
```


Oracle Database Vault Rule Set APIs

You can use the `DBMS_MACADM` PL/SQL package and a set of Oracle Database Vault rule functions to manage rule sets.

- [DBMS_MACADM Rule Set Procedures](#)
The `DBMS_MACADM` rule set procedures enable you to configure both rule sets and individual rules that go within these rule sets.
- [Oracle Database Vault PL/SQL Rule Set Functions](#)
Oracle Database Vault provides functions to use in rule sets to inspect the SQL statement that the rule set protects.

15.1 DBMS_MACADM Rule Set Procedures

The `DBMS_MACADM` rule set procedures enable you to configure both rule sets and individual rules that go within these rule sets.

Only users who have been granted the `DV_OWNER` or `DV_ADMIN` role can use these procedures.

- [ADD_RULE_TO_RULE_SET Procedure](#)
The `ADD_RULE_TO_RULE_SET` procedure adds rule to a rule set; you can enable having the rule checked when the rule set is evaluated.
- [CREATE_RULE Procedure](#)
The `CREATE_RULE` procedure creates both common and local rules, which afterward, can be added to a rule set.
- [CREATE_RULE_SET Procedure](#)
The `CREATE_RULE_SET` procedure creates a rule set.
- [DELETE_RULE Procedure](#)
The `DELETE_RULE` procedure deletes a rule.
- [DELETE_RULE_FROM_RULE_SET Procedure](#)
The `DELETE_RULE_FROM_RULE_SET` procedure deletes a rule from a rule set.
- [DELETE_RULE_SET Procedure](#)
The `DELETE_RULE_SET` procedure deletes a rule set.
- [RENAME_RULE Procedure](#)
The `RENAME_RULE` procedure renames a rule and causes the name change to take effect everywhere the rule is used
- [RENAME_RULE_SET Procedure](#)
The `RENAME_RULE_SET` procedure renames a rule set and causes the name change to take effect everywhere the rule set is used.
- [UPDATE_RULE Procedure](#)
The `UPDATE_RULE` procedure updates a rule.
- [UPDATE_RULE_SET Procedure](#)
The `UPDATE_RULE_SET` procedure updates a rule set.

Related Topics

- [Configuring Rule Sets](#)
Rule sets group one or more rules together; the rules determine whether a user can perform an action on an object.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the DBMS_MACUTL PL/SQL package.

15.1.1 ADD_RULE_TO_RULE_SET Procedure

The ADD_RULE_TO_RULE_SET procedure adds rule to a rule set; you can enable having the rule checked when the rule set is evaluated.

Syntax

```
DBMS_MACADM.ADD_RULE_TO_RULE_SET (
  rule_set_name  IN VARCHAR2,
  rule_name      IN VARCHAR2,
  rule_order     IN NUMBER,
  enabled        IN VARCHAR2);
```

Parameters**Table 15-1 ADD_RULE_TO_RULE_SET Parameters**

| Parameter | Description |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_set_name | Rule set name. To find existing rule sets in the current database instance, query the DBA_DV_RULE_SET view. |
| rule_name | Rule to add to the rule set. To find existing rules, query the DBA_DV_RULE view. To find rules that have been associated with rule sets, query DBA_DV_RULE_SET_RULE. |
| rule_order | Does not apply to this release, but you must include a value for the ADD_RULE_TO_RULE_SET procedure to work. Enter 1. |
| enabled | Optional. Determines whether the rule should be checked when the rule set is evaluated. Possible values are: <ul style="list-style-type: none"> • DBMS_MACUTL.G_YES (default). Enables the rule to be checked during the rule set evaluation. • DBMS_MACUTL.G_NO Prevents the rule from being checked during the rule set evaluation. See also Related Topics. |

Examples

The following example adds a rule to a rule set, and by omitting the enabled parameter, automatically enables the rule to be checked when the rule set is evaluated.

```
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET (
    rule_set_name => 'Limit_DBA_Access',
    rule_name      => 'Restrict DROP TABLE operations',
    rule_order     => 1);
END;
/
```

This example adds the rule to the rule set but disables rule checking.

```
BEGIN
  DBMS_MACADM.ADD_RULE_TO_RULE_SET(
    rule_set_name => 'Limit_DBA_Access',
    rule_name     => 'Check_UPDATE_operations',
    rule_order   => 1,
    enabled      => DBMS_MACUTL.G_NO);
END;
/
```

Related Topics

- [DBMS_MACUTL Constants](#)
You can use a set of constants, available in the DBMS_MACUTL PL/SQL package.

15.1.2 CREATE_RULE Procedure

The CREATE_RULE procedure creates both common and local rules, which afterward, can be added to a rule set.

Syntax

```
DBMS_MACADM.CREATE_RULE(
  rule_name  IN VARCHAR2,
  rule_expr  IN VARCHAR2
  scope      IN NUMBER DEFAULT);
```

Parameters

Table 15-2 CREATE_RULE Parameters

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_name | Rule name, up to 128 characters in mixed-case. Spaces are allowed. To find existing rules in the current database instance, query the DBA_DV_RULE view. To find rules that have been associated with rule sets, query DBA_DV_RULE_SET_RULE. |
| rule_expr | PL/SQL BOOLEAN expression. If the expression contains quotation marks, do not use double quotation marks. Instead, use two single quotation marks. Enclose the entire expression within single quotation marks. For example: <code>'TO_CHAR(SYSDATE, 'HH24') = '12'''</code> |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> • DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the rule is local in the current PDB • DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the rule is in the application root |

Examples

The following example shows how to create a local rule expression that checks if the current session user is SYSADM. The user running this procedure must be in the same PDB in which the rule and its rule set reside. To find the existing PDBs, run the show pdbs command. The rule and rule set must be local.

```

BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check UPDATE operations',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') = ''SYSADM'',
    scope     => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/

```

This example shows a multitenant environment common version of the preceding example. The user running this procedure must be in the CDB root, and the rule and its associated rule set must be common. The rule will reside in the application root.

```

BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check UPDATE operations',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') = ''SYSADM'',
    scope     => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/

```

This example shows how to create a rule expression that uses the public standalone function `OLS_LABEL_DOMINATES` to find if the session label of the `hr_ols_pol` Oracle Label Security policy dominates or is equal to the `hs` label. The value 0 indicates if it is false. (To check if it is equal, you would specify 1.)

```

BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check OLS Factor',
    rule_expr => 'OLS_LABEL_DOMINATES(''hr_ols_pol'', ''hs'') = 1');
END;
/

```

Related Topics

- [Creating a New Rule](#)
You can create a new rule or use the default Oracle Database Vault rules.

15.1.3 CREATE_RULE_SET Procedure

The `CREATE_RULE_SET` procedure creates a rule set.

After you create a rule set, you can use the `CREATE_RULE` and `ADD_RULE_TO_RULE_SET` procedures to create and add rules to the rule set.

Syntax

```

DBMS_MACADM.CREATE_RULE_SET(
  rule_set_name  IN VARCHAR2,
  description    IN VARCHAR2,
  enabled        IN VARCHAR2,
  eval_options   IN NUMBER,
  audit_options  IN NUMBER,
  fail_options   IN NUMBER,
  fail_message   IN VARCHAR2,
  fail_code      IN NUMBER,
  handler_options IN NUMBER,
  handler        IN VARCHAR2,
  is_static      IN BOOLEAN DEFAULT,
  scope          IN NUMBER DEFAULT);

```

Parameters

Table 15-3 CREATE_RULE_SET Parameters

| Parameter | Description |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_set_name | Rule set name, up to 128 characters in mixed-case. Spaces are allowed. To find existing rule sets in the current database instance, query the DBA_DV_RULE_SET view. |
| description | Description of the purpose of the rule set, up to 1024 characters in mixed-case. |
| enabled | DBMS_MACUTL.G_YES (Yes) enables the rule set; DBMS_MACUTL.G_NO (No) disables it. The default is DBMS_MACUTL.G_YES. |
| eval_options | If you plan to assign multiple rules to the rule set, enter one of the following settings: <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_EVAL_ALL: All rules in the rule set must evaluate to true for the rule set itself to evaluate to true (default). DBMS_MACUTL.G_RULESET_EVAL_ANY: At least one rule in the rule set must evaluate to true for the rule set itself to evaluate to true. |
| audit_options | Select one of the following settings: <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_AUDIT_OFF: Disables auditing for the rule set (default) DBMS_MACUTL.G_RULESET_AUDIT_FAIL: Creates an audit record when a rule set violation occurs DBMS_MACUTL.G_RULESET_AUDIT_SUCCESS: Creates an audit record for a successful rule set evaluation DBMS_MACUTL.G_RULESET_AUDIT_FAIL + DBMS_MACUTL.G_RULESET_AUDIT_SUCCESS: Creates an audit record for both successful and failed rule set evaluations Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create Oracle Database Vault unified audit policies instead of using the audit_options parameter. |
| fail_options | Options for reporting errors: <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_FAIL_SHOW: Shows an error message (default) DBMS_MACUTL.G_RULESET_FAIL_SILENT: Does not show an error message |
| fail_message | Enter an error message for failure, up to 80 characters in mixed-case, to associate with the fail code you specify for fail_code. |
| fail_code | Enter a number in the range of -20000 to -20999 or 20000 to 20999 to associate with the fail_message parameter. |
| handler_options | Select one of the following settings: <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_HANDLER_OFF: Disables error handling (default) DBMS_MACUTL.G_RULESET_HANDLER_FAIL: Calls handler on rule set failure DBMS_MACUTL.G_RULESET_HANDLER_SUCCESS: Calls handler on rule set success |
| handler | Name of the PL/SQL function or procedure that defines the custom event handler logic. |

Table 15-3 (Cont.) CREATE_RULE_SET Parameters

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| is_static | Optional. Determines how often a rule set is evaluated when it is accessed. The default is FALSE. <ul style="list-style-type: none"> TRUE: The rule set is evaluated once during the user session. After that, the value is re-used. FALSE: The rule set is evaluated every time. |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the rule set is to be local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the rule set is to be in the application root |

Examples

The following example creates a rule set that is enabled, is set so that at least one rule must evaluate to true for the rule set itself to evaluate to true, and audits both failed and successful attempts. It does not show error messages but uses the fail code 20461 to track failures. It also uses a handler to send email alerts to the appropriate users if there are violations to the rule set.

```
BEGIN
DBMS_MACADM.CREATE_RULE_SET(
  rule_set_name => 'Limit_DBA_Access',
  description   => 'DBA access through predefined processes',
  enabled       => DBMS_MACUTL.G_YES,
  eval_options  => DBMS_MACUTL.G_RULESET_EVAL_ANY,
  audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
  fail_options  => DBMS_MACUTL.G_RULESET_FAIL_SILENT,
  fail_message  => 'Configuration failed; check settings',
  fail_code     => 20461,
  handler_options => DBMS_MACUTL.G_RULESET_HANDLER_FAIL,
  handler       => 'dbavowner.email_alert',
  is_static     => TRUE);
END;
/
```

This rule set uses no fail messages or fail codes, nor does it use any handlers. This rule set will be in the application root of a multitenant environment, so the user running this procedure must be in the application root. Any rules or command rules that are associated with this rule set must be common.

```
BEGIN
DBMS_MACADM.CREATE_RULE_SET(
  rule_set_name => 'Check_HR_Access',
  description   => 'Checks for failed access attempts to the HR schema',
  enabled       => DBMS_MACUTL.G_YES,
  eval_options  => DBMS_MACUTL.G_RULESET_EVAL_ANY,
  audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
  fail_options  => DBMS_MACUTL.G_RULESET_FAIL_SILENT,
  fail_message  => '',
  fail_code     => '',
  handler_options => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
  handler       => '',
  is_static     => TRUE,
  scope        => DBMS_MACUTL.G_SCOPE_COMMON);
```

```
END;
/
```

This rule set is a local version of the preceding rule set. The user who creates this rule set must be in the PDB in which this rule set will reside. To find the existing PDBs, query the DBA_PDBS data dictionary view. Any rules or command rules that are associated with this rule set must be local.

```
BEGIN
  DBMS_MACADM.CREATE_RULE_SET(
    rule_set_name    => 'Check_HR_Access',
    description      => 'Checks for failed access attempts to the HR schema',
    enabled          => DBMS_MACUTL.G_YES,
    eval_options     => DBMS_MACUTL.G_RULESET_EVAL_ANY,
    audit_options    => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
    fail_options     => DBMS_MACUTL.G_RULESET_FAIL_SILENT,
    fail_message     => '',
    fail_code        => '',
    handler_options  => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
    handler          => '',
    is_static        => TRUE,
    scope            => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

15.1.4 DELETE_RULE Procedure

The DELETE_RULE procedure deletes a rule.

Syntax

```
DBMS_MACADM.DELETE_RULE(
  rule_name IN VARCHAR2);
```

Parameter

Table 15-4 DELETE_RULE Parameter

| Parameter | Description |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_name | Rule name. To find existing rules in the current database instance, query the DBA_DV_RULE view. To find rules that have been associated with rule sets, query DBA_DV_RULE_SET_RULE. |

Example

```
EXEC DBMS_MACADM.DELETE_RULE('Check UPDATE operations');
```

15.1.5 DELETE_RULE_FROM_RULE_SET Procedure

The `DELETE_RULE_FROM_RULE_SET` procedure deletes a rule from a rule set.

Syntax

```
DBMS_MACADM.DELETE_RULE_FROM_RULE_SET(
  rule_set_name IN VARCHAR2,
  rule_name     IN VARCHAR2);
```

Parameters

Table 15-5 `DELETE_RULE_FROM_RULE_SET` Parameters

| Parameter | Description |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>rule_set_name</code> | Rule set name. To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view. |
| <code>rule_name</code> | Rule to remove from the rule set. To find existing rules in the current database instance, query the <code>DBA_DV_RULE</code> view. To find rules that have been associated with rule sets, query <code>DBA_DV_RULE_SET_RULE</code> . |

Example

```
BEGIN
  DBMS_MACADM.DELETE_RULE_FROM_RULE_SET(
    rule_set_name => 'Limit_DBA_Access',
    rule_name     => 'Check UPDATE operations');
END;
/
```

15.1.6 DELETE_RULE_SET Procedure

The `DELETE_RULE_SET` procedure deletes a rule set.

Syntax

```
DBMS_MACADM.DELETE_RULE_SET(
  rule_set_name IN VARCHAR2);
```

Parameters

Table 15-6 `DELETE_RULE_SET` Parameter

| Parameter | Description |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <code>rule_set_name</code> | Rule set name. To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view. |

Example

```
EXEC DBMS_MACADM.DELETE_RULE_SET('Limit_DBA_Access');
```

15.1.7 RENAME_RULE Procedure

The `RENAME_RULE` procedure renames a rule and causes the name change to take effect everywhere the rule is used.

Syntax

```
DBMS_MACADM.RENAME_RULE(  
  rule_name  IN VARCHAR2,  
  new_name   IN VARCHAR2);
```

Parameters**Table 15-7 RENAME_RULE Parameters**

| Parameter | Description |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>rule_name</code> | Current rule name. To find existing rules in the current database instance, query the <code>DBA_DV_RULE</code> view. To find rules that have been associated with rule sets, query <code>DBA_DV_RULE_SET_RULE</code> . |
| <code>new_name</code> | New rule name, up to 128 characters in mixed-case. |

Example

```
BEGIN  
  DBMS_MACADM.RENAME_RULE(  
    rule_name => 'Check UPDATE operations',  
    new_name  => 'Check Sector 2 Processes');  
END;  
/
```

15.1.8 RENAME_RULE_SET Procedure

The `RENAME_RULE_SET` procedure renames a rule set and causes the name change to take effect everywhere the rule set is used.

Syntax

```
DBMS_MACADM.RENAME_RULE_SET(  
  rule_set_name IN VARCHAR2,  
  new_name      IN VARCHAR2,  
  scope         IN NUMBER DEFAULT);
```

Parameters

Table 15-8 RENAME_RULE_SET Parameters

| Parameter | Description |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_set_name | Current rule set name. To find existing rule sets in the current database instance, query the DBA_DV_RULE_SET view. |
| new_name | New rule set name, up to 128 characters in mixed-case. Spaces are allowed. |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the rule set is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the rule set is in the application root |

Example

```
BEGIN
  DBMS_MACADM.RENAME_RULE_SET(
    rule_set_name => 'Limit_DBA_Access',
    new_name      => 'Limit Sector 2 Access');
END;
/
```

15.1.9 UPDATE_RULE Procedure

The UPDATE_RULE procedure updates a rule.

Syntax

```
DBMS_MACADM.UPDATE_RULE(
  rule_name  IN VARCHAR2,
  rule_expr  IN VARCHAR2);
```

Parameters

Table 15-9 UPDATE_RULE Parameters

| Parameter | Description |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_name | Rule name. To find existing rules in the current database instance. To find rules that have been associated with rule sets, query DBA_DV_RULE_SET_RULE. |
| rule_expr | PL/SQL BOOLEAN expression. If the expression contains quotation marks, do not use double quotation marks. Instead, use two single quotation marks. Enclose the entire expression within single quotation marks. For example: 'TO_CHAR(SYSDATE, 'HH24') = '12'' See Creating a New Rule for more information on rule expressions. To find existing rule expressions, query the DBA_DV_RULE view. |

Example

```

BEGIN
  DBMS_MACADM.UPDATE_RULE(
    rule_name => 'Check UPDATE operations',
    rule_expr => 'SYS_CONTEXT(''USERENV'', ''SESSION_USER'') = ''SYSADM'' AND
      (
        UPPER(SYS_CONTEXT(''USERENV'', ''MODULE'')) LIKE ''APPSRVR%'' OR
        UPPER(SYS_CONTEXT(''USERENV'', ''MODULE'')) LIKE ''DBAPP%'' )'
      );
END;
/

```

15.1.10 UPDATE_RULE_SET Procedure

The UPDATE_RULE_SET procedure updates a rule set.

Syntax

```

DBMS_MACADM.UPDATE_RULE_SET(
  rule_set_name      IN VARCHAR2,
  description        IN VARCHAR2,
  enabled            IN VARCHAR2,
  eval_options       IN NUMBER,
  audit_options      IN NUMBER,
  fail_options       IN NUMBER,
  fail_message       IN VARCHAR2,
  fail_code          IN NUMBER,
  handler_options    IN NUMBER,
  handler            IN VARCHAR2,
  is_static          IN BOOLEAN DEFAULT);

```

Parameters**Table 15-10** UPDATE_RULE_SET Parameters

| Parameter | Description |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_set_name | Rule set name. To find existing rule sets in the current database instance. |
| description | Description of the purpose of the rule set, up to 1024 characters in mixed-case. |
| enabled | DBMS_MACUTL.G_YES (Yes) enables rule set checking; DBMS_MACUTL.G_NO (No) disables it. The default for the enabled setting is the previously set value, which you can find by querying the DBA_DV_RULE_SET data dictionary view. |
| eval_options | If you plan to assign multiple rules to the rule set, enter one of the following settings: <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_EVAL_ALL: All rules in the rule set must evaluate to true for the rule set itself to evaluate to true. DBMS_MACUTL.G_RULESET_EVAL_ANY: At least one rule in the rule set must evaluate to true for the rule set itself to evaluate to true. The default for eval_options is the previously set value, which you can find by querying the DBA_DV_RULE_SET data dictionary view. |

Table 15-10 (Cont.) UPDATE_RULE_SET Parameters

| Parameter | Description |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| audit_options | <p>Select one of the following settings:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_AUDIT_OFF: Disables auditing for the rule set DBMS_MACUTL.G_RULESET_AUDIT_FAIL: Creates an audit record when a rule set violation occurs DBMS_MACUTL.G_RULESET_AUDIT_SUCCESS: Creates an audit record for a successful rule set evaluation DBMS_MACUTL.G_RULESET_AUDIT_FAIL + DBMS_MACUTL.G_RULESET_AUDIT_SUCCESS: Creates an audit record for both successful and failed rule set evaluations <p>The default for audit_options is the previously set value, which you can find by querying the DBA_DV_RULE_SET data dictionary view.</p> <p>Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create Oracle Database Vault unified audit policies instead of using the audit_options parameter.</p> |
| fail_options | <p>Options for reporting errors:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_FAIL_SHOW: Shows an error message. DBMS_MACUTL.G_RULESET_FAIL_SILENT: Does not show an error message. <p>The default for fail_options is the previously set value, which you can find by querying the DBA_DV_RULE_SET data dictionary view.</p> |
| fail_message | <p>Error message for failure, up to 80 characters in mixed-case, to associate with the fail code you specify for fail_code.</p> |
| fail_code | <p>Enter a number in the range of -20000 to -20999 or 20000 to 20999 to associate with the fail_message parameter.</p> |
| handler_options | <p>Select one of the following settings:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_RULESET_HANDLER_OFF: Disables error handling. DBMS_MACUTL.G_RULESET_HANDLER_FAIL: Call handler on rule set failure. DBMS_MACUTL.G_RULESET_HANDLER_SUCCESS: Call handler on rule set success. <p>The default for handler_options is the previously set value, which you can find by querying the DBA_DV_RULE_SET data dictionary view.</p> |
| handler | <p>Name of the PL/SQL function or procedure that defines the custom event handler logic.</p> |
| is_static | <p>Optional. Determines how often a rule set is evaluated when it is accessed by a SQL statement. The default is FALSE.</p> <ul style="list-style-type: none"> TRUE: The rule set is evaluated once during the user session. After that, the value is re-used. FALSE: The rule set evaluated each time a SQL statement accesses it. |

Example

```

BEGIN
DBMS_MACADM.UPDATE_RULE_SET(
  rule_set_name => 'Limit_DBA_Access',
  description   => 'DBA access through predefined processes',
  enabled       => DBMS_MACUTL.G_YES,
  eval_options  => DBMS_MACUTL.G_RULESET_EVAL_ANY,
  audit_options => DBMS_MACUTL.G_RULESET_AUDIT_OFF,

```

```

fail_options      => DBMS_MACUTL.G_RULESET_FAIL_SHOW,
fail_message     => 'Access denied!',
fail_code        => 20900,
handler_options  => DBMS_MACUTL.G_RULESET_HANDLER_OFF,
handler          => '',
is_static        = TRUE);
END;
/

```

15.2 Oracle Database Vault PL/SQL Rule Set Functions

Oracle Database Vault provides functions to use in rule sets to inspect the SQL statement that the rule set protects.

- **DV_SYSEVENT Function**
The `DV_SYSEVENT` function returns the system event firing the rule set. .
- **DV_LOGIN_USER Function**
The `DV_LOGIN_USER` function returns the session user name, in `VARCHAR2` data type.
- **DV_INSTANCE_NUM Function**
The `DV_INSTANCE_NUM` function returns the database instance number, in `NUMBER` data type.
- **DV_DATABASE_NAME Function**
The `DV_DATABASE_NAME` function returns the database name, in `VARCHAR2` data type.
- **DV_DICT_OBJ_TYPE Function**
The `DV_DICT_OBJ_TYPE` function returns the type of the dictionary object on which the database operation occurred.
- **DV_DICT_OBJ_OWNER Function**
The `DV_DICT_OBJ_OWNER` function returns the name of the owner of the dictionary object on which the database operation occurred.
- **DV_DICT_OBJ_NAME Function**
The `DV_DICT_OBJ_NAME` function returns the name of the dictionary object on which the database operation occurred.
- **DV_SQL_TEXT Function**
The `DV_SQL_TEXT` function returns the first 4000 characters of SQL text of the database statement used in the operation.

15.2.1 DV_SYSEVENT Function

The `DV_SYSEVENT` function returns the system event firing the rule set. .

The event name is the same as that in the syntax of the SQL statement (for example, `INSERT`, `CREATE`.) The return type is `VARCHAR2`.

Syntax

```

DV_SYSEVENT ()
RETURN VARCHAR2;

```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Get System Event Firing the Maintenance Rule Set',
    rule_expr => 'DV_SYSEVENT = ''CREATE''');
END;
/
```

15.2.2 DV_LOGIN_USER Function

The DV_LOGIN_USER function returns the session user name, in VARCHAR2 data type.

Syntax

```
DV_LOGIN_USER ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Session User Name',
    rule_expr => 'DV_LOGIN_USER = ''SEBASTIAN''');
END;
/
```

15.2.3 DV_INSTANCE_NUM Function

The DV_INSTANCE_NUM function returns the database instance number, in NUMBER data type.

Syntax

```
DV_INSTANCE_NUM ()
RETURN NUMBER;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Database Instance Number',
    rule_expr => 'DV_INSTANCE_NUM BETWEEN 6 AND 9');
END;
/
```

15.2.4 DV_DATABASE_NAME Function

The `DV_DATABASE_NAME` function returns the database name, in `VARCHAR2` data type.

Syntax

```
DV_DATABASE_NAME ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Database Name',  
    rule_expr => 'DV_DATABASE_NAME = 'ORCL''');  
END;  
/
```

15.2.5 DV_DICT_OBJ_TYPE Function

The `DV_DICT_OBJ_TYPE` function returns the type of the dictionary object on which the database operation occurred.

For example, dictionary objects it returns are table, procedure, or view. The return type is `VARCHAR2`.

Syntax

```
DV_DICT_OBJ_TYPE ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Dictionary Object Type',  
    rule_expr => 'DV_DICT_OBJ_TYPE IN ('TABLE', 'VIEW')');  
END;  
/
```

15.2.6 DV_DICT_OBJ_OWNER Function

The `DV_DICT_OBJ_OWNER` function returns the name of the owner of the dictionary object on which the database operation occurred.

The return type is `VARCHAR2`.

Syntax

```
DV_DICT_OBJ_OWNER ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Dictionary Object Owner',  
    rule_expr => 'DV_DICT_OBJ_OWNER = ''JSMITH''');  
END;  
/
```

15.2.7 DV_DICT_OBJ_NAME Function

The `DV_DICT_OBJ_NAME` function returns the name of the dictionary object on which the database operation occurred.

The return type is `VARCHAR2`.

Syntax

```
DV_DICT_OBJ_NAME ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Dictionary Object Name',  
    rule_expr => 'DV_DICT_OBJ_NAME = ''SALES''');  
END;  
/
```

15.2.8 DV_SQL_TEXT Function

The `DV_SQL_TEXT` function returns the first 4000 characters of SQL text of the database statement used in the operation.

The return type is `VARCHAR2`.

Syntax

```
DV_SQL_TEXT ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check SQL Text',
    rule_expr => 'DV_SQL_TEXT = ''SELECT SALARY FROM HR.EMPLOYEES''');
END;
/
```

Oracle Database Vault Command Rule APIs

The `DBMS_MACADM` PL/SQL package provides procedures for configuring command rules. .

Only users who have been granted the `DV_OWNER` or `DV_ADMIN` role can use these procedures.

- [CREATE_COMMAND_RULE Procedure](#)
The `CREATE_COMMAND_RULE` procedure creates both command and local command rules, which can be added to a rule set.
- [CREATE_CONNECT_COMMAND_RULE Procedure](#)
The `CREATE_CONNECT_COMMAND_RULE` procedure creates both common and local `CONNECT` command rules that you can associate with a user and a rule set.
- [CREATE_SESSION_EVENT_CMD_RULE Procedure](#)
The `CREATE_SESSION_EVENT_CMD_RULE` procedure creates both common and local command rules that you can associate with session events, based on the `ALTER SESSION` statement.
- [CREATE_SYSTEM_EVENT_CMD_RULE Procedure](#)
The `CREATE_SYSTEM_EVENT_CMD_RULE` procedure creates both command and local command rules that you can associate with system events, based on the `ALTER SYSTEM` statement.
- [DELETE_COMMAND_RULE Procedure](#)
The `DELETE_COMMAND_RULE` procedure drops a command rule declaration.
- [DELETE_CONNECT_COMMAND_RULE Procedure](#)
The `DELETE_CONNECT_COMMAND_RULE` procedure deletes a `CONNECT` command rule that had been created with the `CREATE_CONNECT_COMMAND_RULE` procedure.
- [DELETE_SESSION_EVENT_CMD_RULE Procedure](#)
The `DELETE_SESSION_EVENT_CMD_RULE` procedure deletes a session command rule that was associated with events.
- [DELETE_SYSTEM_EVENT_CMD_RULE Procedure](#)
The `DELETE_SYSTEM_EVENT_CMD_RULE` procedure deletes a system command rule that was associated with events.
- [UPDATE_COMMAND_RULE Procedure](#)
The `UPDATE_COMMAND_RULE` procedure updates the command rule declaration for both common and local command rules.
- [UPDATE_CONNECT_COMMAND_RULE Procedure](#)
The `UPDATE_CONNECT_COMMAND_RULE` procedure updates a `CONNECT` command rule that had been created with the `CREATE_CONNECT_COMMAND_RULE` procedure.
- [UPDATE_SESSION_EVENT_CMD_RULE Procedure](#)
The `UPDATE_SESSION_EVENT_CMD_RULE` procedure updates both common and local session event command rules, based on the `ALTER SESSION` statement.
- [UPDATE_SYSTEM_EVENT_CMD_RULE Procedure](#)
The `UPDATE_SYSTEM_EVENT_CMD_RULE` procedure updates both common and local system event command rules, based on the `ALTER SYSTEM` statement.

Related Topics

- [Configuring Command Rules](#)
You can create command rules or use the default command rules to protect DDL and DML statements.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

16.1 CREATE_COMMAND_RULE Procedure

The `CREATE_COMMAND_RULE` procedure creates both command and local command rules, which can be added to a rule set.

Optionally, you can use it to enable the command rule for rule checking with a rule set.

Syntax

```
DBMS_MACADM.CREATE_COMMAND_RULE(
  command          IN VARCHAR2,
  rule_set_name    IN VARCHAR2,
  object_owner     IN VARCHAR2 DEFAULT,
  object_name      IN VARCHAR2 DEFAULT,
  enabled          IN VARCHAR2,
  privilege_scope  IN NUMBER,
  clause_name      IN VARCHAR2 DEFAULT,
  parameter_name   IN VARCHAR2 DEFAULT,
  event_name       IN VARCHAR2 DEFAULT,
  component_name   IN VARCHAR2 DEFAULT,
  action_name      IN VARCHAR2 DEFAULT,
  scope            IN NUMBER DEFAULT);
```

Parameters**Table 16-1 CREATE_COMMAND_RULE Parameters**

| Parameter | Description |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>command</code> | SQL statement to protect. To find existing command rules, query the <code>DBA_DV_COMMAND_RULE</code> data dictionary view. See also Related Topics . |
| <code>rule_set_name</code> | Name of rule set to associate with this command rule. To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view. |
| <code>object_owner</code> | Database schema to which this command rule will apply. The wildcard <code>%</code> is allowed, except for the <code>SELECT</code> , <code>INSERT</code> , <code>UPDATE</code> , <code>DELETE</code> , and <code>EXECUTE</code> statements. To find the available users, query the <code>DBA_USERS</code> view. |
| <code>object_name</code> | Object to be protected by the command rule. (The wildcard <code>%</code> is allowed.) To find the available objects, query the <code>ALL_OBJECTS</code> view. |

Table 16-1 (Cont.) CREATE_COMMAND_RULE Parameters

| Parameter | Description |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| enabled | Specify one of the following options to set the status of the command rule: <ul style="list-style-type: none"> DBMS_MACUTL.G_YES or 'y' (Yes) to enable the command rule (default) DBMS_MACUTL.G_NO or 'n' to disable the command rule, including the capture of violations in the simulation log DBMS_MACUTL.G_SIMULATION or 's' to enable SQL statements to execute but capture violations in the simulation log |
| privilege_scope | Obsolete parameter |
| clause_name | A clause from the SQL statement that was used to create the command rule. For example, a command rule for the ALTER SESSION SQL statement could have the SET clause as the clause_name parameter. Applies only to command rules for ALTER SYSTEM and ALTER SESSION. The default is %, which includes all clauses. |
| parameter_name | A parameter from the clause_name parameter. For example, for an ALTER SESSION command rule, you could set parameter_name to EVENTS if the clause_name is SET. Applies only to command rules for ALTER SYSTEM and ALTER SESSION. The default is %, which includes all parameters. |
| event_name | An event that the command rule defines. For example, suppose an ALTER SESSION command rule uses SET for the clause_name and EVENTS as the parameter_name. The event_name could be set to TRACE if you want to track trace events. Applies only to ALTER SYSTEM and ALTER SESSION command rules that have the parameter parameter set to EVENTS. The default is %, which includes all events. |
| component_name | A component of the event_name setting. For example, for a TRACE event, the component_name could be GCS. Applies only to ALTER SYSTEM and ALTER SESSION command rules that have the parameter parameter set to EVENTS. The default is %, which includes all components. |
| action_name | An action of the component_name setting. Applies only to ALTER SYSTEM and ALTER SESSION command rules that have the parameter parameter set to EVENTS. The default is %, which includes all actions. |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root If you create the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example: <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |

ALTER SYSTEM Command Rule Settings

Table 16-2 describes the ALTER SYSTEM command rule settings.

Table 16-2 ALTER SYSTEM Command Rule Settings

| clause_name | parameter_name — Parameter Value |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ARCHIVE LOG | <ul style="list-style-type: none"> • ALL — <i>sequence_number</i> • CHANGE — <i>change_number</i> • CURRENT — N/A • GROUP — <i>group_number</i> • LOGFILE — <i>log_file_name</i> • NEXT — N/A • SEQUENCE — N/A |
| CHECK DATAFILES | N/A — global or local |
| CHECKPOINT | N/A — global or local |
| COPY LOGFILE | N/A — N/A |
| DISTRIBUTED RECOVERY | N/A — enable or disable |
| DUMP | <ul style="list-style-type: none"> • DATAFILE — N/A • FLASHBACK — N/A • LOGFILE — N/A • REDO — N/A • TEMPFILE — N/A • UNDO — N/A |
| END SESSION | DISCONNECT SESSION — N/A KILL SESSION — N/A |
| FLUSH | BUFFER_CACHE — N/A GLOBAL_CONTEXT — N/A REDO — <i>target_db_name</i> SHARED_POOL — N/A |
| QUIESCE | QUIESCE RESTRICTED — N/A UNQUIESCE — N/A |
| REFRESH | LDAP_REGISTRATION — N/A |
| REGISTER | N/A — N/A |
| RESET | <i>initialization_parameter_name</i> — N/A |
| RESUME | N/A — N/A |
| SECURITY | RESTRICTED_SESSION — enable or disable SET ENCRYPTION KEY — N/A SET ENCRYPTION WALLET — open or close |

Table 16-2 (Cont.) ALTER SYSTEM Command Rule Settings

| clause_name | parameter_name — Parameter Value |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SET | EVENTS — <i>event_string</i> GLOBAL_TOPIC_ENABLED — true or false <i>initialization_parameter_name</i> — <i>parameter_value</i> LDAP_REGISTRATION_ENABLED — true or false LDAP_REG-SYNC_INTERVAL — Number SINGLETASK DEBUG — N/A USE_STORED_OUTLINES — true, false, or <i>category_name</i> |
| SHUTDOWN DISPPATCHER | N/A — <i>dispatcher_name</i> |
| SWITCH LOGFILE | N/A — all or none |
| SUSPEND | N/A — N/A |
| TX RECOVERY | N/A — enable or disable |

ALTER SESSION Command Rule Settings

[Table 16-3](#) describes the ALTER SESSION command rule settings.

Table 16-3 ALTER SESSION Command Rule Settings

| clause_name | parameter_name — Parameter Value |
|---------------------|--------------------------------------------------------------|
| ADVISE | N/A — COMMIT, ROLLBACK, or NOTHING |
| CLOSE DATABASE LINK | N/A — <i>database_link</i> |
| COMMIT IN PROCEDURE | N/A — ENABLE or DISABLE |
| GUARD | N/A — ENABLE or DISABLE |
| ILM | ROW ACCESS TRACKING — N/A ROW MODIFICATION TRACKING — N/A |
| LOGICAL REPLICATION | N/A — N/A |
| PARALLEL DML | N/A — ENABLE, DISABLE, or FORCE |
| PARALLEL DDL | N/A — ENABLE, DISABLE, or FORCE |
| PARALLEL QUERY | N/A — ENABLE, DISABLE, or FORCE |
| RESUMABLE | N/A — ENABLE or DISABLE |
| SYNC WITH PRIMARY | N/A — N/A |

Table 16-3 (Cont.) ALTER SESSION Command Rule Settings

| clause_name | parameter_name — Parameter Value |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SET | APPLICATION ACTION — <i>action_name</i> APPLICATION MODULE — <i>module_name</i> CONSTRAINTS — IMMEDIATE, DEFERRED, or DEFAULT CONTAINER — <i>container_name</i> CURRENT SCHEMA — <i>schema_name</i> EDITION — <i>edition_name</i> ERROR ON OVERLAP TIME — TRUE or FALSE EVENTS — <i>event_string</i> FLAGGER — OFF, FULL, INTERMEDIATE, ENTRY <i>initialization_parameter_name</i> — <i>parameter_name</i> INSTANCE — <i>instance_number</i> ISOLATION_LEVEL — SERIALIZABLE or READ COMMITTED ROW_ARCHIVAL_VISABILITY — ACTIVE or ALL SQL_TRANSFORMATION_PROFILE — <i>profile_name</i> STANDBY_MAX_DATA_DELAY — NONE <i>number</i> TIME_ZONE — LOCAL, DBTIMEZONE, or <i>other_value</i> USE_PRIVATE_OUTLINES — TRUE, FALSE, or <i>category_name</i> USE_STORED_OUTLINES — TRUE, FALSE, or <i>category_name</i> |

Examples

Simple Command Rules

The following example shows how to create a simple command rule for the SELECT statement on the HR.EMPLOYEES table. This command rule uses a custom rule set called Check User Role. This rule set must exist before the command rule can be created.

```
BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'SELECT',
  rule_set_name => 'Check User Role',
  object_owner  => 'HR',
  object_name   => 'EMPLOYEES',
  enabled       => DBMS_MACUTL.G_YES);
END;
/
```

This example shows how to create a command rule that checks if users can enable or disable the hr_app_aud_pol unified audit policy. Note that if the object is a unified audit policy, then you must have AUDIT POLICY, not AUDIT, for the command parameter.

```
BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'AUDIT POLICY',
  rule_set_name => 'Check ability to audit',
  object_owner  => '%',
  object_name   => 'hr_app_aud_pol',
  enabled       => DBMS_MACUTL.G_YES,
  scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
```

```
END;
/
```

ALTER SESSION Command Rule Using the SET Clause

The following example shows how to create an ALTER SESSION command rule that uses the SET clause with the ERROR_ON_OVERLAP_TIME parameter.

```
BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'ALTER SESSION',
  rule_set_name => 'Test ERROR_ON_OVERLAP_TIME for FALSE',
  object_owner  => '%',
  object_name   => '%',
  enabled       => DBMS_MACUTL.G_YES,
  clause_name   => 'SET',
  parameter_name => 'ERROR_ON_OVERLAP_TIME',
  scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

In this example:

- **rule_set_name:** The ALTER SESSION SQL statement ERROR_ON_OVERLAP_TIME session parameter must be set to either TRUE or FALSE. You can create a rule set that checks if this setting. For example, for the rule:

```
EXEC DBMS_MACADM.CREATE_RULE('RULE_TRUE', 'UPPER(PARAMETER_VALUE) = 'TRUE'');
```

The rule set that is used with this rule can be similar to the following:

```
BEGIN
DBMS_MACADM.CREATE_RULE_SET (
  rule_set_name  => 'Test ERROR_ON_OVERLAP_TIME',
  description    => 'Checks if the ERROR_ON_OVERLAP_TIME setting is TRUE or FALSE',
  enabled        => DBMS_MACUTL.G_YES,
  eval_options   => DBMS_MACUTL.G_RULESET_EVAL_ALL,
  audit_options  => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
  fail_options   => DBMS_MACUTL.G_RULESET_FAIL_SILENT,
  fail_message   => 'false error on overlaptime',
  fail_code      => 20461,
  handler_options => DBMS_MACUTL.G_RULESET_HANDLER_FAIL,
  handler        => '',
  is_static      => false);
END;
/
EXEC DBMS_MACADM.ADD_RULE_TO_RULE_SET('Test ERROR_ON_OVERLAP_TIME', 'RULE_TRUE');
```

- **object_owner** and **object_name** must be set to % for ALTER SESSION and ALTER SYSTEM command rules.
- **enabled** uses the DBMS_MACUTL.G_YES constant to enable the command rule when it is created.
- **clause_name** sets the ALTER SESSION command rule to use the SET clause of the ALTER SESSION PL/SQL statement.
- **parameter_name** is set to the ERROR_ON_OVERLAP_TIME parameter of the SET clause.
- **scope** uses the DBMS_MACUTL.G_SCOPE_COMMON constant to set the command rule to be a common command rule. This command rule will be in the application root of a multitenant environment, so the user running this procedure must be in the CDB root. Any rules or rule sets that are associated with this command rule must be common.

If you were creating the command rule locally, you would set `scope` to `DBMS_MACUTL.G_SCOPE_LOCAL`. In that case, the user who runs this procedure must be in the PDB in which the command rule will reside. To find the existing PDBs, you can query the `DBA_PDBS` data dictionary view. Any rules or rule sets that are associated with this command rule must be local.

ALTER SYSTEM Command Rule Using the CHECKPOINT Clause

This example shows how to create an ALTER SYSTEM command rule that uses the `CHECKPOINT` clause. To have the command rule test for the `CHECKPOINT` setting, you must create a rule set and rule, similar to the ALTER SESSION command rule in the previous example. In this example, the `parameter` setting is not specified because the `CHECKPOINT` setting does not have parameters.

```
BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'ALTER SYSTEM',
  rule_set_name => 'Test CHECKPOINT Setting',
  object_owner  => '%',
  object_name   => '%',
  enabled       => DBMS_MACUTL.G_YES,
  clause_name   => 'CHECKPOINT',
  parameter_name => '',
  scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

ALTER SESSION Command Rule Using the SET Clause

The following ALTER SESSION command rule uses the `SET` clause to specify an `event_name` and `component_name`. You can only use the `event_name`, `component_name`, and `action_name` parameters if the `clause_name` parameter specifies `SET`.

```
BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'ALTER SESSION',
  rule_set_name => 'Check Trace Events',
  object_owner  => '%',
  object_name   => '%',
  enabled       => DBMS_MACUTL.G_YES,
  clause_name   => 'SET',
  parameter_name => 'EVENTS',
  event_name    => 'TRACE',
  component_name => 'GCS',
  scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

Related Topics

- [ALTER SESSION and ALTER SYSTEM Command Rules](#)
You can create different kinds of ALTER SESSION and ALTER SYSTEM command rules that provide fine-grained control for these SQL statements.
- [SQL Statements That Can Be Protected by Command Rules](#)
You can protect a large number of SQL statements by using command rules.

16.2 CREATE_CONNECT_COMMAND_RULE Procedure

The `CREATE_CONNECT_COMMAND_RULE` procedure creates both common and local `CONNECT` command rules that you can associate with a user and a rule set.

Syntax

```
DBMS_MACADM.CREATE_CONNECT_COMMAND_RULE (
  user_name          IN VARCHAR2,
  rule_set_name      IN VARCHAR2,
  enabled            IN VARCHAR2,
  scope              IN NUMBER DEFAULT);
```

Parameters

Table 16-4 CREATE_CONNECT_COMMAND_RULE Parameters

| Parameter | Description |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>user_name</code> | <p>User to whom the <code>CONNECT</code> command rule will apply. If you enter the % wildcard, then the <code>CONNECT</code> command rule will be applied to every database user.</p> <p>If you run this procedure in the root, then specifying % applies to all common users. If you run the procedure in a PDB, then it applies to all local and common users who have access to this PDB. If there are two command rules, one common and one local, and they both apply to the same object, then both must evaluate successfully for the operation to succeed.</p> <p>Ensure that this user is common if the <code>CONNECT</code> command rule is common, and local or common if the <code>CONNECT</code> command rule is local.</p> <p>To find existing database users in the current instance, query the <code>DBA_USERS</code> view, described in <i>Oracle Database Reference</i>.</p> |
| <code>rule_set_name</code> | <p>Name of rule set to associate with this command rule. Ensure that this rule set is common if the <code>CONNECT</code> command rule is common, and local if the <code>CONNECT</code> command rule is local.</p> <p>To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view, described in DBA_DV_RULE_SET View.</p> |
| <code>enabled</code> | <p>Specify one of the following options to set the status of the command rule:</p> <ul style="list-style-type: none"> <code>DBMS_MACUTL.G_YES</code> or 'y' (Yes) to enable the command rule (default) <code>DBMS_MACUTL.G_NO</code> or 'n' to disable the command rule, including the capture of violations in the simulation log <code>DBMS_MACUTL.G_SIMULATION</code> or 's' to enable SQL statements to execute but capture violations in the simulation log |
| <code>scope</code> | <p>Determines how to execute this procedure. The default is local. Options are as follows:</p> <ul style="list-style-type: none"> <code>DBMS_MACUTL.G_SCOPE_LOCAL</code> (or 1) if the command rule is local in the current PDB <code>DBMS_MACUTL.G_SCOPE_COMMON</code> (or 2) if the command rule is in the application root <p>If you create the common <code>CONNECT</code> command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:</p> <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |

Examples

The following example shows how to create a common CONNECT command rule. This command rule will be in the CDB root, so the user who runs this procedure must be in the CDB root. Any user names or rule sets that are associated with this command rule must be common.

```
BEGIN
DBMS_MACADM.CREATE_CONNECT_COMMAND_RULE(
  rule_set_name => 'Allow Sessions',
  user_name     => 'C##HR_ADMIN',
  enabled       => DBMS_MACUTL.G_SIMULATION,
  scope         => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

This example is a local version of the preceding example. The user who runs this procedure must be in the PDB in which the local CONNECT command rule will reside. To find the available PDBs, run the `show pdbs` command. Any rule sets that are associated with this command rule must be local. The user can be either common or local.

```
BEGIN
DBMS_MACADM.CREATE_CONNECT_COMMAND_RULE(
  rule_set_name => 'Allow Sessions',
  user_name     => 'PSMITH',
  enabled       => DBMS_MACUTL.G_SIMULATION,
  scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

16.3 CREATE_SESSION_EVENT_CMD_RULE Procedure

The `CREATE_SESSION_EVENT_CMD_RULE` procedure creates both common and local command rules that you can associate with session events, based on the `ALTER SESSION` statement.

Syntax

```
DBMS_MACADM.CREATE_SESSION_EVENT_CMD_RULE(
  rule_set_name  IN VARCHAR2,
  enabled        IN VARCHAR2,
  event_name     IN VARCHAR2 DEFAULT,
  component_name IN VARCHAR2 DEFAULT,
  action_name    IN VARCHAR2 DEFAULT,
  scope          IN NUMBER DEFAULT,
  pl_sql_stack   IN BOOLEAN DEFAULT);
```

Parameters

Table 16-5 CREATE_SESSION_EVENT_CMD_RULE Parameters

| Parameter | Description |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>rule_set_name</code> | Name of the rule set to associate with the command rule. Ensure that this rule set is common if the session event command rule is common, and local if the command rule is local. To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view. |

Table 16-5 (Cont.) CREATE_SESSION_EVENT_CMD_RULE Parameters

| Parameter | Description |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| enabled | Specify one of the following options to set the status of the command rule: <ul style="list-style-type: none"> DBMS_MACUTL.G_YES or 'y' (Yes) to enable the command rule (default) DBMS_MACUTL.G_NO or 'n' to disable the command rule, including the capture of violations in the simulation log DBMS_MACUTL.G_SIMULATION or 's' to enable SQL statements to execute but capture violations in the simulation log |
| event_name | An event that the command rule defines. This setting enables the command rule to correspond with an ALTER SESSION SET EVENTS <i>event_name</i> statement. For example, to track trace events, you would set <i>event_name</i> to TRACE. |
| component_name | A component of the <i>event_name</i> setting. Example settings are DV, OLS, or GCS. You can find valid component names by issuing ORADEBUG DOC COMPONENT RDBMS as user SYS. The output displays parent and child components, which you can use for the <i>component_name</i> setting. For example, both XS (parent) and XSSESSION (child of XS) are valid component names. If you select the parent component, then the command rule applies to it and the child components. |
| action_name | An action of the <i>component_name</i> setting |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root If you create the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example: ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC; |
| pl_sql_stack | When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter TRUE to record the PL/SQL stack, FALSE to not record. The default is FALSE. |

Examples

The following example shows how to create a common session event command rule in a multitenant environment. This command rule will be in the application root, so the user running this procedure must be in the CDB root. Any user names or rule sets that are associated with this command rule must be common.

```
BEGIN
  DBMS_MACADM.CREATE_SESSION_EVENT_CMD_RULE (
    rule_set_name => 'Allow Sessions',
    event_name    => 'TRACE',
    component_name => 'DV',
    action_name   => 'CURSORTRACE',
    enabled       => DBMS_MACUTL.G_SIMULATION,
    scope         => DBMS_MACUTL.G_SCOPE_COMMON);
```

```
END;
/
```

This example shows how to create a session event for the 47998 trace event. This example will records the PL/SQL stack for failed operations.

```
BEGIN
  DBMS_MACADM.CREATE_SESSION_EVENT_CMD_RULE (
    rule_set_name => 'Allow Sessions',
    event_name    => '47998',
    enabled       => 'y',
    scope        => DBMS_MACUTL.G_SCOPE_LOCAL,
    pl_sql_stack => TRUE);
END;
/
```

16.4 CREATE_SYSTEM_EVENT_CMD_RULE Procedure

The `CREATE_SYSTEM_EVENT_CMD_RULE` procedure creates both command and local command rules that you can associate with system events, based on the `ALTER SYSTEM` statement.

Syntax

```
DBMS_MACADM.CREATE_SYSTEM_EVENT_CMD_RULE (
  rule_set_name  IN VARCHAR2,
  enabled        IN VARCHAR2,
  event_name     IN VARCHAR2 DEFAULT,
  component_name IN VARCHAR2 DEFAULT,
  action_name    IN VARCHAR2 DEFAULT,
  scope          IN NUMBER DEFAULT,
  pl_sql_stack   IN BOOLEAN DEFAULT);
```

Parameters

Table 16-6 CREATE_SYSTEM_EVENT_CMD_RULE Parameters

| Parameter | Description |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>rule_set_name</code> | Name of the rule set to associate with the command rule. Ensure that this rule set is common if the system event command rule is common, and local if the command rule is local. To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view. |
| <code>event_name</code> | An event that the command rule defines. This setting enables the command rule to correspond to an <code>ALTER SYSTEM SET EVENTS event_name</code> statement. For example, to track trace events, you would set <code>event_name</code> to <code>TRACE</code> . |
| <code>component_name</code> | A component of the <code>event_name</code> setting. Example settings are <code>DV</code> , <code>OLS</code> , or <code>GCS</code> . You can find valid component names by issuing <code>ORADEBUG DOC COMPONENT RDBMS</code> as user <code>SYS</code> . The output displays parent and child components, which you can use for the <code>component_name</code> setting. For example, both <code>XS</code> (parent) and <code>XSSSESSION</code> (child of <code>XS</code>) are valid component names. If you select the parent component, then the command rule applies to it and the child components. |
| <code>action_name</code> | An action of the <code>component_name</code> setting |

Table 16-6 (Cont.) CREATE_SYSTEM_EVENT_CMD_RULE Parameters

| Parameter | Description |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| enabled | Specify one of the following options to set the status of the command rule: <ul style="list-style-type: none"> DBMS_MACUTL.G_YES or 'y' to enable the command rule (default) DBMS_MACUTL.G_NO or 'n' to disable the command rule, including the capture of violations in the simulation log DBMS_MACUTL.G_SIMULATION or 's' to enable SQL statements to execute but capture violations in the simulation log |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root <p>If you create the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:</p> <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |
| pl_sql_stack | When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter TRUE to record the PL/SQL stack, FALSE to not record. The default is FALSE. |

Example

The following example shows how to create a common system event command rule in a multitenant environment. This command rule will be in the application root, so the user running this procedure must be in the CDB root. Any user names or rule sets that are associated with this command rule must be common.

```
BEGIN
  DBMS_MACADM.CREATE_SYSTEM_EVENT_CMD_RULE (
    rule_set_name => 'Enabled',
    event_name    => 'TRACE',
    component_name => 'GSIPC',
    action_name   => 'HEAPDUMP',
    enabled       => DBMS_MACUTL.G_YES,
    scope         => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

16.5 DELETE_COMMAND_RULE Procedure

The DELETE_COMMAND_RULE procedure drops a command rule declaration.

Syntax

```
DBMS_MACADM.DELETE_COMMAND_RULE(
  command          IN VARCHAR2,
  object_owner     IN VARCHAR2,
  object_name      IN VARCHAR2,
  clause_name      IN VARCHAR2,
  parameter_name   IN VARCHAR2 DEFAULT,
  event_name       IN VARCHAR2 DEFAULT,
```

```

component_name IN VARCHAR2 DEFAULT,
action_name    IN VARCHAR2 DEFAULT,
scope         IN NUMBER DEFAULT);

```

Parameters

Table 16-7 DELETE_COMMAND_RULE Parameters

| Parameter | Description |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| command | SQL statement the command rule protects. To find available command rules, query the DBA_DV_COMMAND_RULE view. |
| object_owner | Database schema to which this command rule applies. To find the available users in the current database instance, query the DBA_USERS view. |
| object_name | Object name. The wildcard % is allowed. To find the available objects in the current database instance, query the ALL_OBJECTS view. |
| clause_name | A clause from the SQL statement that was used to create the command rule. Applies only to command rules for ALTER SYSTEM and ALTER SESSION. |
| parameter_name | A parameter from the clause_name parameter. Applies only to command rules for ALTER SYSTEM and ALTER SESSION. |
| event_name | An event that the command rule defines. Applies only to command rules for ALTER SYSTEM and ALTER SESSION. |
| component_name | A component of the event_name setting. Applies only to command rules for ALTER SYSTEM and ALTER SESSION. |
| action_name | An action of the component_name setting. Applies only to command rules for ALTER SYSTEM and ALTER SESSION. |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root |

Examples

When you drop a command rule, you must omit the `rule_set_name` and `enabled` parameters, and ensure that the rest of the parameters match the settings that were used the last time the command rule was updated. You can check the most recent settings by querying the `DBA_DV_COMMAND_RULE` data dictionary view.

For example, suppose you created the following command rule:

```

BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'SELECT',
  rule_set_name => 'Enabled',
  object_owner  => 'OE',
  object_name   => 'ORDERS',
  enabled       => DBMS_MACUTL.G_YES,
  scope        => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/

```

To drop this command rule, use the most of same parameters as shown here, but omit `rule_set_name` and `enabled`.

```
BEGIN
  DBMS_MACADM.DELETE_COMMAND_RULE (
    command      => 'SELECT',
    object_owner => 'OE',
    object_name  => 'ORDERS',
    scope       => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

The following example shows how to delete an ALTER SESSION command rule.

```
BEGIN
  DBMS_MACADM.DELETE_COMMAND_RULE (
    command      => 'ALTER SESSION',
    object_owner => '%',
    object_name  => '%',
    clause_name  => 'SET',
    parameter_name => 'EVENTS',
    event_name   => 'TRACE',
    component_name => 'GCS',
    scope       => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

Related Topics

- [DBA_DV_COMMAND_RULE View](#)
The `DBA_DV_COMMAND_RULE` data dictionary view lists the SQL statements that are protected by command rules.

16.6 DELETE_CONNECT_COMMAND_RULE Procedure

The `DELETE_CONNECT_COMMAND_RULE` procedure deletes a `CONNECT` command rule that had been created with the `CREATE_CONNECT_COMMAND_RULE` procedure.

Syntax

```
DBMS_MACADM.DELETE_CONNECT_COMMAND_RULE (
  user_name      IN VARCHAR2,
  scope         IN NUMBER DEFAULT);
```

Parameters

Table 16-8 DELETE_CONNECT_COMMAND_RULE Parameters

| Parameter | Description |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>user_name</code> | User to whom the <code>CONNECT</code> command rule applied. To find this user, query the <code>OBJECT_OWNER</code> field of the <code>DBA_DV_COMMAND_RULE</code> view. |

Table 16-8 (Cont.) DELETE_CONNECT_COMMAND_RULE Parameters

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root |

Example

```
BEGIN
  DBMS_MACADM.DELETE_CONNECT_COMMAND_RULE (
    user_name      => 'PSMITH',
    scope          => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

16.7 DELETE_SESSION_EVENT_CMD_RULE Procedure

The `DELETE_SESSION_EVENT_CMD_RULE` procedure deletes a session command rule that was associated with events.

Syntax

```
DBMS_MACADM.DELETE_SESSION_EVENT_CMD_RULE (
  event_name      IN VARCHAR2 DEFAULT,
  component_name  IN VARCHAR2 DEFAULT,
  action_name     IN VARCHAR2 DEFAULT,
  scope          IN NUMBER DEFAULT);
```

Parameters**Table 16-9 DELETE_SESSION_EVENT_CMD_RULE Parameters**

| Parameter | Description |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| event_name | An event that the session event command rule defines. The <code>DBA_CV_COMMAND_RULE</code> view lists information about existing command rules. |
| component_name | A component of the <code>event_name</code> setting |
| action_name | An action of the <code>component_name</code> setting |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root |

Example

The following example shows how to delete a common session event command rule in the application root a multitenant environment. The user running this procedure must be a common user in the CDB root. When you specify the parameters, ensure that they match

exactly the parameters that were used the last time the command rule was updated. To find the current settings of the command rule, query the DBA_DV_COMMAND_RULE view.

```
BEGIN
DBMS_MACADM.DELETE_SESSION_EVENT_CMD_RULE (
  event_name      => '47999',
  scope           => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

16.8 DELETE_SYSTEM_EVENT_CMD_RULE Procedure

The DELETE_SYSTEM_EVENT_CMD_RULE procedure deletes a system command rule that was associated with events.

Syntax

```
DBMS_MACADM.DELETE_SYSTEM_EVENT_CMD_RULE (
  event_name      IN VARCHAR2 DEFAULT,
  component_name  IN VARCHAR2 DEFAULT,
  action_name     IN VARCHAR2 DEFAULT,
  scope           IN NUMBER DEFAULT);
```

Parameters

Table 16-10 DELETE_SYSTEM_EVENT_CMD_RULE Parameters

| Parameter | Description |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| event_name | An event that the system event command rule defines. The DBA_DV_COMMAND_RULE view lists information about existing command rules. |
| component_name | A component of the event_name setting |
| action_name | An action of the component_name setting |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root |

Examples

The following example shows how to delete a common system event command rule in the application root. The user running this procedure must be a common user in the CDB root. When you specify the parameters, ensure that they match exactly the parameters that were used the last time the command rule was updated. To find the current settings of the command rule, query the DBA_DV_COMMAND_RULE view.

```
BEGIN
DBMS_MACADM.DELETE_SYSTEM_EVENT_CMD_RULE (
  event_name      => 'TRACE',
  component_name  => 'DV',
  action_name     => '',
  scope           => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

16.9 UPDATE_COMMAND_RULE Procedure

The `UPDATE_COMMAND_RULE` procedure updates the command rule declaration for both common and local command rules.

Syntax

```
DBMS_MACADM.UPDATE_COMMAND_RULE (
  command          IN VARCHAR2,
  rule_set_name    IN VARCHAR2,
  object_owner     IN VARCHAR2,
  object_name      IN VARCHAR2,
  enabled          IN VARCHAR2,
  privilege_scope  IN NUMBER,
  clause_name      IN VARCHAR2,
  parameter_name   IN VARCHAR2 DEFAULT,
  event_name       IN VARCHAR2 DEFAULT,
  component_name   IN VARCHAR2 DEFAULT,
  action_name      IN VARCHAR2 DEFAULT,
  scope            IN NUMBER DEFAULT,
  pl_sql_stack     IN BOOLEAN DEFAULT);
```

Parameters

Table 16-11 UPDATE_COMMAND_RULE Parameters

| Parameter | Description |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>command</code> | Command rule to update See also Related Topics. |
| <code>rule_set_name</code> | Name of rule set to associate with this command rule. To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view. |
| <code>object_owner</code> | Database schema to which this command rule applies. To find the available users, query the <code>DBA_USERS</code> view. See also Related Topic on creating a command rule for more details about object owners. |
| <code>object_name</code> | Object name. (The wildcard % is allowed. See also Related Topic on creating a command rule for more details about object names. To find the available objects, query the <code>ALL_OBJECTS</code> view. |
| <code>enabled</code> | Specify one of the following options to set the status of the command rule: <ul style="list-style-type: none"> <code>DBMS_MACUTL.G_YES</code> or <code>'y'</code> to enable the command rule (default) <code>DBMS_MACUTL.G_NO</code> or <code>'n'</code> to disable the command rule, including the capture of violations in the simulation log <code>DBMS_MACUTL.G_SIMULATION</code> or <code>'s'</code> to enable SQL statements to execute but capture violations in the simulation log |
| <code>privilege_scope</code> | Obsolete parameter |
| <code>clause_name</code> | A clause from the SQL statement that was used to create the command rule. For example, a command rule for the <code>ALTER SESSION SQL</code> statement could have the <code>SET</code> clause as the <code>clause_name</code> parameter. Applies only to command rules for <code>ALTER SYSTEM</code> and <code>ALTER SESSION</code> . The command rule settings for these two statements are described in the <code>DBMS_MACADM.CREATE_COMMAND_RULE</code> procedure. See Related Topics. |

Table 16-11 (Cont.) UPDATE_COMMAND_RULE Parameters

| Parameter | Description |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| parameter_name | <p>A parameter from the clause_name parameter. For example, for an ALTER SESSION command rule, you could set parameter_name to EVENTS if the clause_name is SET.</p> <p>Applies only to command rules for ALTER SYSTEM and ALTER SESSION. See Related Topics.</p> |
| event_name | <p>An event that the command rule defines. For example, for an ALTER SESSION command rule that uses SET for the clause_name and EVENTS as the parameter_name, then the event_name could be set to TRACE.</p> <p>Applies only to ALTER SYSTEM and ALTER SESSION command rules that have the parameter parameter set to events. See Related Topics.</p> |
| component_name | <p>A component of the event_name setting. For example, for a TRACE event, the component_name could be GCS.</p> <p>Applies only to ALTER SYSTEM and ALTER SESSION command rules that have the parameter parameter set to events. See Related Topics.</p> |
| action_name | <p>An action of the component_name setting. For example, if component_name is set to GCS, then the action_name setting could be DISK HIGH.</p> <p>Applies only to ALTER SYSTEM and ALTER SESSION command rules that have the parameter parameter set to events. See Related Topics.</p> |
| scope | <p>Determines how to execute this procedure. The default is local. Options are as follows:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root <p>If you update the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:</p> <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |
| pl_sql_stack | <p>When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter TRUE to record the PL/SQL stack, FALSE to not record.</p> |

Examples

The following example shows how to update a simple command rule that protects the HR.EMPLOYEES schema (for example, changing its rule set).

```
BEGIN
  DBMS_MACADM.UPDATE_COMMAND_RULE (
    command      => 'SELECT',
    rule_set_name => 'Disabled',
    object_owner  => 'HR',
    object_name   => 'EMPLOYEES',
    enabled       => DBMS_MACUTL.G_SIMULATION,
    scope        => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

This example shows how to update a more complex command rule, which is based on the ALTER SESSION SQL statement.

```
BEGIN
  DBMS_MACADM.UPDATE_COMMAND_RULE (
    command      => 'ALTER SESSION',
    rule_set_name => 'Enabled',
    object_owner  => '%',
    object_name   => '%',
    enabled       => 's',
    clause_name   => 'SET',
    parameter_name => 'EVENTS',
    event_name    => 'TRACE',
    component_name => 'GCS',
    scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

Related Topics

- [SQL Statements That Can Be Protected by Command Rules](#)
You can protect a large number of SQL statements by using command rules.
- [CREATE_COMMAND_RULE Procedure](#)
The CREATE_COMMAND_RULE procedure creates both command and local command rules, which can be added to a rule set.
- [Creating a Command Rule](#)
You can create a different types of command rules using different command rule APIs.

16.10 UPDATE_CONNECT_COMMAND_RULE Procedure

The UPDATE_CONNECT_COMMAND_RULE procedure updates a CONNECT command rule that had been created with the CREATE_CONNECT_COMMAND_RULE procedure.

Syntax

```
DBMS_MACADM.UPDATE_CONNECT_COMMAND_RULE (
  user_name      IN VARCHAR2,
  rule_set_name  IN VARCHAR2,
  enabled        IN VARCHAR2,
  scope          IN NUMBER DEFAULT);
```

Parameters

Table 16-12 UPDATE_CONNECT_COMMAND_RULE Parameters

| Parameter | Description |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| user_name | <p>User to whom the <code>CONNECT</code> command rule will apply. If you enter the <code>%</code> wildcard, then the <code>CONNECT</code> command rule will be applied to every database user.</p> <p>If you run this procedure in the root, then specifying <code>%</code> applies to all common users. If you run the procedure in a PDB, then it applies to all local and common users who have access to this PDB. If there are two command rules, one common and one local, and they both apply to the same object, then both must evaluate successfully for the operation to succeed.</p> <p>Environment, ensure that this user is common if the <code>CONNECT</code> command rule is common, and local or common if the <code>CONNECT</code> command rule is local.</p> <p>To find existing command rules, query the <code>DBA_DV_COMMAND_RULE</code> view, described in DBA_DV_COMMAND_RULE View.</p> <p>To find existing database users in the current instance, query the <code>DBA_USERS</code> view, described in <i>Oracle Database Reference</i>.</p> |
| rule_set_name | <p>Name of rule set to associate with this command rule. Ensure that this rule set is common if the <code>CONNECT</code> command rule is common, and local if the <code>CONNECT</code> command rule is local.</p> <p>To find existing rule sets in the current database instance, query the <code>DBA_DV_RULE_SET</code> view, described in DBA_DV_RULE_SET View.</p> |
| enabled | <p>Specify one of the following options to set the status of the command rule:</p> <ul style="list-style-type: none"> • <code>DBMS_MACUTL.G_YES</code> or <code>'y'</code> to enable the command rule (default) • <code>DBMS_MACUTL.G_NO</code> or <code>'n'</code> to disable the command rule, including the capture of violations in the simulation log • <code>DBMS_MACUTL.G_SIMULATION</code> or <code>'s'</code> to enable SQL statements to execute but capture violations in the simulation log |
| scope | <p>Determines how to execute this procedure. The default is local. Options are as follows:</p> <ul style="list-style-type: none"> • <code>DBMS_MACUTL.G_SCOPE_LOCAL</code> (or 1) if the command rule is local in the current PDB • <code>DBMS_MACUTL.G_SCOPE_COMMON</code> (or 2) if the command rule is in the application root <p>If you update the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:</p> <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |

Example

```
BEGIN
  DBMS_MACADM.UPDATE_CONNECT_COMMAND_RULE(
    rule_set_name => 'Allow Sessions',
    user_name     => 'PSMITH',
    enabled       => 'DBMS_MACUTL.G_YES',
    scope         => DBMS_MACUTL.G_SCOPE_LOCAL);
END;
/
```

16.11 UPDATE_SESSION_EVENT_CMD_RULE Procedure

The UPDATE_SESSION_EVENT_CMD_RULE procedure updates both common and local session event command rules, based on the ALTER SESSION statement.

Syntax

```
DBMS_MACADM.UPDATE_SESSION_EVENT_CMD_RULE(
  rule_set_name  IN VARCHAR2,
  enabled        IN VARCHAR2,
  event_name     IN VARCHAR2 DEFAULT,
  component_name IN VARCHAR2 DEFAULT,
  action_name    IN VARCHAR2 DEFAULT,
  scope          IN NUMBER DEFAULT,
  pl_sql_stack   IN BOOLEAN DEFAULT);
```

Parameters

Table 16-13 UPDATE_SESSION_EVENT_CMD_RULE Parameters

| Parameter | Description |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_set_name | Name of the rule set to associate with the command rule. Ensure that this rule set is common if the session event command rule is common, and local if the command rule is local. To find existing rule sets in the current database instance, query the DBA_DV_RULE_SET view. |
| enabled | Specify one of the following options to set the status of the command rule: <ul style="list-style-type: none"> DBMS_MACUTL.G_YES or 'y' to enable the command rule (default) DBMS_MACUTL.G_NO or 'n' to disable the command rule, including the capture of violations in the simulation log DBMS_MACUTL.G_SIMULATION or 's' to enable SQL statements to execute but capture violations in the simulation log |
| event_name | An event that the command rule defines. This setting enables the command rule to correspond with an ALTER SESSION SET EVENTS event_name statement. For example, to track trace events, you would set event_name to TRACE. |
| component_name | A component of the event_name setting. Example settings are DV, OLS, or GCS. You can find valid component names by issuing ORADEBUG DOC COMPONENT RDBMS as user SYS. The output displays parent and child components, which you can use for the component_name setting. For example, both XS (parent) and XSSESSION (child of XS) are valid component names. If you select the parent component, then the command rule applies to it and the child components. |
| action_name | An action of the component_name setting |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root <p>If you update the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example:</p> <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |

Table 16-13 (Cont.) UPDATE_SESSION_EVENT_CMD_RULE Parameters

| Parameter | Description |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| pl_sql_stack | When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter TRUE to record the PL/SQL stack, FALSE to not record. |

Example

The following example shows how to update a common session event command rule. This command rule is in the application root, so the user running this procedure must be in the CDB root. Any user names or rule sets that are associated with this command rule must be common.

```
BEGIN
  DBMS_MACADM.UPDATE_SESSION_EVENT_CMD_RULE (
    rule_set_name => 'Allow Sessions',
    event_name    => '47999',
    enabled       => DBMS_MACUTL.G_NO,
    scope        => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

16.12 UPDATE_SYSTEM_EVENT_CMD_RULE Procedure

The UPDATE_SYSTEM_EVENT_CMD_RULE procedure updates both common and local system event command rules, based on the ALTER SYSTEM statement.

Syntax

```
DBMS_MACADM.UPDATE_SYSTEM_EVENT_CMD_RULE (
  rule_set_name  IN VARCHAR2,
  enabled        IN VARCHAR2,
  event_name     IN VARCHAR2 DEFAULT,
  component_name IN VARCHAR2 DEFAULT,
  action_name    IN VARCHAR2 DEFAULT,
  scope          IN NUMBER DEFAULT,
  pl_sql_stack   IN BOOLEAN DEFAULT);
```

Parameters

Table 16-14 UPDATE_SYSTEM_EVENT_CMD_RULE Parameters

| Parameter | Description |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rule_set_name | Name of the rule set to associate with the command rule. Ensure that this rule set is common if the system event command rule is common, and local if the command rule is local. To find existing rule sets in the current database instance, query the DBA_DV_RULE_SET view. |
| enabled | Specify one of the following options to set the status of the command rule: <ul style="list-style-type: none"> DBMS_MACUTL.G_YES or 'y' to enable the command rule (default) DBMS_MACUTL.G_NO or 'n' to disable the command rule, including the capture of violations in the simulation log DBMS_MACUTL.G_SIMULATION or 's' to enable SQL statements to execute but capture violations in the simulation log |

Table 16-14 (Cont.) UPDATE_SYSTEM_EVENT_CMD_RULE Parameters

| Parameter | Description |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| event_name | An event that the command rule defines. This setting enables the command rule to correspond to an ALTER SYSTEM SET EVENTS event_name statement. For example, to track trace events, you would set event_name to TRACE. |
| component_name | A component of the event_name setting. Example settings are DV, OLS, or GCS. You can find valid component names by issuing ORADEBUG DOC COMPONENT RDBMS as user SYS. The output displays parent and child components, which you can use for the component_name setting. For example, both XS (parent) and XSSESSION (child of XS) are valid component names. If you select the parent component, then the command rule applies to it and the child components. |
| action_name | An action of the component_name setting |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root If you update the common command rule in an application root and want it visible to the associated PDBs, then you must synchronize the application. For example: <pre>ALTER PLUGGABLE DATABASE APPLICATION saas_sales_app SYNC;</pre> |
| pl_sql_stack | When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter TRUE to record the PL/SQL stack, FALSE to not record. |

Example

The following example shows how to update a common system event command rule. This command rule is in the application root, so the user running this procedure must be in the CDB root. Any user names or rule sets that are associated with this command rule must be common.

```
BEGIN
  DBMS_MACADM.UPDATE_SYSTEM_EVENT_CMD_RULE (
    rule_set_name => 'Disabled',
    event_name    => 'TRACE',
    component_name => 'DV',
    enabled       => 'n',
    scope         => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

Oracle Database Vault Factor APIs

The `DBMS_MACADM` PL/SQL package has factor-related Oracle Database Vault rule procedures and functions, and `DVF` has functions to manage factors.

- [DBMS_MACADM Factor Procedures and Functions](#)
The `DBMS_MACADM` PL/SQL package provides procedures and functions to configure factors.
- [Oracle Database Vault Run-Time PL/SQL Procedures and Functions](#)
Oracle Database Vault provides procedural interfaces to administer Database Vault security options and manage Database Vault security enforcements.
- [Oracle Database Vault DVF PL/SQL Factor Functions](#)
Oracle Database Vault maintains the `DVF` schema functions when you use the `DBMS_MACADM` PL/SQL package to manage the various factors.

17.1 DBMS_MACADM Factor Procedures and Functions

The `DBMS_MACADM` PL/SQL package provides procedures and functions to configure factors.

Only users who have been granted the `DV_OWNER` or `DV_ADMIN` role can use these procedures and functions.

- [ADD_FACTOR_LINK Procedure](#)
The `ADD_FACTOR_LINK` procedure specifies a parent-child relationship for two factors.
- [ADD_POLICY_FACTOR Procedure](#)
The `ADD_POLICY_FACTOR` procedure specifies that the label for a factor contributes to the Oracle Label Security label for a policy.
- [CHANGE_IDENTITY_FACTOR Procedure](#)
The `CHANGE_IDENTITY_FACTOR` procedure associates an identity with a different factor.
- [CHANGE_IDENTITY_VALUE Procedure](#)
The `CHANGE_IDENTITY_FACTOR` procedure updates the value of an identity.
- [CREATE_DOMAIN_IDENTITY Procedure](#)
The `CREATE_DOMAIN_IDENTITY` procedure is used for Oracle Real Application Clusters (Oracle RAC) and Oracle Label Security.
- [CREATE_FACTOR Procedure](#)
The `CREATE_FACTOR` procedure creates a factor.
- [CREATE_FACTOR_TYPE Procedure](#)
The `CREATE_FACTOR_TYPE` procedure creates a user-defined factor type.
- [CREATE_IDENTITY Procedure](#)
The `CREATE_IDENTITY` procedure assigns an identity and an associated trust level for a given factor.
- [CREATE_IDENTITY_MAP Procedure](#)
The `CREATE_IDENTITY_MAP` procedure defines tests that can derive the identity of a factor from the value of linked child factors (subfactors).

- [DELETE_FACTOR Procedure](#)
The `DELETE_FACTOR` procedure deletes a factor.
- [DELETE_FACTOR_LINK Procedure](#)
The `DELETE_FACTOR_LINK` procedure removes a parent-child relationship for two factors.
- [DELETE_FACTOR_TYPE Procedure](#)
The `DELETE_FACTOR_TYPE` procedure deletes a factor type.
- [DELETE_IDENTITY Procedure](#)
The `DELETE_IDENTITY` procedure removes an identity from an existing factor.
- [DELETE_IDENTITY_MAP Procedure](#)
The `DELETE_IDENTITY_MAP` procedure removes an identity map for a factor.
- [DROP_DOMAIN_IDENTITY Procedure](#)
The `DROP_DOMAIN_IDENTITY` procedure removes an Oracle Real Application Clusters database node from a domain.
- [GET_SESSION_INFO Function](#)
The `GET_SESSION_INFO` function returns information from the `SYS.V_$SESSION` system table for the current session.
- [GET_INSTANCE_INFO Function](#)
The `GET_INSTANCE_INFO` function returns information from the `SYS.V_$INSTANCE` system table about the current database instance.
- [RENAME_FACTOR Procedure](#)
The `RENAME_FACTOR` procedure renames a factor; the name change takes effect everywhere the factor is used.
- [RENAME_FACTOR_TYPE Procedure](#)
The `RENAME_FACTOR` procedure renames a factor type; the name change takes effect everywhere the factor type is used.
- [UPDATE_FACTOR Procedure](#)
The `UPDATE_FACTOR` procedure updates the description of a factor type.
- [UPDATE_FACTOR_TYPE Procedure](#)
The `UPDATE_FACTOR_TYPE` procedure updates a factor type.
- [UPDATE_IDENTITY Procedure](#)
The `UPDATE_IDENTITY` procedure updates the trust level of a factor identity.

Related Topics

- [Configuring Factors](#)
Factors allow you to create and use complex attributes through PL/SQL to make Oracle Database Vault authorization decisions.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

17.1.1 ADD_FACTOR_LINK Procedure

The `ADD_FACTOR_LINK` procedure specifies a parent-child relationship for two factors.

Syntax

```
DBMS_MACADM.ADD_FACTOR_LINK(
    parent_factor_name IN VARCHAR2,
    child_factor_name  IN VARCHAR2,
    label_indicator    IN VARCHAR2);
```

Parameters

Table 17-1 ADD_FACTOR_LINK Parameters

| Parameter | Description |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| parent_factor_name | Parent factor name. To find existing parent and child factors in the current database instance, query the DBA_DV_FACTOR_LINK view. |
| child_factor_name | Child factor name. |
| label_indicator | Indicates that the child factor being linked to the parent factor contributes to the label of the parent factor in an Oracle Label Security integration. Specify either DBMS_MACUTL.G_YES (for Yes) or DBMS_MACUTL.G_NO (for No). To find the Oracle Label Security policies and labels associated with factors, query the following views: <ul style="list-style-type: none"> DBA_DV_MAC_POLICY: Lists Oracle Label Security policies defined in the current database instance. DBA_DV_MAC_POLICY_FACTOR: Lists the factors that are associated with Oracle Label Security policies for the current database instance. DBA_DV_POLICY_LABEL: Lists the Oracle Label Security label for each factor identifier in the DBA_DV_IDENTITY view for each policy. |

Example

```
BEGIN
  DBMS_MACADM.ADD_FACTOR_LINK(
    parent_factor_name => 'HQ_ClientID',
    child_factor_name  => 'Div1_ClientID',
    label_indicator    => DBMS_MACUTL.G_YES);
END;
/
```

17.1.2 ADD_POLICY_FACTOR Procedure

The ADD_POLICY_FACTOR procedure specifies that the label for a factor contributes to the Oracle Label Security label for a policy.

Syntax

```
DBMS_MACADM.ADD_POLICY_FACTOR(
  policy_name  IN VARCHAR2,
  factor_name  IN VARCHAR2);
```

Parameters

Table 17-2 ADD_POLICY_FACTOR Parameters

| Parameter | Description |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| policy_name | Oracle Label Security policy name. To find the policies defined in the current database instance, query the DBA_DV_MAC_POLICY view. To find factors that are associated with Oracle Label Security policies, query DBA_DV_MAC_POLICY_FACTOR. |
| factor_name | Factor name. To find existing factors, query the DBA_DV_FACTOR view. |

Example

```
BEGIN
  DBMS_MACADM.ADD_POLICY_FACTOR(
    policy_name => 'AccessData',
    factor_name => 'Sector2_ClientID');
END;
/
```

17.1.3 CHANGE_IDENTITY_FACTOR Procedure

The CHANGE_IDENTITY_FACTOR procedure associates an identity with a different factor.

Syntax

```
DBMS_MACADM.CHANGE_IDENTITY_FACTOR(
  factor_name      IN VARCHAR2,
  value            IN VARCHAR2,
  new_factor_name IN VARCHAR2);
```

Parameters

Table 17-3 CHANGE_IDENTITY_FACTOR Parameters

| Parameter | Description |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| factor_name | Current factor name. To find existing factors, query the DBA_DV_FACTOR view. |
| value | Value of the identity to update. To find existing identities for each factor in the current database instance, query the DBA_DV_IDENTITY view. To find current identity mappings, query the DBA_DV_IDENTITY_MAP view. |
| new_factor_name | Name of the factor to associate with the identity, which you can find by querying the DBA_DV_FACTOR view. |

Example

```
BEGIN
  DBMS_MACADM.CHANGE_IDENTITY_FACTOR(
    factor_name => 'Sector2_ClientID',
    value      => 'intranet',
```

```

    new_factor_name => 'Sector4_ClientID');
END;
/

```

17.1.4 CHANGE_IDENTITY_VALUE Procedure

The CHANGE_IDENTITY_FACTOR procedure updates the value of an identity.

Syntax

```

DBMS_MACADM.CHANGE_IDENTITY_VALUE(
    factor_name IN VARCHAR2,
    value       IN VARCHAR2,
    new_value   IN VARCHAR2);

```

Parameters

Table 17-4 CHANGE_IDENTITY_VALUE Parameters

| Parameter | Description |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| factor_name | Factor name. To find existing factors, query the DBA_DV_FACTOR view. |
| value | Current value associated with the identity. To find existing identities for each factor in the current database instance, query the DBA_DV_IDENTITY view. To find current identity mappings, query the DBA_DV_IDENTITY_MAP view. |
| new_value | New identity value, up to 1024 characters in mixed-case. |

Example

```

BEGIN
    DBMS_MACADM.CHANGE_IDENTITY_VALUE(
        factor_name => 'Sector2_ClientID',
        value       => 'remote',
        new_value   => 'intranet');
END;
/

```

17.1.5 CREATE_DOMAIN_IDENTITY Procedure

The CREATE_DOMAIN_IDENTITY procedure is used for Oracle Real Application Clusters (Oracle RAC) and Oracle Label Security.

It adds an Oracle RAC database node to the domain factor identities and labels it according to an Oracle Label Security policy

Syntax

```

DBMS_MACADM.CREATE_DOMAIN_IDENTITY(
    domain_name IN VARCHAR2,
    domain_host IN VARCHAR2,
    policy_name IN VARCHAR2 DEFAULT NULL,
    domain_label IN VARCHAR2 DEFAULT NULL);

```

Parameters

Table 17-5 CREATE_DOMAIN_IDENTITY Parameters

| Parameter | Description |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| domain_name | Name of the domain to which to add the host. To find the logical location of the database within the network structure within a distributed database system, run the <code>DVF.F\$DATABASE_DOMAIN</code> function. See Related Topics. |
| domain_host | Oracle Real Application Clusters host name being added to the domain. To find host name of a database, run the <code>DVF.F\$DATABASE_HOSTNAME</code> function. See Related Topics. |
| policy_name | Oracle Label Security policy name. If you omit the policy name, then the domain is not associated with any policy. To find the available policies, query the <code>DBA_DV_MAC_POLICY</code> view. |
| domain_label | Name of the domain to which to add the Oracle Label Security policy. |

Examples

```
BEGIN
  DBMS_MACADM.CREATE_DOMAIN_IDENTITY(
    domain_name => 'example',
    domain_host => 'mydom_host',
    policy_name => 'AccessData',
    domain_label => 'sensitive');
END;
/
```

Related Topics

- [Oracle Database Vault DVF PL/SQL Factor Functions](#)
Oracle Database Vault maintains the `DVF` schema functions when you use the `DBMS_MACADM` PL/SQL package to manage the various factors.

17.1.6 CREATE_FACTOR Procedure

The `CREATE_FACTOR` procedure creates a factor.

After you create a factor, you can give it an identity by using the `CREATE_IDENTITY` procedure.

Syntax

```
DBMS_MACADM.CREATE_FACTOR(
  factor_name          IN VARCHAR2,
  factor_type_name    IN VARCHAR2,
  description          IN VARCHAR2,
  rule_set_name        IN VARCHAR2,
  get_expr             IN VARCHAR2,
  validate_expr        IN VARCHAR2,
  identify_by          IN NUMBER,
  labeled_by           IN NUMBER,
  eval_options         IN NUMBER,
  audit_options        IN NUMBER,
  fail_options         IN NUMBER);
```

Parameters

Table 17-6 CREATE_FACTOR Parameters

| Parameter | Description |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>factor_name</code> | Factor name, up to 128 characters in mixed-case, without spaces. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> view. |
| <code>factor_type_name</code> | Type of the factor, up to 128 characters in mixed-case, without spaces. To find existing factor types, query the <code>DBA_DV_FACTOR_TYPE</code> view, described in . |
| <code>description</code> | Optional description of the purpose of the factor, up to 1024 characters in mixed-case. |
| <code>rule_set_name</code> | Rule set name if you want to use a rule set to control when and how a factor identity is set. To find existing rule sets, query the <code>DBA_DV_RULE_SET</code> view. For more details, see the <code>rule_set_name</code> description for creating factors. (Refer to Related Topics.) |
| <code>get_expr</code> | Valid PL/SQL expression that retrieves the identity of a factor. It can use up to 255 characters in mixed-case. For more details, see the <code>get_expr</code> description for creating factors. (Refer to Related Topics.) |
| <code>validate_expr</code> | Name of the procedure to validate the factor. This is a valid PL/SQL expression that returns a Boolean value (<code>TRUE</code> or <code>FALSE</code>) to validate the identity of the factor. For more details, see the <code>validate_expr</code> description for creating factors. (Refer to Related Topics.) |
| <code>identify_by</code> | Options for determining the identity of a factor, based on the expression set for the <code>get_expr</code> parameter: <ul style="list-style-type: none"> • <code>DBMS_MACUTL.G_IDENTIFY_BY_CONSTANT</code>: By constant • <code>DBMS_MACUTL.G_IDENTIFY_BY_METHOD</code>: By method • <code>DBMS_MACUTL.G_IDENTIFY_BY_FACTOR</code>: By factor • <code>DBMS_MACUTL.G_IDENTIFY_BY_CONTEXT</code>: By context For more details, see the <code>identify_by</code> description for creating factors. (Refer to Related Topics.) |
| <code>labeled_by</code> | Options for labeling the factor: <ul style="list-style-type: none"> • <code>DBMS_MACUTL.G_LABELED_BY_SELF</code>: Labels the identities for the factor directly from the labels associated with an Oracle Label Security policy (default) • <code>DBMS_MACUTL.G_LABELED_BY_FACTORS</code>: Derives the factor identity label from the labels of its child factor identities. For more details, see the <code>labeled_by</code> description for creating factors. (Refer to Related Topics.) |
| <code>eval_options</code> | Options for evaluating the factor when the user logs on: <ul style="list-style-type: none"> • <code>DBMS_MACUTL.G_EVAL_ON_SESSION</code>: When the database session is created (default) • <code>DBMS_MACUTL.G_EVAL_ON_ACCESS</code>: Each time the factor is accessed • <code>DBMS_MACUTL.G_EVAL_ON_STARTUP</code>: On start-up For more details, see the <code>eval_options</code> description for creating factors. (Refer to Related Topics.) |

Table 17-6 (Cont.) CREATE_FACTOR Parameters

| Parameter | Description |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| audit_options | <p>Options for auditing the factor if you want to generate a custom Oracle Database Vault audit record.</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_AUDIT_OFF: Disables auditing. DBMS_MACUTL.G_AUDIT_ALWAYS: Always audits. DBMS_MACUTL.G_AUDIT_ON_GET_ERROR: Audits if get_expr returns an error. DBMS_MACUTL.G_AUDIT_ON_GET_NULL: Audits if get_expr is null. DBMS_MACUTL.G_AUDIT_ON_VALIDATE_ERROR: Audits if the validation procedure returns an error. DBMS_MACUTL.G_AUDIT_ON_VALIDATE_FALSE: Audits if the validation procedure is false. DBMS_MACUTL.G_AUDIT_ON_TRUST_LEVEL_NULL: Audits if there is no trust level set. DBMS_MACUTL.G_AUDIT_ON_TRUST_LEVEL_NEG: Audits if the trust level is negative. <p>Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create Oracle Database Vault unified audit policies instead of using the audit_options parameter.</p> |
| fail_options | <p>Options for reporting factor errors:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_FAIL_WITH_MESSAGE: Shows an error message (default) DBMS_MACUTL.G_FAIL_SILENTLY: Does not show an error message <p>For more details, see the fail_options description for creating factors. (Refer to Related Topics.)</p> |

Example

```

BEGIN
DBMS_MACADM.CREATE_FACTOR(
  factor_name      => 'Sector2_DB',
  factor_type_name => 'Instance',
  description      => ' ',
  rule_set_name    => 'Limit_DBA_Access',
  get_expr         => 'UPPER(SYS_CONTEXT(''USERENV'', ''DB_NAME''))',
  validate_expr    => 'dbavowner.check_db_access',
  identify_by      => DBMS_MACUTL.G_IDENTIFY_BY_METHOD,
  labeled_by       => DBMS_MACUTL.G_LABELED_BY_SELF,
  eval_options     => DBMS_MACUTL.G_EVAL_ON_SESSION,
  audit_options    => DBMS_MACUTL.G_AUDIT_OFF,
  fail_options     => DBMS_MACUTL.G_FAIL_SILENTLY);
END;
/

```

Related Topics

- [CREATE_IDENTITY Procedure](#)
The CREATE_IDENTITY procedure assigns an identity and an associated trust level for a given factor.
- [Creating a Factor](#)
In general, to create a factor, you first create the factor itself, and then you edit the factor to include its identity.

17.1.7 CREATE_FACTOR_TYPE Procedure

The `CREATE_FACTOR_TYPE` procedure creates a user-defined factor type.

Syntax

```
DBMS_MACADM.CREATE_FACTOR_TYPE(
    name          IN VARCHAR2,
    description   IN VARCHAR2);
```

Parameters

Table 17-7 CREATE_FACTOR_TYPE Parameters

| Parameter | Description |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| name | Factor type name, up to 128 characters in mixed-case, without spaces. To find existing factor types, query the <code>DBA_DV_FACTOR_TYPE</code> view. |
| description | Description of the purpose of the factor type, up to 1024 characters in mixed-case. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_FACTOR_TYPE(
    name          => 'Sector2Instance',
    description   => 'Checks DB instances used in Sector 2');
END;
/
```

17.1.8 CREATE_IDENTITY Procedure

The `CREATE_IDENTITY` procedure assigns an identity and an associated trust level for a given factor.

After you create a factor, you must assign it an identity.

Syntax

```
DBMS_MACADM.CREATE_IDENTITY(
    factor_name  IN VARCHAR2,
    value       IN VARCHAR2,
    trust_level  IN NUMBER);
```

Parameters

Table 17-8 CREATE_IDENTITY Parameters

| Parameter | Description |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| factor_name | Factor name. To find existing factors, query the <code>DBA_DV_FACTOR</code> view. |
| value | The actual value of the factor, up to 1024 characters in mixed-case. For example, the identity of an <code>IP_Address</code> factor could be the IP address of 192.0.2.12. |

Table 17-8 (Cont.) CREATE_IDENTITY Parameters

| Parameter | Description |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| trust_level | Number that indicates the magnitude of trust relative to other identities for the same factor. In general, the higher the trust level number is set, the greater the trust. A trust level of 10 indicates "very trusted." Negative trust levels are not trusted. See Related Topics for more information about trust levels and label security. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_IDENTITY(
    factor_name => 'Sector2_ClientID',
    value       => 'intranet',
    trust_level => 5);
END;
/
```

Related Topics

- [Creating and Configuring a Factor Identity](#)
You can create and configure a factor identity for an existing factor.

17.1.9 CREATE_IDENTITY_MAP Procedure

The CREATE_IDENTITY_MAP procedure defines tests that can derive the identity of a factor from the value of linked child factors (subfactors).

Syntax

```
DBMS_MACADM.CREATE_IDENTITY_MAP(
  identity_factor_name IN VARCHAR2,
  identity_factor_value IN VARCHAR2,
  parent_factor_name   IN VARCHAR2,
  child_factor_name    IN VARCHAR2,
  operation            IN VARCHAR2,
  operand1             IN VARCHAR2,
  operand2            IN VARCHAR2);
```

Parameters

Table 17-9 CREATE_IDENTITY_MAP Parameters

| Parameter | Description |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| identity_factor_name | Factor the identity map is for. To find existing factors in the current database instance, query the DBA_DV_FACTOR view. |
| identity_factor_value | Value the factor assumes if the identity map evaluates to TRUE. To find existing factor identities, query the DBA_DV_IDENTITY view. To find current factor identity mappings, use DBA_DV_IDENTITY_MAP. |

Table 17-9 (Cont.) CREATE_IDENTITY_MAP Parameters

| Parameter | Description |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| parent_factor_name | The parent factor link to which the map is related. To find existing parent-child factor mappings, query the DBA_DV_IDENTITY_MAP view. |
| child_factor_name | The child factor link to which the map is related. |
| operation | Relational operator for the identity map (for example, <, >, =, and so on). |
| operand1 | Left operand for the relational operator; refers to the low value you enter. |
| operand2 | Right operand for the relational operator; refers to the high value you enter. |

Example

```
BEGIN
DBMS_MACADM.CREATE_IDENTITY_MAP(
  identity_factor_name => 'Sector2_ClientID',
  identity_factor_value => 'intranet',
  parent_factor_name => 'HQ_ClientID',
  child_factor_name => 'Div1_ClientID',
  operation => '<',
  operand1 => '192.0.2.50',
  operand2 => '192.0.2.100');
END;
/
```

17.1.10 DELETE_FACTOR Procedure

The DELETE_FACTOR procedure deletes a factor.

Syntax

```
DBMS_MACADM.DELETE_FACTOR(
  factor_name IN VARCHAR2);
```

Parameters

Table 17-10 DELETE_FACTOR Parameter

| Parameter | Description |
|-------------|----------------------------------------------------------------------------------------------------------|
| factor_name | Factor name. To find existing factors in the current database instance, query the DBA_DV_FACTOR view. |

Example

```
EXEC DBMS_MACADM.DELETE_FACTOR('Sector2_ClientID');
```

17.1.11 DELETE_FACTOR_LINK Procedure

The `DELETE_FACTOR_LINK` procedure removes a parent-child relationship for two factors.

Syntax

```
DBMS_MACADM.DELETE_FACTOR_LINK(
  parent_factor_name IN VARCHAR2,
  child_factor_name  IN VARCHAR2);
```

Parameters

Table 17-11 DELETE_FACTOR_LINK Parameters

| Parameter | Description |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>parent_factor_name</code> | Factor name. To find factors that are used in parent-child mappings in the current database instance, query the <code>DBA_DV_FACTOR_LINK</code> view. |
| <code>child_factor_name</code> | Factor name |

Example

```
BEGIN
  DBMS_MACADM.DELETE_FACTOR_LINK(
    parent_factor_name => 'HQ_ClientID',
    child_factor_name  => 'Div1_ClientID');
END;
/
```

17.1.12 DELETE_FACTOR_TYPE Procedure

The `DELETE_FACTOR_TYPE` procedure deletes a factor type.

Syntax

```
DBMS_MACADM.DELETE_FACTOR_TYPE(
  name IN VARCHAR2);
```

Parameters

Table 17-12 DELETE_FACTOR_TYPE Parameters

| Parameter | Description |
|-------------------|-----------------------------------------------------------------------------------------------------|
| <code>name</code> | Factor type name. To find existing factor types, query the <code>DBA_DV_FACTOR_TYPE</code> view. |

Example

```
EXEC DBMS_MACADM.DELETE_FACTOR_TYPE('Sector2Instance');
```

17.1.13 DELETE_IDENTITY Procedure

The `DELETE_IDENTITY` procedure removes an identity from an existing factor.

Syntax

```
DBMS_MACADM.DELETE_IDENTITY (
  factor_name IN VARCHAR2,
  value       IN VARCHAR2);
```

Parameters

Table 17-13 `DELETE_IDENTITY` Parameters

| Parameter | Description |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>factor_name</code> | Factor name. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> view. |
| <code>value</code> | Identity value associated with the factor. To find the identities for each factor in the current database instance, query the <code>DBA_DV_IDENTITY</code> view. |

Example

```
BEGIN
  DBMS_MACADM.DELETE_IDENTITY (
    factor_name => 'Sector2_ClientID',
    value       => 'intranet');
END;
/
```

17.1.14 DELETE_IDENTITY_MAP Procedure

The `DELETE_IDENTITY_MAP` procedure removes an identity map for a factor.

Syntax

```
DBMS_MACADM.DELETE_IDENTITY_MAP (
  identity_factor_name IN VARCHAR2,
  identity_factor_value IN VARCHAR2,
  parent_factor_name   IN VARCHAR2,
  child_factor_name    IN VARCHAR2,
  operation             IN VARCHAR2,
  operand1             IN VARCHAR2,
  operand2             IN VARCHAR2);
```

Parameters

Table 17-14 `DELETE_IDENTITY_MAP` Parameters

| Parameter | Description |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| <code>identity_factor_name</code> | Factor the identity map is for. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> view. |

Table 17-14 (Cont.) DELETE_IDENTITY_MAP Parameters

| Parameter | Description |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| identity_factor_value | Value the factor assumes if the identity map evaluates to TRUE. To find existing factor identities, query the DBA_DV_IDENTITY view. To find current factor identity mappings, query DBA_DV_IDENTITY_MAP. |
| parent_factor_name | The parent factor link to which the map is related. To find existing parent-child factors, query the DBA_DV_FACTOR view. |
| child_factor_name | The child factor to which the map is related. |
| operation | Relational operator for the identity map (for example, <, >, =, and so on). |
| operand1 | Left (low value) operand for the relational operator. |
| operand2 | Right (high value) operand for the relational operator. |

Example

```
BEGIN
DBMS_MACADM.DELETE_IDENTITY_MAP (
  identity_factor_name => 'Sector2_ClientID',
  identity_factor_value => 'intranet',
  parent_factor_name => 'HQ_ClientID',
  child_factor_name => 'Div1_ClientID',
  operation => '<',
  operand1 => '192.0.2.10',
  operand2 => '192.0.2.15');
END;
/
```

17.1.15 DROP_DOMAIN_IDENTITY Procedure

The DROP_DOMAIN_IDENTITY procedure removes an Oracle Real Application Clusters database node from a domain.

Syntax

```
DBMS_MACADM.DROP_DOMAIN_IDENTITY (
  domain_name IN VARCHAR2,
  domain_host IN VARCHAR2);
```

Parameters

Table 17-15 DROP_DOMAIN_IDENTITY Parameters

| Parameter | Description |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| domain_name | Name of the domain to which the host was added. To find the domain of a database as specified by the DB_DOMAIN initialization parameter, run the DVF.F\$DATABASE_DOMAIN function. |

Table 17-15 (Cont.) DROP_DOMAIN_IDENTITY Parameters

| Parameter | Description |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| domain_host | Oracle Real Application Clusters host name being that was added to the domain. To find the host name for a specified database, run the DVF.F\$DATABASE_HOSTNAME function. |

Example

```
BEGIN
  DBMS_MACADM.DROP_DOMAIN_IDENTITY(
    domain_name => 'example',
    domain_host => 'mydom_host');
END;
/
```

Related Topics

- [F\\$DATABASE_DOMAIN Function](#)
The F\$DATABASE_DOMAIN function returns the domain of the database as specified in the DB_DOMAIN initialization parameter, in VARCHAR2 data type.

17.1.16 GET_SESSION_INFO Function

The GET_SESSION_INFO function returns information from the SYS.V_\$SESSION system table for the current session.

The V\$SESSION data dictionary view also contains session information from this table.

Syntax

```
DBMS_MACADM.GET_SESSION_INFO(
  p_parameter IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 17-16 GET_SESSION_INFO Parameter

| Parameter | Description |
|-------------|--------------------------------------------------|
| p_parameter | Column name in the SYS.V_\$SESSION system table. |

Example

```
DECLARE
  session_var varchar2 := null;
BEGIN
  session_var = DBMS_MACADM.GET_SESSION_INFO('PROCESS');
END;
/
```


17.1.17 GET_INSTANCE_INFO Function

The `GET_INSTANCE_INFO` function returns information from the `SYS.V_$INSTANCE` system table about the current database instance.

The `V_$INSTANCE` data dictionary view also contains database instance information from this table.

Syntax

```
DBMS_MACADM.GET_INSTANCE_INFO(
  p_parameter IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 17-17 GET_INSTANCE_INFO Parameter

| Parameter | Description |
|--------------------------|---------------------------------------------------------------|
| <code>p_parameter</code> | Column name in the <code>SYS.V_\$INSTANCE</code> system table |

Example

```
DECLARE
  instance_var varchar2 := null;
BEGIN
  instance_var = DBMS_MACADM.GET_INSTANCE_INFO('INSTANCE_NAME');
END;
/
```

17.1.18 RENAME_FACTOR Procedure

The `RENAME_FACTOR` procedure renames a factor; the name change takes effect everywhere the factor is used.

Syntax

```
DBMS_MACADM.RENAME_FACTOR(
  factor_name      IN VARCHAR2,
  new_factor_name IN VARCHAR2);
```

Parameters

Table 17-18 RENAME_FACTOR Parameters

| Parameter | Description |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| <code>factor_name</code> | Current factor name. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> view. |
| <code>new_factor_name</code> | New factor name, up to 128 characters in mixed-case, without spaces. |

Example

```
BEGIN
  DBMS_MACADM.RENAME_FACTOR(
    factor_name      => 'Sector2_ClientID',
    new_factor_name => 'Sector2_Clients');
END;
/
```

17.1.19 RENAME_FACTOR_TYPE Procedure

The `RENAME_FACTOR` procedure renames a factor type; the name change takes effect everywhere the factor type is used.

Syntax

```
DBMS_MACADM.RENAME_FACTOR_TYPE(
  old_name  IN VARCHAR2,
  new_name  IN VARCHAR2);
```

Parameters

Table 17-19 RENAME_FACTOR_TYPE Parameters

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|
| old_name | Current factor type name. To find existing factor types in the current database instance, query the <code>DBA_DV_FACTOR_TYPE</code> view. |
| new_name | New factor type name, up to 128 characters in mixed-case, without spaces. |

Example

```
BEGIN
  DBMS_MACADM.RENAME_FACTOR_TYPE(
    old_name => 'Sector2Instance',
    new_name => 'Sector2DBInstance');
END;
/
```

17.1.20 UPDATE_FACTOR Procedure

The `UPDATE_FACTOR` procedure updates the description of a factor type.

Syntax

```
DBMS_MACADM.UPDATE_FACTOR(
  factor_name      IN VARCHAR2,
  factor_type_name IN VARCHAR2,
  description      IN VARCHAR2,
  rule_set_name    IN VARCHAR2,
  get_expr         IN VARCHAR2,
  validate_expr    IN VARCHAR2,
  identify_by      IN NUMBER,
  labeled_by       IN NUMBER,
  eval_options     IN NUMBER,
```

```
audit_options    IN NUMBER,  
fail_options    IN NUMBER);
```

Parameters

Table 17-20 UPDATE_FACTOR

| Parameter | Description |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| factor_name | Factor name. To find existing factors in the current database instance, query the DBA_DV_FACTOR view. |
| factor_type_name | Factor type name. To find existing factor types, query the DBA_DV_FACTOR_TYPE view. |
| description | Description of the purpose of the factor, up to 1024 characters in mixed-case. |
| rule_set_name | Name of the rule set used to control when and how a factor identity is set. To find existing rule sets, query the DBA_DV_RULE_SET view . |
| get_expr | Valid PL/SQL expression that retrieves the identity of a factor. It can use up to 255 characters in mixed-case. See also the audit_options parameter. |
| validate_expr | Name of the procedure to validate factor. This is a valid PL/SQL expression that returns a Boolean value (TRUE or FALSE) to validate the identity of the factor. |
| identify_by | Options for determining the identity of a factor, based on the expression set for the get_expr parameter: <ul style="list-style-type: none"> DBMS_MACUTL.G_IDENTIFY_BY_CONSTANT: By constant DBMS_MACUTL.G_IDENTIFY_BY_METHOD: By method DBMS_MACUTL.G_IDENTIFY_BY_FACTOR: By factor DBMS_MACUTL.G_IDENTIFY_BY_CONTEXT: By context |
| labeled_by | Options for labeling the factor: <ul style="list-style-type: none"> DBMS_MACUTL.G_LABELED_BY_SELF: Labels the identities for the factor directly from the labels associated with an Oracle Label Security policy DBMS_MACUTL.G_LABELED_BY_FACTORS: Derives the factor identity label from the labels of its child factor identities. <p>The default for labeled_by is the previously set value, which you can find by querying the DBA_DV_FACTOR data dictionary view.</p> |
| eval_options | Options for evaluating the factor when the user logs on: <ul style="list-style-type: none"> DBMS_MACUTL.G_EVAL_ON_SESSION: When the database session is created DBMS_MACUTL.G_EVAL_ON_ACCESS: Each time the factor is accessed DBMS_MACUTL.G_EVAL_ON_STARTUP: On start-up <p>The default for eval_options is the previously set value, which you can find by querying the DBA_DV_FACTOR data dictionary view.</p> |

Table 17-20 (Cont.) UPDATE_FACTOR

| Parameter | Description |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| audit_options | <p>Options for auditing the factor if you want to generate a custom Oracle Database Vault audit record.</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_AUDIT_OFF: Disables auditing. DBMS_MACUTL.G_AUDIT_ALWAYS: Always audits. DBMS_MACUTL.G_AUDIT_ON_GET_ERROR: Audits if get_expr returns an error. DBMS_MACUTL.G_AUDIT_ON_GET_NULL: Audits if get_expr is null. DBMS_MACUTL.G_AUDIT_ON_VALIDATE_ERROR: Audits if the validation procedure returns an error. DBMS_MACUTL.G_AUDIT_ON_VALIDATE_FALSE: Audits if the validation procedure is false. DBMS_MACUTL.G_AUDIT_ON_TRUST_LEVEL_NULL: Audits if there is no trust level set. DBMS_MACUTL.G_AUDIT_ON_TRUST_LEVEL_NEG: Audits if the trust level is negative. <p>The default for audit_options is the previously set value, which you can find by querying the DBA_DV_FACTOR data dictionary view.</p> <p>Starting with Oracle Database release 21c, traditional auditing is deprecated. Oracle recommends that you create Oracle Database Vault unified audit policies instead of using the audit_options parameter.</p> |
| fail_options | <p>Options for reporting factor errors:</p> <ul style="list-style-type: none"> DBMS_MACUTL.G_FAIL_WITH_MESSAGE: Shows an error message. DBMS_MACUTL.G_FAIL_SILENTLY: Does not show an error message. <p>The default for fail_options is the previously set value, which you can find by querying the DBA_DV_FACTOR data dictionary view.</p> |

Example

```

BEGIN
  DBMS_MACADM.UPDATE_FACTOR(
    factor_name      => 'Sector2_DB',
    factor_type_name => 'Instance',
    description     => ' ',
    rule_set_name   => 'Limit_DBA_Access',
    get_expr        => 'UPPER(SYS_CONTEXT(''USERENV'', ''DB_NAME''))',
    validate_expr   => 'dbavowner.check_db_access',
    identify_by    => DBMS_MACUTL.G_IDENTIFY_BY_METHOD,
    labeled_by     => DBMS_MACUTL.G_LABELED_BY_SELF,
    eval_options   => DBMS_MACUTL.G_EVAL_ON_ACCESS,
    audit_options  => DBMS_MACUTL.G_AUDIT_OFF,
    fail_options   => DBMS_MACUTL.G_FAIL_WITH_MESSAGE);
END;
/

```

17.1.21 UPDATE_FACTOR_TYPE Procedure

The UPDATE_FACTOR_TYPE procedure updates a factor type.

Syntax

```
DBMS_MACADM.UPDATE_FACTOR_TYPE(
    name          IN VARCHAR2,
    description   IN VARCHAR2);
```

Parameters

Table 17-21 UPDATE_FACTOR_TYPE Parameters

| Parameter | Description |
|-------------|-------------------------------------------------------------------------------------------------------------------------|
| name | Factor type name. To find existing factor types in the current database instance, query the DBA_DV_FACTOR_TYPE view. |
| description | Description of the purpose of the factor type, up to 1024 characters in mixed case. |

Example

```
BEGIN
    DBMS_MACADM.UPDATE_FACTOR_TYPE(
        name          => 'Sector2DBInstance',
        description   => 'Checks DB instances used in Sector 2');
END;
/
```

17.1.22 UPDATE_IDENTITY Procedure

The UPDATE_IDENTITY procedure updates the trust level of a factor identity.

Syntax

```
DBMS_MACADM.UPDATE_IDENTITY(
    factor_name   IN VARCHAR2,
    value         IN VARCHAR2,
    trust_level   IN NUMBER);
```

Parameters

Table 17-22 UPDATE_IDENTITY Parameters

| Parameter | Description |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| factor_name | Factor name. To find existing factors in the current database instance, query the DBA_DV_FACTOR view. To find factors that have identities, query DBA_DV_IDENTITY. |
| value | New factor identity, up to 1024 characters in mixed-case. For example, the identity of an IP_Address factor could be the IP address of 192.0.2.12. |

Table 17-22 (Cont.) UPDATE_IDENTITY Parameters

| Parameter | Description |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| trust_level | Number that indicates the magnitude of trust relative to other identities for the same factor. In general, the higher the trust level number is set, the greater the trust. A trust level of 10 indicates "very trusted." Negative trust levels are not trusted. |

Example

```

BEGIN
  DBMS_MACADM.UPDATE_IDENTITY(
    factor_name => 'Sector2_ClientID',
    value       => 'intranet',
    trust_level => 10);
END;
/

```

Related Topics

- [Creating and Configuring a Factor Identity](#)
You can create and configure a factor identity for an existing factor.

17.2 Oracle Database Vault Run-Time PL/SQL Procedures and Functions

Oracle Database Vault provides procedural interfaces to administer Database Vault security options and manage Database Vault security enforcements.

- [About Oracle Database Vault Run-Time PL/SQL Procedures and Functions](#)
Oracle Database Vault provides a set of PL/SQL procedures and functions that are specific to factors.
- [SET_FACTOR Procedure](#)
The `SET_FACTOR` procedure can be exposed to an application that requires the ability to set factor identities dynamically.
- [GET_FACTOR Function](#)
The `GET_FACTOR` function is exposed to the `DVF` schema to allow the public factor functions to resolve the identity of a factor. The return type is `VARCHAR2`.
- [GET_FACTOR_LABEL Function](#)
The `GET_FACTOR_LABEL` function returns the label for the specified factor when the factor has a label assigned to it for the specified Oracle Label Security policy. The return type is `VARCHAR2`.
- [GET_TRUST_LEVEL Function](#)
The `GET_TRUST_LEVEL` function returns the trust level of the current session identity for the factor requested. The return type is `VARCHAR2`.
- [GET_TRUST_LEVEL_FOR_IDENTITY Function](#)
The `GET_TRUST_LEVEL_FOR_IDENTITY` function returns the trust level for the factor and identity requested. The return type is `VARCHAR2`.
- [ROLE_IS_ENABLED Function](#)
The `ROLE_IS_ENABLED` function returns a boolean value that specifies whether a database role has been enabled. The return type is `BOOLEAN`.

17.2.1 About Oracle Database Vault Run-Time PL/SQL Procedures and Functions

Oracle Database Vault provides a set of PL/SQL procedures and functions that are specific to factors.

These procedures and functions that expose the logic to validate a DDL command for realm violations and command authorizations. Additional procedures and functions are provided to set the value of a factor (assuming their associated rule sets evaluate to true) (for example, from a Web application), to retrieve the trust level for a session or specific factor identity, and to get the label for a factor identity. These procedures and functions are provided so that a database administrator does not grant the `EXECUTE` privilege on all `DVSYS` package procedures to the general database account population. The procedures and functions expose only the minimum methods that are required. All of these functions and procedures are publicly available for applications that need them.

17.2.2 SET_FACTOR Procedure

The `SET_FACTOR` procedure can be exposed to an application that requires the ability to set factor identities dynamically.

It wraps the package procedure `DBMS_MACADM.SET_FACTOR`. When a factor has a rule set associated with it for assignment and if the rule set returns true, then the value is set. Normal rule set handling occurs, and the factor value (identity) validation method is called. This procedure is available (to execute) to the general database account population.

Syntax

```
SET_FACTOR(  
  p_factor IN VARCHAR2,  
  p_value  IN VARCHAR2);
```

Parameters

Table 17-23 SET_FACTOR Parameters

| Parameter | Description |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>p_factor</code> | Factor name. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> data dictionary view. |
| <code>p_value</code> | Identity value, up to 1024 characters in mixed case. To find the identities for each factor in the current database instance, query the <code>DBA_DV_IDENTITY</code> data dictionary view. |

Example

```
EXECUTE SET_FACTOR('Sector2_ClientID', 'identity');
```

17.2.3 GET_FACTOR Function

The `GET_FACTOR` function is exposed to the `DVF` schema to allow the public factor functions to resolve the identity of a factor. The return type is `VARCHAR2`.

This function enables the `F$` functions in the `DVF` schema. This function is available (to execute) to the general database account population.

Syntax

```
GET_FACTOR(
  p_factor IN VARCHAR2)
RETURN VARCHAR2;
```

Parameter

Table 17-24 GET_FACTOR Parameter

| Parameter | Description |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <code>p_factor</code> | Factor name. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> data dictionary view. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Get Client ID Factor Identity',
    rule_expr => 'GET_FACTOR(''Sector2_ClientID'')');
END;
/
```

17.2.4 GET_FACTOR_LABEL Function

The `GET_FACTOR_LABEL` function returns the label for the specified factor when the factor has a label assigned to it for the specified Oracle Label Security policy. The return type is `VARCHAR2`.

The function returns a label that is merged with the maximum session label for the policy if the policy is configured with Oracle Label Security. The function is available (to execute) to the general database population.

Syntax

```
GET_FACTOR_LABEL(
  p_factor      IN VARCHAR2,
  p_policy_name IN VARCHAR2)
RETURN VARCHAR2;
```


Parameters

Table 17-25 GET_FACTOR_LABEL Parameters

| Parameter | Description |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_factor | Factor name. To find the available factors in the current database instance, query the DBA_DV_FACTOR data dictionary view. To find factors that are associated with Oracle Label Security policies, use DBA_DV_MAC_POLICY_FACTOR. |
| p_policy_name | Oracle Label Security policy name. Use the following data dictionary views to find information about policies and factors in the current database instance: <ul style="list-style-type: none"> DBA_DV_MAC_POLICY: Lists Oracle Label Security policies defined in the current database instance. DBA_DV_MAC_POLICY_FACTOR: Lists the factors that are associated with Oracle Label Security policies for the current database instance. DBA_DV_POLICY_LABEL: Lists the Oracle Label Security label for each factor identifier in the DBA_DV_IDENTITY view for each policy. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Get the ClientID Factor Label',
    rule_expr => 'GET_FACTOR_LABEL('Sector2_ClientID', 'Access Locations')');
END;
/
```

17.2.5 GET_TRUST_LEVEL Function

The GET_TRUST_LEVEL function returns the trust level of the current session identity for the factor requested. The return type is VARCHAR2.

This function is available (to execute) to the general database account population.

Syntax

```
GET_TRUST_LEVEL(
  p_factor IN VARCHAR2)
RETURN VARCHAR2;
```

Parameter

Table 17-26 GET_TRUST_LEVEL Parameter

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------|
| p_factor | Factor name. To find existing factors in the current database instance, query the DBA_DV_FACTOR data dictionary view. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
```

```

    rule_name => 'Get Client ID Trust Level',
    rule_expr => 'GET_TRUST_LEVEL('Sector2_ClientID')');
END;
/

```

Related Topics

- [Creating and Configuring a Factor Identity](#)
You can create and configure a factor identity for an existing factor.

17.2.6 GET_TRUST_LEVEL_FOR_IDENTITY Function

The `GET_TRUST_LEVEL_FOR_IDENTITY` function returns the trust level for the factor and identity requested. The return type is `VARCHAR2`.

This function is available (to execute) to the general database account population.

Syntax

```

GET_TRUST_LEVEL_FOR_IDENTITY(
    p_factor   IN VARCHAR2,
    p_identity IN VARCHAR2)
RETURN VARCHAR2;

```

Parameters

Table 17-27 GET_TRUST_LEVEL_FOR_IDENTITY Parameters

| Parameter | Description |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>p_factor</code> | Factor name. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> view. |
| <code>p_identity</code> | Identity value. To find the identities for each factor in the current database instance, use the <code>DBA_DV_IDENTITY</code> data dictionary view. |

Example

```

BEGIN
    DBMS_MACADM.CREATE_RULE(
        rule_name => 'Get Client ID Identity Trust Level',
        rule_expr => 'GET_TRUST_LEVEL_FOR_IDENTITY('Sector2_ClientID', 'identity')');
END;
/

```

17.2.7 ROLE_IS_ENABLED Function

The `ROLE_IS_ENABLED` function returns a boolean value that specifies whether a database role has been enabled. The return type is `BOOLEAN`.

This function is available (to execute) to the general database account population.

Syntax

```

ROLE_IS_ENABLED(
    p_role IN VARCHAR2)
RETURN BOOLEAN;

```

Parameter

Table 17-28 **ROLE_IS_ENABLED** Parameter

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_role | <p>Database role name to check.</p> <p>To find existing roles, use the following data dictionary views:</p> <ul style="list-style-type: none"> DBA_ROLES: Finds available roles in the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular role. DBA_DV_ROLE: Finds existing secure application roles used in privilege management. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check if SYSADM Role Is Enabled',
    rule_expr => 'ROLE_IS_ENABLED(''SYSADM'')');
END;
/
```

17.3 Oracle Database Vault DVF PL/SQL Factor Functions

Oracle Database Vault maintains the DVF schema functions when you use the DBMS_MACADM PL/SQL package to manage the various factors.

- [About Oracle Database Vault DVF PL/SQL Factor Functions](#)
 Oracle Database Vault provides DVF factor-specific functions for frequently used activities.
- [F\\$AUTHENTICATION_METHOD Function](#)
 The F\$AUTHENTICATION_METHOD function returns the method of authentication in VARCHAR2 data type.
- [F\\$CLIENT_IP Function](#)
 The F\$CLIENT_IP function returns the IP address of the computer from which the client is connected, in VARCHAR2 data type.
- [F\\$DATABASE_DOMAIN Function](#)
 The F\$DATABASE_DOMAIN function returns the domain of the database as specified in the DB_DOMAIN initialization parameter, in VARCHAR2 data type.
- [F\\$DATABASE_HOSTNAME Function](#)
 The F\$DATABASE_HOSTNAME function returns the host name of the computer on which the instance is running, in VARCHAR2 data type.
- [F\\$DATABASE_INSTANCE Function](#)
 The F\$DATABASE_INSTANCE function returns the instance identification number of the current database instance, in VARCHAR2 data type.
- [F\\$DATABASE_IP Function](#)
 The F\$DATABASE_IP function returns the IP address of the computer on which the database instance is running, in VARCHAR2 data type.
- [F\\$DATABASE_NAME Function](#)
 The F\$DATABASE_NAME function returns the name of the database as specified in the DB_NAME initialization parameter, in VARCHAR2 data type.

- **F\$DOMAIN Function**
The `F$DOMAIN` function returns a named collection of physical, configuration, or implementation-specific factors in the run-time environment (for example, a networked IT environment or subset of it) that operates at a specific sensitivity level. The return type is `VARCHAR2`.
- **F\$DV\$_CLIENT_IDENTIFIER Function**
The `FDV_CLIENT_IDENTIFIER` function returns an Oracle Database Vault client identifier.
- **F\$DV\$_DBLINK_INFO Function**
The `FDV_DBLINK_INFO` function returns information about an Oracle Database Vault database link.
- **F\$DV\$_MODULE Function**
The `FDV_MODULE` function returns information about an Oracle Database Vault module.
- **F\$ENTERPRISE_IDENTITY Function**
The `F$ENTERPRISE_IDENTITY` function returns the enterprise-wide identity for a user, in `VARCHAR2` data type.
- **F\$IDENTIFICATION_TYPE Function**
The `F$IDENTIFICATION_TYPE` function returns the way the schema of a user was created in the database. Specifically, it reflects the `IDENTIFIED` clause in the `CREATE/ALTER USER` syntax. The return type is `VARCHAR2`.
- **F\$LANG Function**
The `F$LANG` function returns the ISO abbreviation for the language name, a shorter form than the existing `LANGUAGE` parameter, for the session of the user. The return type is `VARCHAR2`.
- **F\$LANGUAGE Function**
The `F$LANGUAGE` function returns the language and territory currently used by a user session, along with the database character set. The return type is `VARCHAR2`.
- **F\$MACHINE Function**
The `F$MACHINE` function returns the computer (host) name for the database client that established the database session. The return type is `VARCHAR2`.
- **F\$NETWORK_PROTOCOL Function**
The `F$NETWORK_PROTOCOL` function returns the network protocol being used for communication, as specified in the `PROTOCOL=protocol` portion of the connect string. The return type is `VARCHAR2`.
- **F\$PROXY_ENTERPRISE_IDENTITY Function**
The `F$PROXY_ENTERPRISE_IDENTITY` function returns the Oracle Internet Directory distinguished name (DN) when the proxy user is an enterprise user. The return type is `VARCHAR2`.
- **F\$PROXY_USER Function**
The `F$PROXY_USER` function returns the name of a proxy user.
- **F\$SESSION_USER Function**
The `F$SESSION_USER` function returns the database user name by which the current user is authenticated. This value remains the same throughout the session. The return type is `VARCHAR2`.

17.3.1 About Oracle Database Vault DVF PL/SQL Factor Functions

Oracle Database Vault provides DVF factor-specific functions for frequently used activities.

In addition to the functions and procedures made available from the `DVSY` schema, the `DVF` schema contains a single function for each factor defined in the system.

The functions are then available to the general database account population through PL/SQL functions and standard SQL. This enables factors to be used in Oracle Label Security, Oracle Virtual Private Database (VPD), and so on.

Typically, you can incorporate these functions into rule expressions. For example:

The functions are then available to the general database account population through PL/SQL functions and standard SQL. This enables factors to be used in Oracle Label Security, Oracle Virtual Private Database (VPD), and so on.

Typically, you can incorporate these functions into rule expressions. For example:

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Not Internal DBA',
    rule_expr => 'DVF.F$SESSION_USER NOT IN (''JSMTIH'', ''TBROWN'')');
END;
/
```

To find the value of a factor function, select from the `DUAL` system table. For example:

```
SELECT DVF.F$SESSION_USER FROM DUAL;

F$SESSION_USER
-----
SEC_ADMIN_OWEN
```

The name of the factor itself is case-insensitive. For example, the following statements return the same result

```
select dvf.f$session_user from dual;

SELECT DVF.F$SESSION_USER FROM DUAL;
```

17.3.2 F\$AUTHENTICATION_METHOD Function

The `F$AUTHENTICATION_METHOD` function returns the method of authentication in `VARCHAR2` data type.

In the list that follows, the type of user is followed by the method returned:

- Password-authenticated enterprise user, local database user, or `SYSDBA/SYSOPER` using Password File; proxy with user name using password: `PASSWORD`
- Kerberos-authenticated enterprise or external user: `KERBEROS`
- Transport Layer Security (TLS)-authenticated enterprise or external user: `SSL`
- Radius-authenticated external user: `RADIUS`
- Operating system-authenticated external user or `SYSDBA/SYSOPER`: `OS`
- DCE-authenticated external user: `DCE`
- Proxy with certificate, distinguished name (DN), or user name without using password: `NONE`

You can use `IDENTIFICATION_TYPE` to distinguish between external and enterprise users when the authentication method is Password, Kerberos, or TLS.

Syntax

```
DVF.F$AUTHENTICATION_METHOD ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check TLS Authentication Method',  
    rule_expr => 'DVF.F$AUTHENTICATION_METHOD = ''SSL''');  
END;  
/
```

17.3.3 F\$CLIENT_IP Function

The `F$CLIENT_IP` function returns the IP address of the computer from which the client is connected, in `VARCHAR2` data type.

Syntax

```
DVF.F$CLIENT_IP ()  
RETURN VARCHAR2;
```

Parameters

None

Example

The following example shows how to use `DVF.F$CLIENT_IP` in a rule creation statement. Note that you can only enter one IP address, not a range of IP addresses.

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Client IP Address',  
    rule_expr => 'DVF.F$CLIENT_IP = ''192.0.2.10''');  
END;  
/
```

17.3.4 F\$DATABASE_DOMAIN Function

The `F$DATABASE_DOMAIN` function returns the domain of the database as specified in the `DB_DOMAIN` initialization parameter, in `VARCHAR2` data type.

Syntax

```
DVF.F$DATABASE_DOMAIN ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Client Database Domain',
    rule_expr => 'DVF.F$DATABASE_DOMAIN NOT IN (''EXAMPLE'', ''YOURDOMAIN'')');
END;
/
```

17.3.5 F\$DATABASE_HOSTNAME Function

The `F$DATABASE_HOSTNAME` function returns the host name of the computer on which the instance is running, in `VARCHAR2` data type.

Syntax

```
DVF.F$DATABASE_HOSTNAME ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Host Name',
    rule_expr => 'DVF.F$DATABASE_HOSTNAME IN (''SHOBEEN'', ''MAU'')');
END;
/
```

17.3.6 F\$DATABASE_INSTANCE Function

The `F$DATABASE_INSTANCE` function returns the instance identification number of the current database instance, in `VARCHAR2` data type.

Syntax

```
DVF.F$DATABASE_INSTANCE ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Database Instance ID',
    rule_expr => 'DVF.F$DATABASE_INSTANCE = ''SALES_DB''');
END;
/
```

17.3.7 F\$DATABASE_IP Function

The `F$DATABASE_IP` function returns the IP address of the computer on which the database instance is running, in `VARCHAR2` data type.

Syntax

```
DVF.F$DATABASE_IP ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Database IP address',  
    rule_expr => 'DVF.F$DATABASE_IP = ''192.0.2.5''');  
END;  
/
```

17.3.8 F\$DATABASE_NAME Function

The `F$DATABASE_NAME` function returns the name of the database as specified in the `DB_NAME` initialization parameter, in `VARCHAR2` data type.

Syntax

```
DVF.F$DATABASE_NAME ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Database DB_NAME Name',  
    rule_expr => 'DVF.F$DATABASE_NAME = ''ORCL''');  
END;  
/
```

17.3.9 F\$DOMAIN Function

The `F$DOMAIN` function returns a named collection of physical, configuration, or implementation-specific factors in the run-time environment (for example, a networked IT environment or subset of it) that operates at a specific sensitivity level. The return type is `VARCHAR2`.

You can identify a domain using factors such as host name, IP address, and database instance names of the Oracle Database Vault nodes in a secure access path to the database. Each domain can be uniquely determined using a combination of the factor identifiers that identify the domain. You can use these identifying factors and possibly additional factors to define the Maximum Security Label within the domain. This restricts data access and commands,

depending on the physical factors about the Oracle Database Vault session. Example domains of interest may be Corporate Sensitive, Internal Public, Partners, and Customers.

Syntax

```
DVF.F$DOMAIN ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Domain',  
    rule_expr => 'DVF.F$DOMAIN = ''EXAMPLE.COM''');  
END;  
/
```

17.3.10 F\$DV\$_CLIENT_IDENTIFIER Function

The F\$DV\$_CLIENT_IDENTIFIER function returns an Oracle Database Vault client identifier.

Syntax

```
DVF.F$DV$_CLIENT_IDENTIFIER ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Database Vault Client Identifiers',  
    rule_expr => 'DVF.F$DV$_CLIENT_IDENTIFIER = ''14903BUA765454''');  
END;/
```

17.3.11 F\$DV\$_DBLINK_INFO Function

The F\$DV\$_DBLINK_INFO function returns information about an Oracle Database Vault database link.

Syntax

```
DVF.F$DV$_DBLINK_INFO ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  

```

```
rule_name => 'Check Database Vault database link info',
rule_expr => 'DVF.F$DV$_DBLINK_INFO = ''SOURCE_GLOBAL_NAME=SALES.US.EXAMPLE.COM,
DBLINK_NAME=PDB2_LINK, SOURCE_AUDIT_SESSIONID=200057'';
END;/
```

17.3.12 F\$DV\$_MODULE Function

The F\$DV\$_MODULE function returns information about an Oracle Database Vault module.

Syntax

```
DVF.F$DV$_MODULE ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Database Vault modules',
    rule_expr => 'DVF.F$DV$_MODULE = ''SQL*Plus'';
END;/
```

17.3.13 F\$ENTERPRISE_IDENTITY Function

The F\$ENTERPRISE_IDENTITY function returns the enterprise-wide identity for a user, in VARCHAR2 data type.

- For enterprise users: the Oracle Internet Directory DN.
- For external users: the external identity (Kerberos principal name, Radius and DCE schema names, operating system user name, certificate DN).
- For local users and SYSDBA/SYSOPER logins: NULL.

The value of the attribute differs by proxy method:

- For a proxy with DN: the Oracle Internet Directory DN of the client.
- For a proxy with certificate: the certificate DN of the client for external users; the Oracle Internet Directory DN for global users.
- For a proxy with user name: the Oracle Internet Directory DN if the client is an enterprise user; NULL if the client is a local database user.

Syntax

```
DVF.F$ENTERPRISE_IDENTITY ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check User Enterprise Identity',
```

```

    rule_expr => 'DVF.F$ENTERPRISE_IDENTITY NOT IN (''JSMITH'', ''TSMITH'')');
END;
/

```

17.3.14 F\$IDENTIFICATION_TYPE Function

The `F$IDENTIFICATION_TYPE` function returns the way the schema of a user was created in the database. Specifically, it reflects the `IDENTIFIED` clause in the `CREATE/ALTER USER` syntax. The return type is `VARCHAR2`.

In the list that follows, the syntax used during schema creation is followed by the identification type returned:

- `IDENTIFIED BY password`: LOCAL
- `IDENTIFIED EXTERNALLY`: EXTERNAL
- `IDENTIFIED GLOBALLY`: GLOBAL SHARED
- `IDENTIFIED GLOBALLY AS DN`: GLOBAL PRIVATE

Syntax

```

DVF.F$IDENTIFICATION_TYPE ()
RETURN VARCHAR2;

```

Parameters

None

Example

```

BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check User Schema Creation Type',
    rule_expr => 'DVF.F$IDENTIFICATION_TYPE = ''GLOBAL SHARED''');
END;
/

```

17.3.15 F\$LANG Function

The `F$LANG` function returns the ISO abbreviation for the language name, a shorter form than the existing `LANGUAGE` parameter, for the session of the user. The return type is `VARCHAR2`.

Syntax

```

DVF.F$LANG ()
RETURN VARCHAR2;

```

Parameters

None

Example

```

BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check ISO Abbreviated Language Name',
    rule_expr => 'DVF.F$LANG IN (''EN'', ''DE'', ''FR'')');
END;
/

```

Related Topics

- *Oracle Database Globalization Support Guide*

17.3.16 F\$LANGUAGE Function

The `F$LANGUAGE` function returns the language and territory currently used by a user session, along with the database character set. The return type is `VARCHAR2`.

The return type is in the following format:

language_territory.characterset

Syntax

```
DVF.F$LANGUAGE ()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Session Language and Territory',  
    rule_expr => 'DVF.F$LANGUAGE = ''AMERICAN_AMERICA.WE8ISO8859P1''');  
END;  
/
```

Related Topics

- *Oracle Database Globalization Support Guide*

17.3.17 F\$MACHINE Function

The `F$MACHINE` function returns the computer (host) name for the database client that established the database session. The return type is `VARCHAR2`.

Syntax

```
DVF.F$MACHINE ()  
RETURN VARCHAR2;
```

Parameter

None

Example

```
BEGIN  
  DBMS_MACADM.CREATE_RULE(  
    rule_name => 'Check Client Computer Host Name',  
    rule_expr => 'DVF.F$MACHINE NOT IN (''SHOBEEN'', ''SEBASTIAN'')');  
END;  
/
```

17.3.18 F\$NETWORK_PROTOCOL Function

The `F$NETWORK_PROTOCOL` function returns the network protocol being used for communication, as specified in the `PROTOCOL=protocol` portion of the connect string. The return type is `VARCHAR2`.

Syntax

```
DVF.F$NETWORK_PROTOCOL ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Network Protocol',
    rule_expr => 'DVF.F$NETWORK_PROTOCOL = ''TCP''');
END;
/
```

17.3.19 F\$PROXY_ENTERPRISE_IDENTITY Function

The `F$PROXY_ENTERPRISE_IDENTITY` function returns the Oracle Internet Directory distinguished name (DN) when the proxy user is an enterprise user. The return type is `VARCHAR2`.

Syntax

```
DVF.F$PROXY_ENTERPRISE_IDENTITY ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Get OID DN of Enterprise User',
    rule_expr => 'DVF.F$PROXY_ENTERPRISE_IDENTITY = ''cn=Provisioning Admins''');
END;
/
```

17.3.20 F\$PROXY_USER Function

The `F$PROXY_USER` function returns the name of a proxy user.

Syntax

```
DVF.PROXY_USER ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Proxy Users',
    rule_expr => 'DVF.PROXY_USER NOT IN (''ECHICHESTER'', ''PFITCH'')');
END;/
```

17.3.21 F\$SESSION_USER Function

The F\$SESSION_USER function returns the database user name by which the current user is authenticated. This value remains the same throughout the session. The return type is VARCHAR2.

Syntax

```
DVF.F$SESSION_USER ()
RETURN VARCHAR2;
```

Parameters

None

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Check Database User Name',
    rule_expr => 'DVF.F$SESSION_USER IN (''JSMITH'', ''TSMITH'')');
END;
/
```

18

Oracle Database Vault Secure Application Role APIs

The `DBMS_MACADM` and `DBMS_MACSEC_ROLES` PL/SQL packages manage Database Vault secure application roles.

- [DBMS_MACADM Secure Application Role Procedures](#)
The `DBMS_MACADM` package creates, renames, assigns, unassigns, updates, and deletes Oracle Database Vault secure application roles.
- [DBMS_MACSEC_ROLES Secure Application Role Procedure and Function](#)
The `DBMS_MACSEC_ROLES` package checks the authorization for users and sets Oracle Database Vault secure application roles.

Related Topics

- [Configuring Secure Application Roles for Oracle Database Vault](#)
Secure application roles enable you to control how much access users have to an application.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

18.1 DBMS_MACADM Secure Application Role Procedures

The `DBMS_MACADM` package creates, renames, assigns, unassigns, updates, and deletes Oracle Database Vault secure application roles.

- [CREATE_ROLE Procedure](#)
The `CREATE_ROLE` procedure creates an Oracle Database Vault secure application role.
- [DELETE_ROLE Procedure](#)
The `DELETE_ROLE` procedure deletes an Oracle Database Vault secure application role.
- [RENAME_ROLE Procedure](#)
The `RENAME_ROLE` procedure renames an Oracle Database Vault secure application role. The name change takes effect everywhere the role is used.
- [UPDATE_ROLE Procedure](#)
The `UPDATE_ROLE` procedure updates a Oracle Database Vault secure application role.

18.1.1 CREATE_ROLE Procedure

The `CREATE_ROLE` procedure creates an Oracle Database Vault secure application role.

Syntax

```
DBMS_MACADM.CREATE_ROLE (  
  role_name      IN VARCHAR2,  
  enabled        IN VARCHAR2,  
  rule_set_name  IN VARCHAR2);
```

Parameters

Table 18-1 CREATE_ROLE Parameters

| Parameter | Description |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| role_name | Role name, up to 128 characters, with no spaces. Prepend the role name with c## or C## if it is a common role. To find existing secure application roles in the current database instance, query the DBA_DV_ROLE view. |
| enabled | DBMS_MACUTL.G_YES makes the role available for enabling; DBMS_MACUTL.G_NO prevents the role from being enabled. The default is DBMS_MACUTL.G_YES. |
| rule_set_name | Name of rule set to determine whether this secure application can be enabled. To find existing rule sets in the current database instance, query the DBA_DV_RULE_SET view. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_ROLE (
    role_name      => 'Sector2_APP_MGR',
    enabled        => DBMS_MACUTL.G_YES,
    rule_set_name  => 'Check App2 Access');
END;
/
```

18.1.2 DELETE_ROLE Procedure

The DELETE_ROLE procedure deletes an Oracle Database Vault secure application role.

Syntax

```
DBMS_MACADM.DELETE_ROLE (
  role_name IN VARCHAR2);
```

Parameters

Table 18-2 DELETE_ROLE Parameter

| Parameter | Description |
|-----------|---------------------------------------------------------------------------------------------------------------------------|
| role_name | Role name. To find existing secure application roles in the current database instance, query the DBA_DV_ROLE view. |

Example

```
EXEC DBMS_MACADM.DELETE_ROLE ('SECT2_APP_MGR');
```


18.1.3 RENAME_ROLE Procedure

The `RENAME_ROLE` procedure renames an Oracle Database Vault secure application role. The name change takes effect everywhere the role is used.

Syntax

```
DBMS_MACADM.RENAME_ROLE (
  role_name      IN VARCHAR2,
  new_role_name  IN VARCHAR2);
```

Parameters

Table 18-3 RENAME_ROLE Parameters

| Parameter | Description |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>role_name</code> | Current role name. To find existing secure application roles in the current database instance, query the <code>DBA_DV_ROLE</code> view. |
| <code>new_role_name</code> | Role name, up to 128 characters, with no spaces. Ensure that this name follows the standard Oracle naming conventions for role creation described in <i>Oracle Database SQL Language Reference</i> . Prepend the role name with <code>c##</code> or <code>C##</code> if it is a common role. |

Example

```
BEGIN
  DBMS_MACADM.RENAME_ROLE (
    role_name      => 'SECT2_APP_MGR',
    new_role_name  => 'SECT2_SYSADMIN');
END;
/
```

18.1.4 UPDATE_ROLE Procedure

The `UPDATE_ROLE` procedure updates a Oracle Database Vault secure application role.

Syntax

```
DBMS_MACADM.UPDATE_ROLE (
  role_name      IN VARCHAR2,
  enabled        IN VARCHAR2,
  rule_set_name  IN VARCHAR2);
```

Parameters

Table 18-4 UPDATE_ROLE Parameters

| Parameter | Description |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <code>role_name</code> | Role name. To find existing secure application roles in the current database instance, query the <code>DBA_DV_ROLE</code> view. |

Table 18-4 (Cont.) UPDATE_ROLE Parameters

| Parameter | Description |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| enabled | DBMS_MACUTL.G_YES (Yes) makes the role available for enabling; DBMS_MACUTL.G_NO (No) prevents the role from being enabled. The default for enabled is the previously set value, which you can find by querying the DBA_DV_ROLE data dictionary view. |
| rule_set_name | Name of rule set to determine whether this secure application can be enabled. To find existing rule sets in the current database instance, query the DBA_DV_RULE_SET view. |

Example

```

BEGIN
  DBMS_MACADM.UPDATE_ROLE (
    role_name      => 'SECT2_SYSADMIN',
    enabled        => DBMS_MACUTL.G_YES,
    rule_set_name  => 'System Access Controls');
END;
/

```

18.2 DBMS_MACSEC_ROLES Secure Application Role Procedure and Function

The DBMS_MACSEC_ROLES package checks the authorization for users and sets Oracle Database Vault secure application roles.

The DBMS_MACSEC_ROLES package is available to all users.

- [CAN_SET_ROLE Function](#)
The CAN_SET_ROLE function checks if the user invoking the method is authorized to use an Oracle Database Vault secure application role.
- [SET_ROLE Procedure](#)
The SET_ROLE procedure issues the SET ROLE PL/SQL statement for specified roles.

18.2.1 CAN_SET_ROLE Function

The CAN_SET_ROLE function checks if the user invoking the method is authorized to use an Oracle Database Vault secure application role.

The authorization is determined by checking the rule set associated with the role. The return type is BOOLEAN.

Syntax

```

DBMS_MACSEC_ROLES.CAN_SET_ROLE (
  p_role IN VARCHAR2)
RETURN BOOLEAN;

```

Parameters

Table 18-5 CAN_SET_ROLE Parameter

| Parameter | Description |
|-----------|-----------------------------------------------------------------------------------------------------------------------|
| p_role | Role name. To find existing secure application roles in the current database instance, query the DBA_DV_ROLE view. |

Example

```
SET SERVEROUTPUT ON
BEGIN
  IF DBMS_MACSEC_ROLES.CAN_SET_ROLE('SECTOR2_APP_MGR')
    THEN DBMS_OUTPUT.PUT_LINE('''SECTOR2_APP_MGR'' can be enabled.');
```

18.2.2 SET_ROLE Procedure

The SET_ROLE procedure issues the SET ROLE PL/SQL statement for specified roles.

This procedure includes both Oracle Database Vault secure application roles and regular Oracle Database roles in its checking process.

This procedure sets an Oracle Database Vault secure application role only if the rule set that is associated with the role evaluates to true. Before SET ROLE is issued, the CAN_SET_ROLE method is called to check the rule set associated with the role. Run-time rule set behavior such as auditing, failure processing, and event handling occur during this process.

The SET_ROLE procedure is available to the general database account population.

Syntax

```
DBMS_MACSEC_ROLES.SET_ROLE(
  p_role IN VARCHAR2);
```

Parameters

Table 18-6 SET_ROLE Parameter

| Parameter | Description |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_role | Role names. You can enter multiple roles, separated by commas (,), including secure application roles and regular roles. To find existing secure application roles in the current database instance, query the DBA_DV_ROLE view. To find all of the existing roles in the database, query the DBA_ROLES data dictionary view. |

Example

```
EXEC DBMS_MACSEC_ROLES.SET_ROLE('SECTOR2_APP_MGR, APPS_MGR');
```

You can enter the name of the role in any case (for example, Sector2_APP_MGR).

19

Oracle Database Vault Oracle Label Security APIs

You can use the `DBMS_MACADM` PL/SQL package to manage Oracle Label Security labels and policies in Oracle Database Vault.

- [CREATE_MAC_POLICY Procedure](#)
The `CREATE_MAC_POLICY` procedure specifies the algorithm to merge labels when computing the label for a factor, or the Oracle Label Security Session label.
- [CREATE_POLICY_LABEL Procedure](#)
The `CREATE_POLICY_LABEL` procedure labels an identity within an Oracle Label Security policy.
- [DELETE_MAC_POLICY_CASCADE Procedure](#)
The `DELETE_MAC_POLICY_CASCADE` procedure deletes all Oracle Database Vault objects related to an Oracle Label Security policy.
- [DELETE_POLICY_FACTOR Procedure](#)
The `DELETE_POLICY_FACTOR` procedure removes the factor from contributing to the Oracle Label Security label.
- [DELETE_POLICY_LABEL Procedure](#)
The `DELETE_POLICY_LABEL` procedure removes the label from an identity within an Oracle Label Security policy.
- [UPDATE_MAC_POLICY Procedure](#)
The `UPDATE_MAC_POLICY` procedure specifies the algorithm to merge labels when computing the label for a factor, or the Oracle Label Security Session label.

Related Topics

- [Integrating Oracle Database Vault with Other Oracle Products](#)
You can integrate Oracle Database Vault with other Oracle products, such as Oracle Enterprise User Security.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

19.1 CREATE_MAC_POLICY Procedure

The `CREATE_MAC_POLICY` procedure specifies the algorithm to merge labels when computing the label for a factor, or the Oracle Label Security Session label.

Syntax

```
DBMS_MACADM.CREATE_MAC_POLICY(  
    policy_name IN VARCHAR2,  
    algorithm   IN VARCHAR2);
```

Parameters**Table 19-1 CREATE_MAC_POLICY Parameters**

| Parameter | Description |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| policy_name | Name of an existing policy. To find existing policies in the current database instance, query the DBA_DV_MAC_POLICY view. |
| algorithm | Merge algorithm for cases when Oracle Label Security has merged two labels. Enter the code listed in Table 19-2 that corresponds to the merge algorithm you want. For example, enter HUU to if you want to select the Maximum Level/Union/Union merge algorithm. |

Table 19-2 Oracle Label Security Merge Algorithm Codes

| Code | Value |
|------|-----------------------------------------|
| HUU | Maximum Level/Union/Union |
| HIU | Maximum Level/Intersection/Union |
| HMU | Maximum Level/Minus/Union |
| HNU | Maximum Level/Null/Union |
| HUI | Maximum Level/Union/Intersection |
| HI I | Maximum Level/Intersection/Intersection |
| HMI | Maximum Level/Minus/Intersection |
| HNI | Maximum Level/Null/Intersection |
| HUM | Maximum Level/Union/Minus |
| HIM | Maximum Level/Intersection/Minus |
| HMM | Maximum Level/Minus/Minus |
| HNM | Maximum Level/Null/Minus |
| HUN | Maximum Level/Union/Null |
| HIN | Maximum Level/Intersection/Null |
| HMN | Maximum Level/Minus/Null |
| HNN | Maximum Level/Null/Null |
| LUU | Minimum Level/Union/Union |
| LIU | Minimum Level/Intersection/Union |
| LMU | Minimum Level/Minus/Union |
| LNU | Minimum Level/Null/Union |
| LUI | Minimum Level/Union/Intersection |
| LII | Minimum Level/Intersection/Intersection |
| LMI | Minimum Level/Minus/Intersection |
| LNI | Minimum Level/Null/Intersection |
| LUM | Minimum Level/Union/Minus |
| LIM | Minimum Level/Intersection/Minus |

Table 19-2 (Cont.) Oracle Label Security Merge Algorithm Codes

| Code | Value |
|------|---------------------------------|
| LMM | Minimum Level/Minus/Minus |
| LNM | Minimum Level/Null/Minus |
| LUN | Minimum Level/Union/Null |
| LIN | Minimum Level/Intersection/Null |
| LMN | Minimum Level/Minus/Null |
| LNN | Minimum Level/Null/Null |

Example

```
BEGIN
  DBMS_MACADM.CREATE_MAC_POLICY(
    policy_name => 'Access Locations',
    algorithm   => 'HUU');
END;
/
```

19.2 CREATE_POLICY_LABEL Procedure

The `CREATE_POLICY_LABEL` procedure labels an identity within an Oracle Label Security policy.

Syntax

```
DBMS_MACADM.CREATE_POLICY_LABEL(
  identity_factor_name  IN VARCHAR2,
  identity_factor_value IN VARCHAR2,
  policy_name          IN VARCHAR2,
  label                IN VARCHAR2);
```

Parameters**Table 19-3 CREATE_POLICY_LABEL Parameters**

| Parameter | Description |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>identity_factor_name</code> | Name of the factor being labeled. To find existing factors in the current database instance, query the <code>DBA_DV_FACTOR</code> view. To find factors that are associated with Oracle Label Security policies, use <code>DBA_DV_MAC_POLICY_FACTOR</code> . |
| <code>identity_factor_value</code> | Value of identity for the factor being labeled. To find the identities of existing factors in the current database instance, query the <code>DBA_DV_IDENTITY</code> view. |
| <code>policy_name</code> | Name of an existing policy. To find existing policies in the current database instance, query the <code>DBA_DV_MAC_POLICY</code> view. |
| <code>label</code> | Oracle Label Security label name. To find existing policy labels for factor identifiers, query the <code>DBA_DV_POLICY_LABEL</code> view. |

Example

```

BEGIN
  DBMS_MACADM.CREATE_POLICY_LABEL(
    identity_factor_name => 'App_Host_Name',
    identity_factor_value => 'Sect2_Fin_Apps',
    policy_name          => 'Access Locations',
    label                => 'Sensitive');
END;
/

```

19.3 DELETE_MAC_POLICY_CASCADE Procedure

The `DELETE_MAC_POLICY_CASCADE` procedure deletes all Oracle Database Vault objects related to an Oracle Label Security policy.

Syntax

```

DBMS_MACADM.DELETE_MAC_POLICY_CASCADE(
  policy_name IN VARCHAR2);

```

Parameters**Table 19-4** DELETE_MAC_POLICY_CASCADE Parameter

| Parameter | Description |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Name of an existing policy. To find existing policies in the current database instance, query the <code>DBA_DV_MAC_POLICY</code> view. |

Example

```

EXEC DBMS_MACADM.DELETE_MAC_POLICY_CASCADE('Access Locations');

```

19.4 DELETE_POLICY_FACTOR Procedure

The `DELETE_POLICY_FACTOR` procedure removes the factor from contributing to the Oracle Label Security label.

Syntax

```

DBMS_MACADM.DELETE_POLICY_FACTOR(
  policy_name IN VARCHAR2,
  factor_name IN VARCHAR2);

```

Parameters**Table 19-5** DELETE_POLICY_FACTOR Parameters

| Parameter | Description |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Name of an existing policy. To find existing policies in the current database instance, query the <code>DBA_DV_MAC_POLICY</code> view. |

Table 19-5 (Cont.) DELETE_POLICY_FACTOR Parameters

| Parameter | Description |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>factor_name</code> | Name of factor associated with the Oracle Label Security label. To find factors that are associated with Oracle Label Security policies, query <code>DBA_DV_MAC_POLICY_FACTOR</code> . |

Example

```
BEGIN
  DBMS_MACADM.DELETE_POLICY_FACTOR(
    policy_name => 'Access Locations',
    factor_name => 'App_Host_Name');
END;
/
```

19.5 DELETE_POLICY_LABEL Procedure

The `DELETE_POLICY_LABEL` procedure removes the label from an identity within an Oracle Label Security policy.

Syntax

```
DBMS_MACADM.DELETE_POLICY_LABEL(
  identity_factor_name  IN VARCHAR2,
  identity_factor_value IN VARCHAR2,
  policy_name           IN VARCHAR2,
  label                 IN VARCHAR2);
```

Parameters**Table 19-6 DELETE_POLICY_LABEL Parameters**

| Parameter | Description |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>identity_factor_name</code> | Name of the factor that was labeled. To find existing factors in the current database instance that are associated with Oracle Label Security policies, query <code>DBA_DV_MAC_POLICY_FACTOR</code> . |
| <code>identity_factor_value</code> | Value of identity for the factor that was labeled. To find the identities of existing factors in the current database instance, query the <code>DBA_DV_IDENTITY</code> view. |
| <code>policy_name</code> | Name of an existing policy. To find existing policies in the current database instance, query the <code>DBA_DV_MAC_POLICY</code> view. |
| <code>label</code> | Oracle Label Security label name. To find existing policy labels for factor identifiers, query the <code>DBA_DV_POLICY_LABEL</code> view. |

Example

```
BEGIN
  DBMS_MACADM.DELETE_POLICY_LABEL(
    identity_factor_name => 'App_Host_Name',
```



```

identity_factor_value => 'Sect2_Fin_Apps',
policy_name           => 'Access Locations',
label                 => 'Sensitive');
END;
/

```

19.6 UPDATE_MAC_POLICY Procedure

The UPDATE_MAC_POLICY procedure specifies the algorithm to merge labels when computing the label for a factor, or the Oracle Label Security Session label.

Syntax

```

DBMS_MACADM.UPDATE_MAC_POLICY(
  policy_name IN VARCHAR2,
  algorithm   IN VARCHAR2);

```

Parameters

Table 19-7 UPDATE_MAC_POLICY

| Parameter | Description |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| policy_name | Name of an existing policy. To find existing policies in the current database instance, query the DBA_DV_MAC_POLICY view. |
| algorithm | Merge algorithm for cases when Oracle Label Security has merged two labels. See the codes listed in the DBMS_MACADM.CREATE_MAC_POLICY description. |

Example

```

BEGIN
  DBMS_MACADM.UPDATE_MAC_POLICY(
    policy_name => 'Access Locations',
    algorithm   => 'LUI');
END;
/

```

Related Topics

- [CREATE_MAC_POLICY Procedure](#)
The CREATE_MAC_POLICY procedure specifies the algorithm to merge labels when computing the label for a factor, or the Oracle Label Security Session label.

20

Oracle Database Vault Utility APIs

Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

- [DBMS_MACUTL Constants](#)
You can use a set of constants, available in the `DBMS_MACUTL` PL/SQL package.
- [DBMS_MACUTL Package Procedures and Functions](#)
The `DBMS_MACUTL` PL/SQL package can perform tasks such as finding a time value or whether a user has the the appropriate privileges.

20.1 DBMS_MACUTL Constants

You can use a set of constants, available in the `DBMS_MACUTL` PL/SQL package.

- [DBMS_MACUTL Listing of Constants](#)
The `DBMS_MACUTL` PL/SQL package provides constants (fields) to use with Oracle Database Vault PL/SQL packages.
- [Example: Creating a Realm Using DBMS_MACUTL Constants](#)
Constants can be used to answer simple Yes or No settings when you create objects in Oracle Database Vault.
- [Example: Creating a Rule Set Using DBMS_MACUTL Constants](#)
Constants can be used to set options such as the type of auditing used or fail options.
- [Example: Creating a Factor Using DBMS_MACUTL Constants](#)
Constants can be used to set information specific to factors, such as identity or labeling.

20.1.1 DBMS_MACUTL Listing of Constants

The `DBMS_MACUTL` PL/SQL package provides constants (fields) to use with Oracle Database Vault PL/SQL packages.

[Table 20-1](#) summarizes constant (that is, fields) descriptions for the `DBMS_MACUTL` package.

Many of these constants have equivalents in the Oracle Database Vault package. For example, the `enabled` parameter, which is available in several procedures, can accept either `Y` (for Yes) or the constant `G_YES`. Choosing one over the other is a matter of personal preference. They both have the same result.

Table 20-1 DBMS_MACUTL Listing of Constants

| Constant Name | Data Type | Description |
|---------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>G_ALL_OBJECT</code> | <code>VARCHAR2(1)</code> | Used with the realm API <code>object_name</code> and <code>object_type</code> parameters as a wildcard to indicate all object names or all object types. |

Table 20-1 (Cont.) DBMS_MACUTL Listing of Constants

| Constant Name | Data Type | Description |
|-----------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G_AUDIT_ALWAYS | NUMBER | Used with the factor API <code>audit_options</code> parameter to enable traditional auditing. Starting with Oracle Database release 21c, traditional auditing will be deprecated. |
| G_AUDIT_OFF | NUMBER | Used with the factor API <code>audit_options</code> parameter to disable traditional auditing. |
| G_AUDIT_ON_GET_ERROR | NUMBER | Used with the factor API <code>audit_options</code> parameter to audit using traditional auditing if the expression specified in the <code>get_expr</code> parameter returns an error. |
| G_AUDIT_ON_GET_NULL | NUMBER | Used with the factor API <code>audit_options</code> parameter to audit using traditional auditing if the expression in the <code>get_expr</code> field is null. |
| G_AUDIT_ON_TRUST_LEVEL_NEG | NUMBER | Used with the factor API <code>audit_options</code> parameter to audit using traditional auditing if the trust level is negative. |
| G_AUDIT_ON_TRUST_LEVEL_NULL | NUMBER | Used with the factor API <code>audit_options</code> parameter to audit using traditional auditing if no trust level exists. |
| G_AUDIT_ON_VALIDATE_ERROR | NUMBER | Used with the factor API <code>audit_options</code> parameter to audit using traditional auditing if the validation function returns an error. |
| G_AUDIT_ON_VALIDATE_FALSE | NUMBER | Used with the factor API <code>audit_options</code> parameter to audit using traditional auditing if validation function is false. |
| G_DISABLE | NUMBER | Used to disable Oracle Database Vault policies and command rules |
| G_ENABLE | NUMBER | Used to enable Oracle Database Vault policies and command rules |
| G_EVAL_ON_ACCESS | NUMBER | Used with the factor API <code>eval_options</code> parameter to reevaluate the factor each time it is accessed. |
| G_EVAL_ON_SESSION | NUMBER | Used with the factor API <code>eval_options</code> parameter to evaluate the factor only once, when the user logs in to the session. |
| G_FAIL_SILENTLY | NUMBER | Used with the <code>fail_options</code> parameter to fail and show no error message. |
| G_FAIL_WITH_MESSAGE | NUMBER | Used with the <code>fail_options</code> parameter to fail and show an error message. |

Table 20-1 (Cont.) DBMS_MACUTL Listing of Constants

| Constant Name | Data Type | Description |
|------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G_IDENTIFY_BY_CONSTANT | NUMBER | Used with the factor API <code>identify_by</code> parameter: Fixed value in PL/SQL expression defined in the <code>get_expr</code> parameter. |
| G_IDENTIFY_BY_CONTEXT | NUMBER | Used with the factor API <code>identify_by</code> parameter to indicate context. |
| G_IDENTIFY_BY_FACTOR | NUMBER | Used with the factor API <code>identify_by</code> parameter for subfactors through the <code>factor_link</code> table. |
| G_IDENTIFY_BY_METHOD | NUMBER | Used with the factor API <code>identify_by</code> parameter: Expression in <code>get_expr</code> field |
| G_IDENTIFY_BY_RULESET | NUMBER | Used with the factor API <code>identify_by</code> parameter: Expression and Rule Set with the <code>factor_expr</code> table |
| G_LABELED_BY_FACTORS | NUMBER | Used with the factor API <code>labeled_by</code> parameter to derive the label from subfactor and merge algorithm. |
| G_LABELED_BY_SELF | NUMBER | Used with the factor API <code>labeled_by</code> parameter to label the factor identities. |
| G_MAX_SESSION_LABEL | VARCHAR2 (30) | This is the highest label a user could set based on the factors. It does not consider the label for a user. |
| G_MIN_POLICY_LABEL | VARCHAR2 (30) | The label to which a factor with a null label defaults. |
| G_NO | VARCHAR2 (1) | Used with the following APIs: <ul style="list-style-type: none"> The factor API <code>label_indicator</code> parameter to indicate that a child factor linked to a parent factor does not contribute to the label of the parent factor in an Oracle Label Security integration. Any API that uses the <code>enabled</code> parameter. |
| G_OLS_SESSION_LABEL | VARCHAR2 (30) | The Oracle Label Security session label for a user at the time <code>init_session</code> is run. |
| G_PARTIAL | NUMBER | Sets the enforcement state of the realms and command rules under an Oracle Database Vault policy to be changed individually |
| G_REALM_AUDIT_FAIL | NUMBER | Used with the realm API <code>audit_options</code> parameter to audit when the realm is violated. |
| G_REALM_AUDIT_OFF | NUMBER | Used with the realm API <code>audit_options</code> parameter to disable auditing. |

Table 20-1 (Cont.) DBMS_MACUTL Listing of Constants

| Constant Name | Data Type | Description |
|---------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G_REALM_AUDIT_SUCCESS | NUMBER | Used with the realm API <code>audit_options</code> parameter: Audit on successful realm access |
| G_REALM_AUTH_OWNER | NUMBER | Used with the realm API <code>auth_options</code> parameter to set the realm authorization to Owner. |
| G_REALM_AUTH_PARTICIPANT | NUMBER | Used with the realm API <code>auth_options</code> parameter to set the realm authorization to Participant. |
| G_RULESET_AUDIT_FAIL | NUMBER | Used with the rule set API <code>audit_options</code> parameter to audit on rule set failure. |
| G_RULESET_AUDIT_OFF | NUMBER | Used with the rule set API <code>audit_options</code> parameter to disable auditing. |
| G_RULESET_AUDIT_SUCCESS | NUMBER | Used with the rule set API <code>audit_options</code> parameter to audit on rule set success. |
| G_RULESET_EVAL_ALL | NUMBER | Used with the rule set API <code>eval_options</code> parameter to enable the rule set to succeed if all rules evaluate to true. |
| G_RULESET_EVAL_ANY | NUMBER | Used with the rule set API <code>eval_options</code> parameter to succeed if any of the rules evaluate to true. |
| G_RULESET_FAIL_SHOW | NUMBER | Used with the rule set API <code>fail_options</code> parameter to show an error message if the rule set fails. |
| G_RULESET_FAIL_SILENT | NUMBER | Used with the rule set API <code>fail_options</code> parameter to not show an error message if the rule set fails. |
| G_RULESET_HANDLER_FAIL | NUMBER | Used with the rule set API <code>handler_options</code> parameter to call a handler (specified by the <code>handler</code> parameter) if the rule set fails. |
| G_RULESET_HANDLER_OFF | NUMBER | Used with the rule set API <code>handler_options</code> parameter to disable calls to a handler or if no handler is used. |
| G_RULESET_HANDLER_SUCCESS | NUMBER | Used with the rule set API <code>handler_options</code> parameter to call a handler if the rule set succeeds. |

Table 20-1 (Cont.) DBMS_MACUTL Listing of Constants

| Constant Name | Data Type | Description |
|---------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| G_SIMULATION | NUMBER | Used to set the enforcement state of a policy to simulation mode. This mode does not raise errors for realm or command rule violations. Instead, an error is logged in a designated log table with sufficient information relevant to the error (for example, users or SQL command.) |
| G_USER_POLICY_LABEL | VARCHAR2 (30) | This is what Oracle Label Security has decided the user's label should be set to after factoring in the preceding values. |
| G_YES | VARCHAR2 (1) | Used with the following APIs: <ul style="list-style-type: none"> The factor API <code>label_indicator</code> parameter to indicate that a child factor linked to a parent factor contributes to the label of the parent factor in an Oracle Label Security integration. Any API that uses the <code>enabled</code> parameter. |

20.1.2 Example: Creating a Realm Using DBMS_MACUTL Constants

Constants can be used to answer simple Yes or No settings when you create objects in Oracle Database Vault.

[Example 20-1](#) shows how to use the `G_YES` and `G_REALM_AUDIT_FAIL` DBMS_MACUTL constants when creating a realm.

Example 20-1 Creating a Realm Using DBMS_MACUTL Constants

```
BEGIN
DBMS_MACADM.CREATE_REALM(
  realm_name   => 'Performance Statistics Realm',
  description  => 'Realm to measure performance',
  enabled      => DBMS_MACUTL.G_YES,
  audit_options => DBMS_MACUTL.G_REALM_AUDIT_OFF);
END;
/
```

20.1.3 Example: Creating a Rule Set Using DBMS_MACUTL Constants

Constants can be used to set options such as the type of auditing used or fail options.

[Example 20-2](#) shows how to use several DBMS_MACUTL constants when creating a rule set.

Example 20-2 Creating a Rule Set Using DBMS_MACUTL Constants

```
BEGIN
DBMS_MACADM.CREATE_RULE_SET(
  rule_set_name => 'Limit_DBA_Access',
  description   => 'DBA access through predefined processes',
  enabled       => DBMS_MACUTL.G_YES,
  eval_options  => DBMS_MACUTL.G_RULESET_EVAL_ALL,
```

```

audit_options    => DBMS_MACUTL.G_RULESET_AUDIT_OFF,
fail_options     => DBMS_MACUTL.G_RULESET_FAIL_SHOW,
fail_message     => 'Rule Set Limit_DBA_Access has failed.',
fail_code       => 20000,
handler_options  => DBMS_MACUTL.G_RULESET_HANDLER_FAIL,
handler         => 'dbavowner.email_alert');
END;
/

```

20.1.4 Example: Creating a Factor Using DBMS_MACUTL Constants

Constants can be used to set information specific to factors, such as identity or labeling.

[Example 20-3](#) shows how to use constants when creating a factor.

Example 20-3 Creating a Factor Using DBMS_MACUTL Constants

```

BEGIN
DBMS_MACADM.CREATE_FACTOR(
  factor_name       => 'Sector2_DB',
  factor_type_name => 'Instance',
  description       => ' ',
  rule_set_name    => 'DB_access',
  get_expr         => 'UPPER(SYS_CONTEXT(''USERENV'', ''DB_NAME''))',
  validate_expr    => 'dbavowner.check_db_access',
  identify_by      => DBMS_MACUTL.G_IDENTIFY_BY_FACTOR,
  labeled_by       => DBMS_MACUTL.G_LABELED_BY_SELF,
  eval_options     => DBMS_MACUTL.G_EVAL_ON_SESSION,
  audit_options    => DBMS_MACUTL.G_AUDIT_OFF,
  fail_options     => DBMS_MACUTL.G_FAIL_SILENTLY);
END;
/

```

20.2 DBMS_MACUTL Package Procedures and Functions

The DBMS_MACUTL PL/SQL package can perform tasks such as finding a time value or whether a user has the the appropriate privileges.

- [CHECK_DVSYSDML_ALLOWED Procedure](#)
The CHECK_DVSYSDML_ALLOWED procedure checks if a user can issue Data Modification Language (DML) commands to access the DVSYSDML objects.
- [GET_CODE_VALUE Function](#)
The GET_CODE_VALUE function finds the value for a code within a code group, and then returns a VARCHAR2 value.
- [GET_SECOND Function](#)
The GET_SECOND function returns the seconds in Oracle SS (seconds) format (00–59), and then returns a NUMBER value.
- [GET_MINUTE Function](#)
The GET_MINUTE function returns the minute in Oracle MI (minute) format (00–59), in a NUMBER value.
- [GET_HOUR Function](#)
The GET_HOUR function returns the hour in Oracle HH24 (hour) format (00–23), in a NUMBER value.
- [GET_DAY Function](#)
The GET_DAY function returns the day in Oracle DD (day) format (01–31), in a NUMBER value.

- **GET_MONTH Function**
The `GET_MONTH` function returns the month in Oracle MM (month) format (01–12), in a `NUMBER` value.
- **GET_YEAR Function**
The `GET_YEAR` function returns the year in Oracle YYYY (year) format (0001–9999), in a `NUMBER` value.
- **IS_ALPHA Function**
The `IS_ALPHA` function returns a `BOOLEAN` value indicating if a character is alphabetic.
- **IS_DIGIT Function**
The `IS_DIGIT` function checks returns a `BOOLEAN` value indicating if a character is numeric.
- **IS_DVSYSD_OWNER Function**
The `IS_DVSYSD_OWNER` function returns a `BOOLEAN` value indicating if a user is authorized to manage the Oracle Database Vault configuration.
- **IS_OLS_INSTALLED Function**
The `IS_OLS_INSTALLED` function returns a `BOOLEAN` value indicating if Oracle Label Security is installed.
- **IS_OLS_INSTALLED_VARCHAR Function**
The `IS_OLS_INSTALLED_VARCHAR` function returns a `BOOLEAN` value indicating if Oracle Label Security is installed.
- **ROLE_GRANTED_ENABLED_VARCHAR Function**
The `ROLE_GRANTED_ENABLED_VARCHAR` function returns a `VARCHAR2` value indicating the role grant and enablement status of a user.
- **USER_HAS_OBJECT_PRIVILEGE Function**
The `USER_HAS_OBJECT_PRIVILEGE` function returns a `BOOLEAN` value indicating if user or role can access an object through a single specified object privilege grant.
- **USER_HAS_ROLE Function**
The `USER_HAS_ROLE` function returns a `BOOLEAN` value indicating if a user has a role privilege, directly or indirectly (through another role).
- **USER_HAS_ROLE_VARCHAR Function**
The `USER_HAS_ROLE_VARCHAR` function returns a `VARCHAR2` value indicating if a user has a role privilege, directly or indirectly (through another role).
- **USER_HAS_SYSTEM_PRIVILEGE Function**
The `USER_HAS_SYSTEM_PRIVILEGE` function returns a `BOOLEAN` value indicating if a user has a system privilege, directly or indirectly (through a role).

20.2.1 CHECK_DVSYSD_DML_ALLOWED Procedure

The `CHECK_DVSYSD_DML_ALLOWED` procedure checks if a user can issue Data Modification Language (DML) commands to access the `DVSYSD` objects.

Syntax

```
DBMS_MACUTL.CHECK_DVSYSD_DML_ALLOWED(  
    p_user IN VARCHAR2 DEFAULT USER);
```


Parameter

Table 20-2 CHECK_DVSYSDML_ALLOWED Parameter

| Parameter | Description |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_user | User to check. To find existing users in the current database instance, query the following views: <ul style="list-style-type: none"> DBA_USERS: Finds available users for the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular user or role. DBA_DV_ROLE: Finds existing secure application roles used in privilege management. |

Example

User SYSTEM fails the check:

```
EXEC DBMS_MACUTL.CHECK_DVSYSDML_ALLOWED('system');
```

```
ERROR at line 1:
ORA-47920: Authorization failed for user system to perform this operation
ORA-06512: at "DBMS_MACUTL", line 23
ORA-06512: at "DBMS_MACUTL", line 372
ORA-06512: at "DBMS_MACUTL", line 508
ORA-06512: at "DBMS_MACUTL", line 572
ORA-06512: at line 1
```

User sec_admin_owen, who has the DV_OWNER role, passes the check:

```
EXEC DBMS_MACUTL.CHECK_DVSYSDML_ALLOWED('ec_admin_owen');
```

PL/SQL procedure successfully completed.

20.2.2 GET_CODE_VALUE Function

The GET_CODE_VALUE function finds the value for a code within a code group, and then returns a VARCHAR2 value.

Syntax

```
DBMS_MACUTL.GET_CODE_VALUE(
  p_code_group IN VARCHAR2,
  p_code       IN VARCHAR2)
RETURN VARCHAR2;
```

Parameters

Table 20-3 GET_CODE_VALUE Parameters

| Parameter | Description |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| p_code_group | Code group (for example, AUDIT_EVENTS or BOOLEAN). To find available code groups in the current database instance, query the DBA_DV_CODE view. |
| p_code | ID of the code. This ID is listed when you run the DBA_DV_CODE view. |

Example

```
BEGIN
  DBMS_MACADM.CREATE_RULE(
    rule_name => 'Get Label Algorithm for Maximum Level/Union/Null',
    rule_expr => 'DBMS_MACUTL.GET_CODE_VALUE(''LABEL_ALG'', ''HUN'') = ''Union''');
END;
/
```

20.2.3 GET_SECOND Function

The `GET_SECOND` function returns the seconds in Oracle SS (seconds) format (00–59), and then returns a `NUMBER` value.

It is useful for rule expressions based on time data.

Syntax

```
DBMS_MACUTL.GET_SECOND(
  p_date IN DATE DEFAULT SYSDATE)
RETURN NUMBER;
```

Parameter

Table 20-4 GET_SECOND Parameter

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_date | Date in SS format (for example, 59). If you do not specify a date, then Oracle Database Vault uses the Oracle Database SYSDATE function to retrieve the current date and time set for the operating system on which the database resides. |

Example

```
SET SERVEROUTPUT ON
DECLARE
  seconds number;
BEGIN
  seconds := DBMS_MACUTL.GET_SECOND(TO_DATE('03-APR-2009 6:56 PM',
    'dd-mon-yyyy hh:mi PM'));
  DBMS_OUTPUT.PUT_LINE('Seconds: '||seconds);
END;
/
```

This example, which uses a fixed date and time, returns the following:

```
Seconds: 56
```

20.2.4 GET_MINUTE Function

The `GET_MINUTE` function returns the minute in Oracle MI (minute) format (00–59), in a `NUMBER` value.

It is useful for rule expressions based on time data.

Syntax

```
DBMS_MACUTL.GET_MINUTE (
  p_date IN DATE DEFAULT SYSDATE)
RETURN NUMBER;
```

Parameter

Table 20-5 GET_MINUTE Parameter

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_date | Date in MI format (for example, 30, as in 2:30). If you do not specify a date, then Oracle Database Vault uses the Oracle Database SYSDATE function to retrieve the current date and time set for the operating system on which the database resides. |

Example

```
SET SERVEROUTPUT ON
DECLARE
  minute number;
BEGIN
  minute := DBMS_MACUTL.GET_MINUTE(SYSDATE);
  DBMS_OUTPUT.PUT_LINE('Minute: '||minute);
END;
/
```

Output similar to the following appears:

```
Minute: 17
```

20.2.5 GET_HOUR Function

The GET_HOUR function returns the hour in Oracle HH24 (hour) format (00–23), in a NUMBER value.

It is useful for rule expressions based on time data.

Syntax

```
DBMS_MACUTL.GET_HOUR (
  p_date IN DATE DEFAULT SYSDATE)
RETURN NUMBER;
```

Parameter

Table 20-6 GET_HOUR Parameter

| Parameter | Description |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_date | Date in HH24 format (for example, 14 for 2:00 p.m.) If you do not specify a date, then Oracle Database Vault uses the Oracle Database SYSDATE function to retrieve the current date and time set for the operating system on which the database resides. |

Example

```

SET SERVEROUTPUT ON
DECLARE
    hours number;
BEGIN
    hours := DBMS_MACUTL.GET_HOUR(SYSDATE);
    DBMS_OUTPUT.PUT_LINE('Hour: '||hours);
END;
/

```

Output similar to the following appears:

```
Hour: 12
```

20.2.6 GET_DAY Function

The `GET_DAY` function returns the day in Oracle DD (day) format (01–31), in a `NUMBER` value.

It is useful for rule expressions based on time data.

Syntax

```

DBMS_MACUTL.GET_DAY(
    p_date IN DATE DEFAULT SYSDATE)
RETURN NUMBER;

```

Parameter**Table 20-7 GET_DAY Parameter**

| Parameter | Description |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>p_date</code> | Date in DD format (for example, 01 for the first day of the month). If you do not specify a date, then Oracle Database Vault uses the Oracle Database <code>SYSDATE</code> function to retrieve the current date and time set for the operating system on which the database resides. |

Example

```

SET SERVEROUTPUT ON
DECLARE
    day number;
BEGIN
    day := DBMS_MACUTL.GET_DAY(SYSDATE);
    DBMS_OUTPUT.PUT_LINE('Day: '||day);
END;
/

```

Output similar to the following appears:

```
Day: 3
```

20.2.7 GET_MONTH Function

The `GET_MONTH` function returns the month in Oracle MM (month) format (01–12), in a `NUMBER` value.

It is useful for rule expressions based on time data.

Syntax

```
DBMS_MACUTL.GET_MONTH(  
  p_date IN DATE DEFAULT SYSDATE)  
RETURN NUMBER;
```

Parameter

Table 20-8 GET_MONTH Parameter

| Parameter | Description |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_date | Date in MM format (for example, 08 for the month of August). If you do not specify a date, then Oracle Database Vault uses the Oracle Database <code>SYSDATE</code> function to retrieve the current date and time set for the operating system on which the database resides. |

Example

```
SET SERVEROUTPUT ON  
DECLARE  
  month number;  
BEGIN  
  month := DBMS_MACUTL.GET_MONTH(SYSDATE);  
  DBMS_OUTPUT.PUT_LINE('Month: '||month);  
END;  
/
```

Output similar to the following appears:

```
Month: 4
```

20.2.8 GET_YEAR Function

The `GET_YEAR` function returns the year in Oracle YYYY (year) format (0001–9999), in a `NUMBER` value.

It is useful for rule expressions based on time data.

Syntax

```
DBMS_MACUTL.GET_YEAR(  
  p_date IN DATE DEFAULT SYSDATE)  
RETURN NUMBER;
```

Parameter

Table 20-9 GET_YEAR Parameter

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_date | Date in YYYY format (for example, 1984). If you do not specify a date, then Oracle Database Vault uses the SYSDATE function to retrieve the current date and time set for the operating system on which the database resides. |

Example

```
SET SERVEROUTPUT ON
DECLARE
  year number;
BEGIN
  year := DBMS_MACUTL.GET_YEAR(SYSDATE);
  DBMS_OUTPUT.PUT_LINE('Year: '||year);
END;
/
```

20.2.9 IS_ALPHA Function

The IS_ALPHA function returns a BOOLEAN value indicating if a character is alphabetic.

IS_ALPHA returns TRUE if the character is alphabetic.

Syntax

```
DBMS_MACUTL.IS_ALPHA(
  c IN VARCHAR2)
RETURN BOOLEAN;
```

Parameter

Table 20-10 IS_ALPHA Parameter

| Parameter | Description |
|-----------|---------------------------|
| c | String with one character |

Example

```
SET SERVEROUTPUT ON
BEGIN
  IF DBMS_MACUTL.IS_ALPHA('z')
  THEN DBMS_OUTPUT.PUT_LINE('The alphabetic character was found');
  ELSE
  DBMS_OUTPUT.PUT_LINE('No alphabetic characters today.');
```

```
END IF;
END;
/
```

20.2.10 IS_DIGIT Function

The `IS_DIGIT` function checks returns a `BOOLEAN` value indicating if a character is numeric.

`IS_DIGIT` returns `TRUE` if the character is a digit.

Syntax

```
DBMS_MACUTL.IS_DIGIT(  
  c IN VARCHAR2)  
RETURN BOOLEAN;
```

Parameter

Table 20-11 IS_DIGIT Parameter

| Parameter | Description |
|-----------|---------------------------|
| c | String with one character |

Example

```
SET SERVEROUTPUT ON  
BEGIN  
  IF DBMS_MACUTL.IS_DIGIT('7')  
    THEN DBMS_OUTPUT.PUT_LINE('The numeric character was found');  
  ELSE  
    DBMS_OUTPUT.PUT_LINE('No numeric characters today.');
```

```
  END IF;  
END;  
/
```

20.2.11 IS_DVSYST_OWNER Function

The `IS_DVSYST_OWNER` function returns a `BOOLEAN` value indicating if a user is authorized to manage the Oracle Database Vault configuration.

`IS_DVSYST_OWNER` returns `TRUE` if the user is authorized.

Syntax

```
DBMS_MACUTL.IS_DVSYST_OWNER(  
  p_user IN VARCHAR2 DEFAULT USER)  
RETURN BOOLEAN;
```

Parameter**Table 20-12 IS_DVSY_OWNER Parameter**

| Parameter | Description |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_user | <p>User to check.</p> <p>To find existing users, query the following data dictionary views:</p> <ul style="list-style-type: none"> DBA_USERS: Finds available users for the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular user or role. DBA_DV_ROLE: Finds existing secure application roles used in privilege management. |

Example

```

SET SERVEROUTPUT ON
BEGIN
  IF DBMS_MACUTL.IS_DVSY_OWNER('PSMITH')
  THEN DBMS_OUTPUT.PUT_LINE('PSMITH is authorized to manage Database Vault.');
```

20.2.12 IS_OLS_INSTALLED Function

The `IS_OLS_INSTALLED` function returns a `BOOLEAN` value indicating if Oracle Label Security is installed.

If Oracle Label Security is installed, `IS_OLS_INSTALLED` returns `TRUE`.

Syntax

```

DBMS_MACUTL.IS_OLS_INSTALLED()
RETURN BOOLEAN;
```

Parameters

None

Example

```

SET SERVEROUTPUT ON
BEGIN
  IF DBMS_MACUTL.IS_OLS_INSTALLED()
  THEN DBMS_OUTPUT.PUT_LINE('OLS is installed');
```


20.2.13 IS_OLS_INSTALLED_VARCHAR Function

The `IS_OLS_INSTALLED_VARCHAR` function returns a `BOOLEAN` value indicating if Oracle Label Security is installed.

If Oracle Label Security is installed, then `IS_OLS_INSTALLED_VARCHAR` returns `Y`.

Syntax

```
DBMS_MACUTL.IS_OLS_INSTALLED_VARCHAR()  
RETURN VARCHAR2;
```

Parameters

None

Example

```
SET SERVEROUTPUT ON  
BEGIN  
  IF DBMS_MACUTL.IS_OLS_INSTALLED()  
    THEN DBMS_OUTPUT.PUT_LINE('OLS is installed');  
  ELSE  
    DBMS_OUTPUT.PUT_LINE('OLS is not installed');  
  END IF;  
END;  
/
```

20.2.14 ROLE_GRANTED_ENABLED_VARCHAR Function

The `ROLE_GRANTED_ENABLED_VARCHAR` function returns a `VARCHAR2` value indicating the role grant and enablement status of a user.

`ROLE_GRANTED_ENABLED_VARCHAR` function checks whether a user has a role granted directly or indirectly (through another role) with a sufficient scope or the role currently is enabled in the session while the role is not granted. If either of these conditions are true, then it returns `Y`.

Because the `SYS_SESSION_ROLES` namespace of the `SYS_CONTEXT` function does not represent the logged in user roles when it is evaluated as a `DVSYS` command rule, Oracle recommends that you use the `ROLE_GRANTED_ENABLED_VARCHAR` function to check if a role is enabled for a logged in user.

Syntax

```
DBMS_MACUTL.ROLE_GRANTED_ENABLED_VARCHAR(  
  p_role IN VARCHAR2,  
  p_user IN VARCHAR2 DEFAULT USER,  
  p_profile IN NUMBER(38) DEFAULT 1,  
  p_scope IN VARCHAR2 DEFAULT LOCAL)  
RETURN VARCHAR2;
```

Parameters

Table 20-13 `ROLE_GRANTED_ENABLED_VARCHAR` Parameters

| Parameter | Description |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>p_role</code> | <p>Role to check.</p> <p>To find existing roles, query the following views:</p> <ul style="list-style-type: none"> • <code>DBA_ROLES</code>: Finds available roles in the current database instance. • <code>DBA_DV_REALM_AUTH</code>: Finds the authorization of a particular user or role. • <code>DBA_DV_ROLE</code>: Finds existing secure application roles used in privilege management. |
| <code>p_user</code> | <p>User to check. If you want to use <code>ROLE_GRANTED_ENABLED_VARCHAR</code> function as part of a rule evaluation, then you cannot set <code>p_user</code> to <code>CURRENT_USER</code> when <code>ROLE_GRANTED_ENABLED_VARCHAR</code> is being evaluated as an Oracle Database Vault rule. Instead, you can use the <code>SYS_CONTEXT</code> function <code>USERENV</code> namespace <code>SESSION_USER</code> to represent the login user.</p> <p>To find existing users, query the following views:</p> <ul style="list-style-type: none"> • <code>DBA_USERS</code>: Finds available users for the current database instance. • <code>DBA_DV_REALM_AUTH</code>: Finds the authorization of a particular user or role. |
| <code>p_profile</code> | <p>If you are using privilege analysis and the role being checked is used, then specify 1 so that privilege analysis can capture the usage of the role. Otherwise, enter 0.</p> |
| <code>p_scope</code> | <p>Specify either <code>COMMON</code> for a commonly granted role, or <code>LOCAL</code> for a locally granted role.</p> |

Example

This example shows how to use the `DBMS_MACUTL.ROLE_GRANTED_ENABLED_VARCHAR` function in a command rule to check if the logged in user has the enabled role of `EMPLOYEE`.

```
BEGIN
DBMS_MACADM.CREATE_RULE(
  rule_name => 'does role exist',
  rule_expr => 'DVSYS.DBMS_MACUTL.ROLE_GRANTED_ENABLED_VARCHAR(''EMPLOYEE'', ''''''||
dvsys.dv_login_user||''''') = ''Y''');
END;
/
```

20.2.15 `USER_HAS_OBJECT_PRIVILEGE` Function

The `USER_HAS_OBJECT_PRIVILEGE` function returns a `BOOLEAN` value indicating if user or role can access an object through a single specified object privilege grant.

If the user or role has the object privilege, then `USER_HAS_OBJECT_PRIVILEGE` returns `TRUE`.

Syntax

```
DBMS_MACUTL.USER_HAS_OBJECT_PRIVILEGE (
  p_user          VARCHAR2,
  p_object_owner  VARCHAR2,
  p_object_name   VARCHAR2,
  p_privilege     VARCHAR2)
RETURNS BOOLEAN;
```

Parameters

Table 20-14 USER_HAS_OBJECT_PRIVILEGE Parameters

| Parameter | Description |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_user | User or role to check. To find existing users, query the following views: <ul style="list-style-type: none"> DBA_USERS: Finds available users for the current database instance. DBA_ROLES: Finds available roles in the current database instance. DVA_DV_REALM_AUTH: Finds the authorization of a particular user or role. DBA_DV_ROLE: Finds existing secure application roles used in privilege management. |
| p_object_owner | Object owner, such as a schema. To find the available users, query the DBA_USERS view. To find the authorization of a particular user, query the DVA_DV_REALM_AUTH view. |
| p_object_name | Object name, such as a table within the schema specified in the p_object_owner parameter. To find the available objects, query the ALL_OBJECTS view. To find objects that are secured by existing realms, query the DBA_DV_REALM_OBJECT view. |
| p_privilege | Object privilege, such as, UPDATE. To find privileges for a database account excluding PUBLIC privileges, query the DBA_DV_USER_PRIVS view. To find all privileges for a database account, query the DBA_DV_USER_PRIVS_ALL view. |

Example

```

SET SERVEROUTPUT ON
BEGIN
  IF DBMS_MACUTL.USER_HAS_OBJECT_PRIVILEGE (
    'SECTOR2_APP_MGR', 'OE', 'ORDERS', 'UPDATE')
  THEN DBMS_OUTPUT.PUT_LINE('SECTOR2_APP_MGR has the UPDATE privilege for the OE.ORDERS
table');
  ELSE
    DBMS_OUTPUT.PUT_LINE('SECTOR2_APP_MGR does not have the UPDATE privilege for the
OE.ORDERS table.');
```

20.2.16 USER_HAS_ROLE Function

The USER_HAS_ROLE function returns a BOOLEAN value indicating if a user has a role privilege, directly or indirectly (through another role).

If the user has a role privilege, then USER_HAS_ROLE returns TRUE.

Syntax

```

DBMS_MACUTL.USER_HAS_ROLE(
  p_role IN VARCHAR2,
```

```
p_user IN VARCHAR2 DEFAULT USER)
RETURN BOOLEAN;
```

Parameters

Table 20-15 USER_HAS_ROLE Parameters

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_role | <p>Role privilege to check.</p> <p>To find existing roles, query the following views:</p> <ul style="list-style-type: none"> DBA_ROLES: Finds available roles in the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular user or role. DBA_DV_ROLE: Finds existing secure application roles used in privilege management. |
| p_user | <p>User to check.</p> <p>To find existing users, query the following views:</p> <ul style="list-style-type: none"> DBA_USERS: Finds available users for the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular user or role. |

Example

```
SET SERVEROUTPUT ON
BEGIN
  IF DBMS_MACUTL.USER_HAS_ROLE('SECTOR2_APP_MGR', 'PSMITH')
    THEN DBMS_OUTPUT.PUT_LINE('User PSMITH has the SECTOR2_APP_MGR role');
    ELSE
    DBMS_OUTPUT.PUT_LINE('User PSMITH does not have the SECTOR2_APP_MGR role.');
```

```
END IF;
END;
/
```

20.2.17 USER_HAS_ROLE_VARCHAR Function

The `USER_HAS_ROLE_VARCHAR` function returns a `VARCHAR2` value indicating if a user has a role privilege, directly or indirectly (through another role).

If the user has the role privilege specified, then `USER_HAS_ROLE_VARCHAR` returns Y.

Syntax

```
DBMS_MACUTL.USER_HAS_ROLE_VARCHAR(
  p_role IN VARCHAR2,
  p_user IN VARCHAR2 DEFAULT USER)
RETURN VARCHAR2;
```

Parameters

Table 20-16 USER_HAS_ROLE_VARCHAR Parameters

| Parameter | Description |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_role | <p>Role to check.</p> <p>To find existing roles, query the following views:</p> <ul style="list-style-type: none"> DBA_ROLES: Finds available roles in the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular user or role. DBA_DV_ROLE: Finds existing secure application roles used in privilege management. |
| p_user | <p>User to check.</p> <p>To find existing users, query the following views:</p> <ul style="list-style-type: none"> DBA_USERS: Finds available users for the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular user or role. |

20.2.18 USER_HAS_SYSTEM_PRIVILEGE Function

The `USER_HAS_SYSTEM_PRIVILEGE` function returns a `BOOLEAN` value indicating if a user has a system privilege, directly or indirectly (through a role).

If the user has the system privilege specified, then `USER_HAS_SYSTEM_PRIVILEGE` returns `TRUE`.

Syntax

```
DBMS_MACUTL.USER_HAS_SYSTEM_PRIVILEGE (
  p_privilege IN VARCHAR2,
  p_user      IN VARCHAR2 DEFAULT USER)
RETURN BOOLEAN;
```

Parameters

Table 20-17 USER_HAS_SYSTEM_PRIVILEGE Parameters

| Parameter | Description |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| p_privilege | <p>System privilege to check for.</p> <p>To find privileges for a database account excluding <code>PUBLIC</code> privileges, query the <code>DBA_DV_USER_PRIVS</code> view.</p> <p>To find all privileges for a database account, use <code>DBA_DV_USER_PRIVS_ALL</code>.</p> |
| p_user | <p>User to check.</p> <p>To find existing users, query the following views:</p> <ul style="list-style-type: none"> DBA_USERS: Finds available users for the current database instance. DBA_DV_REALM_AUTH: Finds the authorization of a particular user or role. |

Example

```
SET SERVEROUTPUT ON
BEGIN
  IF DBMS_MACUTL.USER_HAS_SYSTEM_PRIVILEGE('EXECUTE', 'PSMITH')
  THEN DBMS_OUTPUT.PUT_LINE('User PSMITH has the EXECUTE ANY PRIVILEGE privilege.');
```

```
  ELSE
    DBMS_OUTPUT.PUT_LINE('User PSMITH does not have the EXECUTE ANY PRIVILEGE
```

```
privilege.');
```

```
END IF;
```

```
END;
```

```
/
```

21

Oracle Database Vault General Administrative APIs

The `DBMS_MACADM` PL/SQL package and the `CONFIGURE_DV` standalone procedure enable you to perform general maintenance tasks.

- [DBMS_MACADM General System Maintenance Procedures](#)
The `DBMS_MACADM` PL/SQL package general system maintenance procedures perform tasks such as authorizing users or adding new language to Oracle Database Vault.
- [CONFIGURE_DV General System Maintenance Procedure](#)
The `CONFIGURE_DV` procedure configures the initial two Oracle Database user accounts, which are granted the `DV_OWNER` and `DV_ACCTMGR` roles, respectively.

21.1 DBMS_MACADM General System Maintenance Procedures

The `DBMS_MACADM` PL/SQL package general system maintenance procedures perform tasks such as authorizing users or adding new language to Oracle Database Vault.

- [ADD_APP_EXCEPTION Procedure](#)
The `ADD_APP_EXCEPTION` procedure enables a common user or package to access local schemas.
- [ADD-NLS_DATA Procedure](#)
The `ADD-NLS_DATA` procedure adds a new language to Oracle Database Vault.
- [ALLOW_COMMON_OPERATION Procedure](#)
The `ALLOW_COMMON_OPERATION` procedure controls the access that a local user has on common objects in a PDB.
- [AUTH_DATAPUMP_GRANT Procedure](#)
The `AUTH_DATAPUMP_GRANT` procedure authorizes an Oracle Data Pump user to grant Oracle Database Vault-protected roles and system privileges during an Oracle Data Pump import operation.
- [AUTH_DATAPUMP_CREATE_USER Procedure](#)
The `AUTH_DATAPUMP_CREATE_USER` procedure authorizes an Oracle Data Pump user to create users during an Oracle Data Pump import operation.
- [AUTH_DATAPUMP_GRANT_ROLE Procedure](#)
The `AUTH_DATAPUMP_GRANT_ROLE` procedure authorizes an Oracle Data Pump user to grant a specific role during an Oracle Data Pump import operation.
- [AUTH_DATAPUMP_GRANT_SYSPRIV Procedure](#)
The `AUTH_DATAPUMP_GRANT_SYSPRIV` procedure authorizes an Oracle Data Pump user to grant system privileges during an Oracle Data Pump import operation.
- [AUTHORIZE_DATAPUMP_USER Procedure](#)
The `AUTHORIZE_DATAPUMP_USER` procedure authorizes a user to perform Oracle Data Pump operations when Oracle Database Vault is enabled.

- [AUTHORIZE_DBCAPTURE Procedure](#)
The `AUTHORIZE_DBCAPTURE` procedure grants a user authorization to perform Oracle Database Replay workload capture operations.
- [AUTHORIZE_DBREPLAY Procedure](#)
The `AUTHORIZE_DBREPLAY` procedure grants a user authorization to perform Oracle Database Replay workload replay operations.
- [AUTHORIZE_DDL Procedure](#)
The `AUTHORIZE_DDL` procedure grants a user authorization to run Data Definition Language (DDL) statements on the specified schema.
- [AUTHORIZE_DIAGNOSTIC_ADMIN Procedure](#)
The `AUTHORIZE_DIAGNOSTIC_ADMIN` procedure authorizes a user to query diagnostic views and tables.
- [AUTHORIZE_MAINTENANCE_USER Procedure](#)
The `AUTHORIZE_MAINTENANCE_USER` procedure grants a user authorization to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.
- [AUTHORIZE_PREPROCESSOR Procedure](#)
The `AUTHORIZE_PREPROCESSOR` procedure grants a user authorization to run preprocessor programs through external tables.
- [AUTHORIZE_PROXY_USER Procedure](#)
The `AUTHORIZE_PROXY_USER` procedure grants a proxy user authorization to proxy other user accounts, as long as the proxy user has database authorization.
- [AUTHORIZE_SCHEDULER_USER Procedure](#)
The `AUTHORIZE_SCHEDULER_USER` procedure grants a user authorization to schedule database jobs when Oracle Database Vault is enabled.
- [AUTHORIZE_TTS_USER Procedure](#)
The `AUTHORIZE_TTS_USER` procedure authorizes a user to perform Oracle Data Pump transportable tablespace operations for a tablespace when Oracle Database Vault is enabled.
- [DELETE_APP_EXCEPTION Procedure](#)
The `DELETE_APP_EXCEPTION` procedure removes a common user or a common user's package from the Database Vault operations control exception list.
- [DISABLE_APP_PROTECTION Procedure](#)
The `DISABLE_APP_PROTECTION` procedure disables Database Vault operations control.
- [DISABLE_DV Procedure](#)
The `DISABLE_DV` procedure disables Oracle Database Vault.
- [DISABLE_DV_DICTIONARY_ACCTS Procedure](#)
The `DISABLE_DV_DICTIONARY_ACCTS` procedure prevents any user from logging into the database as the `DVSYS` or `DVF` schema user.
- [DISABLE_DV_PATCH_ADMIN_AUDIT Procedure](#)
The `DISABLE_DV_PATCH_ADMIN_AUDIT` procedure disables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.
- [DISABLE_ORADEBUG Procedure](#)
The `DISABLE_ORADEBUG` procedure disables the use of the `ORADEBUG` utility in an Oracle Database Vault environment.
- [ENABLE_APP_PROTECTION Procedure](#)
The `ENABLE_APP_PROTECTION` procedure enables Database Vault operations control.

- [ENABLE_DV Procedure](#)
The `ENABLE_DV` procedure enables Oracle Database Vault and Oracle Label Security.
- [ENABLE_DV_DICTIONARY_ACCTS Procedure](#)
The `ENABLE_DV_DICTIONARY_ACCTS` procedure enables users to log into the database as the `DVSY` or `DVF` user.
- [ENABLE_DV_PATCH_ADMIN_AUDIT Procedure](#)
The `ENABLE_DV_PATCH_ADMIN_AUDIT` procedure enables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.
- [ENABLE_ORADEBUG Procedure](#)
The `ENABLE_ORADEBUG` procedure enables the use of the `ORADEBUG` utility in an Oracle Database Vault environment.
- [UNAUTH_DATAPUMP_CREATE_USER Procedure](#)
The `UNAUTH_DATAPUMP_CREATE_USER` procedure removes authorization from an Oracle Data Pump user to create users during an Oracle Data Pump import operation.
- [UNAUTH_DATAPUMP_GRANT Procedure](#)
The `UNAUTH_DATAPUMP_GRANT` procedure removes authorization from an Oracle Data Pump user to grant Oracle Database Vault-protected roles and system privileges during an Oracle Data Pump import operation.
- [UNAUTH_DATAPUMP_GRANT_ROLE Procedure](#)
The `UNAUTH_DATAPUMP_GRANT_ROLE` procedure removes authorization from an Oracle Data Pump user to grant a specific role during an Oracle Data Pump import operation.
- [UNAUTH_DATAPUMP_GRANT_SYSPRIV Procedure](#)
The `UNAUTH_DATAPUMP_GRANT_SYSPRIV` procedure removes authorization from an Oracle Data Pump user to grant system privileges during an Oracle Data Pump import operation.
- [UNAUTHORIZE_DATAPUMP_USER Procedure](#)
The `UNAUTHORIZE_DATAPUMP_USER` procedure revokes the authorization that was granted by the `AUTHORIZE_DATAPUMP_USER` procedure.
- [UNAUTHORIZE_DBCAPTURE Procedure](#)
The `UNAUTHORIZE_DBCAPTURE` procedure revokes authorization from users to perform Oracle Database Replay workload capture operations.
- [UNAUTHORIZE_DBREPLAY Procedure](#)
The `UNAUTHORIZE_DBREPLAY` procedure revokes authorization from users to perform Oracle Database Replay workload replay operations.
- [UNAUTHORIZE_DDL Procedure](#)
The `UNAUTHORIZE_DDL` procedure revokes authorization from a user who was granted authorization to run DDL statements through the `DBMS_MACADM.AUTHORIZE_DDL` procedure.
- [UNAUTHORIZE_DIAGNOSTIC_ADMIN Procedure](#)
The `UNAUTHORIZE_DIAGNOSTIC_ADMIN` procedure revokes authorization from a user who was authorized with the `DBMS_MACADM.AUTHORIZE_DIAGNOSTIC_ADMIN` procedure to query diagnostic views and tables.
- [UNAUTHORIZE_MAINTENANCE_USER Procedure](#)
The `UNAUTHORIZE_MAINTENANCE_USER` procedure revokes privileges from users who have been granted authorization to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.
- [UNAUTHORIZE_PREPROCESSOR Procedure](#)
The `UNAUTHORIZE_PREPROCESSOR` procedure revokes authorization from a user to run preprocessor programs through external tables.

- [UNAUTHORIZE_PROXY_USER Procedure](#)
The UNAUTHORIZE_PROXY_USER procedure revokes authorization from a user who was granted proxy authorization from the DBMS_MACADM.AUTHORIZE_PROXY_USER procedure.
- [UNAUTHORIZE_SCHEDULER_USER Procedure](#)
The UNAUTHORIZE_SCHEDULER_USER procedure revokes the authorization that was granted by the AUTHORIZE_SCHEDULER_USER procedure.
- [UNAUTHORIZE_TTS_USER Procedure](#)
The UNAUTHORIZE_TTS_USER procedure removes from authorization users who had previously been granted the authorization to perform Oracle Data Pump transportable tablespace operations.

21.1.1 ADD_APP_EXCEPTION Procedure

The ADD_APP_EXCEPTION procedure enables a common user or package to access local schemas.

Use this procedure when you are configuring Database Vault operations control to automatically restrict common users from accessing pluggable database (PDB) local data. The procedure applies to the entire container, so you must run it from the CDB root. When the exception is for a package, then owner statements from the given package can access local schemas.

Syntax

```
DBMS_MACADM.ADD_APP_EXCEPTION(
  owner          IN VARCHAR2,
  package_name   IN VARCHAR2);
```

Parameters

Table 21-1 ADD_APP_EXCEPTION

| Parameter | Description |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| owner | Name of the user who you want to add as an exception To find a list of available common users, query the USERNAME and COMMON columns of the DBA_USERS data dictionary view. |
| package_name | Name of the package that you want to add as an exception if you want to specify a package instead of the entire user account. This package must be owned by the user specified in the owner parameter. If you want to create an exception for the entire schema and not any particular package, then specify '%' for the package_name parameter. |

Examples

```
EXEC DBMS_MACADM.ADD_APP_EXCEPTION ('C##HR_ADMIN', '%'); --Applies to the user
c##hr_admin
```

```
EXEC DBMS_MACADM.ADD_APP_EXCEPTION('C##HR_ADMIN', 'validateHRdata'); --Applies to the
package validateHRdata
```

Related Topics

- [Adding Common Users and Packages to an Exception List](#)
Common users and applications that must access PDB local data can be added to an exception list.

- [ENABLE_APP_PROTECTION Procedure](#)
The `ENABLE_APP_PROTECTION` procedure enables Database Vault operations control.
- [DISABLE_APP_PROTECTION Procedure](#)
The `DISABLE_APP_PROTECTION` procedure disables Database Vault operations control.
- [DELETE_APP_EXCEPTION Procedure](#)
The `DELETE_APP_EXCEPTION` procedure removes a common user or a common user's package from the Database Vault operations control exception list.

21.1.2 ADD_NLS_DATA Procedure

The `ADD_NLS_DATA` procedure adds a new language to Oracle Database Vault.

Syntax

```
DBMS_MACADM.ADD_NLS_DATA (
    language          IN VARCHAR );
```

Parameters

Table 21-2 ADD_NLS_DATA

| Parameter | Description |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| language | Enter one of the following settings. (This parameter is case insensitive.) <ul style="list-style-type: none"> • ENGLISH • GERMAN • SPANISH • FRENCH • ITALIAN • JAPANESE • KOREAN • BRAZILIAN PORTUGUESE • SIMPLIFIED CHINESE • TRADITIONAL CHINESE |

Examples

```
EXEC DBMS_MACADM.ADD_NLS_DATA('french');
```

21.1.3 ALLOW_COMMON_OPERATION Procedure

The `ALLOW_COMMON_OPERATION` procedure controls the access that a local user has on common objects in a PDB.

This procedure can only be run in the CDB root by a common user who has been granted the `DV_OWNER` role in the root.

Syntax

```
DBMS_MACADM.ALLOW_COMMON_OPERATION (
    status          IN BOOLEAN DEFAULT TRUE);
```

Parameters

Table 21-3 ALLOW_COMMON_OPERATION

| Parameter | Description |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| status | <p>Enter one of the following settings:</p> <ul style="list-style-type: none"> TRUE prevents local users from creating Oracle Database Vault controls on common user objects. This setting applies to existing local PDB Database Vault controls that were created on common user objects, so that they will not be enforced on common users. Alternatively, you can run this procedure without including any parameter to achieve a TRUE result. FALSE enables local users to create Database Vault controls on common user objects. Existing local PDB controls that were created on common user objects will continue to be enforced. If you do not run DBMS_MACADM.ALLOW_COMMON_OPERATION at all, then the default ALLOW_COMMON_OPERATION status is FALSE, and the default behavior will be to allow local users to create Database Vault controls on common user objects |

Example

```
EXEC DBMS_MACADM.ALLOW_COMMON_OPERATION('TRUE');
```

21.1.4 AUTH_DATAPUMP_GRANT Procedure

The AUTH_DATAPUMP_GRANT procedure authorizes an Oracle Data Pump user to grant Oracle Database Vault-protected roles and system privileges during an Oracle Data Pump import operation.

This procedure applies to the impdp utility only. Be aware that this authorization does not cover Oracle Database Vault roles such as DV_OWNER, DV_ADMIN, DV_MONITOR, and so on.

Syntax

```
DBMS_MACADM.AUTH_DATAPUMP_GRANT(
  uname      IN VARCHAR2);
```

Parameters

Table 21-4 AUTH_DATAPUMP_GRANT

| Parameter | Description |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| user_name | <p>Name of the Oracle Data Pump user who will need to grant roles and privileges to users during the import operation.</p> <p>To find a user's current status, query the DBA_DV_DATAPUMP_AUTH data dictionary view.</p> |

Example

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_GRANT('DP_MGR');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.5 AUTH_DATAPUMP_CREATE_USER Procedure

The `AUTH_DATAPUMP_CREATE_USER` procedure authorizes an Oracle Data Pump user to create users during an Oracle Data Pump import operation.

This procedure applies to the `impdp` utility only.

Syntax

```
DBMS_MACADM.AUTH_DATAPUMP_CREATE_USER (
    uname          IN VARCHAR2);
```

Parameters

Table 21-5 AUTH_DATAPUMP_CREATE_USER

| Parameter | Description |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| uname | Name of the Oracle Data Pump user who will need to create users during the import operation. To find the user's current status, query the <code>DBA_DV_DATAPUMP_AUTH</code> data dictionary view. |

Example

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_CREATE_USER('DP_MGR');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.6 AUTH_DATAPUMP_GRANT_ROLE Procedure

The `AUTH_DATAPUMP_GRANT_ROLE` procedure authorizes an Oracle Data Pump user to grant a specific role during an Oracle Data Pump import operation.

This procedure applies to the `impdp` utility only.

Syntax

```
DBMS_MACADM.AUTH_DATAPUMP_GRANT_ROLE (
    uname          IN VARCHAR2,
    role           IN VARCHAR2 DEFAULT %);
```

Parameters

Table 21-6 AUTH_DATAPUMP_GRANT_ROLE

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| uname | Name of the Oracle Data Pump user who will need to grant a specific role to users during the import operation. To find a user's current status, query the <code>DBA_DV_DATAPUMP_AUTH</code> data dictionary view. |

Table 21-6 (Cont.) AUTH_DATAPUMP_GRANT_ROLE

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| role | The role to grant to the user. Do not specify Oracle Database Vault roles such as DV_OWNER, DV_ADMIN, DV_MONITOR, and so on. If you omit this value or specify %, then the user is authorized to grant any roles (other than Oracle Database Vault roles) during the import operation. Note that if the user has been authorized with the DBMS_MACADM.AUTH_DATAPUMP_GRANT procedure, or if the user has authorization to grant a specific role, then the user can still grant these roles. |

Example

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_GRANT_ROLE('DP_MGR', 'DBA');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.7 AUTH_DATAPUMP_GRANT_SYSPRIV Procedure

The AUTH_DATAPUMP_GRANT_SYSPRIV procedure authorizes an Oracle Data Pump user to grant system privileges during an Oracle Data Pump import operation.

The procedure applies the IMPDP utility only.

Syntax

```
DBMS_MACADM.AUTH_DATAPUMP_GRANT_SYSPRIV(  
  uname          IN VARCHAR2);
```

Parameters**Table 21-7 AUTH_DATAPUMP_GRANT_SYSPRIV**

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| uname | Name of the Oracle Data Pump user who will need to grant system privileges to users during the IMPDP operation. To find a user's current status, query the DBA_DV_DATAPUMP_AUTH data dictionary view. |

Example

```
EXEC DBMS_MACADM.AUTH_DATAPUMP_GRANT_SYSPRIV('DP_MGR');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.8 AUTHORIZE_DATAPUMP_USER Procedure

The `AUTHORIZE_DATAPUMP_USER` procedure authorizes a user to perform Oracle Data Pump operations when Oracle Database Vault is enabled.

It applies to both the `expdp` and `impdp` utilities.

Syntax

```
DBMS_MACADM.AUTHORIZE_DATAPUMP_USER (
    user_name      IN VARCHAR2,
    schema_name    IN VARCHAR2 DEFAULT NULL,
    table_name     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 21-8 `AUTHORIZE_DATAPUMP_USER`

| Parameter | Description |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>user_name</code> | Name of the Oracle Data Pump user to whom you want to grant authorization. To find a list of users who have privileges to use Oracle Data Pump (that is, the <code>EXP_FULL_DATABASE</code> and <code>IMP_FULL_DATABASE</code> roles), query the <code>DBA_ROLE_PRIVS</code> data dictionary view as follows: <pre>SELECT GRANTEE, GRANTED_ROLE FROM DBA_ROLE_PRIVS WHERE GRANTED_ROLE LIKE '%FULL%'</pre> |
| <code>schema_name</code> | Name of the database schema that the Oracle Data Pump user must export or import. If you omit this parameter, then the user is granted global authorization to export and import any schema in the database. In this case, ensure the user has been granted the <code>DV_OWNER</code> role. |
| <code>table_name</code> | Name of the table within the schema specified by the <code>schema_name</code> parameter. If you omit this parameter, then the user you specified can export and import all tables within the schema specified by the <code>schema_name</code> parameter. |

Examples

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR');
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR', 'HR');
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR', 'HR', 'EMPLOYEES');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.9 AUTHORIZE_DBCAPTURE Procedure

The `AUTHORIZE_DBCAPTURE` procedure grants a user authorization to perform Oracle Database Replay workload capture operations.

To find information about users who have been granted this authorization, query the `DBA_DV_DBCAPTURE_AUTH` data dictionary view.

Syntax

```
DBMS_MACADM.AUTHORIZE_DBCAPTURE (
  uname      IN VARCHAR2);
```

Parameters**Table 21-9 AUTHORIZE_DBCAPTURE**

| Parameter | Description |
|-----------|-------------------------------------------------------------------------------------------|
| uname | Name of the user to whom you want to grant Database Replay workload capture authorization |

Example 21-1 Example

```
EXEC DBMS_MACADM.AUTHORIZE_DBCAPTURE('PFITCH');
```

21.1.10 AUTHORIZE_DBREPLAY Procedure

The `AUTHORIZE_DBREPLAY` procedure grants a user authorization to perform Oracle Database Replay workload replay operations.

To find information about users who have been granted this authorization, query the `DBA_DV_DBREPLAY_AUTH` data dictionary view.

Syntax

```
DBMS_MACADM.AUTHORIZE_DBREPLAY (
  uname      IN VARCHAR2);
```

Parameters**Table 21-10 AUTHORIZE_DBREPLAY**

| Parameter | Description |
|-----------|------------------------------------------------------------------------------------------|
| uname | Name of the user to whom you want to grant Database Replay workload replay authorization |

Example 21-2 Example

```
EXEC DBMS_MACADM.AUTHORIZE_DBREPLAY('PFITCH');
```

21.1.11 AUTHORIZE_DDL Procedure

The `AUTHORIZE_DDL` procedure grants a user authorization to run Data Definition Language (DDL) statements on the specified schema.

The DDL authorization allows the grantee to perform DDL operations on users who are authorized to realms or granted Oracle Database Vault roles. However, the DDL authorization does not allow the grantee to perform DDL operations on realm-protected schemas. To enable such operations, you must authorize the user for the realm.

To find information about users who have been granted this authorization, query the `DBA_DV_DDL_AUTH` data dictionary view.

Syntax

```
DBMS_MACADM.AUTHORIZE_DDL(
  user_name      IN VARCHAR2,
  schema_name    IN VARCHAR2);
```

Parameters

Table 21-11 AUTHORIZE_DDL

| Parameter | Description |
|-------------|--------------------------------------------------------------------------------------------------------------------|
| user_name | Name of the user to whom you want to grant DDL authorization. |
| schema_name | Name of the database schema in which the user wants to perform the DDL statements. Enter % to specify all schemas. |

Examples

The following example enables user `psmith` to run DDL statements in any schema:

```
EXEC DBMS_MACADM.AUTHORIZE_DDL('psmith', '%');
```

This example enables user `psmith` to run DDL statements in the `HR` schema only.

```
EXEC DBMS_MACADM.AUTHORIZE_DDL('psmith', 'HR');
```

Related Topics

- [Performing DDL Operations in Oracle Database Vault](#)
Data Definition Language (DDL) operations in Oracle Database Vault can be affected by situations such as schema ownership and patch upgrades.

21.1.12 AUTHORIZE_DIAGNOSTIC_ADMIN Procedure

The `AUTHORIZE_DIAGNOSTIC_ADMIN` procedure authorizes a user to query diagnostic views and tables.

These views and tables are as follows:

| Views and Tables V\$ | Views and Tables X\$ |
|--------------------------------|----------------------|
| V\$DIAG_OPT_TRACE_RECORDS | X\$DBGTFOPTT |
| V\$DIAG_SESS_OPT_TRACE_RECORDS | X\$DBGTFSOPTT |
| V\$DIAG_TRACE_FILE_CONTENTS | X\$DBGTFVIEW |

Without this authorization, when a user queries these tables and views, no values are returned.

Syntax

```
DBMS_MACADM.AUTHORIZE_DIAGNOSTIC_ADMIN(
  uname          IN VARCHAR2);
```

Parameters

Table 21-12 AUTHORIZE_DIAGNOSTIC_ADMIN

| Parameter | Description |
|-----------|-----------------------------------------------------------|
| uname | Name of the user to whom you want to grant authorization. |

Example

```
EXEC DBMS_MACADM.AUTHORIZE_DIAGNOSTIC_ADMIN('PFITCH');
```

21.1.13 AUTHORIZE_MAINTENANCE_USER Procedure

The `AUTHORIZE_MAINTENANCE_USER` procedure grants a user authorization to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.

To find information about users who have been granted this authorization, query the `DBA_DV_MAINTENANCE_AUTH` view.

Syntax

```
DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER (
  uname      IN VARCHAR2,
  sname      IN VARCHAR2 DEFAULT NULL,
  objname    IN VARCHAR2 DEFAULT NULL,
  objtype    IN VARCHAR2 DEFAULT NULL,
  action     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 21-13 AUTHORIZE_MAINTENANCE_USER

| Parameter | Description |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| uname | Name of the user to whom you want to grant authorization |
| sname | Name of the database schema for which the maintenance operations are to be performed. Enter % to specify all schemas. |
| objname | Name of the object (such as the name of a table) in the schema that is specified in the <code>sname</code> parameter for which maintenance operations are to be performed |
| objtype | Type of the <code>objname</code> object, such as <code>table</code> , <code>index</code> , <code>tablespace</code> , and so on |
| action | Maintenance action. Enter <code>ilm</code> for Information Lifecycle Management |

Example

The following example enables user `psmith` to have Database Vault authorization to manage ILM features for the `HR.EMPLOYEES` table:

```
BEGIN
  DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER (
    uname      => 'psmith',
    sname      => 'HR',
    objname    => 'EMPLOYEES',
    objtype    => 'TABLE',
    action     => 'ILM');
```

```
END;
/
```

Related Topics

- [Using Information Lifecycle Management with Oracle Database Vault](#)
Users who perform Information Lifecycle Management operations on an Oracle Database Vault-enabled database must be granted authorization to perform these operations.

21.1.14 AUTHORIZE_PREPROCESSOR Procedure

The `AUTHORIZE_PREPROCESSOR` procedure grants a user authorization to run preprocessor programs through external tables.

To find information about users who have been granted this authorization, query the `DBA_DV_PREPROCESSOR_AUTH` data dictionary view.

Syntax

```
DBMS_MACADM.AUTHORIZE_PREPROCESSOR (
    uname          IN VARCHAR2);
```

Parameters

Table 21-14 `AUTHORIZE_PREPROCESSOR`

| Parameter | Description |
|--------------------|---------------------------------------------------------------------------------------------------------------|
| <code>uname</code> | Name of the user to whom you want to grant authorization to run preprocessor programs through external tables |

Example 21-3 Example

```
EXEC DBMS_MACADM.AUTHORIZE_PREPROCESSOR('PFITCH');
```

Related Topics

- [Running Preprocessor Programs with Oracle Database Vault](#)
Users who run preprocessor programs through external tables must have Oracle Database Vault-specific authorization.
- [DBA_DV_PREPROCESSOR_AUTH View](#)
The `DBA_DV_PREPROCESSOR_AUTH` data dictionary view shows users who have been granted authorization to run preprocessor programs through external tables.

21.1.15 AUTHORIZE_PROXY_USER Procedure

The `AUTHORIZE_PROXY_USER` procedure grants a proxy user authorization to proxy other user accounts, as long as the proxy user has database authorization.

For example, the `CREATE SESSION` privilege is a valid database authorization.

`AUTHORIZE_PROXY_USER` does not control whether a particular user can connect as a proxy of another user. That part is controlled by `GRANT CONNECT THROUGH`, which can be issued only by the a user who has the `DV_ACCTMGR` role. Instead, `AUTHORIZE_PROXY_USER` controls whether the proxy user is allowed to assume all the Database Vault authorizations that the target user has. For example, suppose that the proxy user `hr_proxy_user` successfully connects as user `HR`. Now being `HR`, `hr_proxy_user` can access all the objects to which `HR` has access. However, if

the target objects are Database Vault protected and HR is authorized to access it, hr_proxy_user can access the objects if and only if hr_proxy_user is proxy-authorized for HR. If hr_proxy_user is not proxy-authorized for HR, then even after connecting as HR, hr_proxy_user cannot access the Database Vault-protected objects for which HR is authorized.

To find information about users who have been granted authorization using AUTHORIZE_PROXY_USER, query the DBA_DV_PROXY_AUTH view.

Syntax

```
DBMS_MACADM.AUTHORIZE_PROXY_USER(
  proxy_user  IN VARCHAR2,
  user_name   IN VARCHAR2);
```

Parameters

Table 21-15 AUTHORIZE_PROXY_USER

| Parameter | Description |
|------------|-----------------------------------------------------------------------------------------------------|
| proxy_user | Name of the proxy user. |
| user_name | Name of the database user who will be proxied by the proxy_user user. Enter % to specify all users. |

Examples

The following example enables proxy user preston to proxy all users:

```
EXEC DBMS_MACADM.AUTHORIZE_PROXY_USER('preston', '%');
```

This example enables proxy user preston to proxy database user dkent only.

```
EXEC DBMS_MACADM.AUTHORIZE_PROXY_USER('preston', 'dkent');
```

21.1.16 AUTHORIZE_SCHEDULER_USER Procedure

The AUTHORIZE_SCHEDULER_USER procedure grants a user authorization to schedule database jobs when Oracle Database Vault is enabled.

This authorization applies to anyone who has privileges to schedule database jobs. These privileges include any of the following: CREATE JOB, CREATE ANY JOB, CREATE EXTERNAL JOB, EXECUTE ANY PROGRAM, EXECUTE ANY CLASS, MANAGE SCHEDULER.

Syntax

```
DBMS_MACADM.AUTHORIZE_SCHEDULER_USER(
  user_name      IN VARCHAR2,
  schema_name    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 21-16 AUTHORIZE_SCHEDULER_USER

| Parameter | Description |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| user_name | Name of the user to whom you want to grant authorization. To find a list of users who have privileges (for example, CREATE JOB and CREATE ANY JOB) to schedule jobs, query the GRANTEE and PRIVILEGE columns of the DBA_SYS_PRIVS data dictionary view. |
| schema_name | Name of the database schema for which a job will be scheduled. If you omit this parameter, then the user is granted global authorization to schedule a job for any schema in the database. |

Examples

The following example authorizes the user JOB_MGR to run a job under any schema.

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('JOB_MGR');
```

This example authorizes user JOB_MGR to run a job under the HR schema only.

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('JOB_MGR', 'HR');
```

Related Topics

- [Using Oracle Scheduler with Oracle Database Vault](#)
Users who are responsible for scheduling database jobs must have Oracle Database Vault-specific authorization.

21.1.17 AUTHORIZE_TTS_USER Procedure

The AUTHORIZE_TTS_USER procedure authorizes a user to perform Oracle Data Pump transportable tablespace operations for a tablespace when Oracle Database Vault is enabled.

It applies to both the EXPDP and IMPDP utilities.

Syntax

```
DBMS_MACADM.AUTHORIZE_TTS_USER(
  uname      IN VARCHAR2,
  tname      IN VARCHAR2);
```

Parameters

Table 21-17 AUTHORIZE_TTS_USER

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| uname | Name of the user who you want to authorize to perform Oracle Data Pump transportable tablespace operations. To find a list of users and their current privileges, query the DBA_SYS_PRIVS data dictionary view. |

Table 21-17 (Cont.) AUTHORIZE_TTS_USER

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| tsname | Name of the tablespace in which the uname user is to perform the transportable tablespace operation. To find a list of tablespaces, query the DBA_TABLESPACES data dictionary view. |

Example

```
EXEC DBMS_MACADM.AUTHORIZE_TTS_USER('PSMITH', 'HR_TS');
```

Related Topics

- [Authorizing Users or Roles for Oracle Data Pump Regular Operations in Database Vault](#)
You can authorize a database administrator or a role to use Data Pump for regular operations in an Oracle Database Vault environment.

21.1.18 DELETE_APP_EXCEPTION Procedure

The `DELETE_APP_EXCEPTION` procedure removes a common user or a common user's package from the Database Vault operations control exception list.

The exception list allows a user or package to access local PDB data. Removing a user or package from the exception list will block the user or package from accessing PDB local data.

Syntax

```
DBMS_MACADM.DELETE_APP_EXCEPTION (
  owner          IN VARCHAR2,
  package_name  IN VARCHAR2);
```

Parameters**Table 21-18 DELETE_APP_EXCEPTION**

| Parameter | Description |
|--------------|---------------------------------------------------------------------|
| owner | Name of the user who you want to remove from being an exception |
| package_name | Name of the package that you want to remove from being an exception |

Examples

```
EXEC DBMS_MACADM.DELETE_APP_EXCEPTION ('C##HR_ADMIN'); --Applies to the user c##hr_admin
```

```
EXEC DBMS_MACADM.DELETE_APP_EXCEPTION('C##HR_ADMIN', 'validateHRdata'); --Applies to the package validateHRdata
```

Related Topics

- [Adding Common Users and Packages to an Exception List](#)
Common users and applications that must access PDB local data can be added to an exception list.

- [ADD_APP_EXCEPTION Procedure](#)
The `ADD_APP_EXCEPTION` procedure enables a common user or package to access local schemas.
- [ENABLE_APP_PROTECTION Procedure](#)
The `ENABLE_APP_PROTECTION` procedure enables Database Vault operations control.
- [DISABLE_APP_PROTECTION Procedure](#)
The `DISABLE_APP_PROTECTION` procedure disables Database Vault operations control.

21.1.19 DISABLE_APP_PROTECTION Procedure

The `DISABLE_APP_PROTECTION` procedure disables Database Vault operations control.

Syntax

```
DBMS_MACADM.DISABLE_APP_PROTECTION(
  pdb_name      IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 21-19 DISABLE_APP_PROTECTION

| Parameter | Description |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>pdb_name</code> | Name of the pluggable database (PDB) for which you want to disable Database Vault operations control. If you omit this setting, then it applies to all PDBs in the CDB environment. To find a list of available PDBs, query the <code>DBA_PDBS</code> data dictionary view. |

Examples

```
EXEC DBMS_MACADM.DISABLE_APP_PROTECTION; --Applies to all PDBs
```

```
EXEC DBMS_MACADM.DISABLE_APP_PROTECTION('hr_pdb'); --Applies to a specific PDB
```

Related Topics

- [Disabling Database Vault Operations Control](#)
To disable Database Vault operations control, use the `DBMS_MACADM.DISABLE_APP_PROTECTION` PL/SQL procedure.

21.1.20 DISABLE_DV Procedure

The `DISABLE_DV` procedure disables Oracle Database Vault.

After you run this procedure, you must restart the database.

Syntax

```
DBMS_MACADM.DISABLE_DV;
```

Parameters

None

Example

```
EXEC DBMS_MACADM.DISABLE_DV;
```

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

21.1.21 DISABLE_DV_DICTIONARY_ACCTS Procedure

The `DISABLE_DV_DICTIONARY_ACCTS` procedure prevents any user from logging into the database as the `DVSY` or `DVF` schema user.

By default these two accounts are locked. Only a user who has been granted the `DV_OWNER` role can run this procedure. To find the status of whether users can log into `DVSY` and `DVF`, query the `DBA_DV_DICTIONARY_ACCTS` data dictionary view. For stronger security, run this procedure to better protect the `DVSY` and `DVF` schemas. The disablement takes place immediately, so you do not need to restart the database after running this procedure.

Syntax

```
DBMS_MACADM.DISABLE_DV_DICTIONARY_ACCTS;
```

Parameters

None

Example

```
EXEC DBMS_MACADM.DISABLE_DV_DICTIONARY_ACCTS;
```

Related Topics

- [Archiving and Purging the Oracle Database Vault Audit Trail](#)
If you have not migrated to unified auditing, you should periodically archive and purge the Oracle Database Vault audit trail.

21.1.22 DISABLE_DV_PATCH_ADMIN_AUDIT Procedure

The `DISABLE_DV_PATCH_ADMIN_AUDIT` procedure disables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.

This procedure disables the successful actions of this user, not the failed actions. You should run this procedure after the `DV_PATCH_ADMIN` user has completed database patch operation. To find if auditing is enabled or not, query the `DBA_DV_PATCH_AUDIT` data dictionary view.

Syntax

```
DBMS_MACADM.DISABLE_DV_PATCH_ADMIN_AUDIT;
```

Parameters

None

Example

```
EXEC DBMS_MACADM.DISABLE_DV_PATCH_ADMIN_AUDIT;
```


Related Topics

- [DV_PATCH_ADMIN Database Vault Database Patch Role](#)
The DV_PATCH_ADMIN role is used for patching operations.
- [ENABLE_DV_PATCH_ADMIN_AUDIT Procedure](#)
The ENABLE_DV_PATCH_ADMIN_AUDIT procedure enables realm, command rule, and rule set auditing of the actions by users who have the DV_PATCH_ADMIN role.

21.1.23 DISABLE_ORADEBUG Procedure

The DISABLE_ORADEBUG procedure disables the use of the ORADEBUG utility in an Oracle Database Vault environment.

The disablement takes place immediately, so you do not need to restart the database after running this procedure. To find the status of whether the ORADEBUG utility is available in Database Vault, query the DVYS.DBA_DV_ORADEBUG data dictionary view.

Syntax

```
DBMS_MACADM.DISABLE_ORADEBUG;
```

Parameters

None

Example

```
EXEC DBMS_MACADM.DISABLE_ORADEBUG;
```

Related Topics

- [Using the ORADEBUG Utility with Oracle Database Vault](#)
The ORADEBUG utility is used primarily by Oracle Support to diagnose problems that may arise with an Oracle database.

21.1.24 ENABLE_APP_PROTECTION Procedure

The ENABLE_APP_PROTECTION procedure enables Database Vault operations control.

Syntax

```
DBMS_MACADM.ENABLE_APP_PROTECTION(  
  pdb_name      IN VARCHAR2 DEFAULT NULL);
```

Parameters**Table 21-20** ENABLE_APP_PROTECTION

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| pdb_name | Allows a single PDB to have Database Vault operations control re-enabled after it was disabled. The default is to omit the pdb_name setting and then enable operations control across all of the PDBs. To find a list of available PDBs, query the DBA_PDBS data dictionary view. |

Examples

```
EXEC DBMS_MACADM.ENABLE_APP_PROTECTION; --Applies to all PDBs
```

```
EXEC DBMS_MACADM.ENABLE_APP_PROTECTION('hr_pdb'); --Applies to a specific PDB
```

Related Topics

- [Enabling Database Vault Operations Control](#)
To enable Database Vault operations control, use the `DBMS_MACADM.ENABLE_APP_PROTECTION` PL/SQL procedure.

21.1.25 ENABLE_DV Procedure

The `ENABLE_DV` procedure enables Oracle Database Vault and Oracle Label Security.

If you want to run `DBMS_MACADM.ENABLE_DV` in an application container, then you must run it in the application container outside of application actions.

After you run this procedure, you must restart the database.

Syntax

```
DBMS_MACADM.ENABLE_DV(  
  strict_mode IN VARCHAR2 DEFAULT);
```

Parameters

Table 21-21 ENABLE_DV

| Parameter | Description |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>strict_mode</code> | <p>Specifies one of the following modes:</p> <ul style="list-style-type: none"> • <code>n</code> specifies regular mode, which allows the PDBs to be Database Vault enabled or disabled. (Default) • <code>y</code> specifies strict mode, which puts the PDBs that have not been Database Vault-enabled in restricted mode, until you enable Database Vault in them and then restart the PDB. <p>To apply this setting to all PDBs, run the <code>DBMS_MACADM.ENABLE_DV</code> procedure in the CDB root. To apply it to all PDBs in an application container, run the procedure in the application root.</p> |

Examples

The following example enables Oracle Database Vault in regular mode.

```
EXEC DBMS_MACADM.ENABLE_DV;
```

This example enables Oracle Database Vault in strict mode.

```
EXEC DBMS_MACADM.ENABLE_DV (strict_mode => 'y');
```

Related Topics

- [Disabling and Enabling Oracle Database Vault](#)
Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

21.1.26 ENABLE_DV_DICTIONARY_ACCTS Procedure

The `ENABLE_DV_DICTIONARY_ACCTS` procedure enables users to log into the database as the `DVSY` or `DVF` user.

By default, the `DVSY` and `DVF` accounts are locked.

Only a user who has been granted the `DV_OWNER` role can run this procedure. To find the status of whether users can log into `DVSY` and `DVF`, query the `DBA_DV_DICTIONARY_ACCTS` data dictionary view. For stronger security, only run this procedure when you need to better protect the `DVSY` and `DVF` schemas. The enablement takes place immediately, so you do not need to restart the database after running this procedure.

Syntax

```
DBMS_MACADM.ENABLE_DV_DICTIONARY_ACCTS;
```

Parameters

None

Example

```
EXEC DBMS_MACADM.ENABLE_DV_DICTIONARY_ACCTS;
```

Related Topics

- [Archiving and Purging the Oracle Database Vault Audit Trail](#)
If you have not migrated to unified auditing, you should periodically archive and purge the Oracle Database Vault audit trail.

21.1.27 ENABLE_DV_PATCH_ADMIN_AUDIT Procedure

The `ENABLE_DV_PATCH_ADMIN_AUDIT` procedure enables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.

This procedure is designed to audit these users' actions during a patch upgrade. To find if this auditing is enabled or not, query the `DBA_DV_PATCH_AUDIT` data dictionary view.

Syntax

```
DBMS_MACADM.ENABLE_DV_PATCH_ADMIN_AUDIT;
```

Parameters

None

Example

```
EXEC DBMS_MACADM.ENABLE_DV_PATCH_ADMIN_AUDIT;
```

Related Topics

- [DV_PATCH_ADMIN Database Vault Database Patch Role](#)
The `DV_PATCH_ADMIN` role is used for patching operations.
- [DISABLE_DV_PATCH_ADMIN_AUDIT Procedure](#)
The `DISABLE_DV_PATCH_ADMIN_AUDIT` procedure disables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.

21.1.28 ENABLE_ORADEBUG Procedure

The `ENABLE_ORADEBUG` procedure enables the use of the `ORADEBUG` utility in an Oracle Database Vault environment.

The enablement takes place immediately, so you do not need to restart the database after running this procedure. To find the status of whether the `ORADEBUG` utility is available in Database Vault, query the `DVYS.DBA_DV_ORADEBUG` data dictionary view.

Syntax

```
DBMS_MACADM.ENABLE_ORADEBUG;
```

Parameters

None

Example

```
EXEC DBMS_MACADM.ENABLE_ORADEBUG;
```

Related Topics

- [Using the ORADEBUG Utility with Oracle Database Vault](#)
The `ORADEBUG` utility is used primarily by Oracle Support to diagnose problems that may arise with an Oracle database.

21.1.29 UNAUTH_DATAPUMP_CREATE_USER Procedure

The `UNAUTH_DATAPUMP_CREATE_USER` procedure removes authorization from an Oracle Data Pump user to create users during an Oracle Data Pump import operation.

This procedure applies to the `impdp` utility only.

Syntax

```
DBMS_MACADM.UNAUTH_DATAPUMP_CREATE_USER (
    uname          IN VARCHAR2);
```

Parameters

Table 21-22 UNAUTH_DATAPUMP_CREATE_USER

| Parameter | Description |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>uname</code> | Name of the Oracle Data Pump user whose authorization must be removed. To find a user's current status, query the <code>DBA_DV_DATAPUMP_AUTH</code> data dictionary view. |

Example

```
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_CREATE_USER ('DP_MGR');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.30 UNAUTH_DATAPUMP_GRANT Procedure

The `UNAUTH_DATAPUMP_GRANT` procedure removes authorization from an Oracle Data Pump user to grant Oracle Database Vault-protected roles and system privileges during an Oracle Data Pump import operation.

This procedure applies to the `impdp` utility only.

Syntax

```
DBMS_MACADM.UNAUTH_DATAPUMP_GRANT (
  uname          IN VARCHAR2);
```

Parameters

Table 21-23 UNAUTH_DATAPUMP_GRANT

| Parameter | Description |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>user_name</code> | Name of the Oracle Data Pump user whose authorization must be removed. To find a user's current status, query the <code>DBA_DV_DATAPUMP_AUTH</code> data dictionary view. |

Example

```
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_GRANT('DP_MGR');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.31 UNAUTH_DATAPUMP_GRANT_ROLE Procedure

The `UNAUTH_DATAPUMP_GRANT_ROLE` procedure removes authorization from an Oracle Data Pump user to grant a specific role during an Oracle Data Pump import operation.

This procedure applies to the `impdp` utility only.

Syntax

```
DBMS_MACADM.UNAUTH_DATAPUMP_GRANT_ROLE (
  uname          IN VARCHAR2,
  role           IN VARCHAR2 DEFAULT %);
```

Parameters

Table 21-24 UNAUTH_DATAPUMP_GRANT_ROLE

| Parameter | Description |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>uname</code> | Name of the Oracle Data Pump user whose authorization must be removed. To find a user's current status, query the <code>DBA_DV_DATAPUMP_AUTH</code> data dictionary view. |

Table 21-24 (Cont.) UNAUTH_DATAPUMP_GRANT_ROLE

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| role | The role that the user is authorized to grant during the import operation. Do not specify Oracle Database Vault roles such as DV_OWNER, DV_ADMIN, DV_MONITOR, and so on. If you omit this value, then the user is not authorized to grant roles during the import. |

Example

```
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_GRANT_ROLE('DP_MGR', 'DBA');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.32 UNAUTH_DATAPUMP_GRANT_SYSPRIV Procedure

The UNAUTH_DATAPUMP_GRANT_SYSPRIV procedure removes authorization from an Oracle Data Pump user to grant system privileges during an Oracle Data Pump import operation.

This procedure applies the impdp utility only.

Syntax

```
DBMS_MACADM.UNAUTH_DATAPUMP_GRANT_SYSPRIV(
  uname          IN VARCHAR2);
```

Parameters**Table 21-25 UNAUTH_DATAPUMP_GRANT_SYSPRIV**

| Parameter | Description |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| uname | Name of the Oracle Data Pump user whose authorization must be removed. To find a user's current status, query the DBA_DV_DATAPUMP_AUTH data dictionary view. |

Example

```
EXEC DBMS_MACADM.UNAUTH_DATAPUMP_GRANT_SYSPRIV('DP_MGR');
```

Related Topics

- [Authorizing Users or Roles for Data Pump Regular Export and Import Operations](#)
You can use different authorization types for administrators who perform Oracle Data Pump export and import operations in a Database Vault environment.

21.1.33 UNAUTHORIZE_DATAPUMP_USER Procedure

The `UNAUTHORIZE_DATAPUMP_USER` procedure revokes the authorization that was granted by the `AUTHORIZE_DATAPUMP_USER` procedure.

When you run this procedure, ensure that its settings correspond exactly to the equivalent `AUTHORIZE_DATAPUMP_USER` procedure.

For example, the following two procedures will work because the parameters are consistent:

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('DP_MGR');
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('DP_MGR');
```

However, because the parameters in the following procedures are not consistent, the `UNAUTHORIZE_DATAPUMP_USER` procedure will not work:

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('JSMITH');
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('JSMITH', 'HR');
```

Syntax

```
DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER (
  user_name      IN VARCHAR2,
  schema_name    IN VARCHAR2 DEFAULT NULL,
  table_name     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 21-26 UNAUTHORIZE_DATAPUMP_USER

| Parameter | Description |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>user_name</code> | Name of the Oracle Data Pump user from whom you want to revoke authorization. To find a list of users and authorizations from the <code>AUTHORIZE_DATAPUMP_USER</code> procedure, query the <code>DBA_DV_DATAPUMP_AUTH</code> data dictionary view as follows: <pre>SELECT * FROM DBA_DV_DATAPUMP_AUTH;</pre> |
| <code>schema_name</code> | Name of the database schema that the Oracle Data Pump user is authorized to export or import. |
| <code>table_name</code> | Name of the table within the schema specified by the <code>schema_name</code> parameter. |

Examples

```
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('JSMITH');
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('JSMITH', 'HR');
EXEC DBMS_MACADM.UNAUTHORIZE_DATAPUMP_USER('JSMITH', 'HR', 'SALARY');
```

21.1.34 UNAUTHORIZE_DBCAPTURE Procedure

The UNAUTHORIZE_DBCAPTURE procedure revokes authorization from users to perform Oracle Database Replay workload capture operations.

To find information about users who have been granted this authorization, query the DBA_DV_DBCAPTURE_AUTH data dictionary view.

Syntax

```
DBMS_MACADM.UNAUTHORIZE_DBCAPTURE (
  uname          IN VARCHAR2);
```

Parameters

Table 21-27 UNAUTHORIZE_DBCAPTURE

| Parameter | Description |
|-----------|----------------------------------------------------------------------------------------------|
| uname | Name of the user from whom you want to revoke Database Replay workload capture authorization |

Example 21-4 Example

```
EXEC DBMS_MACADM.UNAUTHORIZE_DBCAPTURE('PFITCH');
```

21.1.35 UNAUTHORIZE_DBREPLAY Procedure

The UNAUTHORIZE_DBREPLAY procedure revokes authorization from users to perform Oracle Database Replay workload replay operations.

To find information about users who have been granted this authorization, query the DBA_DV_DBREPLAY_AUTH data dictionary view.

Syntax

```
DBMS_MACADM.UNAUTHORIZE_DBREPLAY (
  uname          IN VARCHAR2);
```

Parameters

Table 21-28 UNAUTHORIZE_DBREPLAY

| Parameter | Description |
|-----------|---------------------------------------------------------------------------------------------|
| uname | Name of the user from whom you want to revoke Database Replay workload replay authorization |

Example 21-5 Example

```
EXEC DBMS_MACADM.UNAUTHORIZE_DBREPLAY('PFITCH');
```


21.1.36 UNAUTHORIZE_DDL Procedure

The `UNAUTHORIZE_DDL` procedure revokes authorization from a user who was granted authorization to run DDL statements through the `DBMS_MACADM.AUTHORIZE_DDL` procedure.

To find information about users who have been granted this authorization, query the `DBA_DV_DDL_AUTH` data dictionary view.

Syntax

```
DBMS_MACADM.UNAUTHORIZE_DDL (
    user_name      IN VARCHAR2,
    schema_name    IN VARCHAR2);
```

Parameters

Table 21-29 UNAUTHORIZE_DDL

| Parameter | Description |
|--------------------------|-----------------------------------------------------------------------------------------------------------------|
| <code>user_name</code> | Name of the user from whom you want to revoke DDL authorization. |
| <code>schema_name</code> | Name of the database schema in which the user wants to perform the DDL statements. Enter % specify all schemas. |

Examples

The following example revokes DDL statement execution authorization from user `psmith` for all schemas:

```
EXEC DBMS_MACADM.UNAUTHORIZE_DDL('psmith', '%');
```

This example revokes DDL statement execution authorization from user `psmith` for the `HR` schema only.

```
EXEC DBMS_MACADM.UNAUTHORIZE_DDL('psmith', 'HR');
```

Related Topics

- [Performing DDL Operations in Oracle Database Vault](#)
Data Definition Language (DDL) operations in Oracle Database Vault can be affected by situations such as schema ownership and patch upgrades.

21.1.37 UNAUTHORIZE_DIAGNOSTIC_ADMIN Procedure

The `UNAUTHORIZE_DIAGNOSTIC_ADMIN` procedure revokes authorization from a user who was authorized with the `DBMS_MACADM.AUTHORIZE_DIAGNOSTIC_ADMIN` procedure to query diagnostic views and tables.

These views and tables are as follows:

| Views and Tables V\$ | Views and Tables X\$ |
|---------------------------------------------|----------------------------|
| <code>V\$DIAG_OPT_TRACE_RECORDS</code> | <code>X\$DBGTFOPTT</code> |
| <code>V\$DIAG_SESS_OPT_TRACE_RECORDS</code> | <code>X\$DBGTFSOPTT</code> |
| <code>V\$DIAG_TRACE_FILE_CONTENTS</code> | <code>X\$DBGTFVIEW</code> |

Without this authorization, when a user queries these tables and views, no values are returned.

Syntax

```
DBMS_MACADM.UNAUTHORIZE_DIAGNOSTIC_ADMIN(
  uname      IN VARCHAR2);
```

Parameters

Table 21-30 UNAUTHORIZE_DIAGNOSTIC_ADMIN

| Parameter | Description |
|-----------|--------------------------------------------------------------|
| uname | Name of the user from whom you want to revoke authorization. |

Example

```
EXEC DBMS_MACADM.UNAUTHORIZE_DIAGNOSTIC_ADMIN('PFITCH');
```

21.1.38 UNAUTHORIZE_MAINTENANCE_USER Procedure

The `UNAUTHORIZE_MAINTENANCE_USER` procedure revokes privileges from users who have been granted authorization to perform Information Lifecycle Management (ILM) operations in an Oracle Database Vault environment.

To find information about the settings for the ILM authorization, query the `DBA_DV_MAINTENANCE_AUTH` view.

When you run this procedure, ensure that its settings correspond exactly to the equivalent `AUTHORIZE_MAINTENANCE_USER` procedure.

For example, the following two procedures will work because the parameter settings correspond:

```
EXEC DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER('psmith', 'OE', 'ORDERS', 'TABLE', 'ILM');
EXEC DBMS_MACADM.UNAUTHORIZE_MAINTENANCE_USER('psmith', 'OE', 'ORDERS', 'TABLE', 'ILM');
```

However, these two statements will fail because the settings do not correspond:

```
EXEC DBMS_MACADM.AUTHORIZE_MAINTENANCE_USER('psmith', 'OE', 'ORDERS', 'TABLE', 'ILM');
EXEC DBMS_MACADM.UNAUTHORIZE_MAINTENANCE_USER('psmith', '%', '%', '%', 'ILM');
```

Syntax

```
DBMS_MACADM.UNAUTHORIZE_MAINTENANCE_USER(
  uname      IN VARCHAR2,
  sname      IN VARCHAR2 DEFAULT NULL,
  objname    IN VARCHAR2 DEFAULT NULL,
  objtype    IN VARCHAR2 DEFAULT NULL,
  action     IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 21-31 UNAUTHORIZE_MAINTENANCE_USER

| Parameter | Description |
|-----------|-------------------------------------------------------------|
| uname | Name of the user from whom you want to revoke authorization |

Table 21-31 (Cont.) UNAUTHORIZE_MAINTENANCE_USER

| Parameter | Description |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| sname | Name of the database schema for which the maintenance operations are performed. Enter % to specify all schemas. |
| objname | Name of the object (such as the name of a table) in the schema that is specified in the sname parameter for which maintenance operations are performed |
| objtype | Type of the objname object, such as table, index, tablespace, and so on |
| action | Maintenance action. Enter ilm for Information Lifecycle Management |

Example

The following example revokes privileges from Database Vault user psmith so that they can no longer perform ILM operations in any HR schema objects:

```
BEGIN
  DBMS_MACADM.UNAUTHORIZE_MAINTENANCE_USER (
    uname      => 'psmith',
    sname      => 'HR',
    objname    => 'EMPLOYEES',
    objtype    => 'TABLE',
    action     => 'ILM');
END;
/
```

Related Topics

- [Using Information Lifecycle Management with Oracle Database Vault](#)
Users who perform Information Lifecycle Management operations on an Oracle Database Vault-enabled database must be granted authorization to perform these operations.

21.1.39 UNAUTHORIZE_PREPROCESSOR Procedure

The UNAUTHORIZE_PREPROCESSOR procedure revokes authorization from a user to run preprocessor programs through external tables.

To find information about users who have been granted this authorization, query the DBA_DV_PREPROCESSOR_AUTH data dictionary view.

Syntax

```
DBMS_MACADM.UNAUTHORIZE_PREPROCESSOR (
  uname      IN VARCHAR2);
```

Parameters**Table 21-32 UNAUTHORIZE_PREPROCESSOR**

| Parameter | Description |
|-----------|------------------------------------------------------------------------------------------------------------------|
| uname | Name of the user from whom you want to revoke authorization to run preprocessor programs through external tables |

Example 21-6 Example

```
EXEC DBMS_MACADM.UNAUTHORIZE_PREPROCESSOR('PFITCH');
```

Related Topics

- [Running Preprocessor Programs with Oracle Database Vault](#)
Users who run preprocessor programs through external tables must have Oracle Database Vault-specific authorization.
- [DBA_DV_PREPROCESSOR_AUTH View](#)
The `DBA_DV_PREPROCESSOR_AUTH` data dictionary view shows users who have been granted authorization to run preprocessor programs through external tables.

21.1.40 UNAUTHORIZE_PROXY_USER Procedure

The `UNAUTHORIZE_PROXY_USER` procedure revokes authorization from a user who was granted proxy authorization from the `DBMS_MACADM.AUTHORIZE_PROXY_USER` procedure.

Syntax

```
DBMS_MACADM.UNAUTHORIZE_PROXY_USER(
    proxy_user IN VARCHAR2,
    user_name  IN VARCHAR2);
```

Parameters

Table 21-33 UNAUTHORIZE_PROXY_USER

| Parameter | Description |
|-------------------------|--------------------------------------------------------------------------------------------------------------|
| <code>proxy_user</code> | Name of the proxy user from whom you want to revoke authorization. |
| <code>user_name</code> | Name of the database user who was proxied by the <code>proxy_user</code> user. Enter % to specify all users. |

Examples

The following example revokes proxy authorization from user `preston` for proxying all users:

```
DBMS_MACADM.UNAUTHORIZE_PROXY_USER('preston', '%');
```

This example revokes proxy authorization from user `preston` for proxying database user `psmith` only.

```
EXEC DBMS_MACADM.UNAUTHORIZE_PROXY_USER('preston', 'psmith');
```

21.1.41 UNAUTHORIZE_SCHEDULER_USER Procedure

The `UNAUTHORIZE_SCHEDULER_USER` procedure revokes the authorization that was granted by the `AUTHORIZE_SCHEDULER_USER` procedure.

When you run this procedure, ensure that its settings correspond exactly to the equivalent `AUTHORIZE_SCHEDULER_USER` procedure. For example, the following two procedures will work because the parameters are consistent:

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('JOB_MGR');
```

```
EXEC DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER('JOB_MGR');
```

However, because the parameters in the following procedures are not consistent, the `UNAUTHORIZE_SCHEDULER_USER` procedure will not work:

```
EXEC DBMS_MACADM.AUTHORIZE_SCHEDULER_USER('JOB_MGR');

EXEC DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER('JOB_MGR', 'HR');
```

Syntax

```
DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER
  user_name      IN VARCHAR2,
  schema_name    IN VARCHAR2 DEFAULT NULL);
```

Parameters

Table 21-34 UNAUTHORIZE_SCHEDULER_USER

| Parameter | Description |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| user_name | Name of the job scheduling user from whom you want to revoke authorization. To find a list of users and authorizations from the AUTHORIZE_SCHEDULER_USER procedure, query the DBA_DV_JOB_AUTH data dictionary view as follows: SELECT * FROM DBA_DV_JOB_AUTH; |
| schema_name | Name of the database schema for which the user is authorized to schedule jobs. |

Examples

```
EXEC DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER('JOB_MGR');

EXEC DBMS_MACADM.UNAUTHORIZE_SCHEDULER_USER('JOB_MGR', 'HR');
```

21.1.42 UNAUTHORIZE_TTS_USER Procedure

The UNAUTHORIZE_TTS_USER procedure removes from authorization users who had previously been granted the authorization to perform Oracle Data Pump transportable tablespace operations.

Syntax

```
DBMS_MACADM.UNAUTHORIZE_TTS_USER
  uname          IN VARCHAR2,
  tname          IN VARCHAR2);
```

Parameters

Table 21-35 UNAUTHORIZE_TTS_USER

| Parameter | Description |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| uname | Name of the user who you want to remove from being authorized to perform Oracle Data Pump transportable tablespace operations. To find a list of users and their current privileges, query the DBA_SYS_PRIVS data dictionary view. |

Table 21-35 (Cont.) UNAUTHORIZE_TTS_USER

| Parameter | Description |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| tsname | Name of the tablespace that is used in the transportable tablespace operation. To find a list of tablespaces, query the DBA_TABLESPACES data dictionary view. |

Example

```
EXEC DBMS_MACADM.UNAUTHORIZE_TTS_USER('PSMITH', 'HR_TS');
```

21.2 CONFIGURE_DV General System Maintenance Procedure

The `CONFIGURE_DV` procedure configures the initial two Oracle Database user accounts, which are granted the `DV_OWNER` and `DV_ACCTMGR` roles, respectively.

You can check the status of this configuration by querying the `DBA_DV_STATUS` data dictionary view. Before you run the `CONFIGURE_DV` procedure, you must create the two user accounts and grant them the `CREATE SESSION` privilege. The accounts can be either local or common. If you create common user accounts, then the Database Vault roles that are granted to these users apply to the current pluggable database (PDB) only. You then refer to these user accounts for the `CONFIGURE_DV` procedure.

The `CONFIGURE_DV` procedure resides in the `SYS` schema. Oracle provides a synonym, `DVSYD.CONFIGURE_DV`, so that any existing Oracle Database Vault configuration scripts that you may have created in previous releases will continue to work in this release.

You only can run the `CONFIGURE_DV` procedure once, when you are ready to configure and enable Oracle Database Vault with an Oracle database. After you run this procedure, you must run `utlrp.sql` script and then `DBMS_MACADM.ENABLE_DV` to complete the registration process. Oracle strongly recommends that for better security, you use the two accounts you create here as back-up accounts and then create additional accounts for every day use.

If after running `CONFIGURE_DV` you decide that you want to modify the settings that you had entered, you or another user who has the `DV_OWNER` role must disable Database Vault, and then have an administrator with the `SYSDBA` or `SYSOPER` administrative privilege restart the database. As user `SYS`, then commonly grant the `DV_OWNER` user the `DV_OWNER` role, with the `CONTAINER` clause set to `ALL`.

When you run the `CONFIGURE_DV` procedure, it checks the `DVSYD` schema for problems such as missing tables or packages. If it finds problems, then it raises an `ORA-47500 Database Vault cannot be configured` error. If this happens, then you can reinstall Oracle Database Vault onto a PDB by running `catmac.sql`.

Together, the `CONFIGURE_DV` and `DBMS_MACADM.ENABLE_DV` procedures, and the `utlrp.sql` script, are designed to be a command-line alternative to using Oracle Database Configuration Assistant (DBCA) to configure and enable Oracle Database Vault with an Oracle database.

When you configure and enable Oracle Database Vault with an Oracle database, you must run the `CONFIGURE_DV` procedure as user `SYS`.

Syntax

```
CONFIGURE_DV
  dvowner_uname          IN VARCHAR2,
  dvacctmgr_uname       IN VARCHAR2,
  force_local_dvowner   IN BOOLEAN;
```

Parameters

Table 21-36 CONFIGURE_DV

| Parameter | Description |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| dvowner_uname | Name of the user who will be the Database Vault Owner. This user will be granted the DV_OWNER role. |
| dvacctmgr_uname | Name of the user who will be the Database Vault Account Manager. This user will be granted the DV_ACCTMGR role. If you omit this setting, the user specified by the dvowner_uname parameter is made the Database Vault Account Manager and granted the DV_ACCTMGR role. |
| force_local_dvowner | Applies only to the DV_OWNER (dvowner_uname user) in the CDB root or an application root. It does not apply to users who are created in a PDB. <ul style="list-style-type: none"> • TRUE restricts the DV_OWNER role privileges of the dvowner_uname user to be local to the root. • FALSE, the default setting, enables the dvowner_uname user to have DV_OWNER privileges for all containers that are associated with the root. |

Example

```
CREATE USER c##dbv_owner_root_backup IDENTIFIED BY password CONTAINER = CURRENT;
CREATE USER c##dbv_acctmgr_root_backup IDENTIFIED BY password CONTAINER = CURRENT;
GRANT CREATE SESSION TO c##dbv_owner_root_backup, c##dbv_acctmgr_root_backup;
```

```
BEGIN
CONFIGURE_DV (
  dvowner_uname          => 'c##dbv_owner_root_backup',
  dvacctmgr_uname       => 'c##adbv_acctmgr_root_backup',
  force_local_dvowner   => TRUE);
END;
/
```

Related Topics

- [Backup Oracle Database Vault Accounts](#)
As a best practice, you should maintain backup accounts for the DV_OWNER and DV_ACCTMGR roles.
- [Uninstalling Oracle Database Vault](#)
You can uninstall Oracle Database Vault from an Oracle Database installation, for PDBs (but not the root) and Oracle RAC installations.
- [Reinstalling Oracle Database Vault](#)
You can reinstall Oracle Database Vault by manually installing it, and then afterward, configure and enable it.
- [Getting Started with Oracle Database Vault](#)
Before you can start using Oracle Database Vault, you must configure and enable it with the Oracle database.

Oracle Database Vault Policy APIs

You can use the `DBMS_MACADM` PL/SQL package to manage Oracle Database Vault policies.

Only users who have been granted the `DV_OWNER` or `DV_ADMIN` role can use these procedures.

- [ADD_CMD_RULE_TO_POLICY Procedure](#)
The `ADD_COMMAND_RULE_TO_POLICY` procedure enables you to add an existing command rule to an Oracle Database Vault policy.
- [ADD_OWNER_TO_POLICY Procedure](#)
The `ADD_OWNER_TO_POLICY` procedure enables you to add an existing database user to an Oracle Database Vault policy as an owner.
- [ADD_REALM_TO_POLICY Procedure](#)
The `ADD_REALM_TO_POLICY` procedure enables you to add an existing realm to an Oracle Database Vault policy.
- [CREATE_POLICY Procedure](#)
The `CREATE_POLICY` procedure enables you to create an Oracle Database Vault policy.
- [DELETE_CMD_RULE_FROM_POLICY Procedure](#)
The `DELETE_CMD_RULE_FROM_POLICY` procedure enables you to remove an existing command rule from an Oracle Database Vault policy.
- [DELETE_OWNER_FROM_POLICY Procedure](#)
The `DELETE_OWNER_FROM_POLICY` procedure enables you to remove an owner from an Oracle Database Vault policy.
- [DELETE_REALM_FROM_POLICY Procedure](#)
The `DELETE_REALM_FROM_POLICY` procedure enables you to remove an existing realm from an Oracle Database Vault policy.
- [DROP_POLICY Procedure](#)
The `DROP_POLICY` procedure enables you to drop an existing Oracle Database Vault policy.
- [RENAME_POLICY Procedure](#)
The `UPDATE_POLICY_DESCRIPTION` procedure enables you to rename an existing Oracle Database Vault policy.
- [UPDATE_POLICY_DESCRIPTION Procedure](#)
The `UPDATE_POLICY_DESCRIPTION` procedure enables you to update the `description` field in an Oracle Database Vault policy.
- [UPDATE_POLICY_STATE Procedure](#)
The `UPDATE_POLICY_STATE` procedure enables you to update the `policy_state` field in an Oracle Database Vault policy.

Related Topics

- [Configuring Oracle Database Vault Policies](#)
You can use Oracle Database Vault policies to implement frequently used realm and command rule settings.
- [Oracle Database Vault Utility APIs](#)
Oracle Database Vault provides a set of utility APIs in the `DBMS_MACUTL` PL/SQL package.

22.1 ADD_CMD_RULE_TO_POLICY Procedure

The `ADD_COMMAND_RULE_TO_POLICY` procedure enables you to add an existing command rule to an Oracle Database Vault policy.

You can add a command rule to a policy when the command rule is in any state. For example, you can add a disabled command rule to an enabled policy. In this case, the disabled command rule will automatically become enabled when it is added to the policy. A command rule can be added to only one policy. In other words, you cannot assign the same command rule to multiple policies.

Syntax

```
DBMS_MACADM.ADD_CMD_RULE_TO_POLICY(
  policy_name      IN VARCHAR2,
  command         IN VARCHAR2,
  object_owner    IN VARCHAR2,
  object_name     IN VARCHAR2,
  clause_name     IN VARCHAR2 DEFAULT,
  parameter_name  IN VARCHAR2 DEFAULT,
  event_name      IN VARCHAR2 DEFAULT,
  component_name  IN VARCHAR2 DEFAULT,
  action_name     IN VARCHAR2 DEFAULT,
  scope          IN NUMBER DEFAULT);
```

Parameters

Table 22-1 ADD_CMD_RULE_TO_POLICY Parameters

| Parameter | Description |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Policy name. To find existing Database Vault policies in the current database instance, query the <code>DBA_DV_POLICY</code> view. |
| <code>command</code> | Command rule name To find existing Database Vault command rules in the current database instance, query the <code>DBA_DV_COMMAND_RULE</code> view. |
| <code>object_owner</code> | Database schema to which the command rule applies To find existing object owners for this command rule, query the <code>DBA_DV_COMMAND_RULE</code> view. |
| <code>object_name</code> | Object to be protected by the command rule To find existing objects for this command rule, query the <code>DBA_DV_COMMAND_RULE</code> view. |
| <code>clause_name</code> | For <code>ALTER SYSTEM</code> and <code>ALTER SESSION</code> command rules, a clause from the SQL statement that was used to create the command rule To find existing clauses for this command rule, query the <code>DBA_DV_COMMAND_RULE</code> view. |
| <code>parameter_name</code> | For <code>ALTER SYSTEM</code> and <code>ALTER SESSION</code> command rules, a parameter from the <code>clause_name</code> parameter. To find existing parameters for this command rule, query the <code>DBA_DV_COMMAND_RULE</code> view. |

Table 22-1 (Cont.) ADD_CMD_RULE_TO_POLICY Parameters

| Parameter | Description |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| event_name | For ALTER SYSTEM and ALTER SESSION command rules, an event that the command rule defines To find existing event names for this command rule, query the DBA_DV_COMMAND_RULE view. |
| component_name | A component of the event_name setting To find existing component names for this command rule, query the DBA_DV_COMMAND_RULE view. |
| action_name | An action of the component_name setting. To find existing action names for this command rule, query the DBA_DV_COMMAND_RULE view. |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule applies to all the PDBs |

Example

The following example shows how to add a common command rule to a Database Vault policy. This command rule is in the application root of a multitenant environment, so the user running this procedure must be in the application root or the CDB root. Any rules or rule sets that are associated with this command rule must be common.

```
BEGIN
DBMS_MACADM.ADD_CMD_RULE_TO_POLICY(
  policy_name => 'HR_DV_Policy',
  command     => 'ALTER SESSION',
  object_owner => '%',
  object_name  => '%',
  clause_name  => 'PARALLEL DDL',
  parameter_name => '',
  event_name   => '',
  action_name  => '',
  scope       => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

22.2 ADD_OWNER_TO_POLICY Procedure

The ADD_OWNER_TO_POLICY procedure enables you to add an existing database user to an Oracle Database Vault policy as an owner.

When you add an owner to an enabled policy, the change takes place immediately. There is no limit to the number of users that you add to the policy.

Syntax

```
DBMS_MACADM.ADD_OWNER_TO_POLICY(
  policy_name IN VARCHAR2,
  owner_name  IN VARCHAR2);
```

Parameters

Table 22-2 ADD_OWNER_TO_POLICY Parameters

| Parameter | Description |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| policy_name | Policy name. To find existing Database Vault policies in the current database instance, query the DBA_DV_POLICY view. |
| owner_name | User name. To find existing database users (not roles) in the current instance, query the DBA_USERS view. To find existing policy owners, query the DBA_DV_POLICY_OWNER view. |

Example

```
BEGIN
  DBMS_MACADM.ADD_OWNER_TO_POLICY(
    policy_name => 'HR_DV_Policy',
    owner_name  => 'PSMITH');
END;
/
```

22.3 ADD_REALM_TO_POLICY Procedure

The `ADD_REALM_TO_POLICY` procedure enables you to add an existing realm to an Oracle Database Vault policy.

You can add a disabled realm to an enabled policy. In this case, the realm automatically becomes enabled when it is added. A realm can be added to only one policy. In other words, you cannot assign the same realm to multiple policies.

Syntax

```
DBMS_MACADM.ADD_REALM_TO_POLICY(
  policy_name  IN VARCHAR2,
  realm_name   IN VARCHAR2);
```

Parameters

Table 22-3 ADD_REALM_TO_POLICY Parameters

| Parameter | Description |
|-------------|-----------------------------------------------------------------------------------------------------------------------|
| policy_name | Policy name. To find existing Database Vault policies in the current database instance, query the DBA_DV_POLICY view. |
| realm_name | Realm name. To find existing Database Vault realms in the current database instance. |

Example

```
BEGIN
  DBMS_MACADM.ADD_REALM_TO_POLICY(
    policy_name  => 'HR_DV_Policy',
    realm_name   => 'HR Realm');
END;
/
```

22.4 CREATE_POLICY Procedure

The `CREATE_POLICY` procedure enables you to create an Oracle Database Vault policy.

After you create the policy, you must add at least one realm and one command rule to the policy. Optionally, you can set these realms and command rules to be enforced individually or use the enforcement that the policy uses.

An owner for the policy is not required, but if you do not assign an owner to the policy, a user who has been granted the `DV_OWNER` or `DV_ADMIN` role must administer the policy.

After you create the policy, use the following procedures to complete the policy definition:

- `ADD_REALM_TO_POLICY` adds realms to the policy.
- `ADD_CMD_RULE_TO_POLICY` adds command rules to the policy.
- `ADD_OWNER_TO_POLICY` enables the specified database users to manage the policy.

Syntax

```
DBMS_MACADM.CREATE_POLICY(
  policy_name  IN VARCHAR2,
  description  IN VARCHAR2 DEFAULT,
  policy_state IN NUMBER,
  pl_sql_stack IN BOOLEAN DEFAULT);
```

Parameters

Table 22-4 CREATE_POLICY Parameters

| Parameter | Description |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Policy name, up to 128 characters in mixed case To find existing policies in the current database instance, query the <code>DBA_DV_POLICY</code> view. |
| <code>description</code> | Description of the purpose of the policy, up to 4000 characters in mixed-case. |
| <code>policy_state</code> | Specifies how the policy is enabled. Possible values are: <ul style="list-style-type: none"> • <code>DBMS_MACADM.G_ENABLED</code> (1), which enables the policy after you create it • <code>DBMS_MACADM.G_DISABLED</code> (0), which disables the policy after you create it • <code>DBMS_MACADM.G_SIMULATION</code> (2), which sets the policy to simulation mode. In simulation mode, any violations to realms or command rules used in the policy are logged in a designated log table with sufficient information to describe the error, such as the user name or SQL statement used. See also Related Topics. • <code>DBMS_MACADM.G_PARTIAL</code> (3), which sets the policy to partial mode. In partial mode, the enforcement state of realms or command rules associated with the policy can be changed individually. |
| <code>pl_sql_stack</code> | When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter <code>TRUE</code> to record the PL/SQL stack, <code>FALSE</code> to not record. |

Example

The following example creates a policy that uses the partial state and enables the capture of the PL/SQL stack. Later on, when a realm or a command rule is added to this policy, their enforcement state will be able to be changed individually.

```
BEGIN
  DBMS_MACADM.CREATE_POLICY(
    policy_name => 'HR_DV_Policy',
    description => 'Policy to protect the HR schema',
    policy_state => DBMS_MACADM.G_ENABLED,
    pl_sql_stack => TRUE);
END;
/
```

Related Topics

- [About Simulation Mode](#)
Simulation mode enables you to capture violations in a simulation log instead of blocking SQL execution by Oracle Database Vault realms and command rules.

22.5 DELETE_CMD_RULE_FROM_POLICY Procedure

The `DELETE_CMD_RULE_FROM_POLICY` procedure enables you to remove an existing command rule from an Oracle Database Vault policy.

You can remove command rules from a policy anytime regardless of the state of the policy. When a command rule is removed from a policy, the state of command rule remains the same. That is, if the policy is enabled, and a command rule is removed from the policy, then the command rule will be still enabled after you have removed it from the policy.

Syntax

```
DBMS_MACADM.DELETE_CMD_RULE_FROM_POLICY(
  policy_name      IN VARCHAR2,
  command          IN VARCHAR2,
  object_owner    IN VARCHAR2,
  object_name     IN VARCHAR2,
  clause_name     IN VARCHAR2 DEFAULT,
  parameter_name  IN VARCHAR2 DEFAULT,
  event_name      IN VARCHAR2 DEFAULT,
  component_name  IN VARCHAR2 DEFAULT,
  action_name     IN VARCHAR2 DEFAULT,
  scope           IN NUMBER DEFAULT);
```

Parameters

Table 22-5 DELETE_CMD_RULE_FROM_POLICY Parameters

| Parameter | Description |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Policy name. To find existing Database Vault policies in the current database instance, query the <code>DBA_DV_POLICY</code> view. |
| <code>command</code> | Command rule name To find existing Database Vault command rules in the current database instance, query the <code>DBA_DV_COMMAND_RULE</code> view. |

Table 22-5 (Cont.) DELETE_CMD_RULE_FROM_POLICY Parameters

| Parameter | Description |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| object_owner | Database schema to which the command rule applies To find existing object owners for this command rule, query the DBA_DV_COMMAND_RULE view. |
| object_name | Object to be protected by the command rule To find existing objects for this command rule, query the DBA_DV_COMMAND_RULE view. |
| clause_name | For ALTER SYSTEM and ALTER SESSION command rules, a clause from the SQL statement that was used to create the command rule To find existing clauses for this command rule, query the DBA_DV_COMMAND_RULE view. |
| parameter_name | For ALTER SYSTEM and ALTER SESSION command rules, a parameter from the clause_name parameter. To find existing parameters for this command rule, query the DBA_DV_COMMAND_RULE view. |
| event_name | For ALTER SYSTEM and ALTER SESSION command rules, an event that the command rule defines To find existing event names for this command rule, query the DBA_DV_COMMAND_RULE view. |
| component_name | A component of the event_name setting To find existing component names for this command rule, query the DBA_DV_COMMAND_RULE view. |
| action_name | An action of the component_name setting. To find existing action names for this command rule, query the DBA_DV_COMMAND_RULE view. |
| scope | Determines how to execute this procedure. The default is local. Options are as follows: <ul style="list-style-type: none"> DBMS_MACUTL.G_SCOPE_LOCAL (or 1) if the command rule is local in the current PDB DBMS_MACUTL.G_SCOPE_COMMON (or 2) if the command rule is in the application root |

Example

The following example shows how to delete a common command rule from a Database Vault policy. This command rule is in the application root of a multitenant environment, so the user running this procedure must be in the CDB root.

```
BEGIN
DBMS_MACADM.DELETE_CMD_RULE_FROM_POLICY(
  policy_name => 'HR_DV_Policy',
  command     => 'ALTER SESSION',
  object_owner => '%',
  object_name  => '%',
  clause_name  => 'END SESSION',
  parameter_name => 'KILL SESSION',
  event_name   => '',
  action_name  => '',
  scope        => DBMS_MACUTL.G_SCOPE_COMMON);
END;
/
```

22.6 DELETE_OWNER_FROM_POLICY Procedure

The `DELETE_OWNER_FROM_POLICY` procedure enables you to remove an owner from an Oracle Database Vault policy.

You can remove owners from policies any time, regardless of the state (enabled or disabled) of the policy. The change takes effect immediately.

Syntax

```
DBMS_MACADM.DELETE_OWNER_FROM_POLICY(
  policy_name  IN VARCHAR2,
  owner_name   IN VARCHAR2);
```

Parameters

Table 22-6 DELETE_OWNER_FROM_POLICY Parameters

| Parameter | Description |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Policy name. To find existing Database Vault policies in the current database instance, query the <code>DBA_DV_POLICY</code> view. |
| <code>owner_name</code> | User name. To find existing policy owners in the current instance, query the <code>DBA_DV_POLICY_OWNER</code> view. |

Example

```
BEGIN
  DBMS_MACADM.DELETE_OWNER_FROM_POLICY(
    policy_name => 'HR_DV_Policy',
    owner_name  => 'PSMITH');
END;
/
```

22.7 DELETE_REALM_FROM_POLICY Procedure

The `DELETE_REALM_FROM_POLICY` procedure enables you to remove an existing realm from an Oracle Database Vault policy.

You can remove realms from policies any time, regardless of the state (enabled or disabled) of the policy. The change takes effect immediately.

Syntax

```
DBMS_MACADM.DELETE_REALM_FROM_POLICY(
  policy_name  IN VARCHAR2,
  realm_name   IN VARCHAR2);
```

Parameters

Table 22-7 DELETE_REALM_FROM_POLICY Parameters

| Parameter | Description |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Policy name. To find existing Database Vault policies in the current database instance, query the <code>DBA_DV_POLICY</code> view. |

Table 22-7 (Cont.) DELETE_REALM_FROM_POLICY Parameters

| Parameter | Description |
|------------|---------------------------------------------------------------------------------------------------------------|
| realm_name | Realm name. To find existing Database Vault realms in the current database instance, query the DV_REALM view. |

Example

```
BEGIN
  DBMS_MACADM.DELETE_REALM_FROM_POLICY (
    policy_name => 'HR_DV_Policy',
    realm_name  => 'HR Realm');
END;
/
```

22.8 DROP_POLICY Procedure

The DROP_POLICY procedure enables you to drop an existing Oracle Database Vault policy.

You can remove a policy at any time, regardless of the state (enabled or disabled) of the policy.

Syntax

```
DBMS_MACADM.DROP_POLICY (
  policy_name IN VARCHAR2);
```

Parameters**Table 22-8 DROP_POLICY Parameters**

| Parameter | Description |
|-------------|-----------------------------------------------------------------------------------------------------------------------|
| policy_name | Policy name. To find existing Database Vault policies in the current database instance, query the DBA_DV_POLICY view. |

Example

```
EXEC DBMS_MACADM.DROP_POLICY ('HR_DV_Policy');
```

22.9 RENAME_POLICY Procedure

The UPDATE_POLICY_DESCRIPTION procedure enables you to rename an existing Oracle Database Vault policy.

You can rename a policy at any time, regardless of the state (enabled or disabled) of the policy. The change takes effect immediately.

Syntax

```
DBMS_MACADM.RENAME_POLICY (
  policy_name      IN VARCHAR2,
  new_policy_name  IN VARCHAR2);
```


Parameters

Table 22-9 RENAME_POLICY Parameters

| Parameter | Description |
|-----------------|-----------------------------------------------------------------------------------------------------------------------|
| policy_name | Policy name. To find existing Database Vault policies in the current database instance, query the DBA_DV_POLICY view. |
| new_policy_name | New policy name, up to 128 characters in mixed case |

Example

```
BEGIN
  DBMS_MACADM.RENAME_POLICY(
    policy_name      => 'HR_DV_Policy',
    new_policy_name => 'HR_WEST_COAST_DV_Policy');
END;
/
```

22.10 UPDATE_POLICY_DESCRIPTION Procedure

The UPDATE_POLICY_DESCRIPTION procedure enables you to update the description field in an Oracle Database Vault policy.

Syntax

```
DBMS_MACADM.UPDATE_POLICY_DESCRIPTION(
  policy_name IN VARCHAR2,
  description IN VARCHAR2 DEFAULT);
```

Parameters

Table 22-10 UPDATE_POLICY_DESCRIPTION Parameters

| Parameter | Description |
|-------------|-----------------------------------------------------------------------------------------------------------------------|
| policy_name | Policy name. To find existing Database Vault policies in the current database instance, query the DBA_DV_POLICY view. |
| description | New description of the purpose of the policy, up to 4000 characters in mixed-case |

Example

```
BEGIN
  DBMS_MACADM.UPDATE_POLICY_DESCRIPTION(
    policy_name => 'HR_DV_Policy',
    description => 'HR schema protection policy');
END;
/
```

22.11 UPDATE_POLICY_STATE Procedure

The `UPDATE_POLICY_STATE` procedure enables you to update the `policy_state` field in an Oracle Database Vault policy.

Syntax

```
DBMS_MACADM.UPDATE_POLICY_STATE (
  policy_name  IN VARCHAR2,
  policy_state IN NUMBER,
  pl_sql_stack IN BOOLEAN DEFAULT);
```

Parameters

Table 22-11 UPDATE_POLICY_STATE Parameters

| Parameter | Description |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>policy_name</code> | Policy name. To find existing Database Vault policies in the current database instance, query the <code>DBA_DV_POLICY</code> view. |
| <code>policy_state</code> | Specifies how the policy is enabled. Possible values are: <ul style="list-style-type: none"> <code>DBMS_MACADM.G_ENABLED</code> (1), which enables the policy after you create it <code>DBMS_MACADM.G_DISABLED</code> (0), which disables the policy after you create it <code>DBMS_MACADM.G_SIMULATION</code> (2), which sets the policy to simulation mode. In simulation mode, any violations to realms or command rules used in the policy are logged in a designated log table with sufficient information to describe the error, such as the user name or SQL statement used. See also Related Topics. <code>DBMS_MACADM.G_PARTIAL</code> (3), which sets the policy to partial mode. In partial mode, the enforcement state of realms or command rules associated with the policy can be changed individually. See About Simulation Mode for more information about simulation mode |
| <code>pl_sql_stack</code> | When simulation mode is enabled, specifies whether to record the PL/SQL stack for failed operations. Enter <code>TRUE</code> to record the PL/SQL stack, <code>FALSE</code> to not record. |

Example

```
BEGIN
  DBMS_MACADM.UPDATE_POLICY_STATE (
    policy_name => 'HR_DV_Policy',
    policy_state => DBMS_MACADM.G_DISABLED,
    pl_sql_stack => TRUE);
END;
/
```

Related Topics

- [About Simulation Mode](#)
Simulation mode enables you to capture violations in a simulation log instead of blocking SQL execution by Oracle Database Vault realms and command rules.

Oracle Database Vault API Reference

Oracle Database Vault provides a rich set of APIs, both in PL/SQL packages and in standalone procedures.

- [DBMS_MACADM PL/SQL Package Contents](#)
The `DBMS_MACADM` package enables you to configure the realms, factors, rule sets, command rules, secure application roles, and Oracle Label Security policies.
- [DBMS_MACSEC_ROLES PL/SQL Package Contents](#)
The `DBMS_MACSEC_ROLES` package enables you to check and set Oracle Database Vault secure application roles.
- [DBMS_MACUTL PL/SQL Package Contents](#)
The `DBMS_MACUTL` PL/SQL package defines constants and utility methods that are commonly used by other Oracle Database Vault packages, such as error handling.
- [CONFIGURE_DV PL/SQL Procedure](#)
The `CONFIGURE_DV` configures the initial two Oracle Database user accounts, which are granted the `DV_OWNER` and `DV_ACCTMGR` roles, respectively.
- [DVF PL/SQL Interface Contents](#)
The `DVF` schema provides a set of factor-related PL/SQL functions.

23.1 DBMS_MACADM PL/SQL Package Contents

The `DBMS_MACADM` package enables you to configure the realms, factors, rule sets, command rules, secure application roles, and Oracle Label Security policies.

The `DBMS_MACADM` package is available only for users who have been granted the `DV_ADMIN` or `DV_OWNER` role.

DBMS_MACADM Realm Procedures

[Table 23-1](#) lists the realm procedures in the `DBMS_MACADM` package.

Table 23-1 DBMS_MACADM Realm Procedures

| Procedure | Description |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>ADD_AUTH_TO_REALM</code> procedure | Authorizes a user or role to access a realm as an owner or a participant |
| <code>ADD_OBJECT_TO_REALM</code> procedure | Registers a set of objects for realm protection |
| <code>CREATE_REALM</code> procedure | Creates a realm |
| <code>DELETE_AUTH_FROM_REALM</code> procedure | Removes the authorization of a user or role to access a realm |
| <code>DELETE_OBJECT_FROM_REALM</code> procedure | Removes a set of objects from realm protection |
| <code>DELETE_REALM</code> procedure | Deletes a realm, including its related Database Vault configuration information that specifies who is authorized and what objects are protected |

Table 23-1 (Cont.) DBMS_MACADM Realm Procedures

| Procedure | Description |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| DELETE_REALM_CASCADE procedure | Deletes a realm, including its related Database Vault configuration information that specifies who is authorized and what objects are protected |
| RENAME_REALM procedure | Renames a realm. The name change takes effect everywhere the realm is used. |
| UPDATE_REALM procedure | Updates a realm |
| UPDATE_REALM_AUTH procedure | Updates the authorization of a user or role to access a realm |

DBMS_MACADM Rule Set and Rule Procedures

[Table 23-2](#) lists the rule set and rule procedures in the `DBMS_MACADM` package.

Table 23-2 DBMS_MACADM Rule Set and Rule Procedures

| Procedure | Description |
|-------------------------------------|-----------------------------------------------------------------------------------|
| CREATE_RULE_SET procedure | Creates a rule set |
| RENAME_RULE_SET procedure | Renames a rule set. The name change takes effect everywhere the rule set is used. |
| DELETE_RULE_FROM_RULE_SET procedure | Deletes a rule from a rule set |
| DELETE_RULE_SET procedure | Deletes a rule set |
| UPDATE_RULE_SET procedure | Updates a rule set |
| CREATE_RULE procedure | Creates a rule |
| ADD_RULE_TO_RULE_SET procedure | Adds a rule to a rule set |
| DELETE_RULE procedure | Deletes a rule |
| RENAME_RULE procedure | Renames a rule. The name change takes effect everywhere the rule is used. |
| UPDATE_RULE procedure | Updates a rule |

DBMS_MACADM Command Rule Procedures

[Table 23-3](#) lists the command rule procedures in the `DBMS_MACADM` package.

Table 23-3 DBMS_MACADM Command Rule Procedures

| Procedure | Description |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| CREATE_COMMAND_RULE procedure | Creates a command rule, associates it with a rule set, and lets you enable the command rule for rule checking with a rule set |
| CREATE_CONNECT_COMMAND_RULE procedure | Creates a <code>CONNECT</code> command rule |
| CREATE_SESSION_EVENT_CMD_RULE procedure | Creates a session event command rule, using the <code>ALTER SESSION SQL</code> statement |

Table 23-3 (Cont.) DBMS_MACADM Command Rule Procedures

| Procedure | Description |
|-----------------------------------------|---------------------------------------------------------------------------|
| CREATE_SYSTEM_EVENT_CMD_RULE procedure | Creates a system event command rule, using the ALTER SYSTEM SQL statement |
| DELETE_COMMAND_RULE procedure | Drops a command rule declaration |
| DELETE_CONNECT_COMMAND_RULE procedure | Drops a CONNECT command rule declaration |
| DELETE_SESSION_EVENT_CMD_RULE procedure | Drops a SESSION_EVENT_CMD command rule declaration |
| DELETE_SYSTEM_EVENT_CMD_RULE procedure | Drops a SYSTEM_EVENT_CMD command rule declaration |
| UPDATE_COMMAND_RULE procedure | Updates a command rule declaration |
| UPDATE_CONNECT_COMMAND_RULE procedure | Updates a CONNECT command rule declaration |
| UPDATE_SESSION_EVENT_CMD_RULE procedure | Updates a SESSION_EVENT_CMD command rule declaration |
| UPDATE_SYSTEM_EVENT_CMD_RULE procedure | Updates a SYSTEM_EVENT_CMD command rule declaration |

DBMS_MACADM Factor Procedures and Functions

lists the factor procedures and functions in the DBMS_MACADM package.

Table 23-4 DBMS_MACADM Factor Procedures and Functions

| Procedure or Function | Description |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ADD_FACTOR_LINK procedure | Specifies a parent-child relationship for two factors |
| ADD_POLICY_FACTOR procedure | Specifies that the label for a factor contributes to the Oracle Label Security label for a policy. |
| CHANGE_IDENTITY_FACTOR procedure | Associates an identity with a different factor |
| CHANGE_IDENTITY_VALUE procedure | Updates the value of an identity |
| CREATE_DOMAIN_IDENTITY procedure | Adds an Oracle Real Application Clusters (Oracle RAC) database node to the domain factor identities and labels it according to the Oracle Label Security policy. |
| CREATE_FACTOR procedure | Creates a factor |
| CREATE_FACTOR_TYPE procedure | Creates a factor type |
| CREATE_IDENTITY procedure | Creates an identity |
| CREATE_IDENTITY_MAP procedure | Defines a set of tests that are used to derive the identity of a factor from the value of linked child factors (subfactors) |
| DELETE_FACTOR procedure | Deletes a factor |
| DELETE_FACTOR_LINK procedure | Removes a parent-child relationship for two factors |
| DELETE_FACTOR_TYPE procedure | Deletes a factor type |
| DELETE_IDENTITY procedure | Removes an identity |
| DELETE_IDENTITY_MAP procedure | Removes an identity map from a factor |

Table 23-4 (Cont.) DBMS_MACADM Factor Procedures and Functions

| Procedure or Function | Description |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| DROP_DOMAIN_IDENTITY procedure | Removes an Oracle RAC database node from a domain |
| GET_INSTANCE_INFO function | Returns information from the SYS.V_\$INSTANCE system table about the current database instance; returns a VARCHAR2 value |
| GET_SESSION_INFO function | Returns information from the SYS.V_\$SESSION system table for the current session; returns a VARCHAR2 value |
| RENAME_FACTOR procedure | Renames a factor. The name change takes effect everywhere the factor is used. |
| RENAME_FACTOR_TYPE procedure | Renames a factor type. The name change takes effect everywhere the factor type is used. |
| UPDATE_FACTOR procedure | Updates a factor |
| UPDATE_FACTOR_TYPE procedure | Updates the description of a factor type |
| UPDATE_IDENTITY procedure | Updates the trust level of a factor identity |

DBMS_MACADM Secure Application Role Procedures

[Table 23-5](#) lists the secure application role procedures in the DBMS_MACADM package.

Table 23-5 DBMS_MACADM Secure Application Role Procedures

| Procedure | Description |
|-------------------------|---------------------------------------------------------------------------------------------------------------------|
| CREATE_ROLE procedure | Creates an Oracle Database Vault secure application role |
| DELETE_ROLE procedure | Deletes an Oracle Database Vault secure application role |
| RENAME_ROLE procedure | Renames an Oracle Database Vault secure application role. The name change takes effect everywhere the role is used. |
| UNASSIGN_ROLE procedure | Unassigns an Oracle Database Vault secure application role from a user |
| UPDATE_ROLE procedure | Updates a Oracle Database Vault secure application role |

DBMS_MACADM Oracle Label Security Procedures

[Table 23-6](#) lists the Oracle Label Security procedures in the DBMS_MACADM package.

Table 23-6 DBMS_MACADM Oracle Label Security Procedures

| Procedure | Description |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| CREATE_MAC_POLICY procedure | Specifies the algorithm that is used to merge labels when computing the label for a factor, or the Oracle Label Security Session label |
| CREATE_POLICY_LABEL procedure | Labels an identity within an Oracle Label Security policy |
| DELETE_MAC_POLICY_CASCADE procedure | Deletes all Oracle Database Vault objects related to an Oracle Label Security policy. |
| DELETE_POLICY_FACTOR procedure | Removes the factor from contributing to the Oracle Label Security label |

Table 23-6 (Cont.) DBMS_MACADM Oracle Label Security Procedures

| Procedure | Description |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| DELETE_POLICY_LABEL procedure | Removes the label from an identity within an Oracle Label Security policy |
| UPDATE_MAC_POLICY procedure | Specifies the algorithm that is used to merge labels when computing the label for a factor, or the Oracle Label Security Session label |

DBMS_MACADM Database Vault Policy Procedures

[Table 23-7](#) lists the Database Vault policy procedures in the `DBMS_MACADM` package.

Table 23-7 DBMS_MACADM Database Vault Policy Procedures

| Procedure | Description |
|---------------------------------------|--------------------------------------------------------------|
| ADD_CMD_RULE_TO_POLICY procedure | Adds a command rule to a Database Vault policy |
| ADD_OWNER_TO_POLICY procedure | Adds an owner to a Database Vault policy |
| ADD_REALM_TO_POLICY procedure | Adds a realm to a Database Vault policy |
| CREATE_POLICY procedure | Creates a Database Vault policy |
| DELETE_CMD_RULE_FROM_POLICY procedure | Deletes a command rule from a Database Vault policy |
| DELETE_OWNER_FROM_POLICY procedure | Deletes an owner from a Database Vault policy |
| DELETE_REALM_FROM_POLICY procedure | Deletes a realm from a Database Vault policy |
| DROP_POLICY procedure | Drops a Database Vault policy |
| RENAME_POLICY procedure | Renames a Database Vault policy |
| UPDATE_POLICY_DESCRIPTION procedure | Updates a Database Vault policy description |
| UPDATE_POLICY_STATE procedure | Updates the enablement status of the a Database Vault policy |

DBMS_MACADM General Administrative Procedures

[Table 23-8](#) lists the general administrative procedures in the `DBMS_MACADM` package.

Table 23-8 DBMS_MACADM General Administrative Procedures

| Procedure | Description |
|--------------------------------------|------------------------------------------------------------------------------------------------|
| ADD-NLS_DATA procedure | Adds a new language to Oracle Database Vault |
| ADD_APP_EXCEPTION procedure | Enables a common user or package to access local schemas |
| AUTHORIZE_DATAPUMP_USER procedure | Authorizes a user to perform Oracle Data Pump operations when Oracle Database Vault is enabled |
| AUTHORIZE_DDL procedure | Grants a user authorization to run data definition language (DDL) statements |
| AUTHORIZE_MAINTENANCE_USER procedure | Grants a user authorization to perform Information Lifecycle Management (ILM) operations |

Table 23-8 (Cont.) DBMS_MACADM General Administrative Procedures

| Procedure | Description |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUTHORIZE_PROXY_USER procedure | Grants a proxy user authorization to proxy other user accounts |
| AUTHORIZE_SCHEDULER_USER procedure | Authorizes a user to schedule database jobs when Oracle Database Vault is enabled |
| AUTHORIZE_TTS_USER procedure | Authorizes a user to perform Oracle Data Pump transportable tablespace operations for a tablespace when Oracle Database Vault is enabled |
| DELETE_APP_EXCEPTION procedure | Deletes the exception for a common user or package to access a local schema |
| DISABLE_DV_DICTIONARY_ACCTS procedure | Prevents users from logging into the DVSYS and DFV schema accounts |
| DISABLE_DV_PATCH_ADMIN | Disables auditing of the DV_PATCH_ADMIN user |
| DISABLE_DV procedure | Disables Oracle Database Vault |
| DISABLE_APP_PROTECTION procedure | Disables Database Vault operation control |
| DISABLE_ORADEBUG procedure | Disables the use of the ORADEBUG utility in an Oracle Database Vault environment |
| ENABLE_DV_DICTIONARY_ACCTS procedure | Enables users to log into the DVSYS and DFV schema accounts |
| ENABLE_DV_PATCH_ADMIN | Enables auditing of the DV_PATCH_ADMIN user |
| ENABLE_DV procedure | Enables Oracle Database Vault |
| ENABLE_APP_PROTECTION procedure | Enables Database Vault operations control |
| ENABLE_ORADEBUG procedure | Enables the use of the ORADEBUG utility in an Oracle Database Vault environment |
| UNAUTHORIZE_DATAPUMP_USER procedure | Revokes the authorization that was granted by the DBMS_MACADM.AUTHORIZE_DATAPUMP_USER procedure |
| UNAUTHORIZE_DDL procedure | Revokes authorization from a user who was granted authorization to run DDL statements through the DBMS_MACADM.AUTHORIZE_DDL procedure |
| UNAUTHORIZE_MAINTENANCE_USER procedure | Revokes authorization to perform ILM operations |
| UNAUTHORIZE_PROXY_USER procedure | Revokes authorization from a user who was granted proxy authorization from the DBMS_MACADM.AUTHORIZE_PROXY_USER procedure |
| UNAUTHORIZE_SCHEDULER_USER procedure | Revokes authorization that was granted by the DBMS_MACADM.AUTHORIZE_SCHEDULER_USER procedure |
| UNAUTHORIZE_TTS_USER procedure | Revokes from authorization a user who had been granted authorization to perform Oracle Data Pump transportable tablespace operations for a tablespace when Oracle Database Vault is enabled |

23.2 DBMS_MACSEC_ROLES PL/SQL Package Contents

The `DBMS_MACSEC_ROLES` package enables you to check and set Oracle Database Vault secure application roles.

This package is available to the general database account population.

[Table 23-9](#) lists the contents of the `DBMS_MACSEC_ROLES` package.

Table 23-9 DBMS_MACSEC_ROLES PL/SQL Package Contents

| Procedure or Function | Description |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>CAN_SET_ROLE</code> function | Checks whether the user invoking the method is authorized to use the specified Oracle Database Vault secure application role. Returns a <code>BOOLEAN</code> value. |
| <code>SET_ROLE</code> procedure | Issues the <code>SET ROLE</code> statement for an Oracle Database Vault secure application role. |

23.3 DBMS_MACUTL PL/SQL Package Contents

The `DBMS_MACUTL` PL/SQL package defines constants and utility methods that are commonly used by other Oracle Database Vault packages, such as error handling.

This package can be run by the general database account population. This allows for security developers to leverage the constants in scripted configuration files. Utility methods such as `USER_HAS_ROLE` can also be used in Oracle Database Vault rules.

[Table 23-10](#) lists the `DBMS_MACUTL` package contents.

Table 23-10 DBMS_MACUTL PL/SQL Package Contents

| Procedure or Function | Description |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <code>CHECK_DVSYSDML_ALLOWED</code> procedure | Verifies that public-packages are not being bypassed by users updating the Oracle Database Vault configuration |
| <code>GET_CODE_VALUE</code> function | Looks up the value for a code within a code group. |
| <code>GET_SECOND</code> function | Returns the seconds in Oracle SS format (00-59). Useful for rule expressions based on time data |
| <code>GET_MINUTE</code> function | Returns the minute in Oracle MI format (00-59). Useful for rule expressions based on time data |
| <code>GET_HOUR</code> function | Returns the month in Oracle HH24 format (00-23). Useful for rule expressions based on time data |
| <code>GET_DAY</code> function | Returns the day in Oracle DD format (01-31). Useful for rule expressions based on time data |
| <code>GET_MONTH</code> function | Returns the month in Oracle MM format (01-12). Useful for rule expressions based on time data |
| <code>GET_YEAR</code> function | Returns the year in Oracle YYYY format (0001-9999). Useful for rule expressions based on time data |
| <code>IS_ALPHA</code> function | Checks whether the character is alphabetic |
| <code>IS_DIGIT</code> function | Checks whether the character is numeric |

Table 23-10 (Cont.) DBMS_MACUTL PL/SQL Package Contents

| Procedure or Function | Description |
|------------------------------------|-------------------------------------------------------------------------------------------|
| IS_DVSYS_OWNER function | Determines whether a user is authorized to manage the Oracle Database Vault configuration |
| IS_OLS_INSTALLED function | Returns an indicator regarding whether Oracle Label Security is installed |
| IS_OLS_INSTALLED_VARCHAR function | Returns an indicator regarding whether Oracle Label Security is installed |
| USER_HAS_ROLE function | Checks whether a user has a role privilege, directly or indirectly (through another role) |
| USER_HAS_ROLE_VARCHAR function | Checks whether a user has a role privilege, directly or indirectly (through another role) |
| USER_HAS_SYSTEM_PRIVILEGE function | Checks whether a user has a system privilege, directly or indirectly (through a role) |

23.4 CONFIGURE_DV PL/SQL Procedure

The `CONFIGURE_DV` configures the initial two Oracle Database user accounts, which are granted the `DV_OWNER` and `DV_ACCTMGR` roles, respectively.

This procedure is used as part of the registration process for Oracle Database Vault with an Oracle database. You only need to use it once for the database instance.

23.5 DVF PL/SQL Interface Contents

The `DVF` schema provides a set of factor-related PL/SQL functions.

The functions are then available to the general database account population through PL/SQL functions and standard SQL.

[Table 23-11](#) lists the `DVF` factor functions.

Table 23-11 DVF PL/SQL Interface Contents

| Function | Description |
|----------------------|--------------------------------------------------------------------------------------------------------|
| F\$CLIENT_IP | Returns the IP address of the computer from which the client is connected |
| F\$DATABASE_DOMAIN | Returns the domain of the database as specified in the <code>DB_DOMAIN</code> initialization parameter |
| F\$DATABASE_HOSTNAME | Returns the host name of the computer on which the database instance is running |
| F\$DATABASE_INSTANCE | Returns the database instance identification number of the current database instance |
| F\$DATABASE_IP | Returns the IP address of the computer on which the database instance is running |
| F\$DATABASE_NAME | Returns the name of the database as specified in the <code>DB_NAME</code> initialization parameter |

Table 23-11 (Cont.) DVF PL/SQL Interface Contents

| Function | Description |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F\$DOMAIN | Returns a named collection of physical, configuration, or implementation-specific factors in the run-time environment (for example, a networked IT environment or subset of it) that operates at a specific sensitivity level |
| F\$ENTERPRISE_IDENTITY | Returns the enterprise-wide identity for a user |
| F\$IDENTIFICATION_TYPE | Returns the way the schema of a user was created in the database. Specifically, it reflects the IDENTIFIED clause in the CREATE USER or ALTER USER syntax. |
| F\$LANG | Returns the ISO abbreviation for the language name, a shorter form than the existing LANGUAGE parameter |
| F\$LANGUAGE | Returns the language and territory currently used by your session, in VARCHAR2 data type, along with the database character set |
| F\$MACHINE | Returns the computer (host) name for the database client that established the database session. |
| F\$NETWORK_PROTOCOL | Returns the network protocol being used for communication, as specified in the PROTOCOL= <i>protocol</i> portion of the connect string |
| F\$PROXY_ENTERPRISE_IDENTITY | Returns the Oracle Internet Directory distinguished name (DN) when the proxy user is an enterprise user |
| F\$SESSION_USER | Returns the database user name by which the current user is authenticated |

Oracle Database Vault Data Dictionary Views

You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

- [About the Oracle Database Vault Data Dictionary Views](#)
Oracle Database Vault provides a set of DBA-style data dictionary views that can be accessed through the `DV_SECANALYST` role or the `DV_ADMIN` role.
- [CDB_DV_STATUS View](#)
The `CDB_DV_STATUS` data dictionary view shows the Database Vault operations control, configuration, and enablement status for all PDBs.
- [DBA_DV_APP_EXCEPTION View](#)
The `DBA_DV_APP_EXCEPTION` data dictionary view lists the common schemas and package names that are in the Database Vault operations control exception list.
- [DBA_DV_CODE View](#)
The `DBA_DV_CODE` data dictionary view lists generic lookup codes for the user interface, error messages, and constraint checking.
- [DBA_DV_COMMAND_RULE View](#)
The `DBA_DV_COMMAND_RULE` data dictionary view lists the SQL statements that are protected by command rules.
- [DBA_DV_DATAPUMP_AUTH View](#)
The `DBA_DV_DATAPUMP_AUTH` data dictionary view lists the authorizations for using Oracle Data Pump in an Oracle Database Vault environment.
- [DBA_DV_DBCAPTURE_AUTH View](#)
The `DBA_DV_DBCAPTURE_AUTH` data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload capture operations.
- [DBA_DV_DBREPLAY View](#)
The `DBA_DV_DBREPLAY_AUTH` data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload replay operations.
- [DBA_DV_DDL_AUTH View](#)
The `DBA_DV_DDL` data dictionary view lists the users and schemas that were specified by the `DBMS_MACADM.AUTHORIZE_DDL` procedure.
- [DBA_DV_DICTIONARY_ACCTS View](#)
The `DBA_DV_DICTIONARY_ACCTS` data dictionary view indicates whether users can directly log into the `DVSYS` and `DVF` schema accounts.
- [DBA_DV_FACTOR View](#)
The `DBA_DV_FACTOR` data dictionary view lists the existing factors in the current PDB.
- [DBA_DV_FACTOR_TYPE View](#)
The `DBA_DV_FACTOR_TYPE` data dictionary view lists the names and descriptions of factor types used in the system.
- [DBA_DV_FACTOR_LINK View](#)
The `DBA_DV_FACTOR_LINK` data dictionary view shows the relationships of each factor whose identity is determined by the association of child factors.

- [DBA_DV_IDENTITY View](#)
The `DBA_DV_IDENTITY` data dictionary view lists the identities for each factor.
- [DBA_DV_IDENTITY_MAP View](#)
The `DBA_DV_IDENTITY_MAP` data dictionary view lists the mappings for each factor identity.
- [DBA_DV_JOB_AUTH View](#)
The `DBA_DV_JOB_AUTH` data dictionary view lists the authorizations for using Oracle Scheduler in an Oracle Database Vault environment.
- [DBA_DV_MAC_POLICY View](#)
The `DBA_DV_MAC_POLICY` data dictionary view lists the Oracle Label Security policies defined for use with Oracle Database Vault.
- [DBA_DV_MAC_POLICY_FACTOR View](#)
The `DBA_DV_MAC_POLICY` data dictionary view lists the factors that are associated with Oracle Label Security policies.
- [DBA_DV_MAINTENANCE_AUTH View](#)
The `DBA_DV_MAINTENANCE_AUTH` data dictionary view provides information about the configuration of Oracle Database Vault authorizations to use Information Life Management (ILM) features.
- [DBA_DV_ORADEBUG View](#)
The `DBA_DV_ORADEBUG` data dictionary view indicates whether users can use the `ORADEBUG` utility in an Oracle Database Vault environment.
- [DBA_DV_PATCH_ADMIN_AUDIT View](#)
The `DBA_DV_PATCH_ADMIN_AUDIT` data dictionary view indicates if auditing has been enabled or disabled for the user who has been granted the `DV_ADMIN_PATCH` role.
- [DBA_DV_POLICY View](#)
The `DBA_DV_POLICY` data dictionary view lists the Oracle Database Vault policies that were created in the current database instance.
- [DBA_DV_POLICY_LABEL View](#)
The `DBA_DV_POLICY_LABEL` data dictionary view lists the Oracle Label Security label for each factor identifier in the `DBA_DV_IDENTITY` view for each policy.
- [DBA_DV_POLICY_OBJECT View](#)
The `DBA_DV_POLICY_OBJECT` data dictionary view lists information about the objects that are protected by Oracle Database Vault policies in the current database instance.
- [DBA_DV_POLICY_OWNER View](#)
The `DBA_DV_POLICY_OWNER` data dictionary view lists the owners of Oracle Database Vault policies that were created in the current database instance.
- [DBA_DV_PREPROCESSOR_AUTH View](#)
The `DBA_DV_PREPROCESSOR_AUTH` data dictionary view shows users who have been granted authorization to run preprocessor programs through external tables.
- [DBA_DV_PROXY_AUTH View](#)
The `DBA_DV_PROXY_AUTH` data dictionary view lists the proxy users and schemas that were specified by the `DBMS_MACADM.AUTHORIZE_PROXY_USER` procedure.
- [DBA_DV_PUB_PRIVS View](#)
The `DBA_DV_PUB_PRIVS` data dictionary view lists data reflected in the Oracle Database Vault privilege management reports used in Oracle Database Vault Administrator.
- [DBA_DV_REALM View](#)
The `DBA_DV_REALM` data dictionary view lists the realms created in the current database instance.

- [DBA_DV_REALM_AUTH View](#)
The `DBA_DV_REALM_AUTH` data dictionary view lists database user account or role authorization (`GRANTEE`) who can access realm objects.
- [DBA_DV_REALM_OBJECT View](#)
The `DBA_DV_REALM_OBJECT` data dictionary view lists the database schemas, or subsets of schemas, that are secured by the realms.
- [DBA_DV_ROLE View](#)
The `DBA_DV_ROLE` data dictionary view lists the Oracle Database Vault secure application roles used in privilege management.
- [DBA_DV_RULE View](#)
The `DBA_DV_RULE` data dictionary view lists the rules that have been defined.
- [DBA_DV_RULE_SET View](#)
The `DBA_DV_RULE_SET` data dictionary view lists the rules sets that have been created.
- [DBA_DV_RULE_SET_RULE View](#)
The `DBA_DV_RULE_SET_RULE` data dictionary view lists rules that are associated with existing rule sets.
- [DBA_DV_SIMULATION_LOG View](#)
The `DBA_DV_SIMULATION_LOG` data dictionary view captures simulation log information for realms and command rules that have had simulation mode enabled.
- [DBA_DV_STATUS or SYS.DBA_DV_STATUS View](#)
The `DBA_DV_STATUS` (or `SYS.DBA_DV_STATUS`) data dictionary view shows the status of Oracle Database Vault being enabled and configured.
- [DBA_DV_TTS_AUTH View](#)
The `DBA_DV_TTS_AUTH` data dictionary view lists users who have been granted authorization through the `DBMS_MACADM.AUTHORIZE_TTS_USER` procedure to perform Oracle Data Pump transportable operations.
- [DBA_DV_USER_PRIVS View](#)
The `DBA_DV_USER_PRIVS` data dictionary view lists the privileges for a database user account excluding privileges granted through the `PUBLIC` role.
- [DBA_DV_USER_PRIVS_ALL View](#)
The `DBA_DV_USER_PRIVS_ALL` data dictionary view lists the privileges for a database account including privileges granted through `PUBLIC`.
- [DVSYS.DV\\$CONFIGURATION_AUDIT View](#)
The `DVSYS.DV$CONFIGURATION_AUDIT` data dictionary view captures `DVSYS.AUDIT_TRAIL$` table audit trail records.
- [DVSYS.DV\\$ENFORCEMENT_AUDIT View](#)
The `DVSYS.DV$ENFORCEMENT_AUDIT` data dictionary view provides information about enforcement-related audits from the `DVSYS.AUDIT_TRAIL$` table.
- [DVSYS.DV\\$REALM View](#)
The `DVSYS.DV$REALM` data dictionary view describes settings that were used to create Oracle Database Vault realms, such as which audit options have been assigned or whether the realm is a mandatory realm.
- [DVSYS.DBA_DV_COMMON_OPERATION_STATUS View](#)
The `DVSYS.DBA_DV_COMMON_OPERATION_STATUS` data dictionary view displays the status of the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure setting.

- [DVSYS.POLICY_OWNER_COMMAND_RULE View](#)
The `DVSYS.POLICY_OWNER_COMMAND_RULE` data dictionary view enables `DV_POLICY_OWNER` role users to find information about the command rules that are used by Database Vault policies.
- [DVSYS.POLICY_OWNER_POLICY View](#)
The `DVSYS.POLICY_OWNER_POLICY` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information such as the names, descriptions, and states of existing policies in the current database instance, including policies created by other policy owners.
- [DVSYS.POLICY_OWNER_REALM View](#)
The `POLICY_OWNER_REALM` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the realms that have been associated with Database Vault policies.
- [DVSYS.POLICY_OWNER_REALM_AUTH View](#)
The `DVSYS.POLICY_OWNER_REALM_AUTH` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the authorization that was granted to realms that have been associated with Database Vault policies.
- [DVSYS.POLICY_OWNER_REALM_OBJECT View](#)
The `DVSYS.POLICY_OWNER_REALM_OBJECT` data dictionary view enables users to find information about the objects that have been added to realms that are associated with Database Vault policies, such as. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.
- [DVSYS.POLICY_OWNER_RULE View](#)
The `DVSYS.POLICY_OWNER_RULE` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the rules that have been associated with rule sets in Database Vault policies, such as the rule name and its expression. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.
- [DVSYS.POLICY_OWNER_RULE_SET View](#)
The `DVSYS.POLICY_OWNER_RULE_SET` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the rule sets that have been associated with Database Vault policies.
- [DVSYS.POLICY_OWNER_RULE_SET_RULE View](#)
The `DVSYS.POLICY_OWNER_RULE_SET_RULE` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the rule sets that contain rules used in Database Vault policies.
- [AUDSYS.DV\\$CONFIGURATION_AUDIT View](#)
The `AUDSYS.DV$CONFIGURATION_AUDIT` view is almost the same as the `DVSYS.DV$CONFIGURATION_AUDIT` view except that it captures unified audit trail Database Vault audit records.
- [AUDSYS.DV\\$ENFORCEMENT_AUDIT View](#)
The `AUDSYS.DV$ENFORCEMENT_AUDIT` view is almost the same as the `DVSYS.DV$ENFORCEMENT_AUDIT` view except that it captures unified audit trail Database Vault audit records.

24.1 About the Oracle Database Vault Data Dictionary Views

Oracle Database Vault provides a set of DBA-style data dictionary views that can be accessed through the `DV_SECANALYST` role or the `DV_ADMIN` role.

These views provide access to the various underlying Oracle Database Vault tables in the DVSYS and LBACSYS schemas without exposing the primary and foreign key columns that may be present. These views are intended for the database administrative user to report on the state of the Oracle Database Vault configuration without having to perform the joins required to get the labels for codes that are stored in the core tables or from the related tables.



See Also:

[Oracle Database Vault Reports](#) if you are interested in running reports on Oracle Database Vault

24.2 CDB_DV_STATUS View

The CDB_DV_STATUS data dictionary view shows the Database Vault operations control, configuration, and enablement status for all PDBs.

Only Oracle Database administrative users, such users who have been granted the DBA role, can query this view. Database Vault administrators do not have access to this view.

For example:

```
SELECT * FROM CDB_DV_STATUS;
```

Output similar to the following appears:

| NAME | STATUS | CON_ID |
|---------------------|---------|--------|
| DV_APP_PROTECTION | ENABLED | 5 |
| DV_CONFIGURE_STATUS | TRUE | 5 |
| DV_ENABLE_STATUS | TRUE | 5 |

| Column | Datatype | Null | Description |
|--------|---------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | VARCHAR2 (19) | NOT NULL | Shows either of the following settings: <ul style="list-style-type: none"> DV_APP_PROTECTION shows whether Database Vault operations control is enabled or not enabled. DV_CONFIGURE_STATUS shows whether Oracle Database Vault is configured (that is, with the CONFIGURE_DV procedure). DV_ENABLE_STATUS shows whether Oracle Database Vault is enabled (that is, with the DBMS_MACADM.ENABLE_DV procedure). |
| STATUS | VARCHAR2 (64) | NOT NULL | For DV_CONFIGURE_STATUS and DV_ENABLE_STATUS, TRUE means that Oracle Database Vault is configured or enabled; FALSE means that it is not. For DV_APP_PROTECTION, the output is ENABLED or DISABLED. |
| CON_ID | NUMBER | NOT NULL | The identification number of the PDB container in which Oracle Database Vault is used |

Related Topics

- [DBA_DV_STATUS](#) or [SYS.DBA_DV_STATUS View](#)
The `DBA_DV_STATUS` (or `SYS.DBA_DV_STATUS`) data dictionary view shows the status of Oracle Database Vault being enabled and configured.

24.3 DBA_DV_APP_EXCEPTION View

The `DBA_DV_APP_EXCEPTION` data dictionary view lists the common schemas and package names that are in the Database Vault operations control exception list.

You must query this view from the CDB root only. If you try to query this view from a pluggable database (PDB), then no output appears.

For example:

```
SELECT * FROM DBA_DV_APP_EXCEPTION WHERE GRANTEE = 'C##HR_ADMIN';
```

Output similar to the following appears:

```
GRANTEE          PACKAGE_NAME
-----
C##HR_ADMIN      PATCH_APP
```

| Column | Datatype | Null | Description |
|--------------|--------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GRANTEE | VARCHAR(128) | NOT NULL | Name of the grantee To find the names of common users, query the <code>USERNAME</code> and <code>COMMON</code> columns of the <code>DBA_USERS</code> data dictionary view. |
| PACKAGE_NAME | VARCHAR(128) | NOT NULL | Name of the package |

24.4 DBA_DV_CODE View

The `DBA_DV_CODE` data dictionary view lists generic lookup codes for the user interface, error messages, and constraint checking.

These codes are used for the user interface, views, and for validating input in a translatable fashion.

For example:

```
SELECT CODE, VALUE FROM DBA_DV_CODE WHERE CODE_GROUP = 'BOOLEAN';
```

Output similar to the following appears:

```
CODE  VALUE
-----
Y      True
N      False
```

| Column | Datatype | Null | Description |
|------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------|
| CODE_GROUP | VARCHAR(128) | NOT NULL | Displays one of the code groups that are listed in Table 24-1 |
| CODE | VARCHAR(128) | NOT NULL | Boolean code used; either Y (Yes) or N (No). |
| VALUE | VARCHAR(4000) | NULL | Boolean value used; either <code>True</code> if the Boolean code is Y or <code>False</code> if the Boolean code is N. |

| Column | Datatype | Null | Description |
|-------------|---------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LANGUAGE | VARCHAR(3) | NOT NULL | Language for this installation of Oracle Database Vault. Supported languages are as follows: <ul style="list-style-type: none"> en: English de: German es: Spanish fr: French it: Italian ja: Japanese ko: Korean pt_BR: Brazilian Portuguese zh_CN: Simplified Chinese zh_TW: Traditional Chinese |
| DESCRIPTION | VARCHAR(1024) | NULL | Brief description of the code group. |

Table 24-1 describes the possible values from the CODE_GROUP column in the DBA_DV_CODE data dictionary view.

Table 24-1 DBA_DV_CODE View CODE_GROUP Values

| CODE_GROUP Name | Description |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| AUDIT_EVENTS | Contains the action numbers and action names that are used for the custom event audit trail records |
| BOOLEAN | A simple Yes or No or True or False lookup |
| DB_OBJECT_TYPE | The database object types that can be used for realm objects and command authorizations |
| SQL_CMDS | The DDL commands that can be protected through command rules |
| FACTOR_AUDIT | The auditing options for factor retrieval processing |
| FACTOR_EVALUATE | The evaluation options (by session or by access) for factor retrieval |
| FACTOR_FAIL | The options for propagating errors when a factor retrieval method fails |
| FACTOR_IDENTIFY | The options for determining how a factor identifier is resolved (for example, by method or by factors) |
| FACTOR_LABEL | The options for determining how a factor identifier is labeled in the session establishment phase |
| LABEL_ALG | The algorithms that can be used to determine the maximum session label for a database session for each policy. See Related Topics. |
| OPERATORS | The Boolean operators that can be used for identity maps |
| REALM_AUDIT | The options for auditing realm access or realm violations |
| REALM_OPTION | The options for ownership of a realm |
| RULESET_AUDIT | The options for auditing rule set execution or rule set errors |
| RULESET_EVALUATE | The options for determining the success or failure of a rule set based on all associated rules being true or any associated rule being true |
| RULESET_EVENT | The options to invoke a custom event handler when a rule set evaluates to Succeeds or Fails |
| RULESET_FAIL | The options to determine the run-time visibility of a rule set failing |

Related Topics

- [Table 19-2](#)

24.5 DBA_DV_COMMAND_RULE View

The `DBA_DV_COMMAND_RULE` data dictionary view lists the SQL statements that are protected by command rules.

For example:

```
SELECT COMMAND, RULE_SET_NAME FROM DBA_DV_COMMAND_RULE;
```

Output similar to the following appears:

```
COMMAND          RULE_SET_NAME
-----
GRANT             Can Grant VPD Administration
REVOKE           Can Grant VPD Administration
ALTER SYSTEM     Allow System Parameters
ALTER USER       Can Maintain Own Account
CREATE USER      Can Maintain Account/Profiles
DROP USER        Can Maintain Account/Profiles
CREATE PROFILE   Can Maintain Account/Profiles
DROP PROFILE     Can Maintain Account/Profiles
ALTER PROFILE    Can Maintain Account/Profiles
```

| Column | Datatype | Null | Description |
|----------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COMMAND | VARCHAR(128) | NOT NULL | Name of the command rule. |
| CLAUSE_NAME | VARCHAR(100) | NOT NULL | A clause from either the ALTER SYSTEM or ALTER SESSION SQL statement, which was used to create the command rule. For example, you it could list the SET clause for the ALTER SESSION statement. The command rule settings for these two statements are described in the DBMS_MACADM.CREATE_COMMAND_RULE procedure. See Related Topics. |
| PARAMETER_NAME | VARCHAR(128) | NOT NULL | A parameter from the ALTER SYSTEM or ALTER SESSION command rule CLAUSE_NAME setting. See Related Topics. |
| EVENT_NAME | VARCHAR(128) | NOT NULL | An event that the ALTER SYSTEM or ALTER SESSION command rule defines. See Related Topics. |
| COMPONENT_NAME | VARCHAR(128) | NOT NULL | A component of the EVENT_NAME setting for the ALTER SYSTEM or ALTER SESSION command rule. See Related Topics. |
| ACTION_NAME | VARCHAR(128) | NOT NULL | An action of the EVENT_NAME setting for the ALTER SYSTEM or ALTER SESSION command rule. See Related Topics. |
| RULE_SET_NAME | VARCHAR(128) | NOT NULL | Name of the rule set associated with this command rule. |
| OBJECT_OWNER | VARCHAR(128) | NOT NULL | The owner of the object that the command rule affects. |
| OBJECT_NAME | VARCHAR(128) | NOT NULL | The name of the database object the command rule affects (for example, a database table). |

| Column | Datatype | Null | Description |
|-----------------|------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ENABLED | VARCHAR(1) | NOT NULL | Possible values are as follows: <ul style="list-style-type: none"> Y indicates the command rule is enabled N indicates it is disabled S indicates it is in simulation mode |
| PRIVILEGE_SCOPE | NUMBER | NOT NULL | Obsolete column |
| COMMON | VARCHAR(3) | NOT NULL | Indicates whether the command rule is local or common. Possible values are: <ul style="list-style-type: none"> YES if the command rule is common NO if the command rule is local |
| INHERITED | VARCHAR(3) | NOT NULL | Shows the inheritance status of the command rule, when the COMMON column output is YES. Values are as follows: <ul style="list-style-type: none"> YES means that the command rule was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. NO means that the command rule is a local object, or it is common from that container. For example, in an application root, an application common realm will have an INHERITED value NO but a CDB root common command rule will have an INHERITED value of YES. |
| ID# | NUMBER | NOT NULL | The ID number of the command rule, which is automatically generated when the command rule is created |
| ORACLE_SUPPLIED | VARCHAR(3) | NULL | Indicates whether the command rule is a default (that is, Oracle-supplied) command rule or a user-created command rule. Possible values are: <ul style="list-style-type: none"> YES if the command rule is a default command rule NO if the command rule is a user-created command rule |
| PL_SQL_STACK | VARCHAR(3) | NULL | When simulation mode is enabled, indicates whether the PL/SQL stack has been recorded for failed operations. TRUE indicates that the PL/SQL stack has been recorded; FALSE indicates that the PL/SQL stack has not been recorded. |

Related Topics

- [Configuring Command Rules](#)
You can create command rules or use the default command rules to protect DDL and DML statements.
- [CREATE_COMMAND_RULE Procedure](#)
The CREATE_COMMAND_RULE procedure creates both command and local command rules, which can be added to a rule set.

24.6 DBA_DV_DATAPUMP_AUTH View

The DBA_DV_DATAPUMP_AUTH data dictionary view lists the authorizations for using Oracle Data Pump in an Oracle Database Vault environment.

For example:

```
SELECT * FROM DBA_DV_DATAPUMP_AUTH WHERE GRANTEE = 'PRESTON';
```

Output similar to the following appears:

```
GRANTEE SCHEMA OBJECT TYPE ACTION
-----
PRESTON OE ORDERS % CREATE_USER
```

| Column | Datatype | Null | Description |
|---------|----------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------|
| GRANTEE | VARCHAR2 (128) | NOT NULL | Name of the user who has been granted Data Pump authorization |
| SCHEMA | VARCHAR2 (128) | NOT NULL | Name of the schema on which the user GRANTEE is authorized to perform Data Pump operations |
| OBJECT | VARCHAR2 (128) | NOT NULL | Name of the object within the schema specified by the SCHEMA parameter on which the GRANTEE user has Data Pump authorization (such as a table) |
| TYPE | VARCHAR2 (32) | NOT NULL | For Oracle Data Pump import operations, indicates the type of grant, such as ROLE) |
| ACTION | VARCHAR2 (30) | NOT NULL | For Oracle Data Pump import operations, indicates action that is associated with the TYPE: %, TABLE, CREATE_USER, or GRANT |

Related Topics

- [Using Oracle Data Pump with Oracle Database Vault](#)
Database administrators can authorize Oracle Data Pump users to work in a Database Vault environment.

24.7 DBA_DV_DBCAPTURE_AUTH View

The DBA_DV_DBCAPTURE_AUTH data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload capture operations.

For example:

```
SELECT * FROM DBA_DV_DBCAPTURE_AUTH WHERE GRANTEE = 'PFITCH';
```

Output similar to the following appears:

```
GRANTEE
-----
PFITCH
```

| Column | Datatype | Null | Description |
|---------|----------------|----------|--------------------------------------------------------------------------------------|
| GRANTEE | VARCHAR2 (128) | NOT NULL | Name of the user who has been granted Database Replay workload capture authorization |

Related Topics

- [Using Oracle Database Replay with Oracle Database Vault](#)
Database administrators can authorize Oracle Database Replay users to work in a Database Vault environment.

24.8 DBA_DV_DBREPLAY View

The `DBA_DV_DBREPLAY_AUTH` data dictionary view shows users who have been granted authorization to perform Oracle Database Replay workload replay operations.

For example:

```
SELECT * FROM DBA_DV_DBREPLAY_AUTH WHERE GRANTEE = 'PFITCH';
```

Output similar to the following appears:

```
GRANTEE
-----
PFITCH
```

| Column | Datatype | Null | Description |
|---------|----------------|----------|-------------------------------------------------------------------------------------|
| GRANTEE | VARCHAR2 (128) | NOT NULL | Name of the user who has been granted Database Replay workload replay authorization |

Related Topics

- [Using Oracle Database Replay with Oracle Database Vault](#)
Database administrators can authorize Oracle Database Replay users to work in a Database Vault environment.

24.9 DBA_DV_DDL_AUTH View

The `DBA_DV_DDL` data dictionary view lists the users and schemas that were specified by the `DBMS_MACADM.AUTHORIZE_DDL` procedure.

This procedure grants a user authorization to run Data Definition Language (DDL) statements.

For example:

```
SELECT * FROM DBA_DV_DDL_AUTH WHERE GRANTEE = 'psmith';
```

Output similar to the following appears:

```
GRANTEE SCHEMA
-----
PSMITH HR
```

| Column | Datatype | Null | Description |
|---------|----------------|----------|--------------------------------------------------------------------------------------|
| GRANTEE | VARCHAR2 (128) | NOT NULL | Name of the user who has been granted DDL authorization |
| SCHEMA | VARCHAR2 (128) | NOT NULL | Name of the schema on which the user GRANTEE is authorized to perform DDL operations |

Related Topics

- [AUTHORIZE_DDL Procedure](#)
The `AUTHORIZE_DDL` procedure grants a user authorization to run Data Definition Language (DDL) statements on the specified schema.

- [UNAUTHORIZE_DDL Procedure](#)
The UNAUTHORIZE_DDL procedure revokes authorization from a user who was granted authorization to run DDL statements through the DBMS_MACADM.AUTHORIZE_DDL procedure.

24.10 DBA_DV_DICTIONARY_ACCTS View

The DBA_DV_DICTIONARY_ACCTS data dictionary view indicates whether users can directly log into the DVSYS and DVF schema accounts.

For example:

```
SELECT * FROM DBA_DV_DICTIONARY_ACCTS;
```

Output similar to the following appears:

```
STATE
-----
ENABLED
```

| Column | Datatype | Null | Description |
|--------|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STATE | VARCHAR2(8) | NOT NULL | Describes whether users can log directly into the DVSYS and DVF schemas. Possible values are: <ul style="list-style-type: none"> • ENABLED means that users can log directly into the DVSYS and DVF schemas • DISABLED means that users cannot log directly into the DVSYS and DVF schemas |

24.11 DBA_DV_FACTOR View

The DBA_DV_FACTOR data dictionary view lists the existing factors in the current PDB.

For example:

```
SELECT NAME, GET_EXPR FROM DBA_DV_FACTOR WHERE NAME = 'Session_User';
```

Output similar to the following appears:

```
NAME          GET_EXPR
-----
Session_User  UPPER(SYS_CONTEXT('USERENV', 'SESSION_USER'))
```

| Column | Datatype | Null | Description |
|----------------------|----------------|----------|--------------------------------------------------------------------------------------------|
| NAME | VARCHAR2(128) | NOT NULL | Name of the factor. |
| DESCRIPTION | VARCHAR2(4000) | NULL | Description of the factor. |
| FACTOR_TYPE_NAME | VARCHAR2(128) | NOT NULL | Category of the factor, which is used to classify the purpose of the factor. |
| ASSIGN_RULE_SET_NAME | VARCHAR2(128) | NULL | Rule set used to control the identify of the factor. |
| GET_EXPR | VARCHAR2(1024) | NULL | PL/SQL expression that retrieves the identity of a factor. |
| VALIDATE_EXPR | VARCHAR2(1024) | NULL | PL/SQL expression used to validate the identity of the factor. It returns a Boolean value. |

| Column | Datatype | Null | Description |
|-----------------------|----------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IDENTIFIED_BY | NUMBER | NOT NULL | <p>Determines the identity of a factor, based on the expression listed in the GET_EXPR column. Possible values are:</p> <ul style="list-style-type: none"> 0: By constant 1: By method 2: By factors |
| IDENTIFIED_BY_MEANING | VARCHAR2(4000) | NULL | <p>Provides a text description for the corresponding value in the IDENTIFIED_BY column. Possible values are:</p> <ul style="list-style-type: none"> By Constant: If IDENTIFIED_COLUMN is 0 By Method: If IDENTIFIED_COLUMN is 1 By Factors: If IDENTIFIED_COLUMN is 2 |
| LABELED_BY | NUMBER | NOT NULL | <p>Determines the labeling the factor:</p> <ul style="list-style-type: none"> 0: Labels the identities for the factor directly from the labels associated with an Oracle Label Security policy 1: Derives the factor identity label from the labels of its child factor identities. |
| LABELED_BY_MEANING | VARCHAR2(4000) | NULL | <p>Provides a text description for the corresponding value in the LABELED_BY column. Possible values are:</p> <ul style="list-style-type: none"> By Self: If LABELED_BY column is 0 By Factors: If LABELED_BY column is 1 |
| EVAL_OPTIONS | NUMBER | NOT NULL | <p>Determines how the factor is evaluated when the user logs on:</p> <ul style="list-style-type: none"> 0: When the database session is created 1: Each time the factor is accessed 2: On start-up |
| EVAL_OPTIONS_MEANING | VARCHAR2(4000) | NULL | <p>Provides a text description for the corresponding value in the EVAL_OPTIONS column. Possible values are:</p> <ul style="list-style-type: none"> For Session: If EVAL_OPTIONS is 0 By Access: If EVAL_OPTIONS is 1 On Startup: If EVAL_OPTIONS is 2 |
| AUDIT_OPTIONS | NUMBER | NOT NULL | <p>Option for auditing the factor using traditional auditing if you want to generate a custom Oracle Database Vault audit record. Possible values are:</p> <ul style="list-style-type: none"> 0: No auditing set 1: Always audits 2: Audits if get_expr returns an error 4: Audits if get_expr is null 8: Audits if the validation procedure returns an error 16: Audits if the validation procedure is false 32: Audits if there is no trust level set 64: Audits if the trust level is negative. <p>Starting with Oracle Database release 21c, traditional auditing is deprecated.</p> |

| Column | Datatype | Null | Description |
|----------------------|----------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FAIL_OPTIONS | NUMBER | NOT NULL | Options for reporting factor errors: <ul style="list-style-type: none"> 1: Shows an error message. 2: Does not show an error message. |
| FAIL_OPTIONS_MEANING | VARCHAR2(4000) | NULL | Provides a text description for the corresponding value in the FAIL_OPTIONS column. Possible values are: <ul style="list-style-type: none"> Show Error Message Do Not Show Error Message: |
| ID# | NUMBER | NOT NULL | The ID number of the factor, which is automatically generated when the factor is created |
| ORACLE_SUPPLIED | VARCHAR(3) | NOT NULL | Indicates whether the factor is a default (that is, Oracle-supplied) factor or a user-created factor. Possible values are: <ul style="list-style-type: none"> YES if the factor is a default factor NO if the factor is a user-created factor |

Related Topics

- [DBA_DV_FACTOR_LINK View](#)
The DBA_DV_FACTOR_LINK data dictionary view shows the relationships of each factor whose identity is determined by the association of child factors.
- [DBA_DV_FACTOR_TYPE View](#)
The DBA_DV_FACTOR_TYPE data dictionary view lists the names and descriptions of factor types used in the system.

24.12 DBA_DV_FACTOR_TYPE View

The DBA_DV_FACTOR_TYPE data dictionary view lists the names and descriptions of factor types used in the system.

For example:

```
SELECT * FROM DBA_DV_FACTOR_TYPE WHERE NAME = 'Time';
```

Output similar to the following appears:

```
NAME          DESCRIPTION
-----
Time          Time-based factor
```

| Column | Datatype | Null | Description |
|-------------|---------------|----------|---------------------------------|
| NAME | VARCHAR(128) | NOT NULL | Name of the factor type. |
| DESCRIPTION | VARCHAR(1024) | NULL | Description of the factor type. |

Related Topics

- [DBA_DV_FACTOR View](#)
The DBA_DV_FACTOR data dictionary view lists the existing factors in the current PDB.
- [DBA_DV_FACTOR_LINK View](#)
The DBA_DV_FACTOR_LINK data dictionary view shows the relationships of each factor whose identity is determined by the association of child factors.

24.13 DBA_DV_FACTOR_LINK View

The `DBA_DV_FACTOR_LINK` data dictionary view shows the relationships of each factor whose identity is determined by the association of child factors.

This view contains one entry for each parent factor and child factor. You can use this view to resolve the relationships from the factor links to identity maps.

For example:

```
SELECT PARENT_FACTOR_NAME, CHILD_FACTOR_NAME FROM DBA_DV_FACTOR_LINK;
```

Output similar to the following appears:

```
PARENT_FACTOR_NAME          CHILD_FACTOR_NAME
-----
Domain                      Database_Instance
Domain                      Database_IP
Domain                      Database_Hostname
```

Related Views

- [DBA_DV_FACTOR View](#)
- [DBA_DV_FACTOR_TYPE View](#)

| Column | Datatype | Null | Description |
|--------------------|--------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PARENT_FACTOR_NAME | VARCHAR(128) | NOT NULL | Name of the parent factor |
| CHILD_FACTOR_NAME | VARCHAR(128) | NOT NULL | Name of the child factor of the parent factor |
| LABEL_IND | VARCHAR(1) | NOT NULL | Indicates whether the child factor that is linked to the parent factor contributes to the label of the parent factor in an Oracle Label Security integration. Possible values are: <ul style="list-style-type: none"> • Y (for Yes) • N (for No) |

Related Topics

- [DBA_DV_FACTOR View](#)
The `DBA_DV_FACTOR` data dictionary view lists the existing factors in the current PDB.
- [DBA_DV_FACTOR_TYPE View](#)
The `DBA_DV_FACTOR_TYPE` data dictionary view lists the names and descriptions of factor types used in the system.

24.14 DBA_DV_IDENTITY View

The `DBA_DV_IDENTITY` data dictionary view lists the identities for each factor.

For example:

```
SELECT * FROM DBA_DV_IDENTITY WHERE VALUE = 'GLOBAL SHARED';
```

Output similar to the following appears, assuming you have created only one factor identity:

```

FACTOR_NAME          VALUE          TRUST_LEVEL
-----
Identification_Type GLOBAL SHARED  1

```

Related Views

- [DBA_DV_FACTOR View](#)
- [DBA_DV_IDENTITY_MAP View](#)

| Column | Datatype | Null | Description |
|-------------|---------------|----------|------------------------------------------------------------------------------------------------|
| FACTOR_NAME | VARCHAR(128) | NOT NULL | Name of the factor. |
| VALUE | VARCHAR(1024) | NOT NULL | Value of the factor. |
| TRUST_LEVEL | NUMBER | NOT NULL | Number that indicates the magnitude of trust relative to other identities for the same factor. |

Related Topics

- [DBA_DV_FACTOR View](#)
The `DBA_DV_FACTOR` data dictionary view lists the existing factors in the current PDB.
- [DBA_DV_IDENTITY_MAP View](#)
The `DBA_DV_IDENTITY_MAP` data dictionary view lists the mappings for each factor identity.

24.15 DBA_DV_IDENTITY_MAP View

The `DBA_DV_IDENTITY_MAP` data dictionary view lists the mappings for each factor identity.

The view includes mapping factors that are identified by other factors to combinations of parent-child factor links. For each factor, the maps are joined by the `OR` operation, and for different factors, the maps are joined by the `AND` operation.

You can use this view to resolve the identity for factors that are identified by other factors (for example, a domain) or for factors that have continuous domains (for example, Age or Temperature).

For example:

```
SELECT FACTOR_NAME, IDENTITY_VALUE FROM DBA_DV_IDENTITY_MAP;
```

Output similar to the following appears:

```

FACTOR_NAME          IDENTITY_VALUE
-----
Sector2_Program      Accounting-Sensitive

```

| Column | Datatype | Null | Description |
|-----------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------|
| FACTOR_NAME | VARCHAR(128) | NOT NULL | Factor the identity map is for. |
| IDENTITY_VALUE | VARCHAR(1024) | NOT NULL | Value the factor assumes if the identity map evaluates to TRUE. |
| OPERATION_CODE | VARCHAR(128) | NOT NULL | Descriptive name of the operation in the <code>OPERATION_VALUE</code> column. |
| OPERATION_VALUE | VARCHAR(4000) | NULL | Relational operator for the identity map (for example, <code><</code> , <code>></code> , <code>=</code> , and so on). |

| Column | Datatype | Null | Description |
|--------------------|----------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OPERAND1 | VARCHAR (1024) | NULL | Left operand for the relational operator; refers to the low value you enter. |
| OPERAND2 | VARCHAR (1024) | NULL | Right operand for the relational operator; refers to the high value you enter. |
| PARENT_FACTOR_NAME | VARCHAR (128) | NULL | The parent factor link to which the map is related. |
| CHILD_FACTOR_NAME | VARCHAR (128) | NULL | The child factor link to which the map is related. |
| LABEL_IND | VARCHAR (1) | NULL | Indicates whether the child factor being linked to the parent factor contributes to the label of the parent factor in an Oracle Label Security integration. Possible values are: <ul style="list-style-type: none"> Y (for Yes) N (for No) |

Related Topics

- [DBA_DV_FACTOR View](#)
The `DBA_DV_FACTOR` data dictionary view lists the existing factors in the current PDB.
- [DBA_DV_IDENTITY View](#)
The `DBA_DV_IDENTITY` data dictionary view lists the identities for each factor.

24.16 DBA_DV_JOB_AUTH View

The `DBA_DV_JOB_AUTH` data dictionary view lists the authorizations for using Oracle Scheduler in an Oracle Database Vault environment.

For example:

```
SELECT * FROM DBA_DV_JOB_AUTH WHERE GRANTEE = 'PRESTON';
```

Output similar to the following appears:

```
GRANTEE SCHEMA
-----
PRESTON OE
```

| Column | Datatype | Null | Description |
|---------|----------------|----------|----------------------------------------------------------------------------------------------------------------|
| GRANTEE | VARCHAR2 (128) | NOT NULL | Name of the user who has been granted Oracle Scheduler authorization |
| SCHEMA | VARCHAR2 (128) | NOT NULL | Name of the schema on which the user <code>GRANTEE</code> is authorized to perform Oracle Scheduler operations |

24.17 DBA_DV_MAC_POLICY View

The `DBA_DV_MAC_POLICY` data dictionary view lists the Oracle Label Security policies defined for use with Oracle Database Vault.

For example:

```
SELECT POLICY_NAME, ALGORITHM_CODE, ALGORITHM_MEANING
FROM DBA_DV_MAC_POLICY;
```

Output similar to the following appears:

```
POLICY_NAME      ALGORITHM_CODE  ALGORITHM_MEANING
-----
ACCESS_DATA      LUI              Minimum Level/Union/Intersection
```

| Column | Datatype | Null | Description |
|-------------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------|
| POLICY_NAME | VARCHAR(128) | NOT NULL | Name of the policy. |
| ALGORITHM_CODE | VARCHAR(128) | NOT NULL | Merge algorithm code used for the policy. See Related Topics. |
| ALGORITHM_MEANING | VARCHAR(4000) | NULL | Provides a text description for the corresponding value in the ALGORITHM_CODE column. See Related Topics. |
| ERROR_LABEL | VARCHAR(4000) | NULL | Label specified for initialization errors, to be set when a configuration error or run-time error occurs during session initialization. |

Related Topics

- [Table 19-2](#)
- [DBA_DV_MAC_POLICY_FACTOR View](#)
The DBA_DV_MAC_POLICY data dictionary view lists the factors that are associated with Oracle Label Security policies.
- [DBA_DV_POLICY_LABEL View](#)
The DBA_DV_POLICY_LABEL data dictionary view lists the Oracle Label Security label for each factor identifier in the DBA_DV_IDENTITY view for each policy.

24.18 DBA_DV_MAC_POLICY_FACTOR View

The DBA_DV_MAC_POLICY data dictionary view lists the factors that are associated with Oracle Label Security policies.

You can use this view to determine what factors contribute to the maximum session label for each policy using the DBA_DV_MAC_POLICY view.

For example:

```
SELECT * FROM DBA_DV_MAC_POLICY_FACTOR;
```

Output similar to the following appears:

```
FACTOR_NAME      MAC_POLICY_NAME
-----
App_Host_Name    Access Locations
```

| Column | Datatype | Null | Description |
|-----------------|--------------|----------|----------------------------------------------------------------------|
| FACTOR_NAME | VARCHAR(128) | NOT NULL | Name of the factor |
| MAC_POLICY_NAME | VARCHAR(128) | NOT NULL | Name of the Oracle Label Security policy associated with this factor |

Related Topics

- [DBA_DV_MAC_POLICY View](#)
The DBA_DV_MAC_POLICY data dictionary view lists the Oracle Label Security policies defined for use with Oracle Database Vault.

- [DBA_DV_POLICY_LABEL View](#)
The `DBA_DV_POLICY_LABEL` data dictionary view lists the Oracle Label Security label for each factor identifier in the `DBA_DV_IDENTITY` view for each policy.

24.19 DBA_DV_MAINTENANCE_AUTH View

The `DBA_DV_MAINTENANCE_AUTH` data dictionary view provides information about the configuration of Oracle Database Vault authorizations to use Information Life Management (ILM) features.

For example:

```
SELECT GRANTEE, ACTION STATE FROM DBA_DV_MAINTENANCE_AUTH;
```

Output similar to the following appears:

```
GRANTEE          ACTION
-----
PSMITH           ILM
```

| Column | Datatype | Null | Description |
|-------------|--------------|----------|------------------------------------------------|
| GRANTEE | VARCHAR(128) | NOT NULL | Name of the grantee |
| SCHEMA | VARCHAR(128) | NOT NULL | Schema name or % (for all schemas) |
| OBJECT | VARCHAR(128) | NOT NULL | Object name or % (for all objects in a schema) |
| OBJECT_TYPE | VARCHAR(30) | NOT NULL | Object type |
| ACTION | VARCHAR(30) | NOT NULL | Maintenance action ILM for ILM operations |

24.20 DBA_DV_ORADEBUG View

The `DBA_DV_ORADEBUG` data dictionary view indicates whether users can use the `ORADEBUG` utility in an Oracle Database Vault environment.

For example:

```
SELECT * FROM DBA_DV_ORADEBUG;
```

Output similar to the following appears:

```
STATE
-----
DISABLED
```

| Column | Datatype | Null | Description |
|--------|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STATE | VARCHAR2(8) | NOT NULL | Describes whether the <code>ORADEBUG</code> utility can be used in a Database Vault-enabled environment. Possible values are: <ul style="list-style-type: none"> • <code>ENABLED</code> means that users can run the <code>ORADEBUG</code> utility • <code>DISABLED</code> means that users cannot run the <code>ORADEBUG</code> utility |

24.21 DBA_DV_PATCH_ADMIN_AUDIT View

The `DBA_DV_PATCH_ADMIN_AUDIT` data dictionary view indicates if auditing has been enabled or disabled for the user who has been granted the `DV_ADMIN_PATCH` role.

The `DBMS_MACADM.ENABLE_DV_PATCH_ADMIN_AUDIT` procedure enables this type of auditing.

For example:

```
SELECT * FROM DBA_DV_PATCH_ADMIN_AUDIT;
```

Output similar to the following appears:

```
STATE
-----
DISABLED
```

| Column | Datatype | Null | Description |
|--------|--------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STATE | VARCHAR2 (8) | NOT NULL | Describes whether auditing has been enabled or disabled for the <code>DV_ADMIN_PATCH</code> role user. Possible values are: <ul style="list-style-type: none"> ENABLED means that the auditing has been enabled DISABLED means that the auditing has been disabled |

Related Topics

- [ENABLE_DV_PATCH_ADMIN_AUDIT Procedure](#)
The `ENABLE_DV_PATCH_ADMIN_AUDIT` procedure enables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.
- [DISABLE_DV_PATCH_ADMIN_AUDIT Procedure](#)
The `DISABLE_DV_PATCH_ADMIN_AUDIT` procedure disables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.

24.22 DBA_DV_POLICY View

The `DBA_DV_POLICY` data dictionary view lists the Oracle Database Vault policies that were created in the current database instance.

For example:

```
SELECT POLICY_NAME, STATE FROM DBA_DV_POLICY
WHERE STATE = 'ENABLED';
```

Output similar to the following appears:

```
POLICY_NAME                                STATE
-----
Oracle Account Management Controls         ENABLED
Oracle System Protection Controls          ENABLED
```

| Column | Datatype | Null | Description |
|-------------|----------------|----------|---------------------------------------------------------------------|
| POLICY_NAME | VARCHAR (128) | NOT NULL | Names of the Oracle Database Vault policies that have been created. |
| DESCRIPTION | VARCHAR (1024) | NULL | Description of the policy that was created |

| Column | Datatype | Null | Description |
|-----------------|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STATE | VARCHAR (8) | NULL | Specifies whether the policy is enabled. Possible values are: <ul style="list-style-type: none"> ENABLED DISABLED SIMULATION |
| ID# | VARCHAR (1) | NOT NULL | Is a system-generated ID that was assigned to the policy when the policy was created |
| ORACLE_SUPPLIED | VARCHAR (3) | NULL | Indicates whether the policy is a default Oracle Database Vault policy |
| PL_SQL_STACK | VARCHAR (3) | NULL | When simulation mode is enabled, indicates whether the PL/SQL stack has been recorded for failed operations. TRUE indicates that the PL/SQL stack has been recorded; FALSE indicates that the PL/SQL stack has not been recorded. |

Related Topics

- [DBA_DV_POLICY_OBJECT View](#)
The `DBA_DV_POLICY_OBJECT` data dictionary view lists information about the objects that are protected by Oracle Database Vault policies in the current database instance.
- [DBA_DV_SIMULATION_LOG View](#)
The `DBA_DV_SIMULATION_LOG` data dictionary view captures simulation log information for realms and command rules that have had simulation mode enabled.
- [DVSYS.POLICY_OWNER_POLICY View](#)
The `DVSYS.POLICY_OWNER_POLICY` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information such as the names, descriptions, and states of existing policies in the current database instance, including policies created by other policy owners.

24.23 DBA_DV_POLICY_LABEL View

The `DBA_DV_POLICY_LABEL` data dictionary view lists the Oracle Label Security label for each factor identifier in the `DBA_DV_IDENTITY` view for each policy.

For example:

```
SELECT * FROM DBA_DV_POLICY_LABEL;
```

Output similar to the following appears:

```
IDENTITY_VALUE  FACTOR_NAME      POLICY_NAME      LABEL
-----
App_Host_Name   Sect2_Fin_Apps   Access Locations  Sensitive
```

| Column | Datatype | Null | Description |
|----------------|---------------|----------|-----------------------------------------------------------------------|
| IDENTITY_VALUE | VARCHAR(1024) | NOT NULL | Name of the factor identifier. |
| FACTOR_NAME | VARCHAR(128) | NOT NULL | Name of the factor associated with the factor identifier. |
| POLICY_NAME | VARCHAR(128) | NOT NULL | Name of the Oracle Label Security policy associated with this factor. |
| LABEL | VARCHAR(4000) | NOT NULL | Name of the Oracle Label Security label associated with the policy. |

Related Topics

- [DBA_DV_MAC_POLICY View](#)
The `DBA_DV_MAC_POLICY` data dictionary view lists the Oracle Label Security policies defined for use with Oracle Database Vault.
- [DBA_DV_MAC_POLICY_FACTOR View](#)
The `DBA_DV_MAC_POLICY` data dictionary view lists the factors that are associated with Oracle Label Security policies.

24.24 DBA_DV_POLICY_OBJECT View

The `DBA_DV_POLICY_OBJECT` data dictionary view lists information about the objects that are protected by Oracle Database Vault policies in the current database instance.

For example:

```
SELECT POLICY_NAME, OBJECT_TYPE FROM DBA_DV_POLICY_OBJECT WHERE POLICY_NAME LIKE
'%Protection Controls';
```

Output similar to the following appears:

```
POLICY_NAME                OBJECT_TYPE
-----
Oracle System Protection Controls  REALM
```

| Column | Datatype | Null | Description |
|--------------------------------|---------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>POLICY_NAME</code> | <code>VARCHAR(128)</code> | NOT NULL | Names of the Oracle Database Vault policies that have been created. |
| <code>OBJECT_TYPE</code> | <code>VARCHAR(12)</code> | NULL | Type of object that is being protected, such as <code>REALM</code> |
| <code>COMMAND</code> | <code>VARCHAR(128)</code> | NULL | Name of the command rules that are protected by Database Vault policies |
| <code>COMMAND_OBJ_OWNER</code> | <code>VARCHAR(128)</code> | NULL | Names of object owners that are associated with Database Vault policies |
| <code>COMMAND_OBJ_NAME</code> | <code>VARCHAR(128)</code> | NULL | Names of objects that are associated with Database Vault policies |
| <code>COMMAND_CLAUSE</code> | <code>VARCHAR(100)</code> | NULL | A clause from either the <code>ALTER SYSTEM</code> or <code>ALTER SESSION</code> SQL statement, which was used to create the command rule. For example, you it could list the <code>SET</code> clause for the <code>ALTER SESSION</code> statement. The command rule settings for these two statements are described in the <code>DBMS_MACADM.CREATE_COMMAND_RULE</code> procedure. See Related Topics. |
| <code>COMMAND_PARAMETER</code> | <code>VARCHAR(128)</code> | NULL | A parameter from the <code>ALTER SYSTEM</code> or <code>ALTER SESSION</code> command rule <code>CLAUSE_NAME</code> setting. See Related Topics. |
| <code>COMMAND_EVENT</code> | <code>VARCHAR(128)</code> | NULL | An event that the <code>ALTER SYSTEM</code> or <code>ALTER SESSION</code> command rule defines. See Related Topics. |
| <code>COMMAND_COMPONENT</code> | <code>VARCHAR(128)</code> | NULL | A component of the <code>EVENT_NAME</code> setting for the <code>ALTER SYSTEM</code> or <code>ALTER SESSION</code> command rule. See Related Topics. |

| Column | Datatype | Null | Description |
|----------------|--------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COMMAND_ACTION | VARCHAR(128) | NULL | An action of the EVENT_NAME setting for the ALTER SYSTEM or ALTER SESSION command rule. See Related Topics. |
| COMMON | VARCHAR(3) | NULL | Indicates if the policy objects are local or common. Possible values are: <ul style="list-style-type: none"> YES if the policy objects are common NO if the policy objects are local |
| INHERITED | VARCHAR(3) | NULL | Shows the inheritance status of the policy object, when the COMMON column output is YES. Values are as follows: <ul style="list-style-type: none"> YES means that the policy object was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. NO means that the policy object is a local object, or it is common from that container. For example, in an application root, an application common realm will have an INHERITED value NO but a CDB root common command rule will have an INHERITED value of YES. |

Related Topics

- [CREATE_COMMAND_RULE Procedure](#)
The CREATE_COMMAND_RULE procedure creates both command and local command rules, which can be added to a rule set.
- [DBA_DV_POLICY View](#)
The DBA_DV_POLICY data dictionary view lists the Oracle Database Vault policies that were created in the current database instance.
- [DBA_DV_POLICY_OWNER View](#)
The DBA_DV_POLICY_OWNER data dictionary view lists the owners of Oracle Database Vault policies that were created in the current database instance.

24.25 DBA_DV_POLICY_OWNER View

The DBA_DV_POLICY_OWNER data dictionary view lists the owners of Oracle Database Vault policies that were created in the current database instance.

For example:

```
SELECT * FROM DBA_DV_POLICY_OWNER;
```

Output similar to the following appears:

```
POLICY_OWNER          POLICY_OWNER
-----
Oracle System Protection Controls  PSMITH
```

| Column | Datatype | Null | Description |
|--------------|--------------|----------|---------------------------------------------------------------------|
| POLICY_NAME | VARCHAR(128) | NOT NULL | Names of the Oracle Database Vault policies that have been created. |
| POLICY_OWNER | VARCHAR(128) | NOT NULL | Names of users who have own Database Vault policies |

Related Topics

- [DBA_DV_POLICY View](#)
The `DBA_DV_POLICY` data dictionary view lists the Oracle Database Vault policies that were created in the current database instance.
- [DBA_DV_POLICY_OBJECT View](#)
The `DBA_DV_POLICY_OBJECT` data dictionary view lists information about the objects that are protected by Oracle Database Vault policies in the current database instance.

24.26 DBA_DV_PREPROCESSOR_AUTH View

The `DBA_DV_PREPROCESSOR_AUTH` data dictionary view shows users who have been granted authorization to run preprocessor programs through external tables.

For example:

```
SELECT * FROM DBA_DV_PREPROCESSOR_AUTH WHERE GRANTEE = 'PFITCH';
```

Output similar to the following appears:

```
GRANTEE
-----
PFITCH
```

| Column | Datatype | Null | Description |
|---------|----------------|----------|----------------------------------------------------------------------------------|
| GRANTEE | VARCHAR2 (128) | NOT NULL | Name of the user who has been granted authorization to run preprocessor programs |

Related Topics

- [Using Oracle Database Replay with Oracle Database Vault](#)
Database administrators can authorize Oracle Database Replay users to work in a Database Vault environment.

24.27 DBA_DV_PROXY_AUTH View

The `DBA_DV_PROXY_AUTH` data dictionary view lists the proxy users and schemas that were specified by the `DBMS_MACADM.AUTHORIZE_PROXY_USER` procedure.

This procedure grants a proxy user authorization to proxy other user accounts.

For example:

```
SELECT * FROM DBA_DV_DDL_AUTH WHERE GRANTEE = 'PRESTON';
```

Output similar to the following appears:

```
GRANTEE SCHEMA
-----
PRESTON DKENT
```

| Column | Datatype | Null | Description |
|---------|----------------|----------|---------------------------------------------------------|
| GRANTEE | VARCHAR2 (128) | NOT NULL | Name of the proxy user |
| SCHEMA | VARCHAR2 (128) | NOT NULL | Name of the schema that is proxied by the GRANTEE user. |

Related Topics

- [AUTHORIZE_PROXY_USER Procedure](#)
The `AUTHORIZE_PROXY_USER` procedure grants a proxy user authorization to proxy other user accounts, as long as the proxy user has database authorization.
- [UNAUTHORIZE_PROXY_USER Procedure](#)
The `UNAUTHORIZE_PROXY_USER` procedure revokes authorization from a user who was granted proxy authorization from the `DBMS_MACADM.AUTHORIZE_PROXY_USER` procedure.

24.28 DBA_DV_PUB_PRIVS View

The `DBA_DV_PUB_PRIVS` data dictionary view lists data reflected in the Oracle Database Vault privilege management reports used in Oracle Database Vault Administrator.

See also [Privilege Management - Summary Reports](#).

For example:

```
SELECT USERNAME, ACCESS_TYPE FROM DBA_DV_PUB_PRIVS WHERE USERNAME = 'OE';
```

Output similar to the following appears:

```
USERNAME    ACCESS_TYPE
-----
OE          PUBLIC
```

| Column | Datatype | Null | Description |
|-------------|--------------|----------|--------------------------------------------------------------------------------------|
| USERNAME | VARCHAR(128) | NOT NULL | Database schema in the current database instance. |
| ACCESS_TYPE | VARCHAR(128) | NULL | Access type granted to the user listed in the USERNAME column (for example, PUBLIC). |
| PRIVILEGE | VARCHAR(40) | NOT NULL | Privilege granted to the user listed in the USERNAME column. |
| OWNER | VARCHAR(128) | NOT NULL | Owner of the database schema to which the USERNAME user has been granted privileges. |
| OBJECT_NAME | VARCHAR(128) | NOT NULL | Name of the object within the schema listed in the OWNER column. |

Related Topics

- [Privilege Management - Summary Reports](#)
The privilege management summary reports track privilege distribution by grantees, owners, and privileges.
- [DBA_DV_USER_PRIVS View](#)
The `DBA_DV_USER_PRIVS` data dictionary view lists the privileges for a database user account excluding privileges granted through the `PUBLIC` role.
- [DBA_DV_USER_PRIVS_ALL View](#)
The `DBA_DV_USER_PRIVS_ALL` data dictionary view lists the privileges for a database account including privileges granted through `PUBLIC`.
- [DBA_DV_ROLE View](#)
The `DBA_DV_ROLE` data dictionary view lists the Oracle Database Vault secure application roles used in privilege management.

24.29 DBA_DV_REALM View

The `DBA_DV_REALM` data dictionary view lists the realms created in the current database instance.

For example:

```
SELECT NAME, ENABLED, COMMON FROM DBA_DV_REALM ORDER BY NAME;
```

Output similar to the following appears:

```
NAME                                ENABLED  COMMON
-----                                -
Database Vault Account Management    Y        NO
...
```

| Column | Datatype | Null | Description |
|---------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | VARCHAR(128) | NOT NULL | Names of the realms created. |
| DESCRIPTION | VARCHAR(1024) | NOT NULL | Description of the realm created. |
| AUDIT_OPTIONS | NUMBER | NOT NULL | Specifies whether auditing using traditional auditing is enabled. Possible values are: <ul style="list-style-type: none"> 0: No auditing for the realm. 1: Creates an audit record when a realm violation occurs (for example, when an unauthorized user tries to modify an object that is protected by the realm). 2: Creates an audit record for authorized activities on objects protected by the realm. 3: Creates an audit record for both authorized and unauthorized activities on objects protected by the realm. Starting with Oracle Database release 21c, traditional auditing is deprecated. |
| REALM_TYPE | VARCHAR(9) | NULL | Type of realm: whether it is a regular realm or a mandatory realm. See <code>realm_type</code> in the <code>UPDATE_REALM</code> command description for more information about possible values. (See Related Topics.) |
| COMMON | VARCHAR(3) | NOT NULL | Indicates whether the realm is local or common. Possible values are: <ul style="list-style-type: none"> YES if the realm is common NO if the realm is local |
| INHERITED | VARCHAR(3) | NULL | Shows the inheritance status of the realm, when the <code>COMMON</code> column output is YES. Values are as follows: <ul style="list-style-type: none"> YES means that the realm was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. NO means that the realm is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value NO but a CDB root common command rule will have an <code>INHERITED</code> value of YES. |

| Column | Datatype | Null | Description |
|-----------------|------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ENABLED | VARCHAR(1) | NOT NULL | Possible values are as follows: <ul style="list-style-type: none"> Y indicates that realm checking is enabled N indicates it is disabled S indicates the realm is in simulation mode |
| ID# | NUMBER | NOT NULL | The ID number of the realm, which is automatically generated when the realm is created |
| ORACLE_SUPPLIED | VARCHAR(3) | NOT NULL | Indicates whether the realm is a default (that is, Oracle-supplied) realm or a user-created command rule. Possible values are: <ul style="list-style-type: none"> YES if the realm is a default realm NO if the realm is a user-created realm |
| PL_SQL_STACK | VARCHAR(3) | NULL | When simulation mode is enabled, indicates whether the PL/SQL stack has been recorded for failed operations. TRUE indicates that the PL/SQL stack has been recorded; FALSE indicates that the PL/SQL stack has not been recorded. |

Related Topics

- [DBA_DV_REALM_AUTH View](#)
The DBA_DV_REALM_AUTH data dictionary view lists database user account or role authorization (GRANTEE) who can access realm objects.
- [DBA_DV_REALM_OBJECT View](#)
The DBA_DV_REALM_OBJECT data dictionary view lists the database schemas, or subsets of schemas, that are secured by the realms.
- [UPDATE_REALM Procedure](#)
The UPDATE_REALM procedure updates a realm.

24.30 DBA_DV_REALM_AUTH View

The DBA_DV_REALM_AUTH data dictionary view lists database user account or role authorization (GRANTEE) who can access realm objects.

For example:

```
SELECT REALM_NAME, GRANTEE, AUTH_RULE_SET_NAME FROM DBA_DV_REALM_AUTH;
```

Output similar to the following appears:

```
REALM_NAME                GRANTEE  AUTH_RULE_SET_NAME
-----
Performance Statistics Realm  SYSADM   Check Conf Access
```

| Column | Datatype | Null | Description |
|--------------|--------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REALM_NAME | VARCHAR(128) | NULL | Name of the realm. |
| COMMON_REALM | VARCHAR(3) | NULL | For a multitenant environment, indicates whether the realm is local or common. Possible values are: <ul style="list-style-type: none"> YES if the realm is common NO if the realm is local |

| Column | Datatype | Null | Description |
|--------------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| INHERITED_REALM | VARCHAR(3) | NULL | Shows the inheritance status of the realm, when the <code>COMMON</code> column output is <code>YES</code> . Values are as follows: <ul style="list-style-type: none"> <code>YES</code> means that the realm was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. <code>NO</code> means that the realm is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value <code>NO</code> but a CDB root common command rule will have an <code>INHERITED</code> value of <code>YES</code>. |
| GRANTEE | VARCHAR(128) | NOT NULL | User or role name to authorize as owner or participant. |
| AUTH_RULE_SET_NAME | VARCHAR(128) | NULL | Rule set to check before authorizing. If the rule set evaluates to <code>TRUE</code> , then the authorization is allowed. |
| AUTH_OPTIONS | VARCHAR(4000) | NULL | Type of realm authorization: either <code>Participant</code> or <code>Owner</code> . |
| COMMON_AUTH | VARCHAR(3) | NULL | Indicates whether the authorization to the common realm is local or common. Possible values are: <ul style="list-style-type: none"> <code>YES</code> if the authorization is common <code>NO</code> if the authorization is local to this PDB |
| INHERITED_AUTH | VARCHAR(3) | NULL | Shows the inheritance status of the realm authorization, when the <code>COMMON_AUTH</code> column output is <code>YES</code> . Values are as follows: <ul style="list-style-type: none"> <code>YES</code> means that the realm authorization was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was applied. <code>NO</code> means that the realm authorization is local, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED_AUTH</code> value <code>NO</code> but a CDB root common command rule will have an <code>INHERITED_AUTH</code> value of <code>YES</code>. |

Related Topics

- [About Realm Authorization](#)
Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.
- [DBA_DV_REALM View](#)
The `DBA_DV_REALM` data dictionary view lists the realms created in the current database instance.
- [DBA_DV_REALM_OBJECT View](#)
The `DBA_DV_REALM_OBJECT` data dictionary view lists the database schemas, or subsets of schemas, that are secured by the realms.

24.31 DBA_DV_REALM_OBJECT View

The `DBA_DV_REALM_OBJECT` data dictionary view lists the database schemas, or subsets of schemas, that are secured by the realms.

See [About Realm-Secured Objects](#) for more information.

For example:

```
SELECT REALM_NAME, OWNER, OBJECT_NAME, COMMON_REALM FROM DBA_DV_REALM_OBJECT;
```

Output similar to the following appears:

```
REALM_NAME          OWNER    OBJECT_NAME  COMMON_REALM
-----
Performance Statistics Realm OE      ORDERS      NO
```

| Column | Datatype | Null | Description |
|-----------------|--------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REALM_NAME | VARCHAR(128) | NOT NULL | Name of the realm. |
| COMMON_REALM | VARCHAR(3) | NOT NULL | Indicates whether this realm is a common realm or a local realm. Possible values are: <ul style="list-style-type: none"> YES if the realm is common NO if the realm is local |
| INHERITED_REALM | VARCHAR(3) | NOT NULL | Shows the inheritance status of the realm when the <code>COMMON</code> column output is <code>YES</code> . Values are as follows: <ul style="list-style-type: none"> <code>YES</code> means that the realm was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. <code>NO</code> means that the realm is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value <code>NO</code> but a CDB root common command rule will have an <code>INHERITED</code> value of <code>YES</code>. |
| OWNER | VARCHAR(128) | NOT NULL | Database schema owner who owns the object. |
| OBJECT_NAME | VARCHAR(128) | NOT NULL | Name of the object the realm protects. |
| OBJECT_TYPE | VARCHAR(32) | NOT NULL | Type of object the realm protects, such as a database table, view, index, or role. |

Related Topics

- [About Realm-Secured Objects](#)
Realm-secured objects define the territory—a set of schema and database objects and roles—that a realm protects.
- [DBA_DV_REALM View](#)
The `DBA_DV_REALM` data dictionary view lists the realms created in the current database instance.
- [DBA_DV_REALM_AUTH View](#)
The `DBA_DV_REALM_AUTH` data dictionary view lists database user account or role authorization (`GRANTEE`) who can access realm objects.

24.32 DBA_DV_ROLE View

The `DBA_DV_ROLE` data dictionary view lists the Oracle Database Vault secure application roles used in privilege management.

For example:

```
SELECT ROLE, RULE_NAME FROM DBA_DV_ROLE;
```

Output similar to the following appears:

```
ROLE                RULE_NAME
-----
Sector2_APP_MGR     Check App2 Access
Sector2_APP_DBA     Check App2 Access
```

| Column | Datatype | Null | Description |
|-----------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ROLE | VARCHAR(128) | NOT NULL | Name of the secure application role. |
| RULE_NAME | VARCHAR(128) | NOT NULL | Name of the rule set associated with the secure application role. |
| ENABLED | VARCHAR(1) | NOT NULL | Indicates whether the secure application role is enabled. Possible values are: <ul style="list-style-type: none"> Y (Yes) if the role is enabled N (No) if the role is disabled |
| ID# | NUMBER | NOT NULL | The ID number of the command rule, which is automatically generated when the command rule is created |
| ORACLE_SUPPLIED | VARCHAR(3) | NOT NULL | Indicates whether the command rule is a default (that is, Oracle-supplied) command rule or a user-created command rule. Possible values are: <ul style="list-style-type: none"> YES if the command rule is a default command rule NO if the command rule is a user-created command rule |

Related Topics

- [DBA_DV_PUB_PRIVS View](#)
The `DBA_DV_PUB_PRIVS` data dictionary view lists data reflected in the Oracle Database Vault privilege management reports used in Oracle Database Vault Administrator.
- [DBA_DV_USER_PRIVS View](#)
The `DBA_DV_USER_PRIVS` data dictionary view lists the privileges for a database user account excluding privileges granted through the `PUBLIC` role.
- [DBA_DV_USER_PRIVS_ALL View](#)
The `DBA_DV_USER_PRIVS_ALL` data dictionary view lists the privileges for a database account including privileges granted through `PUBLIC`.

24.33 DBA_DV_RULE View

The `DBA_DV_RULE` data dictionary view lists the rules that have been defined.

For example:

```
SELECT NAME, RULE_EXPR FROM DBA_DV_RULE WHERE NAME = 'Maintenance Window';
```

Output similar to the following appears:

```

NAME                RULE_EXP
-----
Maintenance Window TO_CHAR(SYSDATE,'HH24') BETWEEN '10' AND '12'

```

To find the rule sets that use specific rules, query the `DBA_DV_RULE_SET_RULE` view.

| Column | Datatype | Null | Description |
|-----------------|---------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | VARCHAR(128) | NOT NULL | Name of the rule. |
| RULE_EXPR | VARCHAR(1024) | NOT NULL | PL/SQL expression for the rule. |
| COMMON | VARCHAR(3) | NOT NULL | Indicates whether the rule is local or common. Possible values are: <ul style="list-style-type: none"> YES if the rule is common NO if the rule is local |
| INHERITED | VARCHAR(3) | NULL | Shows the inheritance status of the rule, when the <code>COMMON</code> column output is <code>YES</code> . Values are as follows: <ul style="list-style-type: none"> <code>YES</code> means that the rule was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. <code>NO</code> means that the rule is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value <code>NO</code> but a CDB root common command rule will have an <code>INHERITED</code> value of <code>YES</code>. |
| ID# | NUMBER | NOT NULL | The ID number of the rule, which is automatically generated when the rule is created |
| ORACLE_SUPPLIED | VARCHAR(3) | NULL | Indicates whether the rule is a default (that is, Oracle-supplied) rule or a user-created rule. Possible values are: <ul style="list-style-type: none"> YES if the rule is a default rule NO if the rule is a user-created rule |

Related Topics

- [DBA_DV_RULE_SET View](#)
The `DBA_DV_RULE_SET` data dictionary view lists the rules sets that have been created.
- [DBA_DV_RULE_SET_RULE View](#)
The `DBA_DV_RULE_SET_RULE` data dictionary view lists rules that are associated with existing rule sets.

24.34 DBA_DV_RULE_SET View

The `DBA_DV_RULE_SET` data dictionary view lists the rules sets that have been created.

For example:

```

SELECT RULE_SET_NAME, HANDLER_OPTIONS, HANDLER FROM DBA_DV_RULE_SET
WHERE RULE_SET_NAME = 'Maintenance Period';

```

Output similar to the following appears:

```

RULE_SET_NAME      HANDLER_OPTIONS  HANDLER
-----
Maintenance Period                1 dbavowner.email_alert

```

| Column | Datatype | Null | Description |
|----------------------|---------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RULE_SET_NAME | VARCHAR(128) | NOT NULL | Name of the rule set. |
| DESCRIPTION | VARCHAR(1024) | NULL | Description of the rule set. |
| ENABLED | VARCHAR(1) | NOT NULL | Indicates whether the rule set has been enabled. Y (Yes) enables the rule set; N (No) disables it. |
| EVAL_OPTIONS_MEANING | VARCHAR(4000) | NULL | For rules sets that contain multiple rules, determines how many rules are evaluated. Possible values are: <ul style="list-style-type: none"> All True: All rules in the rule set must evaluate to true for the rule set itself to evaluate to TRUE. Any True: At least one rule in the rule set must evaluate to true for the rule set itself to evaluate to TRUE. |
| AUDIT_OPTIONS | NUMBER | NOT NULL | Indicates when auditing using traditional auditing is used. Possible values are: <ul style="list-style-type: none"> 0: No auditing 1: Audit on failure 2: Audit on success 3: Audit on both failure and success Starting with Oracle Database release 21c, traditional auditing is deprecated. |
| FAIL_OPTIONS_MEANING | VARCHAR(4000) | NULL | Determines when an audit record is created for the rule set. Possible values are: <ul style="list-style-type: none"> Do Not Show Error Message. Show Error Message |
| FAIL_MESSAGE | VARCHAR(80) | NULL | Error message for failure that is associated with the fail code listed in the FAIL_CODE column. |
| FAIL_CODE | VARCHAR(10) | NULL | The error message number associated with the message listed in the FAIL_MESSAGE column. Possible values are in the ranges of -20000 to -20999 or 20000 to 20999. |
| HANDLER_OPTIONS | NUMBER | NOT NULL | Determines how error handling is used. Possible values are: <ul style="list-style-type: none"> 0: Disables error handling. 1: Call handler on rule set failure. 2: Call handler on rule set success. |
| HANDLER | VARCHAR(1024) | NULL | Name of the PL/SQL function or procedure that defines the custom event handler logic. |
| IS_STATIC | VARCHAR2(5) | NULL | Indicates how often the rule set is evaluated during a user session. Possible values are: <ul style="list-style-type: none"> TRUE: The rule set is evaluated once, and result of the rule set is reused throughout the user session. FALSE (default): The rule set is evaluated each time it is accessed during the user session. |

| Column | Datatype | Null | Description |
|-----------------|--------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COMMON | VARCHAR2 (3) | NULL | Indicates whether the rule set is local or common. Possible values are: <ul style="list-style-type: none"> • YES if the rule set is common • NO if the rule set is local |
| INHERITED | VARCHAR2 (3) | NULL | Shows the inheritance status of the rule set, when the COMMON column output is YES. Values are as follows: <ul style="list-style-type: none"> • YES means that the rule set was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. • NO means that the rule set is a local object, or it is common from that container. For example, in an application root, an application common realm will have an INHERITED value NO but a CDB root common command rule will have an INHERITED value of YES. |
| ID# | NUMBER) | NOT NULL | The ID number of the rule set, which is automatically generated when the rule set is created |
| ORACLE_SUPPLIED | VARCHAR2 (3) | NULL | Indicates whether the rule set is a default (that is, Oracle-supplied) rule set or a user-created rule set. Possible values are: <ul style="list-style-type: none"> • YES if the rule set is a default rule set • NO if the rule set is a user-created rule set |

Related Topics

- [DBA_DV_RULE View](#)
The DBA_DV_RULE data dictionary view lists the rules that have been defined.
- [DBA_DV_RULE_SET_RULE View](#)
The DBA_DV_RULE_SET_RULE data dictionary view lists rules that are associated with existing rule sets.

24.35 DBA_DV_RULE_SET_RULE View

The DBA_DV_RULE_SET_RULE data dictionary view lists rules that are associated with existing rule sets.

For example:

```
SELECT RULE_SET_NAME, RULE_NAME, RULE_EXPR FROM DBA_DV_RULE_SET_RULE
WHERE RULE_NAME = 'Is Security Officer';
```

Output similar to the following appears:

```
RULE_SET_NAME          RULE_NAME          RULE_EXP
-----
Can Grant VPD Administration Is Security Owner  DBMS_MACUTL.USER_HAS_ROLE_VARCHAR
('DV_OWNER',
dvsys.dv_login_user) = 'Y'
```

| Column | Datatype | Null | Description |
|---------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RULE_SET_NAME | VARCHAR(128) | NOT NULL | Name of the rule set that contains the rule. |
| RULE_NAME | VARCHAR(128) | NOT NULL | Name of the rule. |
| RULE_EXPR | VARCHAR(1024) | NOT NULL | PL/SQL expression that defines the rule listed in the RULE_NAME column. |
| ENABLED | VARCHAR(1) | NOT NULL | Indicates whether the rule is enabled or disabled. Y (Yes) enables the rule set; N (No) disables it. |
| RULE_ORDER | NUMBER | NOT NULL | The order in which rules are used within the rule set. Does not apply to this release. |
| COMMON | VARCHAR(3) | NOT NULL | Indicates whether the rule is local or common. Possible values are: <ul style="list-style-type: none"> YES if the rule is common NO if the rule is local |
| INHERITED | VARCHAR(3) | NOT NULL | Shows the inheritance status of the rule, when the COMMON column output is YES. Values are as follows: <ul style="list-style-type: none"> YES means that the rule was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. NO means that the rule is a local object, or it is common from that container. For example, in an application root, an application common realm will have an INHERITED value NO but a CDB root common command rule will have an INHERITED value of YES. |

Related Topics

- [DBA_DV_RULE View](#)
The DBA_DV_RULE data dictionary view lists the rules that have been defined.
- [DBA_DV_RULE_SET View](#)
The DBA_DV_RULE_SET data dictionary view lists the rules sets that have been created.

24.36 DBA_DV_SIMULATION_LOG View

The DBA_DV_SIMULATION_LOG data dictionary view captures simulation log information for realms and command rules that have had simulation mode enabled.

For example:

```
SELECT USERNAME, COMMAND
FROM DBA_DV_SIMULATION_LOG, REALM_NAME
WHERE REALM_NAME = 'HR Realm';
```

Output similar to the following appears:

```
USERNAME      COMMAND
-----
PSMITH        SELECT
```

| Column | Datatype | Null | Description |
|--------|----------|----------|-------------------|
| ID | NUMBER | NOT NULL | Simulation log ID |

| Column | Datatype | Null | Description |
|-----------------------|-----------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| USERNAME | VARCHAR2 (128) | NOT NULL | Name of the user whose information is being tracked |
| COMMAND | VARCHAR2 (128) | NOT NULL | Command rule being tracked For a listing of existing command rules, query the DBA_DV_COMMAND_RULE view. |
| VIOLATION_TYPE | VARCHAR2 (4000) | NULL | Type of violation. See Table 24-2 for more information. |
| REALM_NAME | VARCHAR2 (4000) | NULL | Realm being tracked. Multiple realms are represented as comma separated names in the VARCHAR2 field. For a listing of existing realms, query the DBA_DV_REALM view. |
| REALM_TYPE | VARCHAR2 (9) | NULL | Type of realm being tracked (for example, mandatory realms). |
| OBJECT_OWNER | VARCHAR2 (128) | NULL | For command rules, the database schema to which the command rule applied |
| OBJECT_NAME | VARCHAR2 (128) | NULL | For command rules, the database object that the command rule protects |
| OBJECT_TYPE | VARCHAR2 (129) | NULL | For command rules, the type of object that is being protected |
| RULE_SET_NAME | VARCHAR2 (4000) | NULL | Rule set being tracked; it is associated with a command rule. Multiple rule sets are represented as comma separated names in the VARCHAR2 field. For a listing of existing rule sets, query the DBA_DV_RULE_SET view, described in DBA_DV_RULE_SET View |
| RETURNCODE | NUMBER | NOT NULL | The Oracle Database ORA error that results if the Database Vault entity was in the enabled state rather than in simulation state |
| SQLTEXT | VARCHAR2 (4000) | NULL | SQL text that the simulation mode captures |
| AUTHENTICATION_METHOD | VARCHAR2 (10) | NULL | Authentication method used. |
| CLIENT_IP | VARCHAR2 (45) | NULL | The IP address of the machine from which the client is connected |
| DB_DOMAIN | VARCHAR2 (128) | NULL | The domain of the database as specified in the DB_DOMAIN initialization parameter |
| DATABASE_HOSTNAME | VARCHAR2 (128) | NULL | The host name of the computer on which the instance is running |
| DATABASE_INSTANCE | VARCHAR2 (5) | NULL | The instance identification number of the current instance |
| DATABASE_IP | VARCHAR2 (45) | NULL | The IP address of the computer on which the instance is running |
| DATABASE_NAME | VARCHAR2 (128) | NULL | The name of the database as specified in the DB_NAME initialization parameter |
| DOMAIN | VARCHAR2 (4000) | NULL | A named collection of physical, configuration, or implementation-specific factors in the run-time environment. |
| ENTERPRISE_IDENTITY | VARCHAR2 (1024) | NULL | The enterprise-wide identity for the user. |

| Column | Datatype | Null | Description |
|---------------------------|-----------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IDENTIFICATION_TYPE | VARCHAR2 (14) | NULL | The way the user schema was created in the database. |
| LANG | VARCHAR2 (10) | NULL | The ISO abbreviation for the language name, a shorter form than the existing LANGUAGE parameter |
| LANGUAGE | VARCHAR2 (100) | NULL | The language and territory your session currently uses, along with the database character set. |
| MACHINE | VARCHAR2 (64) | NULL | The host name for the database client that established the current session. If you must find out whether the computer was used for a client or server session, then you can compare this setting with the Database_Hostname factor to make the determination |
| NETWORK_PROTOCOL | VARCHAR2 (4) | NULL | The network protocol being used for communication, as specified in the PROTOCOL=protocol portion of the connect string |
| PROXY_ENTERPRISE_IDENTITY | VARCHAR2 (1024) | NULL | The Oracle Internet Directory DN when the proxy user is an enterprise user |
| PROXY_USER | VARCHAR2 (128) | NULL | The name of the database user who opened the current session on behalf of SESSION_USER |
| SESSION_USER | VARCHAR2 (128) | NULL | The database user name by which the current user is authenticated. This value remains the same throughout the session. |
| DV\$_DBLINK_INFO | VARCHAR2 (128) | NULL | Returns the source of a database link session. The string that it returns has this form: SOURCE_GLOBAL_NAME=dblink_src_global_name, DBLINK_NAME=dblink_name, SOURCE_AUDIT_SESSIONID=dblink_src_audit_sessionid In this specification: <ul style="list-style-type: none"> • dblink_src_global_name is the unique global name of the source database • dblink_name is the name of the database link on the source database • dblink_src_audit_sessionid source database that initiated source database that initiated the connection to the remote database using dblink_name |
| DV\$_MODULE | VARCHAR2 (64) | NULL | The application name (module) that was set through the DBMS_APPLICATION_INFO PL/SQL package or Oracle Call Interface (OCI). |
| DV\$_CLIENT_IDENTIFIER | VARCHAR2 (64) | NULL | Returns an identifier that is set by the application through the DBMS_SESSION.SET_IDENTIFIER procedure, the OCI attribute OCI_ATTR_CLIENT_IDENTIFIER, or Oracle Dynamic Monitoring Service (DMS). Various Oracle Database components use this attribute to identify lightweight application users who authenticate as the same database user. |

| Column | Datatype | Null | Description |
|----------------|---------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FACTOR_CONTEXT | VARCHAR2 (4000) | NULL | An XML document that contains all of the factor identifiers for the current session at the point when the audit event was triggered |
| TIMESTAMP | TIMESTAMP (6) WITH TIME ZONE | NULL | Time stamp of user action, in UTC (Coordinated Universal Time) time zone |
| PL_SQL_STACK | CLOB | NULL | When simulation mode is enabled, indicates whether the PL/SQL stack has been recorded for failed operations. TRUE indicates that the PL/SQL stack has been recorded; FALSE indicates that the PL/SQL stack has not been recorded. |

VIOLATION_TYPE Code Values

Table 24-2 lists the VIOLATION_TYPE code values for the DBA_DV_SIMULATION_LOG view.

Table 24-2 DBA_DV_SIMULATION_LOG VIOLATION_TYPE Code Values

| Code | Meaning |
|------|------------------------------------------|
| 1000 | Realm violation |
| 1001 | Command rule violation |
| 1002 | Oracle Data Pump authorization violation |
| 1003 | Simulation violation |
| 1004 | Oracle Scheduler authorization violation |
| 1005 | DDL authorization violation |
| 1006 | PARSE_AS_USER violation |

Related Topics

- [DBA_DV_REALM View](#)
The DBA_DV_REALM data dictionary view lists the realms created in the current database instance.
- [DBA_DV_COMMAND_RULE View](#)
The DBA_DV_COMMAND_RULE data dictionary view lists the SQL statements that are protected by command rules.
- [DBA_DV_POLICY View](#)
The DBA_DV_POLICY data dictionary view lists the Oracle Database Vault policies that were created in the current database instance.

24.37 DBA_DV_STATUS or SYS.DBA_DV_STATUS View

The DBA_DV_STATUS (or SYS.DBA_DV_STATUS) data dictionary view shows the status of Oracle Database Vault being enabled and configured.

For example:

```
SELECT * FROM DBA_DV_STATUS;
```

Output similar to the following appears:

| NAME | STATUS |
|---------------------|----------------|
| DV_APP_PROTECTION | NOT CONFIGURED |
| DV_CONFIGURE_STATUS | TRUE |
| DV_ENABLE_STATUS | TRUE |

Related Views

- [CDB_DV_STATUS View](#)

| Column | Datatype | Null | Description |
|--------|---------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | VARCHAR2 (19) | NOT NULL | Shows one of the following settings: <ul style="list-style-type: none"> • DV_APP_PROTECTION shows whether Database Vault operations control has been configured or not configured • DV_CONFIGURE_STATUS shows whether Oracle Database Vault has been configured, that is, with the CONFIGURE_DV procedure. • DV_ENABLE_STATUS shows whether Oracle Database Vault has been enabled, that is, with the DBMS_MACADM.ENABLE_DV procedure. |
| STATUS | VARCHAR2 (64) | NOT NULL | TRUE means that Oracle Database Vault is configured or enabled; FALSE means that it is not. For DV_APP_PROTECTION, it shows either CONFIGURED or NOT CONFIGURED. |

24.38 DBA_DV_TTS_AUTH View

The `DBA_DV_TTS_AUTH` data dictionary view lists users who have been granted authorization through the `DBMS_MACADM.AUTHORIZE_TTS_USER` procedure to perform Oracle Data Pump transportable operations.

For example:

```
SELECT * FROM DBA_DV_TTS_AUTH;
```

Output similar to the following appears:

| GRANTEE | TSNAME |
|---------|--------|
| DB_MGR | HR_TS |

Related Views

- [DBA_DV_DATAPUMP_AUTH View](#)

| Column | Datatype | Null | Description |
|---------|---------------|----------|-----------------------------------------------------------------------------------------------|
| GRANTEE | VARCHAR (128) | NOT NULL | Name of the user who has been granted transportable tablespace authorization |
| TSNAME | VARCHAR (128) | NOT NULL | Name of the transportable tablespace to which the GRANTEE user has been granted authorization |

Related Topics

- [Using Oracle Data Pump with Oracle Database Vault](#)
Database administrators can authorize Oracle Data Pump users to work in a Database Vault environment.
- [DBA_DV_DATAPUMP_AUTH View](#)
The `DBA_DV_DATAPUMP_AUTH` data dictionary view lists the authorizations for using Oracle Data Pump in an Oracle Database Vault environment.

24.39 DBA_DV_USER_PRIVS View

The `DBA_DV_USER_PRIVS` data dictionary view lists the privileges for a database user account excluding privileges granted through the `PUBLIC` role.

For example:

```
SELECT USERNAME, ACCESS_TYPE, PRIVILEGE FROM DBA_DV_USER_PRIVS;
```

Output similar to the following appears:

```
USERNAME  ACCESS_TYPE          PRIVILEGE
-----  -
DVOWNER   DV_ADMIN             SELECT
SYS       SELECT_CATALOG_ROLE  SELECT
...
```

| Column | Datatype | Null | Description |
|-------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| USERNAME | VARCHAR(128) | NOT NULL | Name of the database schema account in which privileges have been defined. |
| ACCESS_TYPE | VARCHAR(128) | NULL | Role the database user account listed in the <code>USERNAME</code> column uses to access the database. Oracle Database Vault accounts have direct access. |
| PRIVILEGE | VARCHAR(40) | NOT NULL | Privilege granted to the user listed in the <code>USERNAME</code> column. |
| OWNER | VARCHAR(128) | NOT NULL | Name of the database user account. |
| OBJECT_NAME | VARCHAR(128) | NOT NULL | Name of the PL/SQL function or procedure used to define privileges. |

Related Topics

- [DBA_DV_PUB_PRIVS View](#)
The `DBA_DV_PUB_PRIVS` data dictionary view lists data reflected in the Oracle Database Vault privilege management reports used in Oracle Database Vault Administrator.
- [DBA_DV_ROLE View](#)
The `DBA_DV_ROLE` data dictionary view lists the Oracle Database Vault secure application roles used in privilege management.
- [DBA_DV_USER_PRIVS_ALL View](#)
The `DBA_DV_USER_PRIVS_ALL` data dictionary view lists the privileges for a database account including privileges granted through `PUBLIC`.

24.40 DBA_DV_USER_PRIVS_ALL View

The `DBA_DV_USER_PRIVS_ALL` data dictionary view lists the privileges for a database account including privileges granted through `PUBLIC`.

For example:

```
SELECT USERNAME, ACCESS_TYPE, PRIVILEGE FROM DBA_DV_USER_PRIVS;
```

Output similar to the following appears:

```

USERNAME          ACCESS_TYPE  PRIVILEGE
-----
BEA_DVACCTMGR     CONNECT     CREATE_SESSION
LEO_DVOWNER       DIRECT      CREATE_PROCEDURE
...

```

| Column | Datatype | Null | Description |
|-------------|--------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| USERNAME | VARCHAR(128) | NULL | Name of the database schema account in which privileges have been defined. |
| ACCESS_TYPE | VARCHAR(128) | NULL | Role the database user account listed in the <code>USERNAME</code> column uses to access the database. Oracle Database Vault accounts have direct access. |
| PRIVILEGE | VARCHAR(40) | NULL | Privilege granted to the user listed in the <code>USERNAME</code> column. |
| OWNER | VARCHAR(128) | NULL | Name of the database user account. |
| OBJECT_NAME | VARCHAR(128) | NULL | Name of the PL/SQL function or procedure used to define privileges. |

Related Topics

- [DBA_DV_PUB_PRIVS View](#)
The `DBA_DV_PUB_PRIVS` data dictionary view lists data reflected in the Oracle Database Vault privilege management reports used in Oracle Database Vault Administrator.
- [DBA_DV_ROLE View](#)
The `DBA_DV_ROLE` data dictionary view lists the Oracle Database Vault secure application roles used in privilege management.
- [DBA_DV_USER_PRIVS View](#)
The `DBA_DV_USER_PRIVS` data dictionary view lists the privileges for a database user account excluding privileges granted through the `PUBLIC` role.

24.41 DVSYS.DV\$CONFIGURATION_AUDIT View

The `DVSYS.DV$CONFIGURATION_AUDIT` data dictionary view captures `DVSYS.AUDIT_TRAIL$` table audit trail records.

It includes records that are related to successful and failed configuration changes made to realms, rules, rule sets, factors, and other Oracle Database Vault policy configuration activities.

For example:

```
SELECT USERNAME, ACTION_NAME FROM DVSYS.DV$CONFIGURATION_AUDIT
WHERE USERNAME = 'PSMITH';
```

Output similar to the following appears:

```

-----
USERNAME  ACTION_NAME
-----
PSMITH    Realm Creation Audit
PSMITH    Rule Set Update Audit

```

| Column | Datatype | Null | Description |
|--------------------|----------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ID# | NUMBER | NOT NULL | Numeric identifier for the audit record |
| OS_USERNAME | VARCHAR(255) | NULL | Operating system login user name of the user whose actions were audited |
| USERNAME | VARCHAR(128) | NULL | Name of the database user whose actions were audited |
| USERHOST | VARCHAR2(128) | NULL | Client computer name |
| TERMINAL | VARCHAR2(30) | NULL | Identifier for the user's terminal |
| TIMESTAMP | DATA | NULL | Date and time of creation of the audit trail entry (in the local database session time zone) |
| OWNER | VARCHAR2(128) | NULL | Creator of the object affected by the action, always DVSYS (because DVSYS is where objects are created) |
| OBJ_NAME | VARCHAR2(128) | NULL | Name of the object affected by the action. Expected values are: <ul style="list-style-type: none"> • ROLE\$ • REALM\$ • CODE\$ • FACTOR\$ |
| ACTION | NUMBER | NOT NULL | Numeric action type code. The corresponding name of the action type is in the ACTION_NAME column. See Table 24-3 for a listing of the possible actions. |
| ACTION_NAME | VARCHAR2(128) | NULL | Name of the action type corresponding to the numeric code in the ACTION column. See Table 24-3 for a listing of the possible actions. |
| ACTION_OBJECT_ID | NUMBER | NULL | The unique identifier of the record in the table specified under OBJ_NAME |
| ACTION_OBJECT_NAME | VARCHAR2(128) | NULL | The unique name or natural key of the record in the table specified under OBJ_NAME |
| ACTION_COMMAND | VARCHAR2(4000) | NULL | The SQL text of the command procedure that was run that resulted in the audit event being triggered |
| AUDIT_OPTION | VARCHAR2(4000) | NULL | The labels for all (traditional) audit options specified in the record that resulted in the audit event being triggered. For example, a factor set operation that is supposed to audit on get failure and get NULL would indicate these two options. Starting with Oracle Database release 21c, traditional auditing is deprecated. |
| RULE_SET_ID | NUMBER | NULL | The unique identifier of the rule set that was executing and caused the audit event to trigger |
| RULE_SET_NAME | VARCHAR2(128) | NULL | The unique name of the rule set that was executing and caused the audit event to trigger |
| RULE_ID | NUMBER | NULL | Not used |
| RULE_NAME | VARCHAR2(128) | NULL | Not used |
| FACTOR_CONTEXT | VARCHAR2(4000) | NULL | An XML document that contains all of the factor identifiers for the current session at the point when the audit event was triggered |

| Column | Datatype | Null | Description |
|--------------------|------------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COMMENT_TEXT | VARCHAR2 (4000) | NULL | Text comment on the audit trail entry, providing more information about the statement audited |
| SESSIONID | NUMBER | NOT NULL | Numeric identifier for each Oracle session |
| ENTRYID | NUMBER | NOT NULL | Same as the value in the ID# column |
| STATEMENTID | NUMBER | NOT NULL | Numeric identifier for the statement invoked that caused the audit event to be generated. This is empty for most Oracle Database Vault events. |
| RETURNCODE | NUMBER | NOT NULL | Oracle error code generated by the action. The error code for a statement or procedure invoked that caused the audit event to be generated. This is empty for most Oracle Database Vault events. |
| EXTENDED_TIMESTAMP | TIMESTAMP (6) WITH TIME ZONE | NULL | Time stamp of creation of the audit trail entry (time stamp of user login for entries) in UTC (Coordinated Universal Time) time zone |
| PROXY_SESSIONID | NUMBER | NULL | Proxy session serial number, if an enterprise user has logged in through the proxy mechanism |
| GLOBAL_UID | VARCHAR2 (32) | NULL | Global user identifier for the user, if the user has logged in as an enterprise user |
| INSTANCE_NUMBER | NUMBER | NULL | Instance number as specified by the INSTANCE_NUMBER initialization parameter |
| OS_PROCESS | VARCHAR2 (16) | NULL | Operating system process identifier of the Oracle process |
| CREATED_BY | VARCHAR2 (128) | NULL | Database login user name of the user whose actions were audited |
| CREATE_DATE | DATE | NULL | Date on which the action occurred, based on the SYSDATE date |
| UPDATED_BY | VARCHAR2 (128) | NULL | Same as CREATED_BY column value |
| UPDATE_DATE | DATE | NULL | Same as UPDATED_BY column value |
| GRANTEE | VARCHAR2 (128) | NULL | User ID of users who have been granted Database Vault-protected roles, realm authorization, command-rule authorization, job scheduler authorization, or Oracle Data Pump authorizations |
| ENABLED_STATUS | VARCHAR2 (1) | NULL | Indicates whether the configuration was enabled |

Table 24-3 describes the possible values for the ACTION column of the DVSYS.DV\$CONFIGURATION_AUDIT view.

Table 24-3 DVSYS.DV\$CONFIGURATION_AUDIT View ACTION Values

| Action Type Code | Action Name |
|------------------|------------------------------|
| 20001 | Enable DV enforcement Audit |
| 20002 | Disable DV enforcement Audit |
| 20003 | Realm Creation Audit |
| 20004 | Realm Update Audit |
| 20005 | Realm Rename Audit |
| 20006 | Realm Deletion Audit |

Table 24-3 (Cont.) DVSYS.DV\$CONFIGURATION_AUDIT View ACTION Values

| Action Type Code | Action Name |
|------------------|---------------------------------|
| 20007 | Add Realm Auth Audit |
| 20008 | Delete Realm Auth Audit |
| 20009 | Update Realm Auth Audit |
| 20010 | Add Realm Object Audit |
| 20011 | Update Realm Object Audit |
| 20012 | Delete Realm Object Audit |
| 20013 | Enable Event Audit |
| 20014 | Disable Event Audit |
| 20015 | Rule Set Creation Audit |
| 20016 | Rule Set Update Audit |
| 20017 | Rule Set Rename Audit |
| 20018 | Rule Set Deletion Audit |
| 20019 | Add Rule To Rule Set Audit |
| 20020 | Delete Rule From Rule Set Audit |
| 20021 | Rule Creation Audit |
| 20022 | Rule Update Audit |
| 20023 | Rule Rename Audit |
| 20024 | Rule Deletion Audit |
| 20025 | CommandRule Creation Audit |
| 20026 | CommandRule Update Audit |
| 20027 | CommandRule Deletion Audit |
| 20028 | Authorize Datapump User Audit |
| 20029 | Unauthorize Datapump User Audit |
| 20030 | Authorize Job User Audit |
| 20031 | Unauthorize Job User Audit |
| 20032 | Factor_Type Creation Audit |
| 20033 | Factor_Type Deletion Audit |
| 20034 | Factor_Type Update Audit |
| 20035 | Factor_Type Rename Audit |
| 20036 | Factor Creation Audit |
| 20037 | G_FACTOR_DELETION_AUDIT_CODE |
| 20038 | Factor Update Audit |
| 20039 | Factor Rename Audit |
| 20040 | Add Factor Link Audit |
| 20041 | Delete Factor Link Audit |
| 20042 | Add Policy Factor Audit |
| 20043 | Delete Policy Factor Audit |

Table 24-3 (Cont.) DVSYS.DV\$CONFIGURATION_AUDIT View ACTION Values

| Action Type Code | Action Name |
|-------------------------|--------------------------------------|
| 20044 | Create Identity Audit |
| 20045 | Delete Identity Audit |
| 20046 | Update Identity Audit |
| 20047 | Change Identity Factor Audit |
| 20048 | Change Identity Value Audit |
| 20049 | Create Identity Map Audit |
| 20050 | Delete Identity Map Audit |
| 20051 | Create Policy Label Audit |
| 20052 | Delete Policy Label Audit |
| 20053 | Create Mac Policy Audit |
| 20054 | Update Mac Policy Audit |
| 20055 | Delete Mac Policy Audit |
| 20056 | Create Role Audit |
| 20057 | Delete Role Audit |
| 20058 | Update Role Audit |
| 20059 | Rename Role Audit |
| 20060 | Create Domain Identity Audit |
| 20061 | Drop Domain Identity Audit |
| 20062 | Enable Oradebug Audit |
| 20063 | Disable Oradebug Audit |
| 20064 | Authorize Proxy User Audit |
| 20065 | Unauthorize Proxy User Audit |
| 20066 | Enable DV Dictionary Accounts Audit |
| 20067 | Disable DV Dictionary Accounts Audit |
| 20068 | Authorize DDL Audit |
| 20069 | Unauthorize DDL Audit |
| 20070 | Authorize TTS Audit |
| 20071 | Unauthorize TTS Audit |
| 20072 | Authorize PREPROCESSOR Audit |
| 20073 | Unauthorize PREPROCESSOR Audit |
| 20074 | Create Policy Audit |
| 20075 | Update Policy Description Audit |
| 20076 | Update Policy State Audit |
| 20077 | Rename Policy Audit |
| 20078 | Drop Policy Audit |
| 20079 | Add Realm to Policy Audit |
| 20080 | Delete Realm From Policy Audit |

Table 24-3 (Cont.) DVSYS.DV\$CONFIGURATION_AUDIT View ACTION Values

| Action Type Code | Action Name |
|------------------|---------------------------------------|
| 20081 | Add Command Rule to Policy Audit |
| 20082 | Delete Command Rule from Policy Audit |
| 20083 | Add Policy Owner Audit |
| 20084 | Delete Policy Owner Audit |
| 20085 | Authorize Maintenance Audit |
| 20086 | Unauthorize Maintenance Audit |

Related Topics

- [AUDSYS.DV\\$CONFIGURATION_AUDIT View](#)
The AUDSYS.DV\$CONFIGURATION_AUDIT view is almost the same as the DVSYS.DV\$CONFIGURATION_AUDIT view except that it captures unified audit trail Database Vault audit records.

24.42 DVSYS.DV\$ENFORCEMENT_AUDIT View

The DVSYS.DV\$ENFORCEMENT_AUDIT data dictionary view provides information about enforcement-related audits from the DVSYS.AUDIT_TRAIL\$ table.

It captures user violations on command rules, realms, and factors.

For example:

```
SELECT USERNAME, ACTION_COMMMAND FROM DVSYS.DV$ENFORCEMENT_AUDIT
WHERE OWNER = 'HR';
```

Output similar to the following appears:

```
USERNAME      ACTION_COMMMAND
-----
PSMITH        CREATE_REALM
```

| Column | Datatype | Null | Description |
|-------------|--------------|----------|---------------------------------------------------------------------------------------------------------|
| ID# | NUMBER | NOT NULL | Numeric identifier for the audit record |
| OS_USERNAME | VARCHAR(255) | NULL | Operating system login user name of the user whose actions were audited |
| USERNAME | VARCHAR(128) | NULL | Name of the database user whose actions were audited |
| USERHOST | VARCHAR(255) | NULL | Client computer name |
| TERMINAL | VARCHAR(255) | NULL | Identifier for the user's terminal |
| TIMESTAMP | DATE | NULL | Date and time of creation of the audit trail entry (in the local database session time zone) |
| OWNER | VARCHAR(128) | NULL | Creator of the object affected by the action, always DVSYS (because DVSYS is where objects are created) |

| Column | Datatype | Null | Description |
|--------------------|-----------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OBJ_NAME | VARCHAR(128) | NULL | Name of the object affected by the action. Expected values are: <ul style="list-style-type: none"> • ROLE\$ • REALM\$ • CODE\$ • FACTOR\$ |
| ACTION | NUMBER | NOT NULL | Numeric action type code. The corresponding name of the action type is in the ACTION_NAME column. See Table 24-4 for a listing of the possible actions. |
| ACTION_NAME | VARCHAR(128) | NULL | Name of the action type corresponding to the numeric code in the ACTION column |
| ACTION_OBJECT_ID | NUMBER | NULL | The unique identifier of the record in the table specified under OBJ_NAME |
| ACTION_OBJECT_NAME | VARCHAR(128) | NULL | The unique name or natural key of the record in the table specified under OBJ_NAME |
| ACTION_COMMAND | VARCHAR2(4000) | NULL | The SQL text of the command procedure that was run that resulted in the audit event being triggered |
| AUDIT_OPTION | VARCHAR2(4000) | NULL | The labels for all (traditional) audit options specified in the record that resulted in the audit event being triggered. For example, a factor set operation that is supposed to audit on get failure and get NULL would indicate these two options. Starting with Oracle Database release 21c, traditional auditing is deprecated. |
| RULE_SET_ID | NUMBER | NULL | The unique identifier of the rule set that was executing and caused the audit event to trigger |
| RULE_SET_NAME | VARCHAR(128) | NULL | The unique name of the rule set that was executing and caused the audit event to trigger |
| RULE_ID | NUMBER | NULL | Not used |
| RULE_NAME | VARCHAR2(128) | NULL | Not used |
| FACTOR_CONTEXT | VARCHAR2(4000) | NULL | An XML document that contains all of the factor identifiers for the current session at the point when the audit event was triggered |
| COMMENT_TEXT | VARCHAR2(4000) | NULL | Text comment on the audit trail entry, providing more information about the statement audited |
| SESSIONID | NUMBER | NOT NULL | Numeric identifier for each Oracle session |
| ENTRYID | NUMBER | NOT NULL | Same as the value in the ID# column |
| STATEMENTID | NUMBER | NOT NULL | Numeric identifier for the statement invoked that caused the audit event to be generated. This is empty for most Oracle Database Vault events. |
| RETURNCODE | NUMBER | NOT NULL | Oracle error code generated by the action. The error code for a statement or procedure invoked that caused the audit event to be generated. This is empty for most Oracle Database Vault events. |
| EXTENDED_TIMESTAMP | TIMESTAMP(6) WITH TIME ZONE | NULL | Time stamp of creation of the audit trail entry (time stamp of user login for entries) in UTC (Coordinated Universal Time) time zone |

| Column | Datatype | Null | Description |
|-----------------|----------------|------|----------------------------------------------------------------------------------------------|
| PROXY_SESSIONID | NUMBER | NULL | Proxy session serial number, if an enterprise user has logged in through the proxy mechanism |
| GLOBAL_UID | VARCHAR2 (32) | NULL | Global user identifier for the user, if the user has logged in as an enterprise user |
| INSTANCE_NUMBER | NUMBER | NULL | Instance number as specified by the INSTANCE_NUMBER initialization parameter |
| OS_PROCESS | VARCHAR2 (16) | NULL | Operating system process identifier of the Oracle process |
| CREATED_BY | VARCHAR2 (128) | NULL | Database login user name of the user whose actions were audited |
| CREATE_DATE | DATE | NULL | Date on which the action occurred, based on the SYSDATE date |
| UPDATED_BY | VARCHAR2 (128) | NULL | Same as CREATED_BY column value |
| UPDATE_DATE | DATE | NULL | Same as UPDATED_BY column value |

The following table describes the possible values for the ACTION column of the DVSYS.DV\$ENFORCEMENT_AUDIT view.

Table 24-4 DVSYS.DV\$ENFORCEMENT_AUDIT View ACTION Values

| Action Type Code | Action Name |
|------------------|------------------------------------|
| 10000 | Factor Evaluation Audit |
| 10001 | Factor Assignment Audit |
| 10002 | Factor Expression Audit |
| 10003 | Realm Violation Audit |
| 10004 | Realm Authorization Audit |
| 10005 | Command Authorization Audit |
| 10006 | Secure Role Audit |
| 10007 | Session Initialization Audit |
| 10008 | Secure Command Authorization Audit |
| 10009 | OLS Session Initialization Audit |
| 10010 | OLS Attempt to Upgrade Label Audit |
| 10011 | Command Failure Audit |

Related Topics

- [AUDSYS.DV\\$ENFORCEMENT_AUDIT View](#)
The AUDSYS.DV\$ENFORCEMENT_AUDIT view is almost the same as the DVSYS.DV\$ENFORCEMENT_AUDIT view except that it captures unified audit trail Database Vault audit records.

24.43 DVSYS.DV\$REALM View

The `DVSYS.DV$REALM` data dictionary view describes settings that were used to create Oracle Database Vault realms, such as which audit options have been assigned or whether the realm is a mandatory realm.

This view also indicates information such as who created and updated the realm, and when the realm was created and updated.

For example:

```
SELECT NAME, CREATED_BY, TYPE FROM DVSYS.DV$REALM WHERE NAME LIKE 'Statistics';
```

Output similar to the following appears:

```
NAME                                CREATED_BY TYPE
-----
Performance Statistics Realm JGODFREY 2
```

| Column | Datatype | Null | Description |
|---------------|----------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ID# | NUMBER | NOT NULL | ID number of the realm |
| NAME | VARCHAR2(128) | NOT NULL | Name of the realm |
| DESCRIPTION | VARCHAR2(1024) | NULL | Description of the realm |
| AUDIT_OPTIONS | NUMBER | NOT NULL | Audit options set for the realm. See <code>audit_options</code> in the <code>UPDATE_REALM</code> procedure description. See Related Topics. |
| REALM_TYPE | NUMBER | NULL | Type of realm: whether it is a regular realm or a mandatory realm. See <code>realm_type</code> in the <code>UPDATE_REALM</code> procedure description. See Related Topics. |
| COMMON | VARCHAR2(3) | NULL | Indicates whether the realm is local or common. Possible values are: <ul style="list-style-type: none"> YES if the realm is common NO if the realm is local |
| INHERITED | VARCHAR2(3) | NULL | Shows the inheritance status of the realm, when the <code>COMMON</code> column output is YES. Values are as follows: <ul style="list-style-type: none"> YES means that the realm was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. NO means that the realm is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value NO but a CDB root common command rule will have an <code>INHERITED</code> value of YES. |
| ENABLED | VARCHAR2(1) | NOT NULL | Whether the realm has been enabled. See <code>enabled</code> in the <code>DBMS_MACADM.UPDATE_REALM</code> procedure description. See Related Topics. |
| VERSION | NUMBER | NULL | Version of Oracle Database Vault in which the realm was created |

| Column | Datatype | Null | Description |
|-------------|----------------|------|------------------------------------------|
| CREATED_BY | VARCHAR2 (128) | NULL | User who created the realm |
| CREATE_DATE | DATE | NULL | Date on which the realm was created. |
| UPDATED_BY | VARCHAR2 (128) | NULL | User who last updated the realm |
| UPDATE_DATE | DATE | NULL | Date on which the realm was last updated |

Related Topics

- [DBA_DV_REALM View](#)
The `DBA_DV_REALM` data dictionary view lists the realms created in the current database instance.
- [UPDATE_REALM Procedure](#)
The `UPDATE_REALM` procedure updates a realm.

24.44 DVSYS.DBA_DV_COMMON_OPERATION_STATUS View

The `DVSYS.DBA_DV_COMMON_OPERATION_STATUS` data dictionary view displays the status of the `DBMS_MACADM.ALLOW_COMMON_OPERATION` procedure setting.

For example:

```
SELECT * FROM DVSYS.DBA_DV_COMMON_OPERATION_STATUS;
```

Output similar to the following appears:

```
NAME                                STATUS
-----                                -
DV_ALLOW_COMMON_OPERATION            FALSE
```

| Column | Datatype | Null | Description |
|--------|-------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | CHAR (25) | NOT NULL | Name of this control, that is, <code>DV_ALLOW_COMMON_OPERATION</code> |
| STATUS | VARCHAR (5) | NOT NULL | Either of the following: <ul style="list-style-type: none"> • <code>TRUE</code> prevents local users from creating Oracle Database Vault controls on common user objects. This setting applies to existing local PDB Database Vault controls that were created on common user objects, so that they will not be enforced on common users. • <code>FALSE</code> enables local users to create Database Vault controls on common user objects. Existing local PDB controls that were created on common user objects will continue to be enforced. |

24.45 DVSYS.POLICY_OWNER_COMMAND_RULE View

The `DVSYS.POLICY_OWNER_COMMAND_RULE` data dictionary view enables `DV_POLICY_OWNER` role users to find information about the command rules that are used by Database Vault policies.

Examples of information that users can find include the command rule name, its associated rule set, and whether it is enabled. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.

For example:

```
SELECT COMMAND, OBJECT_OWNER, OBJECT_NAME FROM DVSYS.POLICY_OWNER_COMMAND_RULE;
```

Output similar to the following appears:

```
COMMAND      OBJECT_OWNER  OBJECT_NAME
-----
SELECT       HR            EMPLOYEES
```

| Column | Datatype | Null | Description |
|-----------------|--------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COMMAND | VARCHAR(128) | NOT NULL | Name of the command rule. |
| CLAUSE_NAME | VARCHAR(100) | NOT NULL | A clause from either the ALTER SYSTEM or ALTER SESSION SQL statement, which was used to create the command rule. For example, you it could list the SET clause for the ALTER SESSION statement. The command rule settings for these two statements are described in the DBMS_MACADM.CREATE_COMMAND_RULE procedure. See Related Topics. |
| PARAMETER_NAME | VARCHAR(128) | NOT NULL | A parameter from the ALTER SYSTEM or ALTER SESSION command rule CLAUSE_NAME setting. See Related Topics. |
| EVENT_NAME | VARCHAR(128) | NOT NULL | An event that the ALTER SYSTEM or ALTER SESSION command rule defines. See Related Topics. |
| COMPONENT_NAME | VARCHAR(128) | NOT NULL | A component of the EVENT_NAME setting for the ALTER SYSTEM or ALTER SESSION command rule. See Related Topics. |
| ACTION_NAME | VARCHAR(128) | NOT NULL | An action of the EVENT_NAME setting for the ALTER SYSTEM or ALTER SESSION command rule. See Related Topics. |
| RULE_SET_NAME | VARCHAR(128) | NOT NULL | Name of the rule set associated with this command rule. |
| OBJECT_OWNER | VARCHAR(128) | NOT NULL | The owner of the object that the command rule affects. |
| OBJECT_NAME | VARCHAR(128) | NOT NULL | The name of the database object the command rule affects (for example, a database table). |
| ENABLED | VARCHAR(1) | NOT NULL | Y indicates the command rule is enabled; N indicates it is disabled. |
| PRIVILEGE_SCOPE | NUMBER | NOT NULL | Obsolete column |
| ID# | NUMBER | NOT NULL | The ID number of the command rule, which is automatically generated when the command rule is created |
| ORACLE_SUPPLIED | VARCHAR(3) | NULL | Indicates whether the command rule is a default (that is, Oracle-supplied) command rule or a user-created command rule. Possible values are: <ul style="list-style-type: none"> • YES if the command rule is a default command rule • NO if the command rule is a user-created command rule |

Related Topics

- [CREATE_COMMAND_RULE Procedure](#)
The CREATE_COMMAND_RULE procedure creates both command and local command rules, which can be added to a rule set.

- [DVSYS.POLICY_OWNER_POLICY View](#)
The DVSYS.POLICY_OWNER_POLICY data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information such as the names, descriptions, and states of existing policies in the current database instance, including policies created by other policy owners.

24.46 DVSYS.POLICY_OWNER_POLICY View

The DVSYS.POLICY_OWNER_POLICY data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information such as the names, descriptions, and states of existing policies in the current database instance, including policies created by other policy owners.

The columns of the DVSYS.POLICY_OWNER_POLICY view are the same as those in DBA_DV_POLICY. Only users who have been granted the DV_POLICY_OWNER role can query this view.

For example:

```
SELECT POLICY_NAME, STATE FROM DVSYS.POLICY_OWNER_POLICY
WHERE STATE != 'ENABLED';
```

Output similar to the following appears:

```
POLICY_NAME                                STATE
-----
HR.EMPLOYEES_pol                            ENABLED
```

Related Topics

- [DBA_DV_POLICY View](#)
The DBA_DV_POLICY data dictionary view lists the Oracle Database Vault policies that were created in the current database instance.

24.47 DVSYS.POLICY_OWNER_REALM View

The POLICY_OWNER_REALM data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information about the realms that have been associated with Database Vault policies.

Examples of information that users can find include the realm name, audit options, type, whether it is inherited, and if it is enabled. Only users who have been granted the DV_POLICY_OWNER role can query this view.

For example:

```
SELECT NAME, ENABLED FROM DVSYS.POLICY_OWNER_REALM;
```

Output similar to the following appears:

```
NAME                                ENABLED
-----
HR.EMPLOYEES_realm                    S
```

| Column | Datatype | Null | Description |
|--------|--------------|----------|-----------------------------------------------------------------------------|
| NAME | VARCHAR(128) | NOT NULL | Names of the realms that have been associated with Database Vault policies. |

| Column | Datatype | Null | Description |
|-----------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DESCRIPTION | VARCHAR(1024) | NULL | Description of the realm |
| AUDIT_OPTIONS | NUMBER | NOT NULL | Audit options using traditional auditing set for the realm. See <code>audit_options</code> in the <code>UPDATE_REALM</code> command description. See Related Topics for a description of the possible values. Starting with Oracle Database release 21c, traditional auditing is deprecated. |
| REALM_TYPE | NUMBER | NULL | Type of realm: whether it is a regular realm or a mandatory realm. See <code>realm_type</code> in the <code>UPDATE_REALM</code> command description. See Related Topics . |
| COMMON_REALM | VARCHAR2(3) | NULL | Indicates whether the realm is local or common. Possible values are: <ul style="list-style-type: none"> YES if the realm is common NO if the realm is local |
| INHERITED_REALM | VARCHAR2(3) | NULL | Shows the inheritance status of the realm, when the <code>COMMON</code> column output is YES. Values are as follows: <ul style="list-style-type: none"> YES means that the realm was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. NO means that the realm is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value NO but a CDB root common command rule will have an <code>INHERITED</code> value of YES. |
| ENABLED | VARCHAR2(1) | NOT NULL | Indicates the enablement status of the realm. Possible values are: <ul style="list-style-type: none"> Y for yes (enabled) N for no (not enabled) S for simulation mode |
| ID# | NUMBER | NOT NULL | The ID number of the realm, which is automatically generated when the realm is created |
| ORACLE_SUPPLIED | VARCHAR(3) | NOT NULL | Indicates whether the realm is a default (that is, Oracle-supplied) realm or a user-created realm. Possible values are: <ul style="list-style-type: none"> YES if the realm is a default realm NO if the realm is a user-created realm |

Related Topics

- [DVSYS.POLICY_OWNER_REALM_AUTH View](#)
The `DVSYS.POLICY_OWNER_REALM_AUTH` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the authorization that was granted to realms that have been associated with Database Vault policies.
- [DVSYS.POLICY_OWNER_REALM_OBJECT View](#)
The `DVSYS.POLICY_OWNER_REALM_OBJECT` data dictionary view enables users to find information about the objects that have been added to realms that are associated with Database Vault policies, such as. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.
- [UPDATE_REALM Procedure](#)
The `UPDATE_REALM` procedure updates a realm.

24.48 DVSYS.POLICY_OWNER_REALM_AUTH View

The `DVSYS.POLICY_OWNER_REALM_AUTH` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the authorization that was granted to realms that have been associated with Database Vault policies.

Examples of the information that users can find are the realm name, grantee, and associated rule set. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.

For example:

```
SELECT REALM_NAME, INHERITED_REALM FROM DVSYS.POLICY_OWNER_REALM_AUTH;
```

Output similar to the following appears:

```
REALM_NAME          INHERITED
-----
HR.EMPLOYEES_realm  NO
```

| Column | Datatype | Null | Description |
|---------------------------------|----------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>REALM_NAME</code> | <code>VARCHAR(128)</code> | NOT NULL | Names of the realms that have been associated with Database Vault policies. See also Related Topics . |
| <code>COMMON_REALM</code> | <code>VARCHAR2(3)</code> | NULL | Indicates whether the realm is local or common. |
| <code>INHERITED_REALM</code> | <code>VARCHAR2(3)</code> | NULL | Shows the inheritance status of the realm, when the <code>COMMON</code> column output is <code>YES</code> . Values are as follows: <ul style="list-style-type: none"> <code>YES</code> means that the realm was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. <code>NO</code> means that the realm is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value <code>NO</code> but a CDB root common command rule will have an <code>INHERITED</code> value of <code>YES</code>. |
| <code>GRANTEE</code> | <code>VARCHAR(128)</code> | NOT NULL | User or role name to authorize as owner or participant. |
| <code>AUTH_RULE_SET_NAME</code> | <code>VARCHAR(128)</code> | NULL | Rule set to check before authorizing. If the rule set evaluates to <code>TRUE</code> , then the authorization is allowed. |
| <code>AUTH_OPTIONS</code> | <code>VARCHAR(4000)</code> | NULL | Type of realm authorization: either <code>Participant</code> or <code>Owner</code> . |
| <code>COMMON_AUTH</code> | <code>VARCHAR(3)</code> | NULL | Indicates whether the user who is authorized for this realm is local or common. Possible values are: <ul style="list-style-type: none"> <code>YES</code> if the user is a common user <code>NO</code> if the users is a local user |
| <code>INHERITED_AUTH</code> | <code>VARCHAR(3)</code> | NULL | Possible values are: <ul style="list-style-type: none"> <code>YES</code> <code>NO</code> |

Related Topics

- [DBA_DV_REALM View](#)
The `DBA_DV_REALM` data dictionary view lists the realms created in the current database instance.

- [DVSYS.POLICY_OWNER_REALM View](#)
The `POLICY_OWNER_REALM` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the realms that have been associated with Database Vault policies.
- [DVSYS.POLICY_OWNER_REALM_OBJECT View](#)
The `DVSYS.POLICY_OWNER_REALM_OBJECT` data dictionary view enables users to find information about the objects that have been added to realms that are associated with Database Vault policies, such as. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.

24.49 DVSYS.POLICY_OWNER_REALM_OBJECT View

The `DVSYS.POLICY_OWNER_REALM_OBJECT` data dictionary view enables users to find information about the objects that have been added to realms that are associated with Database Vault policies, such as. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.

Examples of information that users can find include the realm name, grantee, and associated rule set.

For example:

```
SELECT REALM_NAME, OWNER, OBJECT_NAME, OBJECT_TYPE FROM DVSYS.POLICY_OWNER_REALM_OBJECT;
```

Output similar to the following appears:

```
REALM_NAME          OWNER  OBJECT_NAME  OBJECT_TYPE
-----
HR.EMPLOYEES_realm HR      EMPLOYEES    TABLE
```

| Column | Datatype | Null | Description |
|------------------------------|---------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>REALM_NAME</code> | <code>VARCHAR(128)</code> | NOT NULL | Names of the realms that have been associated with Database Vault policies. See also Related Topics. |
| <code>COMMON_REALM</code> | <code>VARCHAR2(3)</code> | NULL | Indicates whether the realm is local or common. |
| <code>INHERITED_REALM</code> | <code>VARCHAR2(3)</code> | NULL | Shows the inheritance status of the realm, when the <code>COMMON</code> column output is <code>YES</code> . Values are as follows: <ul style="list-style-type: none"> • <code>YES</code> means that the realm was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. • <code>NO</code> means that the realm is a local object, or it is common from that container. For example, in an application root, an application common realm will have an <code>INHERITED</code> value <code>NO</code> but a CDB root common command rule will have an <code>INHERITED</code> value of <code>YES</code>. |
| <code>OWNER</code> | <code>VARCHAR(128)</code> | NOT NULL | Database schema owner who owns the object. |
| <code>OBJECT_NAME</code> | <code>VARCHAR(128)</code> | NOT NULL | Name of the object the realm protects. |
| <code>OBJECT_TYPE</code> | <code>VARCHAR(32)</code> | NOT NULL | Type of object the realm protects, such as a database table, view, index, or role. |

Related Topics

- [DBA_DV_REALM View](#)
The DBA_DV_REALM data dictionary view lists the realms created in the current database instance.
- [DVSYS.POLICY_OWNER_REALM View](#)
The POLICY_OWNER_REALM data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information about the realms that have been associated with Database Vault policies.
- [DVSYS.POLICY_OWNER_REALM_AUTH View](#)
The DVSYS.POLICY_OWNER_REALM_AUTH data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information about the authorization that was granted to realms that have been associated with Database Vault policies.

24.50 DVSYS.POLICY_OWNER_RULE View

The DVSYS.POLICY_OWNER_RULE data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information about the rules that have been associated with rule sets in Database Vault policies, such as the rule name and its expression. Only users who have been granted the DV_POLICY_OWNER role can query this view.

For example:

```
SELECT NAME, RULE_EXPR FROM DVSYS.POLICY_OWNER_RULE WHERE NAME = 'True';
```

Output similar to the following appears:

```
NAME          RULE_EXPR
-----
True          1=1
```

| Column | Datatype | Null | Description |
|-----------|---------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NAME | VARCHAR(128) | NOT NULL | Name of the rule. |
| RULE_EXPR | VARCHAR(1024) | NOT NULL | PL/SQL expression for the rule. |
| COMMON | VARCHAR(3) | NOT NULL | Indicates whether the rule is local or common. Possible values are: <ul style="list-style-type: none"> • YES if the rule is common • NO if the rule is local |
| INHERITED | VARCHAR(3) | NULL | Shows the inheritance status of the rule, when the COMMON column output is YES. Values are as follows: <ul style="list-style-type: none"> • YES means that the rule was defined in another container that is higher in the hierarchy of the container tree, and inherited in this container when the Database Vault policy was synced during the synchronization process of applications in an application PDB. • NO means that the rule is a local object, or it is common from that container. For example, in an application root, an application common realm will have an INHERITED value NO but a CDB root common command rule will have an INHERITED value of YES. |
| ID# | NUMBER | NOT NULL | The ID number of the rule, which is automatically generated when the rule is created |

| Column | Datatype | Null | Description |
|-----------------|------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ORACLE_SUPPLIED | VARCHAR(3) | NULL | Indicates whether the rule is a default (that is, Oracle-supplied) rule or a user-created rule. Possible values are: <ul style="list-style-type: none"> • YES if the rule is a default rule • NO if the rule is a user-created rule |

Related Topics

- [DVSYS.POLICY_OWNER_COMMAND_RULE View](#)
The DVSYS.POLICY_OWNER_COMMAND_RULE data dictionary view enables DV_POLICY_OWNER role users to find information about the command rules that are used by Database Vault policies.
- [DVSYS.POLICY_OWNER_RULE_SET View](#)
The DVSYS.POLICY_OWNER_RULE_SET data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information about the rule sets that have been associated with Database Vault policies.

24.51 DVSYS.POLICY_OWNER_RULE_SET View

The DVSYS.POLICY_OWNER_RULE_SET data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information about the rule sets that have been associated with Database Vault policies.

Examples of information that users can find include the rule set name, its handler information, and whether it is enabled. Only users who have been granted the DV_POLICY_OWNER role can query this view.

For example:

```
SELECT RULE_SET_NAME, ENABLED FROM DVSYS.POLICY_OWNER_RULE_SET;
```

Output similar to the following appears:

```
RULE_SET_NAME  ENABLED
-----
Allow Sessions Y
```

| Column | Datatype | Null | Description |
|----------------------|---------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RULE_SET_NAME | VARCHAR(128) | NOT NULL | Name of the rule set. |
| DESCRIPTION | VARCHAR(1024) | NULL | Description of the rule set. |
| ENABLED | VARCHAR(1) | NOT NULL | Indicates whether the rule set has been enabled. Y (Yes) enables the rule set; N (No) disables it. |
| EVAL_OPTIONS_MEANING | VARCHAR(4000) | NULL | For rules sets that contain multiple rules, determines how many rules are evaluated. Possible values are: <ul style="list-style-type: none"> • All True: All rules in the rule set must evaluate to true for the rule set itself to evaluate to TRUE. • Any True: At least one rule in the rule set must evaluate to true for the rule set itself to evaluate to TRUE. |

| Column | Datatype | Null | Description |
|--------------------------|---------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AUDIT_OPTIONS | NUMBER | NOT NULL | Indicates when auditing using traditional auditing is used. Possible values are: <ul style="list-style-type: none"> 0: No auditing 1: Audit on failure 2: Audit on success 3: Audit on both failure and success Starting with Oracle Database release 21c, traditional auditing is deprecated. |
| FAIL_OPTIONS_MEA NING | VARCHAR(4000) | NULL | Determines when an audit record is created for the rule set. Possible values are: <ul style="list-style-type: none"> Do Not Show Error Message. Show Error Message |
| FAIL_MESSAGE | VARCHAR(80) | NULL | Error message for failure that is associated with the fail code listed in the FAIL_CODE column. |
| FAIL_CODE | VARCHAR(10) | NULL | The error message number associated with the message listed in the FAIL_MESSAGE column. Possible values are in the ranges of -20000 to -20999 or 20000 to 20999. |
| HANDLER_OPTIONS | NUMBER | NOT NULL | Determines how error handling is used. Possible values are: <ul style="list-style-type: none"> 0: Disables error handling. 1: Call handler on rule set failure. 2: Call handler on rule set success. |
| HANDLER | VARCHAR(1024) | NULL | Name of the PL/SQL function or procedure that defines the custom event handler logic. |
| IS_STATIC | VARCHAR2(5) | NULL | Indicates how often the rule set is evaluated during a user session. Possible values are: <ul style="list-style-type: none"> TRUE: The rule set is evaluated once, and result of the rule set is reused throughout the user session. FALSE (default): The rule set is evaluated each time it is accessed during the user session. |
| ID# | NUMBER) | NOT NULL | The ID number of the rule set, which is automatically generated when the rule set is created |
| ORACLE_SUPPLIED | VARCHAR2(3) | NULL | Indicates whether the rule set is a default (that is, Oracle-supplied) rule set or a user-created rule set. Possible values are: <ul style="list-style-type: none"> YES if the rule set is a default rule set NO if the rule set is a user-created rule set |

Related Topics

- [DVSYS.POLICY_OWNER_COMMAND_RULE View](#)
The DVSYS.POLICY_OWNER_COMMAND_RULE data dictionary view enables DV_POLICY_OWNER role users to find information about the command rules that are used by Database Vault policies.
- [DVSYS.POLICY_OWNER_RULE View](#)
The DVSYS.POLICY_OWNER_RULE data dictionary view enables users who have been granted the DV_POLICY_OWNER role to find information about the rules that have been associated with rule sets in Database Vault policies, such as the rule name and its expression. Only users who have been granted the DV_POLICY_OWNER role can query this view.

- [DVSYS.POLICY_OWNER_RULE_SET View](#)
The `DVSYS.POLICY_OWNER_RULE_SET` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the rule sets that have been associated with Database Vault policies.

24.52 DVSYS.POLICY_OWNER_RULE_SET_RULE View

The `DVSYS.POLICY_OWNER_RULE_SET_RULE` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the rule sets that contain rules used in Database Vault policies.

Examples of information that users can find include the rule set name and whether it is enabled. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.

For example:

```
SELECT ENABLED FROM DVSYS.POLICY_OWNER_RULE_SET_RULE WHERE RULE_SET_NAME = 'Can Maintain Own Account';
```

Output similar to the following appears:

```
ENABLED
-----
Y
```

| Column | Datatype | Null | Description |
|----------------------------|----------------------------|----------|------------------------------------------------------------------------------------------------------|
| <code>RULE_SET_NAME</code> | <code>VARCHAR(128)</code> | NOT NULL | Name of the rule set that contains the rule. |
| <code>RULE_NAME</code> | <code>VARCHAR(128)</code> | NOT NULL | Name of the rule. |
| <code>RULE_EXPR</code> | <code>VARCHAR(1024)</code> | NOT NULL | PL/SQL expression that defines the rule listed in the <code>RULE_NAME</code> column. |
| <code>ENABLED</code> | <code>VARCHAR(1)</code> | | Indicates whether the rule is enabled or disabled. Y (Yes) enables the rule set; N (No) disables it. |
| <code>RULE_ORDER</code> | <code>NUMBER</code> | NOT NULL | The order in which rules are used within the rule set. Does not apply to this release. |

Related Topics

- [DVSYS.POLICY_OWNER_COMMAND_RULE View](#)
The `DVSYS.POLICY_OWNER_COMMAND_RULE` data dictionary view enables `DV_POLICY_OWNER` role users to find information about the command rules that are used by Database Vault policies.
- [DVSYS.POLICY_OWNER_RULE_SET View](#)
The `DVSYS.POLICY_OWNER_RULE_SET` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the rule sets that have been associated with Database Vault policies.
- [DVSYS.POLICY_OWNER_RULE View](#)
The `DVSYS.POLICY_OWNER_RULE` data dictionary view enables users who have been granted the `DV_POLICY_OWNER` role to find information about the rules that have been associated with rule sets in Database Vault policies, such as the rule name and its expression. Only users who have been granted the `DV_POLICY_OWNER` role can query this view.

24.53 AUDSYS.DV\$CONFIGURATION_AUDIT View

The `AUDSYS.DV$CONFIGURATION_AUDIT` view is almost the same as the `DVSYSDV$CONFIGURATION_AUDIT` view except that it captures unified audit trail Database Vault audit records.

Related Topics

- [DVSYS.DV\\$CONFIGURATION_AUDIT View](#)
The `DVSYS.DV$CONFIGURATION_AUDIT` data dictionary view captures `DVSYS.AUDIT_TRAIL$` table audit trail records.

24.54 AUDSYS.DV\$ENFORCEMENT_AUDIT View

The `AUDSYS.DV$ENFORCEMENT_AUDIT` view is almost the same as the `DVSYSDV$ENFORCEMENT_AUDIT` view except that it captures unified audit trail Database Vault audit records.

Related Topics

- [DVSYS.DV\\$ENFORCEMENT_AUDIT View](#)
The `DVSYS.DV$ENFORCEMENT_AUDIT` data dictionary view provides information about enforcement-related audits from the `DVSYS.AUDIT_TRAIL$` table.

Monitoring Oracle Database Vault

You can monitor Oracle Database Vault by checking for violations to the Database Vault configurations and by tracking changes to policies.

- [About Monitoring Oracle Database Vault](#)
You can use the Database Vault home page in Oracle Enterprise Manager Cloud Control to monitor a Database Vault-enabled database.
- [Monitoring Security Violations and Configuration Changes](#)
A user who has been granted the appropriate role can use Oracle Database Vault Administrator to monitor security violations and configuration changes.

25.1 About Monitoring Oracle Database Vault

You can use the Database Vault home page in Oracle Enterprise Manager Cloud Control to monitor a Database Vault-enabled database.

This feature displays the top five attempted violations and who the top five attempted violators are. The attempted violations cover violations to realms and to command rules. The attempted violators is categorized into users and client hosts. By clicking the **Oracle Database Vault** link under Top 5 Attempted Violations, you can find details such as the type of violation, when it occurred, who the user was, and so on. Similarly, if you click the user link (for example, **SYS**) under Top 5 Attempted Violators, you can find detailed information about each violator, such as the action they performed, the client host name where the action originated, and when the violation occurred. You can manually refresh the data, and restrict the data view, such as within the last 24 hours. This page also shows a table listing all alerts that have been generated.

Before you can view these events, if you have not migrated your database to unified auditing, then you must ensure that the `AUDIT_TRAIL` initialization parameter is set to `DB` or `DB, EXTENDED`. If you have migrated your database to use unified auditing, then you do not need to configure any additional settings. You are ready to check for security violations.

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.

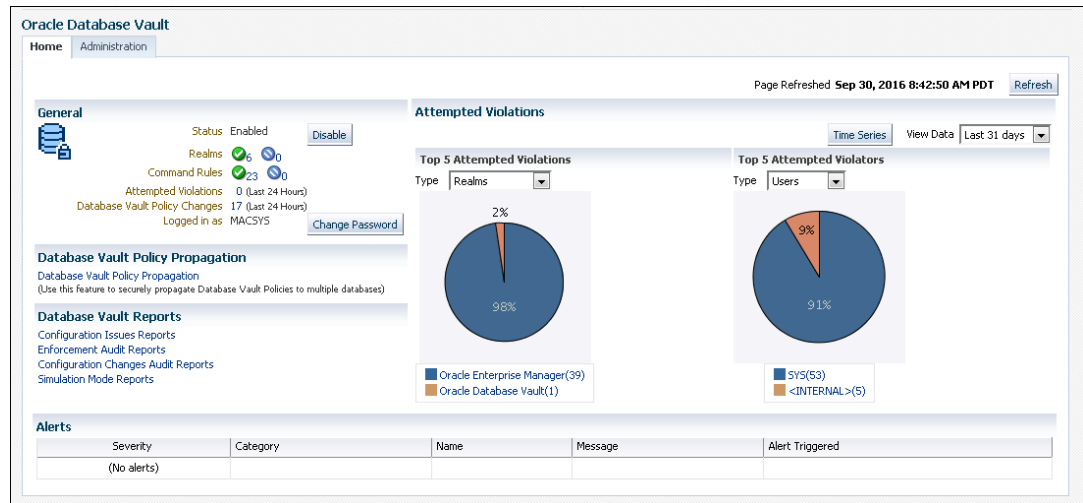
25.2 Monitoring Security Violations and Configuration Changes

A user who has been granted the appropriate role can use Oracle Database Vault Administrator to monitor security violations and configuration changes.

1. Log in to Oracle Database Vault Administrator from Cloud Control as a user who has been granted the `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role and the `SELECT ANY DICTIONARY` privilege. [Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#) explains how to log in.

2. Select the **Home** tab.

A page similar to the following appears:



- To find attempted violations for a specific time, such as the last 7 days, select from the menu under the **Time Series** button in the upper right corner.

You also can change the pie chart to a graph by clicking the **Time Series** button.

- To find the **Configuration Issues Reports**, **Enforcement Audit Reports**, **Configuration Changes Audit Reports**, and **Simulation Mode Reports**, select the appropriate link under Database Vault reports.

See [Oracle Database Vault Reports](#) for detailed information about the Database Vault reports.

Oracle Database Vault Reports

Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.

- [About the Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that display security-related information from the database.
- [Who Can Run the Oracle Database Vault Reports?](#)
Users must have the `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role before they can run the Oracle Database Vault reports.
- [Running the Oracle Database Vault Reports](#)
A user who has been granted the appropriate roles can run the Oracle Database Vault reports from Database Vault Administrator.
- [Oracle Database Vault Configuration Issues Reports](#)
The configuration issues reports track the settings for command rules, rule sets, realms, and other Oracle Database Vault configurations.
- [Oracle Database Vault Auditing Reports](#)
If you have unified auditing enabled, then the Oracle Database Vault audit reports capture the results of unified audit policies.
- [Oracle Database Vault General Security Reports](#)
The general security reports track information such as object privileges related to `PUBLIC` or privileges granted to a database account or role.

26.1 About the Oracle Database Vault Reports

Oracle Database Vault provides reports that display security-related information from the database.

These reports also show custom Oracle Database Vault audit event information. If you have unified auditing enabled, then the reports capture the results of your unified audit policies.

The reports are in two categories:

- **Database Vault Reports.** These reports allow you to check configuration issues with realms, command rules, factors, factor identities, rule sets, and secure application roles. These reports also reveal realm violations, auditing results, and so on.
- **General Security Reports.** These reports allow you to check the status of object privileges, database account system privileges, sensitive objects, privilege management, powerful database accounts and roles, initialization parameters, profiles, account passwords, security audits, and other security vulnerability reports.

Related Topics

- [Oracle Database Vault-Specific Reports in Enterprise Manager Cloud Control](#)
From the Database Vault home page, you can find information about violations.

- [Oracle Database Vault Data Dictionary Views](#)
You can find information about the Oracle Database Vault configuration settings by querying the Database Vault-specific data dictionary views.

26.2 Who Can Run the Oracle Database Vault Reports?

Users must have the `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role before they can run the Oracle Database Vault reports.

Related Topics

- [DV_OWNER Database Vault Owner Role](#)
The `DV_OWNER` role enables you to manage the Oracle Database Vault roles and its configuration.
- [DV_ADMIN Database Vault Configuration Administrator Role](#)
The `DV_ADMIN` role controls the Oracle Database Vault PL/SQL packages.
- [DV_SECANALYST Database Vault Security Analyst Role](#)
The `DV_SECANALYST` role enables users to analyze activities.

26.3 Running the Oracle Database Vault Reports

A user who has been granted the appropriate roles can run the Oracle Database Vault reports from Database Vault Administrator.

1. Log in to Oracle Database Vault Administrator from Cloud Control as a user who has been granted the `DV_OWNER`, `DV_ADMIN`, or `DV_SECANALYST` role and the `SELECT ANY DICTIONARY` privilege. [Logging in to Oracle Database Vault from Oracle Enterprise Cloud Control](#) explains how to log in.
2. In the Home page, under Reports, select **Database Vault Reports**.
3. On the left side, select the category of reports that you want.
 - Database Vault Configuration Issues
 - Database Vault Enforcement Audit Reports
 - Database Vault Configuration Changes
4. In the Reports page, expand the category that contains the report.
For example, to find the Rule Set Configurations Issues report, you must expand **Database Vault Configuration Issues**.
5. Select the report (for example, **Rule Set Configuration Issues**).
The report appears in the right pane.
6. Optionally, use the **Search** field to filter the report.
For example, you can search for reported incidents that involve a specific rule set. The Search field contents vary depending on the report.
7. When you finished viewing the report, click the **OK** button.

26.4 Oracle Database Vault Configuration Issues Reports

The configuration issues reports track the settings for command rules, rule sets, realms, and other Oracle Database Vault configurations.

- [Command Rule Configuration Issues Report](#)
The Command Rule Configuration Issues Report displays command rules that have configuration issues.
- [Rule Set Configuration Issues Report](#)
The Rule Set Configuration Issues Report displays Oracle Database Vault rule set configuration issues.
- [Realm Authorization Configuration Issues Report](#)
The Realm Authorization Configuration Issues Report displays Oracle Database Vault realm configuration issues.
- [Factor Configuration Issues Report](#)
The Factor Configuration Issues Report displays Oracle Database Vault factors configuration issues.
- [Factor Without Identities Report](#)
The Factor Without Identities Report displays Oracle Database Vault factors that have no identities configured.
- [Identity Configuration Issues Report](#)
The Identity Configuration Issues Report displays Oracle Database Vault factor identity configuration issues.
- [Secure Application Configuration Issues Report](#)
The Secure Application Configuration Issues Report displays Database Vault secure application role configuration issues.

26.4.1 Command Rule Configuration Issues Report

The Command Rule Configuration Issues Report displays command rules that have configuration issues.

These issues are as follows:

- Rule set for the command rule is disabled.
- Rule set for the command rule is incomplete.
- Object owner for the command rule does not exist. This can happen when the user account for the object has been dropped.

26.4.2 Rule Set Configuration Issues Report

The Rule Set Configuration Issues Report displays Oracle Database Vault rule set configuration issues.

This report tracks when no rules are defined or enabled for a rule set.

26.4.3 Realm Authorization Configuration Issues Report

The Realm Authorization Configuration Issues Report displays Oracle Database Vault realm configuration issues.

These issues are as follows:

- Rule set for a realm authorization is disabled.
- Grantee does not exist for a realm authorization.

- Owner does not exist for a realm-secured object. This can happen when the user account has been dropped.

In most cases, however, these types of issues are caught when you configure the realm and during validation.

26.4.4 Factor Configuration Issues Report

The Factor Configuration Issues Report displays Oracle Database Vault factors configuration issues.

These issues are as follows:

- Rule set for factor assignment is disabled.
- Rule set for factor assignment is incomplete.
- Audit options for the factor are invalid.
- No factor retrieval method or constant exists.
- No subfactors (that is, child factors) are linked to a factor identity.
- No subfactors (child factors) are linked to a label factor.
- Oracle Label Security policy does not exist for the factor.

26.4.5 Factor Without Identities Report

The Factor Without Identities Report displays Oracle Database Vault factors that have no identities configured.

For some factors such as `Background_Job_Id`, this may not be a real problem, but the report can help you determine whether your access control configuration is complete and whether you have accounted for all factor configuration.

26.4.6 Identity Configuration Issues Report

The Identity Configuration Issues Report displays Oracle Database Vault factor identity configuration issues.

These issues are as follows:

- Label identity for the Oracle Label Security label for this identity has been removed and no longer exists.
- No map exists for the identity.

26.4.7 Secure Application Configuration Issues Report

The Secure Application Configuration Issues Report displays Database Vault secure application role configuration issues.

These issues are as follows:

- The database role does not exist. This can happen when the database role has been dropped.
- The rule set for role is disabled.
- The rule set for role is incomplete.

26.5 Oracle Database Vault Auditing Reports

If you have unified auditing enabled, then the Oracle Database Vault audit reports capture the results of unified audit policies.

- [Realm Audit Report](#)
The Realm Audit Report shows audit records generated by the realm protection and realm authorization operations.
- [Command Rule Audit Report](#)
The Command Rule Audit Report shows audit records generated by command rule processing operations.
- [Factor Audit Report](#)
The Factor Audit Report shows factors that failed to evaluate or were set to create audit records under various conditions.
- [Label Security Integration Audit Report](#)
The Label Security Integration Audit Report shows audit records the session initialization operation generates and the session label assignment operation of label security.
- [Core Database Vault Audit Trail Report](#)
The Core Database Vault Audit Trail Report shows audit records that the core access security session initialization operation generates.
- [Secure Application Role Audit Report](#)
The Secure Application Role Audit Report shows the audit records that the Oracle Database Vault secure application role-enabling operation generates.

26.5.1 Realm Audit Report

The Realm Audit Report shows audit records generated by the realm protection and realm authorization operations.

You can manage realm authorizations by using rule sets, and then audit the rule set processing results. A realm violation occurs when the database account, performing an action on a realm-protected object, is not authorized to perform that action. Oracle Database Vault audits the violation even if you do not specify any rule sets attached to the realm. When you configure a realm, you can set it to audit instances of realm violations. You can use this information to investigate attempts to break security.

26.5.2 Command Rule Audit Report

The Command Rule Audit Report shows audit records generated by command rule processing operations.

When you configure a command rule, you can set it to audit the rule set processing results.

26.5.3 Factor Audit Report

The Factor Audit Report shows factors that failed to evaluate or were set to create audit records under various conditions.

This report also shows failed attempts to set factors.

You can audit instances where a factor identity cannot be resolved and assigned (such as *No data found* or *Too many rows*). A factor can have an associated rule set that assigns an identity

to the factor at run time. When you configure a factor, you can set it to audit the rule set processing results.

26.5.4 Label Security Integration Audit Report

The Label Security Integration Audit Report shows audit records the session initialization operation generates and the session label assignment operation of label security.

You can audit instances where the label security session fails to initialize, and where the label security component prevents a session from setting a label that exceeds the maximum session label.

26.5.5 Core Database Vault Audit Trail Report

The Core Database Vault Audit Trail Report shows audit records that the core access security session initialization operation generates.

You can audit instances where the access security session fails to initialize. It displays the following data:

| Data A-R | Data R-U |
|-----------------|-----------|
| Account | Rule Set |
| Command | Timestamp |
| Instance Number | Rule Set |
| Object Name | User Host |
| Return Code | - |

26.5.6 Secure Application Role Audit Report

The Secure Application Role Audit Report shows the audit records that the Oracle Database Vault secure application role-enabling operation generates.

Related Topics

- [Configuring Secure Application Roles for Oracle Database Vault](#)
Secure application roles enable you to control how much access users have to an application.

26.6 Oracle Database Vault General Security Reports

The general security reports track information such as object privileges related to `PUBLIC` or privileges granted to a database account or role.

- [Object Privilege Reports](#)
The object privilege reports track privileges affected by `PUBLIC`, direct object privileges, and object dependencies.
- [Database Account System Privileges Reports](#)
The database account system privileges reports track activities such as direct, indirect, hierarchical, and `ANY` system privileges.
- [Sensitive Objects Reports](#)
The sensitive objects reports track activities such as grants on the `EXECUTE` privilege on `SYS` schema objects and access to sensitive objects.

- [Privilege Management - Summary Reports](#)
The privilege management summary reports track privilege distribution by grantees, owners, and privileges.
- [Powerful Database Accounts and Roles Reports](#)
The powerful database accounts and roles reports track information about users who have been granted power privileges, such as the `WITH ADMIN` privilege.
- [Initialization Parameters and Profiles Reports](#)
The initialization parameters and profiles reports track database parameters, resource profiles, and system limits.
- [Database Account Password Reports](#)
The database account password reports track default passwords and account statuses of database accounts.
- [Security Audit Report: Core Database Audit Report](#)
The Core Database Audit Report lists database audit trail records..
- [Other Security Vulnerability Reports](#)
Other security vulnerability reports track vulnerabilities that arise with activities such as Java policy grants in operating system directory objects.

26.6.1 Object Privilege Reports

The object privilege reports track privileges affected by `PUBLIC`, direct object privileges, and object dependencies.

- [Object Access By PUBLIC Report](#)
The Object Access By PUBLIC Report lists all objects whose access has been granted to `PUBLIC`.
- [Object Access Not By PUBLIC Report](#)
The Object Access Not By PUBLIC Report describes the object access used by the database accounts on the Report Parameters page.
- [Direct Object Privileges Report](#)
The Direct Object Privileges Report shows the direct object privileges granted to *nonsystem* database accounts.
- [Object Dependencies Report](#)
The Object Dependencies Report describes dependencies in the database between procedures, packages, functions, package bodies, and triggers.

26.6.1.1 Object Access By PUBLIC Report

The Object Access By PUBLIC Report lists all objects whose access has been granted to `PUBLIC`.

This report details all the object access the database accounts that you specify on the Report Parameters page, through object grants to `PUBLIC`. On the Reports Parameters page, you can filter the results based on the privilege, the object owner, or the object name.



Note:

This report can be quite large if you choose the defaults.

26.6.1.2 Object Access Not By PUBLIC Report

The Object Access Not By PUBLIC Report describes the object access used by the database accounts on the Report Parameters page.

It checks the grants to the account directly or through a role, but excluding the grants to PUBLIC.

On the Reports Parameters page, you can filter the results based on the privilege, the object owner or the object name.



Note:

This report can be quite large if you choose the defaults.

26.6.1.3 Direct Object Privileges Report

The Direct Object Privileges Report shows the direct object privileges granted to *nonsystem* database accounts.

The following database accounts are excluded from the report:

Accounts C-O

CTXSYS

DMSYS

DVSYS

LBACSYS

MDSYS

ORDSYS

Accounts P-W

PUBLIC

SYS

SYSMAN

SYSTEM

WKSYS

WMSYS

26.6.1.4 Object Dependencies Report

The Object Dependencies Report describes dependencies in the database between procedures, packages, functions, package bodies, and triggers.

The report includes dependencies on views created without any database links.

This report can help you develop a security policy using the principle of least privilege for existing applications. If a database object, such as a UTL_FILE package, has privileges granted to PUBLIC or some other global role, then you can use the Object Dependencies Report to determine an account that may depend on the object and to determine how the account uses the object. To run the report, enter the database account you are inspecting for dependency and the object it may be dependent on, in the Report Parameters page.

The Report Results page shows the dependent object and object type and the source object name and type. This report shows where the potentially sensitive object is being used. By looking at several accounts, you might be able to see patterns that can help you develop restricted roles. These restricted roles can replace PUBLIC grants on widely used sensitive objects.

26.6.2 Database Account System Privileges Reports

The database account system privileges reports track activities such as direct, indirect, hierarchical, and `ANY` system privileges.

- [Direct System Privileges By Database Account Report](#)
The Direct System Privileges By Database Account Report lists system privileges directly granted to the database account selected on the Report Parameters page.
- [Direct and Indirect System Privileges By Database Account Report](#)
The Direct and Indirect System Privileges By Database Account Report displays system privileges for the database account selected on the Report Parameters page.
- [Hierarchical System Privileges by Database Account Report](#)
The Hierarchical System Privileges by Database Account Report shows a hierarchical breakdown of role-based system privileges and direct system privileges.
- [ANY System Privileges for Database Accounts Report](#)
The ANY System Privileges for Database Accounts Report shows `ANY` system privileges granted to the specified database account or role.
- [System Privileges By Privilege Report](#)
The System Privileges By Privilege Report lists database accounts and roles that have the system privilege selected on the Report Parameters page.

26.6.2.1 Direct System Privileges By Database Account Report

The Direct System Privileges By Database Account Report lists system privileges directly granted to the database account selected on the Report Parameters page.

This report also shows whether a privilege has been granted the `WITH ADMIN` option.

26.6.2.2 Direct and Indirect System Privileges By Database Account Report

The Direct and Indirect System Privileges By Database Account Report displays system privileges for the database account selected on the Report Parameters page.

The system privileges may have been granted directly or granted through a database role that has the `WITH ADMIN` status.

26.6.2.3 Hierarchical System Privileges by Database Account Report

The Hierarchical System Privileges by Database Account Report shows a hierarchical breakdown of role-based system privileges and direct system privileges.

These privileges are granted to the database account specified on the Report Parameters page.

26.6.2.4 ANY System Privileges for Database Accounts Report

The ANY System Privileges for Database Accounts Report shows `ANY` system privileges granted to the specified database account or role.

`ANY` system privileges are very powerful and should be judiciously assigned to accounts and roles.

26.6.2.5 System Privileges By Privilege Report

The System Privileges By Privilege Report lists database accounts and roles that have the system privilege selected on the Report Parameters page.

Another way to control privileges is to create privilege analysis policies to analyze privilege use.

26.6.3 Sensitive Objects Reports

The sensitive objects reports track activities such as grants on the `EXECUTE` privilege on `SYS` schema objects and access to sensitive objects.

- [Execute Privileges to Strong SYS Packages Report](#)
The Execute Privileges to Strong SYS Packages Report shows database accounts and roles with the `EXECUTE` privilege on powerful system packages.
- [Access to Sensitive Objects Report](#)
The Access to Sensitive Objects Report shows database accounts and roles that have object privileges on system tables or views that have sensitive information.
- [Public Execute Privilege To SYS PL/SQL Procedures Report](#)
The Public Execute Privilege to SYS PL/SQL Procedures Report shows database accounts and roles that have `EXECUTE` privileges on that `SYS` owns.
- [Accounts with SYSDBA/SYSOPER Privilege Report](#)
The Accounts with SYSDBA/SYSOPER Privilege Report displays database accounts that have `SYS`-privileged connection privileges.

26.6.3.1 Execute Privileges to Strong SYS Packages Report

The Execute Privileges to Strong SYS Packages Report shows database accounts and roles with the `EXECUTE` privilege on powerful system packages.

For example, these types of packages can be used to access operating system resources.

The following system PL/SQL packages are included:

Packages D-D

DBMS_ALERT
DBMS_BACKUP_RESTORE
DBMS_CAPTURE_ADM
DBMS_CRYPTO
DBMS_DDL
DBMS_DISTRIBUTED_TRUST_ADMIN
DBMS_FGA
DBMS_JOB
DBMS_LDAP
DBMS_LOB
DBMS_LOGMNR
DBMS_LOGMNR_D

Packages D-U

DBMS_RANDOM
DBMS_REPAIR
DBMS_REPCAT
DBMS_REPCAT_ADMIN
DBMS_RESOURCE_MANAGER
DBMS_RESOURCE_MANAGER_PRIVS
DBMS_RLS
DBMS_SESSION
DEBUG_EXTPROC
UTL_FILE
UTL_HTTP
UTL_SMTP

Packages D-D

DBMS_ORACLE_TRACE_AGENT
DBMS_PIPE

Packages D-U

UTL_TCP
-

26.6.3.2 Access to Sensitive Objects Report

The Access to Sensitive Objects Report shows database accounts and roles that have object privileges on system tables or views that have sensitive information.

This report includes the following system tables and views:

Tables/Views A-O

ALL_SOURCE
ALL_USERS
APPROLE\$
AUD\$
AUDIT_TRAIL\$
DBA_ROLE_PRIVS
DBA_ROLES
DBA_TAB_PRIVS
DBMS_BACKUP_RESTORE
DEFROLE\$
FGA_LOG\$
LINK\$
OBJ\$
OBJAUTH\$
OBJPRIV\$

Tables/Views P-S

PROFILE\$
PROXY_ROLE_DATA\$
PROXY_ROLE_INFO\$
ROLE_ROLE_PRIVS
SOURCE\$
STATS\$SQLTEXT
STATS\$SQL_SUMMARY
SYSTEM_PRIVILEGE_MAP
TABLE_PRIVILEGE_MAP
TRIGGER\$
USER\$
USER_HISTORY\$
USER_TAB_PRIVS
SYSTEM_PRIVILEGE_MAP
-

26.6.3.3 Public Execute Privilege To SYS PL/SQL Procedures Report

The Public Execute Privilege to SYS PL/SQL Procedures Report shows database accounts and roles that have EXECUTE privileges on that SYS owns.

This report can be used to determine which privileges can be revoked from PUBLIC, or from other accounts and roles. This reduces vulnerabilities as part of an overall security policy implementation using the principle of least privilege.

26.6.3.4 Accounts with SYSDBA/SYSOPER Privilege Report

The Accounts with SYSDBA/SYSOPER Privilege Report displays database accounts that have SYS-privileged connection privileges.

This report also shows whether the accounts use an external password. However, note that this report does not include operating system users who can become SYSDBA.

26.6.4 Privilege Management - Summary Reports

The privilege management summary reports track privilege distribution by grantees, owners, and privileges.

- [Privileges Distribution By Grantee Report](#)
The Privileges Distribution By Grantee Report displays the count of privileges granted to a database account or role.
- [Privileges Distribution By Grantee, Owner Report](#)
The Privileges Distribution By Grantee, Owner Report displays a count of privileges based on the grantee and the owner of the object.
- [Privileges Distribution By Grantee, Owner, Privilege Report](#)
The Privileges Distribution By Grantee, Owner, Privilege Report displays a count of privileges based on the privilege, the grantee, and the object owner.



See Also:

[DBA_DV_PUB_PRIVS View](#) to find the values on which the counts listed in these reports are based

26.6.4.1 Privileges Distribution By Grantee Report

The Privileges Distribution By Grantee Report displays the count of privileges granted to a database account or role.

This report provides insight into accounts and roles that may have powerful privileges.

26.6.4.2 Privileges Distribution By Grantee, Owner Report

The Privileges Distribution By Grantee, Owner Report displays a count of privileges based on the grantee and the owner of the object.

This report provides insight into accounts or roles that may have powerful privileges. You can use this report if you suspect potential intruders or insider threats are looking for accounts that have powerful privileges as accounts to attack or compromise. If intruders can compromise the account (for example, by guessing the password), they can get more privileges than they already have.

26.6.4.3 Privileges Distribution By Grantee, Owner, Privilege Report

The Privileges Distribution By Grantee, Owner, Privilege Report displays a count of privileges based on the privilege, the grantee, and the object owner.

This report provides insight into the accounts or roles that may have powerful privileges.

26.6.5 Powerful Database Accounts and Roles Reports

The powerful database accounts and roles reports track information about users who have been granted power privileges, such as the `WITH ADMIN` privilege.

- [WITH ADMIN Privilege Grants Report](#)
The WITH ADMIN Privileges Grants Report shows all database accounts and roles that have been granted privileges with the `WITH ADMIN` clause.
- [Accounts With DBA Roles Report](#)
The Accounts With DBA Roles Report shows all database accounts that have the `DBA` role granted to them.
- [Security Policy Exemption Report](#)
The Security Policy Exemption Report shows database (but not Oracle Database Vault) accounts and roles that have the `EXEMPT ACCESS POLICY` system privilege.
- [BECOME USER Report](#)
The BECOME USER Report shows database accounts roles that have the `BECOME USER` system privilege.
- [ALTER SYSTEM or ALTER SESSION Report](#)
The ALTER SYSTEM or ALTER SESSION Report shows database accounts and roles that have the `ALTER SYSTEM` or `ALTER SESSION` privilege.
- [Password History Access Report](#)
The Password History Access Report shows database accounts that have access to the `USER_HISTORY$` table.
- [WITH GRANT Privileges Report](#)
The WITH GRANT Privileges Report shows database accounts that are granted privileges with the `WITH GRANT` clause.
- [Roles/Accounts That Have a Given Role Report](#)
This report displays the database accounts and roles to which a role has been granted.
- [Database Accounts With Catalog Roles Report](#)
The Database Accounts With Catalog Roles Report displays all database accounts and roles that have the catalog-related roles granted to them.
- [AUDIT Privileges Report](#)
The AUDIT Privileges Report displays all database accounts and roles that have the `AUDIT ANY` or `AUDIT SYSTEM` privilege.
- [OS Security Vulnerability Privileges Report](#)
The OS Security Vulnerability Privileges Report lists database accounts and roles that have privileges to export sensitive information to the operating system.

26.6.5.1 WITH ADMIN Privilege Grants Report

The WITH ADMIN Privileges Grants Report shows all database accounts and roles that have been granted privileges with the `WITH ADMIN` clause.

This privilege can be misused to give another account more system privileges than required.

26.6.5.2 Accounts With DBA Roles Report

The Accounts With DBA Roles Report shows all database accounts that have the `DBA` role granted to them.

The `DBA` role is a privileged role that can be misused. It is often granted to a database account to save time and to avoid having to determine the least number of privileges an account really needs. This report can help you to start applying a policy using the principle of least privilege to an existing database.

**See Also:**

[Oracle Database Vault Security Guidelines](#) for guidelines on deciding who should have privileged roles

26.6.5.3 Security Policy Exemption Report

The Security Policy Exemption Report shows database (but not Oracle Database Vault) accounts and roles that have the `EXEMPT ACCESS POLICY` system privilege.

Accounts that have this privilege can bypass all Virtual Private Database (VPD) policy filters and any Oracle Label Security policies that use Oracle Virtual Private Database indirectly. This is a powerful system privilege that should be granted only if absolutely necessary, as it presents a target to gain access to sensitive information in tables that are protected by Oracle Virtual Private Database or Oracle Label Security. You can use the auditing policies described in [Auditing Oracle Database Vault](#), to audit the use of this privilege.

26.6.5.4 BECOME USER Report

The BECOME USER Report shows database accounts roles that have the `BECOME USER` system privilege.

The `BECOME USER` privilege is a very powerful system privilege: it enables the `IMP_FULL_DATABASE` and `EXP_FULL_DATABASE` roles for use with Oracle Data Pump. Accounts that possess this privilege can be misused to get sensitive information or to compromise an application.

26.6.5.5 ALTER SYSTEM or ALTER SESSION Report

The ALTER SYSTEM or ALTER SESSION Report shows database accounts and roles that have the `ALTER SYSTEM` or `ALTER SESSION` privilege.

Oracle recommends that you restrict these privileges only to those accounts and roles that truly need them (for example, the `SYS` account and the `DV_ADMIN` role). The `ALTER SYSTEM` statement can be used to change the security-related database initialization parameters that are set to recommended values as part of the Oracle Database Vault security strengthening service. Both the `ALTER SYSTEM` and `ALTER SESSION` statements can be used to dump database trace files, potentially containing sensitive configuration information, to the operating system.

**See Also:**

[ALTER SYSTEM and ALTER SESSION Privilege Security Considerations](#) for guidelines on using the `ALTER SYSTEM` and `ALTER SESSION` privileges

26.6.5.6 Password History Access Report

The Password History Access Report shows database accounts that have access to the `USER_HISTORY$` table.

This table stores hashed passwords that were previously used by each account.

Access to this table can make guessing the existing password for an account easier for someone hacking the database.

26.6.5.7 WITH GRANT Privileges Report

The WITH GRANT Privileges Report shows database accounts that are granted privileges with the WITH GRANT clause.

Remember that WITH GRANT is used for object-level privileges: An account that has been granted privileges using the WITH GRANT option can be misused to grant object privileges to another account.

26.6.5.8 Roles/Accounts That Have a Given Role Report

This report displays the database accounts and roles to which a role has been granted.

This report is provided for dependency analysis.

26.6.5.9 Database Accounts With Catalog Roles Report

The Database Accounts With Catalog Roles Report displays all database accounts and roles that have the catalog-related roles granted to them.

These roles are as follows:

- DELETE_CATALOG_ROLE
- EXECUTE_CATALOG_ROLE
- RECOVERY_CATALOG_OWNER
- SELECT_CATALOG_ROLE

These catalog-based roles have a very large number of powerful privileges. They should be granted with caution, much like the DBA role, which uses them.

26.6.5.10 AUDIT Privileges Report

The AUDIT Privileges Report displays all database accounts and roles that have the AUDIT ANY or AUDIT SYSTEM privilege.

This privilege can be used to disable auditing, which could be used to eliminate the audit trail record of an intruder who has compromised the system. The accounts that have this privilege could be targets for intruders.

26.6.5.11 OS Security Vulnerability Privileges Report

The OS Security Vulnerability Privileges Report lists database accounts and roles that have privileges to export sensitive information to the operating system.

This report can reveal important vulnerabilities related to the operating system.

26.6.6 Initialization Parameters and Profiles Reports

The initialization parameters and profiles reports track database parameters, resource profiles, and system limits.

- [Security Related Database Parameters Report](#)
The Security Related Database Parameters Report lists database parameters that can cause security vulnerabilities if they not set correctly.
- [Resource Profiles Report](#)
The Resource Profiles Report lists resource profiles that may be allowing unlimited resource consumption.
- [System Resource Limits Report](#)
The System Resource Limits Report provides insight into the current system resource usage by the database.

26.6.6.1 Security Related Database Parameters Report

The Security Related Database Parameters Report lists database parameters that can cause security vulnerabilities if they not set correctly.

This report can be used to compare the recommended settings with the current state of the database parameter values.

26.6.6.2 Resource Profiles Report

The Resource Profiles Report lists resource profiles that may be allowing unlimited resource consumption.

Examples of resource profiles are `CPU_PER_SESSION` and `IDLE_TIME`. You should review the profiles that might need a cap on the potential resource usage.

26.6.6.3 System Resource Limits Report

The System Resource Limits Report provides insight into the current system resource usage by the database.

This report helps determine whether any of these resources are approaching their limits under the existing application load. Resources that show large increases over a short period may point to a denial-of-service (DoS) attack. You might want to reduce the upper limit for the resource to prevent the condition in the future.

26.6.7 Database Account Password Reports

The database account password reports track default passwords and account statuses of database accounts.

- [Database Account Default Password Report](#)
The Database Account Default Password Report lists the database accounts that have default passwords.
- [Database Account Status Report](#)
The Database Account Status Report lists existing database accounts.

26.6.7.1 Database Account Default Password Report

The Database Account Default Password Report lists the database accounts that have default passwords.

Default passwords are provided during the Oracle Database installation.

You should change the passwords for accounts included in this report to nondefault, complex passwords to help secure the database.

26.6.7.2 Database Account Status Report

The Database Account Status Report lists existing database accounts.

This report shows the account status for each account, which helps you identify accounts that must be locked. Lock and expiry dates provide information that helps determine whether the account was locked as a result of password aging. If a special password and resource secure profile is used, then you can identify accounts that are not using them. Accounts not using organizationally defined default tablespaces also can be identified, and the temporary tablespace for accounts can be determined. This report also identifies accounts that use external passwords.

26.6.8 Security Audit Report: Core Database Audit Report

The Core Database Audit Report lists database audit trail records..

This report applies to a non-unified auditing environment.

The Core Database Audit Report returns audit records for the audit policy defined in [Auditing Oracle Database Vault](#), and any auditing records that are generated for audit statements you have defined.

This report only displays audit records that are captured if the database initialization parameter `AUDIT_TRAIL` has been set to `DB` (with unified auditing disabled).



See Also:

Oracle Database Reference for more information about the `AUDIT_TRAIL` parameter

26.6.9 Other Security Vulnerability Reports

Other security vulnerability reports track vulnerabilities that arise with activities such as Java policy grants in operating system directory objects.

- [Java Policy Grants Report](#)
The Java Policy Grants Report shows the Java policy permissions stored in the database.
- [OS Directory Objects Report](#)
The OS Directory Objects Report shows directory objects in the database, their privileges, and whether they are available to `PUBLIC`.
- [Objects Dependent on Dynamic SQL Report](#)
The Objects Dependent on Dynamic SQL Report lists objects that use dynamic SQL.
- [Unwrapped PL/SQL Package Bodies Report](#)
The Unwrapped PL/SQL Package Bodies Report lists PL/SQL package procedures that are not wrapped.
- [Username/Password Tables Report](#)
The Username/Password Tables Report identifies application tables in the database that store user names and password strings.

- [Tablespace Quotas Report](#)
The Tablespace Quotas Report lists database accounts that have quotas on one or more tablespaces.
- [Non-Owner Object Trigger Report](#)
The Non-Owner Object Trigger Report lists non-owner triggers.

26.6.9.1 Java Policy Grants Report

The Java Policy Grants Report shows the Java policy permissions stored in the database.

This report helps reveal violations to the principle of least privilege. Look for `GRANT`, `READ`, or `WRITE` privileges to `PUBLIC` or other accounts and roles that do not necessarily need the privilege. It is advisable to disable Java loading privileges from `PUBLIC`, if Java is not required in the database.

 **Note:**

Oracle JVM, the Java virtual machine option provided with Oracle Database Vault, must be installed before you can run the Java Policy Grants Report.

26.6.9.2 OS Directory Objects Report

The OS Directory Objects Report shows directory objects in the database, their privileges, and whether they are available to `PUBLIC`.

Directory objects should exist only for secured operating system (OS) directories, and access to them within the database should be protected. You should never use the root operating system directory on any storage device (for example, `/`), because it allows remote database sessions to look at all files on the device.

26.6.9.3 Objects Dependent on Dynamic SQL Report

The Objects Dependent on Dynamic SQL Report lists objects that use dynamic SQL.

Potential intruders have a greater chance of using this channel if parameter checking or bind variables are not used. The report helps by narrowing the scope of where to look for problems by pointing out who is using dynamic SQL. Such objects can be a target for a SQL injection attack and must be secured to avoid this type of attack. After determining the objects that use dynamic SQL, do the following:

- Check the privileges that client applications (for example, a Web application) have over the object.
- Check the access granted for the object to `PUBLIC` or a wider account base.
- Validate parameters.
- Use bind variables where possible.

26.6.9.4 Unwrapped PL/SQL Package Bodies Report

The Unwrapped PL/SQL Package Bodies Report lists PL/SQL package procedures that are not wrapped.

Oracle provides a wrap utility that obfuscates code to the point where it cannot be read in the data dictionary or from the data dictionary views. This helps reduce the ability of an intruder to circumvent data protection by eliminating the ability to read source code that manipulates data.

26.6.9.5 Username/Password Tables Report

The Username/Password Tables Report identifies application tables in the database that store user names and password strings.

You should examine these tables to determine if the information is encrypted. (Search for column names such as %USER%NAME% or %PASSWORD%.) If it is not, modify the code and applications using these tables to protect them from being visible to database sessions.

26.6.9.6 Tablespace Quotas Report

The Tablespace Quotas Report lists database accounts that have quotas on one or more tablespaces.

These tablespaces can become potential targets for denial-of-service (DoS) attacks.

26.6.9.7 Non-Owner Object Trigger Report

The Non-Owner Object Trigger Report lists non-owner triggers.

These are triggers that are owned by a database account that is different from the account that owns the database object on which the trigger acts.

If the trigger is not part of a trusted database application, then it can *steal* sensitive data, possibly from tables protected through Oracle Label Security or Virtual Private Database (VPD), and place it into an unprotected table for subsequent viewing or export.

A

Auditing Oracle Database Vault

You can audit activities in Oracle Database Vault, such as changes to policy configurations.

- [About Auditing in Oracle Database Vault](#)
All activities in Oracle Database Vault can be audited, including Database Vault administrator activities.
- [Protection of the Unified Audit Trail in an Oracle Database Vault Environment](#)
By default, `AUDSYS` schema, which contains the unified audit trail, is not protected by a realm.
- [Oracle Database Vault Specific Audit Events](#)
Oracle Database Vault traditional (non-unified) audit events track activities such as whether an action attempted on a realm was successful.
- [Archiving and Purging the Oracle Database Vault Audit Trail](#)
If you have not migrated to unified auditing, you should periodically archive and purge the Oracle Database Vault audit trail.
- [Oracle Database Audit Settings Created for Oracle Database Vault](#)
When you install Oracle Database Vault, it creates several `AUDIT` settings in the database.

A.1 About Auditing in Oracle Database Vault

All activities in Oracle Database Vault can be audited, including Database Vault administrator activities.

There are two ways that you audit Oracle Database Vault: unified auditing or the Oracle Database Vault traditional, non-unified auditing tools.

Auditing Oracle Database Vault Using Unified Auditing

Unified auditing is the recommended way to audit Oracle Database Vault because in addition to the advantages that unified auditing provides, non-unified auditing is deprecated starting with Oracle Database release 21c.

Unified auditing enables you to create custom policies that capture more fine-tuned data than you can capture with traditional Oracle Database Vault auditing. For example, you can create unified auditing policies that capture Database Vault-specific events from Oracle products that are integrated with Database Vault, such as Oracle Data Pump or Oracle Label Security. In addition to this functionality, unified auditing provides the following two predefined policies that are designed for common Database Vault auditing needs:

- `ORA_DV_AUDPOL` audits Oracle Database Vault `DVSY` and `LBACSYS` schema objects.
- `ORA_DV_AUDPOL2` audits the Oracle Database Vault default realms and command rules.

When you migrate to unified auditing, then the auditing features in the Database Vault APIs (the `audit_options` parameter) are no longer effective. You should archive and purge these audit records. From then on, you can manage Database Vault audit policies through the unified audit policy PL/SQL statements. Oracle recommends that you migrate to full unified auditing.

To learn how to create unified audit policies, see *Oracle Database Security Guide*.

Auditing Oracle Database Vault Using Traditional, Non-Unified Auditing

Traditional, non-unified auditing uses the Oracle Database Vault APIs to collect audit records and write these audit records to the Oracle Database Vault data dictionary views and reports. This type of auditing is deprecated starting with Oracle Database release 21c.

You can audit individual policies that you create for realms, rule sets, and factors. The audit indicates if the user's action succeeded (that is, the policy enabled the user to accomplish a task) or if the user's action failed (the policy was violated). These actions are written to audit logs, whose contents you can find either by querying the appropriate data dictionary views, or running the Oracle Database Vault reports.

All configuration changes made to Database Vault are mandatorily audited, including actions of unprivileged users who attempt to modify Database Vault policies.

When you install a new database and configure it to use Oracle Database Vault, then by default it uses a mixed-mode environment, that is, a mixture of unified auditing and pre-migrated auditing. If you have upgraded from previous release, then Database Vault uses the auditing that was available from that release.

Before you migrate to a full unified auditing environment, you can create audit policies as follows:

- **Using the Database Vault APIs:** That is, you use the `DBMS_MACADM` PL/SQL package or the Database Vault pages in Enterprise Manager. In this case, the audit records are written to the Database Vault audit trail, which is stored in the `DVSYS.AUDIT_TRAIL$` table. You can query the `DVSYS.DV$CONFIGURATION_AUDIT` and `DVSYS.DV$ENFORCEMENT_AUDIT` views for these audit records.
- **Using the unified audit policy SQL statements:** These statements are the `CREATE AUDIT POLICY`, `ALTER AUDIT POLICY`, `DROP AUDIT POLICY`, `AUDIT`, and `NO AUDIT` statements. They are written to the unified audit trail, which is captured by the `UNIFIED_AUDIT_TRAIL`, `AUDSYS.DV$CONFIGURATION_AUDIT`, and `AUDSYS.DV$ENFORCEMENT_AUDIT` data dictionary views. Oracle Database provides a default unified auditing policy, `ORA_DV_AUDPOL`, that audits all actions that are performed on the Oracle Database Vault `DVSYS` and `DVF` schema objects and the Oracle Label Security `LBACSYS` schema objects.

Related Topics

- [Archiving and Purging the Oracle Database Vault Audit Trail](#)
If you have not migrated to unified auditing, you should periodically archive and purge the Oracle Database Vault audit trail.
- *Oracle Database Security Guide*

A.2 Protection of the Unified Audit Trail in an Oracle Database Vault Environment

By default, `AUDSYS` schema, which contains the unified audit trail, is not protected by a realm.

To better protect the unified audit trail, Oracle recommends that you do the following:

- Create a regular (not mandatory) realm around the `AUDSYS` schema so that only authorized users (that is, users who have been granted the `AUDIT_ADMIN` and `AUDIT_VIEWER` roles) can query the unified audit trail views and use the `DBMS_AUDIT_MGMT` PL/SQL package to manage the audit trail. This realm will prevent highly privileged users, including `SYS`, from performing these actions until they are added to that realm's authorization list.

- Create a command rule for the `CREATE AUDIT POLICY`, `ALTER AUDIT POLICY`, and `DROP AUDIT POLICY` SQL statements so that only authorized users can run these statements.

Related Topics

- [Creating a Realm](#)
The first step in enabling realm protection is to create the realm itself, and then add realm-secured objects, roles, and authorizations.
- [Creating a Command Rule](#)
You can create a different types of command rules using different command rule APIs.

A.3 Oracle Database Vault Specific Audit Events

Oracle Database Vault traditional (non-unified) audit events track activities such as whether an action attempted on a realm was successful.

- [Oracle Database Vault Policy Audit Events](#)
Oracle Database Vault uses audit events to track configuration activities, using traditional, non-unified auditing.
- [Oracle Database Vault Audit Trail Record Format](#)
If you do not use unified auditing, then Oracle Database Vault writes audit records to the `DVSYSAUDIT_TRAIL$` table.

A.3.1 Oracle Database Vault Policy Audit Events

Oracle Database Vault uses audit events to track configuration activities, using traditional, non-unified auditing.

These activities are as follows:

- **Realm Audit.** You can audit both successful and failed actions, based on the auditing option that you set when you created the realm. The exception to this is actions performed by the schema owner.
- **Rule Set Audit.** Audits the rule set processing results. You can audit both successful and failed processing. Realm authorizations can be managed using rule sets. You can audit the rule set processing results. Factor assignments and secure application roles audits can be managed using a rule set.
- **Factor Audit.** You can audit both successful and failed factor processing. For failed factor processing, you can audit on all or any of the following events: Retrieval Error, Retrieval Null, Validation Error, Validation False, Trust Level Null, or Trust Level Less Than Zero.
- **Oracle Label Security Session Initialization Failed.** Audits instances where the Oracle Label Security session fails to initialize.
- **Oracle Label Security Attempt to Upgrade Session Label Failed.** Audits instances where the Oracle Label Security component prevents a session from setting a label that exceeds the maximum session label.

Related Topics

- [Creating a Factor](#)
In general, to create a factor, you first create the factor itself, and then you edit the factor to include its identity.
- [About Realm Authorization](#)
Realm authorizations establish the set of database accounts and roles that manage or access objects protected in realms.

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.

A.3.2 Oracle Database Vault Audit Trail Record Format

If you do not use unified auditing, then Oracle Database Vault writes audit records to the `DVSYS.AUDIT_TRAIL$` table.

These audit records are not part of the Oracle Database audit trail, and how auditing is enabled in the database has no effect how Oracle Database Vault collects its audit data in the `DVSYS.AUDIT_TRAIL$` table. In fact, even if auditing has been disabled in Oracle Database, then the Oracle Database Vault audit functionality continues to write to the `DVSYS.AUDIT_TRAIL$` table.

Users who have been granted the `DV_OWNER`, `DV_ADMIN`, `DV_SECANALYST` or `DV_MONITOR` role can directly query the `DVYS.AUDIT_TRAIL$` table.

[Table A-1](#) describes the format of the audit trail, which you must understand if you plan to create custom reports that use the `DVSYS.AUDIT_TRAIL$` table.

Table A-1 Oracle Database Vault Audit Trail Format

| Column | Datatype | Null | Description |
|------------------|----------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ID# | NUMBER | NOT NULL | Numeric identifier for the audit record |
| OS_USERNAME | VARCHAR2 (255) | NULL | Operating system login user name of the user whose actions were audited |
| USERNAME | VARCHAR2 (30) | NULL | Name of the database user whose actions were audited |
| USERHOST | VARCHAR2 (128) | NULL | Client computer name |
| TERMINAL | VARCHAR2 (255) | NULL | Identifier for the user's terminal |
| TIMESTAMP | DATE | NULL | Date and time of creation of the audit trail entry (in the local database session time zone) |
| OWNER | VARCHAR2 (30) | NULL | Creator of the object affected by the action, always <code>DVSYS</code> (because <code>DVSYS</code> is where objects are created) |
| OBJ_NAME | VARCHAR2 (128) | NULL | Name of the object affected by the action. Expected values are: <ul style="list-style-type: none"> • <code>ROLE\$</code> • <code>REALM\$</code> • <code>CODE\$</code> • <code>FACTOR\$</code> |
| ACTION | NUMBER | NOT NULL | Numeric action type code. The corresponding name of the action type is in the <code>ACTION_NAME</code> column. See Table 24-3 for a list of the expected <code>ACTION</code> and <code>ACTION_NAME</code> values. |
| ACTION_NAME | VARCHAR2 (128) | NULL | Name of the action type corresponding to the numeric code in the <code>ACTION</code> column |
| ACTION_OBJECT_ID | NUMBER | NULL | The unique identifier of the record in the table specified under <code>OBJ_NAME</code> . For realms, this field contains a list of comma-separated values of all realm IDs that have the Audit on Failure audit option. |

Table A-1 (Cont.) Oracle Database Vault Audit Trail Format

| Column | Datatype | Null | Description |
|--------------------|------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACTION_OBJECT_NAME | VARCHAR2 (128) | NULL | The unique name or natural key of the record in the table specified under OBJ_NAME. For realms, this field contains a list of comma-separated values of all realm names that have the Audit on Failure audit option. |
| ACTION_COMMAND | VARCHAR2 (4000) | NULL | The SQL text of the command procedure that was run that resulted in the audit event being triggered |
| AUDIT_OPTION | VARCHAR2 (4000) | NULL | The labels for all audit options specified in the record that resulted in the audit event being triggered. For example, a factor set operation that is supposed to audit on get failure and get NULL would indicate these two options. |
| RULE_SET_ID | NUMBER | NULL | The unique identifier of the rule set that was executing and caused the audit event to trigger |
| RULE_SET_NAME | VARCHAR2 (30) | NULL | The unique name of the rule set that was executing and caused the audit event to trigger |
| RULE_ID | NUMBER | NULL | Not used |
| RULE_NAME | VARCHAR2 (30) | NULL | Not used |
| FACTOR_CONTEXT | VARCHAR2 (4000) | NULL | An XML document that contains all of the factor identifiers for the current session at the point when the audit event was triggered |
| COMMENT_TEXT | VARCHAR2 (4000) | NULL | Text comment on the audit trail entry, providing more information about the statement audited |
| SESSIONID | NUMBER | NOT NULL | Numeric identifier for each Oracle session |
| ENTRYID | NUMBER | NOT NULL | Same as the value in the ID# column |
| STATEMENTID | NUMBER | NOT NULL | Numeric identifier for the statement invoked that caused the audit event to be generated. This is empty for most Oracle Database Vault events. |
| RETURNCODE | NUMBER | NOT NULL | Oracle error code generated by the action. The error code for a statement or procedure invoked that caused the audit event to be generated. This is empty for most Oracle Database Vault events. |
| EXTENDED_TIMESTAMP | TIMESTAMP (6) WITH TIME ZONE | NULL | Time stamp of creation of the audit trail entry (time stamp of user login for entries) in UTC (Coordinated Universal Time) time zone |
| PROXY_SESSIONID | NUMBER | NULL | Proxy session serial number, if an enterprise user has logged in through the proxy mechanism |
| GLOBAL_UID | VARCHAR2 (32) | NULL | Global user identifier for the user, if the user has logged in as an enterprise user |
| INSTANCE_NUMBER | NUMBER | NULL | Instance number as specified by the INSTANCE_NUMBER initialization parameter |
| OS_PROCESS | VARCHAR2 (16) | NULL | Operating system process identifier of the Oracle process |
| CREATED_BY | VARCHAR2 (30) | NULL | Database login user name of the user whose actions were audited |
| CREATE_DATE | DATE | NULL | Date on which the action occurred, based on the SYSDATE date |

Table A-1 (Cont.) Oracle Database Vault Audit Trail Format

| Column | Datatype | Null | Description |
|-------------|---------------|------|---------------------------------|
| UPDATED_BY | VARCHAR2 (30) | NULL | Same as CREATED_BY column value |
| UPDATE_DATE | DATE | NULL | Same as UPDATED_BY column value |

A.4 Archiving and Purging the Oracle Database Vault Audit Trail

If you have not migrated to unified auditing, you should periodically archive and purge the Oracle Database Vault audit trail.

- [About Archiving and Purging the Oracle Database Vault Audit Trail](#)
In a traditional, non-unified auditing environment, you can archive the Oracle Database Vault audit trail by exporting the `DVSYS.AUDIT_TRAIL$` table to a dump file.
- [Archiving the Oracle Database Vault Audit Trail](#)
You can use SQL*Plus and Oracle Data Pump to archive the Oracle Database Vault audit trail from the root or a PDB.
- [Purging the Oracle Database Vault Audit Trail](#)
You can purge the (traditional, non-unified auditing) Oracle Database Vault audit trail from the root or a PDB.

A.4.1 About Archiving and Purging the Oracle Database Vault Audit Trail

In a traditional, non-unified auditing environment, you can archive the Oracle Database Vault audit trail by exporting the `DVSYS.AUDIT_TRAIL$` table to a dump file.

You should periodically archive and then purge the audit trail to prevent it from growing too large.

If you choose to migrate to unified auditing, then use this procedure to archive and purge the Database Vault audit trail records after you complete the migration. When unified auditing begins to collect records, then the new records will be available for viewing from the `UNIFIED_AUDIT_TRAIL`, `AUDSYS.DV$CONFIGURATION_AUDIT`, and `AUDSYS.DV$ENFORCEMENT_AUDIT` data dictionary views.

A.4.2 Archiving the Oracle Database Vault Audit Trail

You can use SQL*Plus and Oracle Data Pump to archive the Oracle Database Vault audit trail from the root or a PDB.

Use this procedure to archive the traditional, non-unified audit trail in Oracle Database Vault.

1. As user `SYS` with the `SYSDBA` administrative privilege, log in to the root or to the PDB.
2. Ensure that the user who will perform archiving has the appropriate privileges.

For example:

```
GRANT CREATE ANY DIRECTORY, EXP_FULL_DATABASE, UNLIMITED TABLESPACE TO psmith;
```

3. Connect to the root or the PDB as a user who has been granted the `DV_OWNER` or `DV_AUDIT_CLEANUP` role.
4. Ensure that the user who will perform archiving has the appropriate privileges.

```
GRANT CREATE ANY DIRECTORY, EXP_FULL_DATABASE, UNLIMITED TABLESPACE TO user_name;
```

5. Connect to the root or the PDB as a user who has been granted the DV_OWNER or DV_AUDIT_CLEANUP role.
6. Archive the Oracle Database Vault audit trail into a new table in an appropriate schema.

For example:

```
CREATE TABLE psmith.dv_audit_trail nologging \
AS SELECT * FROM DVSYS.AUDIT_TRAIL$;
```

7. If the schema is already protected by a realm, then ensure that you or the user performing the export operation has been granted the appropriate authorization to use Oracle Data Pump in a Database Vault environment.

For example, to authorize user psmith to perform Data Pump operations on their own schema:

```
EXEC DBMS_MACADM.AUTHORIZE_DATAPUMP_USER('PSMITH', 'PSMITH');
```

8. Connect to the root or the PDB as the Data Pump user.
9. Create a directory for the Database Vault audit trail.

```
CREATE DIRECTORY dv_audit_dir AS 'dv_audit_trail_directory';
```

10. Exit SQL*Plus.

```
EXIT
```

11. Using Data Pump, export the Database Vault audit trail into the directory object that you just created.

```
expdp psmith directory=dv_audit_dir tables=psmith.dv_audit_trail \
dumpfile=dv_audit.dmp log=dv_audit_exp.log
```

12. Connect to the root or the PDB as a user who has been granted the DV_OWNER role.
13. If you have not done so, then create a realm around the schema that now contains the Database Vault audit trail.

- a. Create the realm. For example:

```
BEGIN
  DBMS_MACADM.CREATE_REALM(
    realm_name => 'DV Audit Trail Realm',
    description => 'Realm to protect the DV audit trail',
    enabled => DBMS_MACUTL.G_YES,
    audit_options => DBMS_MACUTL.G_REALM_AUDIT_ON,
    realm_type => 1);
END;
/
```

- b. Add the schema that contains to audit trail to this realm. For example:

```
BEGIN
  DBMS_MACADM.ADD_OBJECT_TO_REALM(
    realm_name => 'DV Audit Trail Realm',
    object_owner => 'psmith',
    object_name => '%',
    object_type => '%');
END;
/
```

- c. Authorize a trusted user for this realm.

```
BEGIN
  DBMS_MACADM.ADD_AUTH_TO_REALM(
```

```

realm_name => 'DV Audit Trail Realm',
grantee    => 'PSMITH',
auth_options => DBMS_MACUTL.G_REALM_AUTH_OWNER);
END;
/

```

Related Topics

- [Using Oracle Data Pump with Oracle Database Vault](#)
Database administrators can authorize Oracle Data Pump users to work in a Database Vault environment.
- *Oracle Database SQL Language Reference*
- *Oracle Database Utilities*

A.4.3 Purging the Oracle Database Vault Audit Trail

You can purge the (traditional, non-unified auditing) Oracle Database Vault audit trail from the root or a PDB.

1. As user who has been granted the `DV_OWNER` role or the `DV_AUDIT_CLEANUP` role, log in to the root or to the PDB.

For example, to log in to the root:

```

sqlplus c##sec_admin_owen
Enter password: password

```

To log in to a PDB:

```

sqlplus ebrown@pdb_name
Enter password: password

```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

Note that the `DV_OWNER` and `DV_AUDIT_CLEANUP` roles do not allow their grantees to truncate the `DVSYS.AUDIT_TRAIL$` system table.

You can query the `DBA_ROLE_PRIVS` data dictionary view to find the roles that have been granted to a user.

2. Purge the Database Vault audit trail.

```

DELETE FROM DVSYS.AUDIT_TRAIL$;

```

Related Topics

- [DV_AUDIT_CLEANUP Audit Trail Cleanup Role](#)
The `DV_AUDIT_CLEANUP` role is used for purge operations.

A.5 Oracle Database Audit Settings Created for Oracle Database Vault

When you install Oracle Database Vault, it creates several `AUDIT` settings in the database.

In a traditional, non-unified auditing environment, in order for these audit settings to take place, auditing must be enabled in this database. You can check if auditing is enabled by using the `SHOW PARAMETER` command to find the value of the `AUDIT_TRAIL` initialization parameter. By default, auditing is enabled in Oracle Database.

Table A-2 lists the AUDIT settings that Oracle Database Vault adds to the database.

Table A-2 Audit Policy Settings Oracle Database Vault Adds to Oracle Database

| Audit Setting Type | Audited Statements (BY ACCESS and on Success or Failure Unless Otherwise Noted) |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| User Audit Settings for DVSYS/DVF | ADMINISTER DATABASE TRIGGER |
| User Audit Settings for LBACSYS | ALTER <i>object</i> AUDIT SYSTEM BECOME USER CLUSTER COMMENT CONTEXT CREATE <i>object</i> DATABASE LINK DEBUG DIRECTORY DROP <i>object</i> EXECUTE LIBRARY (WHENEVER NOT SUCCESSFUL) EXECUTE PROCEDURE (WHENEVER NOT SUCCESSFUL) EXEMPT ACCESS POLICY EXPORT FULL DATABASE GRANT <i>object</i> IMPORT FULL DATABASE INDEX MANAGE SCHEDULER MANAGE TABLESPACE MATERIALIZED VIEW (audits both accessing and creating materialized views) SELECT SEQUENCE (WHENEVER NOT SUCCESSFUL) SELECT TABLE (WHENEVER NOT SUCCESSFUL) |
| Object Audit Settings for DVF | AUDIT PACKAGE/PROCEDURE/FUNCTION/SEQUENCE/TABLE COMMENT TABLE/VIEW DELETE TABLE/VIEW EXECUTE PACKAGE/PROCEDURE/FUNCTION (WHENEVER NOT SUCCESSFUL) GRANT PACKAGE/PROCEDURE/FUNCTION/SEQUENCE/TABLE RENAME PACKAGE/PROCEDURE/FUNCTION/SEQUENCE/VIEW/TABLE SELECT SEQUENCE/TABLE/VIEW (WHENEVER NOT SUCCESSFUL) |
| Object Audit Settings for DVSYS | AUDIT PACKAGE/PROCEDURE/FUNCTION/SEQUENCE/TABLE |
| Object Audit Settings for LBACSYS | COMMENT TABLE/VIEW DELETE TABLE/VIEW EXECUTE PACKAGE/PROCEDURE/FUNCTION (WHENEVER NOT SUCCESSFUL) GRANT PACKAGE/PROCEDURE/FUNCTION/SEQUENCE/TABLE INSERT TABLE/VIEW RENAME PACKAGE/PROCEDURE/FUNCTION/SEQUENCE/VIEW/TABLE SELECT SEQUENCE/TABLE/VIEW (WHENEVER NOT SUCCESSFUL) UPDATE TABLE/VIEW |

Related Topics

- [Oracle Database Vault Schemas](#)
The Oracle Database Vault schemas, `DVSYS` and `DVF`, support the administration and run-time processing of Oracle Database Vault.

B

Disabling and Enabling Oracle Database Vault

Periodically you must disable and then re-enable Oracle Database Vault, for activities such as installing Oracle Database optional products or features.

- [When You Must Disable Oracle Database Vault](#)
You may need to disable Oracle Database Vault to perform upgrade tasks or correct erroneous configurations.
- [Step 1: Disable Oracle Database Vault](#)
Be aware that after you disable Oracle Database Vault, Oracle Label Security, which is required to run Database Vault, is still enabled.
- [Step 2: Perform the Required Tasks](#)
At this stage, Oracle Database Vault is disabled and you can perform the required tasks.
- [Step 3: Enable Oracle Database Vault](#)
You can enable Oracle Database Vault and Oracle Label Security from SQL*Plus from either the root or a PDB.

B.1 When You Must Disable Oracle Database Vault

You may need to disable Oracle Database Vault to perform upgrade tasks or correct erroneous configurations.

You can reenable Oracle Database Vault after you complete the corrective tasks.

The following situations require you to disable Oracle Database Vault:

- You must install any of the Oracle Database optional products or features, such as Oracle Spatial, by using Database Configuration Assistant (DBCA).
- If you did not configure backup `DV_OWNER` and `DV_ACCTMGR` accounts when you configured and enabled Oracle Database Vault, and these accounts are inadvertently locked or their passwords forgotten. Note that if your site only has one `DV_OWNER` user and this user has lost their password, you will be unable to disable Oracle Database Vault. However, if your site's only `DV_ACCTMGR` user has lost the password, you can disable Database Vault. As a best practice, you should grant the `DV_OWNER` and `DV_ACCTMGR` roles to new or existing user accounts, and use the Database Vault Owner and Account Manager accounts that you created when you configured and enabled Database Vault as back-up accounts.
- If you want to configure Oracle Internet Directory (OID) using Oracle Database Configuration Assistant (DBCA).
- If Oracle Database Vault is enabled and you are upgrading an entire CDB, then use one of the following methods:
 - **CDB upgrade method 1:** Temporarily grant the `DV_PATCH_ADMIN` to user `SYS` commonly by logging into the root container as a common user with the `DV_OWNER` role, and then issuing the `GRANT DV_PATCH_ADMIN TO SYS CONTAINER=ALL` statement. Oracle Database Vault controls will be in the same state as it was before the upgrade. When the upgrade is complete, log into the root container as the `DV_OWNER` user and revoke the `DV_PATCH_ADMIN` role from `SYS` by issuing the `REVOKE DV_PATCH_ADMIN FROM SYS CONTAINER=ALL` statement.

- **CDB upgrade method 2:** Log into each container as a user who has the `DV_OWNER` role and then run the `DBMS_MACADM.DISABLE_DV` procedure. You must first disable the PDBs (in any order) and then after that, disable the root container last. If you are upgrading only one PDB, then you can disable Oracle Database Vault in that PDB only. After you have completed the upgrade, you can enable Oracle Database Vault by logging into each container as the `DV_OWNER` user and then executing the `DVSYS.DBMS_MACADM.ENABLE_DV` procedure. The order of enabling Oracle Database Vault must be the root container first and PDBs afterward. You can enable the PDBs in any order, but the root container must be enabled first.

 **Note:**

Be aware that if you disable Oracle Database Vault, the privileges that were revoked from existing users and roles during the Oracle Database Vault configuration remain in effect.

Related Topics

- [Verifying That Database Vault Is Configured and Enabled](#)
The `DBA_DV_STATUS`, `CDB_DV_STATUS`, and `DBA_OLS_STATUS` data dictionary views verify if Oracle Database is configured and enabled.
- [Backup Oracle Database Vault Accounts](#)
As a best practice, you should maintain backup accounts for the `DV_OWNER` and `DV_ACCTMGR` roles.
- [Privileges That Are Revoked from Existing Users and Roles](#)
The Oracle Database Vault configuration revokes privileges from several Oracle Database-supplied users and roles, for better separation of duty.

B.2 Step 1: Disable Oracle Database Vault

Be aware that after you disable Oracle Database Vault, Oracle Label Security, which is required to run Database Vault, is still enabled.

1. As a user who has been granted the `DV_OWNER` role, log in to the root or to the PDB in which you want to disable Oracle Database Vault.

For example, to log in to the root:

```
sqlplus c##sec_admin_owen
Enter password: password
```

To log in to a PDB:

```
sqlplus sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. If necessary, verify the enablement status of Oracle Database Vault.
3. Disable Oracle Database Vault.

```
EXEC DBMS_MACADM.DISABLE_DV;
```
4. Restart the CDB or close and then reopen the PDB.

To restart the CDB from the root:

```
CONNECT SYS@pdb_name AS SYSOPER
Enter password: password
```

```
SQL> SHUTDOWN IMMEDIATE
SQL> STARTUP
```

To close and reopen the PDB:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

```
SQL> ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;
SQL> ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

5. For Oracle RAC installations, repeat these steps for each node on which the database is installed.

Related Topics

- [Verifying That Database Vault Is Configured and Enabled](#)
The `DBA_DV_STATUS`, `CDB_DV_STATUS`, and `DBA_OLS_STATUS` data dictionary views verify if Oracle Database is configured and enabled.

B.3 Step 2: Perform the Required Tasks

At this stage, Oracle Database Vault is disabled and you can perform the required tasks.

You can perform the following types of activities:

- **Use the Oracle Database Vault PL/SQL packages and functions.** For example, to correct a login or `CONNECT` rule set error, use the `DBMS_MACADM` PL/SQL package or the Oracle Database Vault pages in Enterprise Manager Cloud Control. Note that a `CONNECT` command rule cannot prevent a user who has the `DV_OWNER` or `DV_ADMIN` role from connecting to the database. This enables a Database Vault administrator to correct a misconfigured protection without having to disable Database Vault.
- **Use the `SYSTEM` or `SYS` accounts to perform tasks such as creating or changing passwords, or locking and unlocking accounts.** In addition to modifying standard database and administrative user accounts, you can modify passwords and the lock status of any of the Oracle Database Vault-specific accounts, such as users who have been granted the `DV_ADMIN` or `DV_ACCTMGR` roles.
- **Perform the installation or other tasks that require security protections to be disabled.**

B.4 Step 3: Enable Oracle Database Vault

You can enable Oracle Database Vault and Oracle Label Security from SQL*Plus from either the root or a PDB.

1. As a user who has been granted the `DV_OWNER` role, log in to the root or to the PDB in which you want to enable Oracle Database Vault.

For example, to log in to the root:

```
sqlplus c##sec_admin_owen
Enter password: password
```


To log in to a PDB:

```
sqlplus sec_admin_owen@pdb_name
Enter password: password
```

To find the available PDBs, query the `PDB_NAME` column of the `DBA_PDBS` data dictionary view. To check the current container, run the `show con_name` command.

2. If necessary, verify the enablement status of Oracle Database Vault.
3. Enable Database Vault.

```
EXEC DBMS_MACADM.ENABLE_DV (strict_mode => 'n');
-- For regular mode
EXEC DBMS_MACADM.ENABLE_DV (strict_mode => 'y');
-- For strict mode
```

4. Check if Oracle Label Security is enabled.

```
SELECT VALUE FROM V$OPTION WHERE PARAMETER = 'Oracle Label Security';
```

Oracle Label security must be enabled before you can use Database Vault. If it is not enabled, then this query returns `FALSE`.

5. If Oracle Label Security is not enabled, then enable it.

```
EXEC LBACSYS.CONFIGURE_OLS;
EXEC LBACSYS.OLS_ENFORCEMENT.ENABLE_OLS;
```

6. Restart the CDB or close and then reopen the PDB.

To restart the CDB from the root:

```
CONNECT SYS@pdb_name AS SYSOPER
Enter password: password
```

```
SQL> SHUTDOWN IMMEDIATE
SQL> STARTUP
```

To close and reopen the PDB:

```
CONNECT sec_admin_owen@pdb_name
Enter password: password
```

```
SQL> ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;
SQL> ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

7. For Oracle RAC installations, repeat these steps for each node on which the database is installed.

Related Topics

- [Verifying That Database Vault Is Configured and Enabled](#)

The `DBA_DV_STATUS`, `CDB_DV_STATUS`, and `DBA_OLS_STATUS` data dictionary views verify if Oracle Database is configured and enabled.

C

Postinstallation Oracle Database Vault Procedures

After you configure and enable Oracle Database Vault, you can perform specialized tasks, such as adding languages or uninstalling and reinstalling Oracle Database Vault.

- [Adding Languages to Oracle Database Vault](#)
By default, Oracle Database Vault loads only the English language tables.
- [Uninstalling Oracle Database Vault](#)
You can uninstall Oracle Database Vault from an Oracle Database installation, for PDBs (but not the root) and Oracle RAC installations.
- [Reinstalling Oracle Database Vault](#)
You can reinstall Oracle Database Vault by manually installing it, and then afterward, configure and enable it.

Related Topics

- [Converting a Standalone Oracle Database to a PDB and Plugging It into a CDB](#)
You can convert a standalone Oracle Database database from release 12c through 19c to a PDB, and then plug this PDB into a CDB.

C.1 Adding Languages to Oracle Database Vault

By default, Oracle Database Vault loads only the English language tables.

You can add more languages by running the `DBMS_MACADM.ADD-NLS_DATA` procedure for each new language that you want to add. You can add more than one language to Database Vault, to either a specific PDB or to the root for all PDBs.

1. Log into the root or the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Run the following procedure:

```
EXEC DBMS_MACADM.ADD-NLS_DATA('language');
```

You can specify the `language` setting using any case. For example:

```
EXEC DBMS_MACADM.ADD-NLS_DATA('french');
```

```
EXEC DBMS_MACADM.ADD-NLS_DATA('JAPANESE');
```

Replace `language` with one of the following supported languages:

- ENGLISH
- GERMAN
- SPANISH
- FRENCH
- ITALIAN

- JAPANESE
- KOREAN
- BRAZILIAN PORTUGUESE
- SIMPLIFIED CHINESE
- TRADITIONAL CHINESE

C.2 Uninstalling Oracle Database Vault

You can uninstall Oracle Database Vault from an Oracle Database installation, for PDBs (but not the root) and Oracle RAC installations.

The uninstallation process does not affect the initialization parameter settings, even those settings that were modified during the installation process, nor does it affect Oracle Label Security.

1. Connect to the PDB as a user who has been granted the `DV_OWNER` or `DV_ADMIN` role.
2. Run the following procedure to disable Oracle Database Vault:

```
EXEC DBMS_MACADM.DISABLE_DV;
```

3. Close and reopen the PDB, or for Oracle RAC, restart the database.

As a user who has the `ALTER PLUGGABLE DATABASE` privilege:

```
ALTER PLUGGABLE DATABASE pdb_name CLOSE IMMEDIATE;
ALTER PLUGGABLE DATABASE pdb_name OPEN;
```

For Oracle RAC installations, shut down and then restart each database instance as follows:

```
srvctl stop database -db db_name
srvctl start database -db db_name
```

4. Run the `dvremov.sql` script to remove Oracle Database Vault.

For example:

```
$ORACLE_HOME/rdbms/admin/dvremov.sql
```

5. If necessary, in SQL*Plus, as user `SYS` with the `SYSDBA` administrative privilege, manually revoke the `EXECUTE` privilege on the `DBMS_RLS` PL/SQL package from any users who have been granted the `DV_OWNER` role.

When you configure Oracle Database Vault, one of the privileges that `DV_OWNER` users are granted is this privilege. However, when you remove Oracle Database Vault, `DV_OWNER` users still have this privilege. Optionally, you can revoke it.

```
REVOKE EXECUTE ON DBMS_RLS FROM dbv_owner_backup;
```

Afterward, you can double-check that Oracle Database Vault is truly deinstalled by logging in to SQL*Plus and entering the following statement:

```
SELECT * FROM V$OPTION WHERE PARAMETER = 'Oracle Database Vault';
```

If Oracle Database Vault is deinstalled, the following output appears:

| PARAMETER | VALUE |
|-----------------------|-------|
| Oracle Database Vault | FALSE |

C.3 Reinstalling Oracle Database Vault

You can reinstall Oracle Database Vault by manually installing it, and then afterward, configure and enable it.

Related Topics

- [Manually Installing Oracle Database Vault](#)
Under certain conditions, you must manually install Oracle Database Vault.
- [Configuring and Enabling Oracle Database Vault](#)
You can configure and enable Oracle Database Vault based on several scenarios.

D

Oracle Database Vault Security Guidelines

As with all Oracle Database products, you should follow security guidelines to better secure your Oracle Database Vault installation.

- [Separation of Duty Guidelines](#)
Oracle Database Vault is designed to easily implement separation of duty guidelines.
- [Managing Oracle Database Administrative Accounts](#)
Oracle provides guidelines for managing security for administrative accounts such as `SYSTEM` or users who have the `SYSDBA` administrative privilege.
- [Accounts and Roles Trusted by Oracle Database Vault](#)
Oracle Database Vault restricts access to application data from many privileged users and roles in the database.
- [Accounts and Roles That Should be Limited to Trusted Individuals](#)
You should limit powerful accounts and roles only to trusted individuals.
- [Guidelines for Using Oracle Database Vault in a Production Environment](#)
You should follow special guidelines when you run Oracle Database Vault in a production environment.
- [Secure Configuration Guidelines](#)
You should be aware of security considerations for special PL/SQL packages, privileges, and the recycle bin.

D.1 Separation of Duty Guidelines

Oracle Database Vault is designed to easily implement separation of duty guidelines.

- [How Oracle Database Vault Handles Separation of Duty](#)
Separation of duty is restricting each user's privileges *only* to the tasks they are responsible for, and *no more*.
- [Separation of Tasks in an Oracle Database Vault Environment](#)
Oracle Database Vault defines the several main responsibilities.
- [Separation of Duty Matrix for Oracle Database Vault](#)
Before applying separation of duty, you must understand who performs basic administration tasks in your environment and what these administration tasks are.
- [Identification and Documentation of the Tasks of Database Users](#)
You should document the areas of the tasks that your organization needs.

D.1.1 How Oracle Database Vault Handles Separation of Duty

Separation of duty is restricting each user's privileges *only* to the tasks they are responsible for, and *no more*.

You should assign specific categories of privileges to specific users, rather than granting many privileges to one user. Simply put, separation of duty creates accountability for each task that your organization requires.

Separation of duty has taken on increased importance over the past 10 years. For many organizations, separation of duty is a new concept that continues to evolve. Database consolidation, regulatory compliance, and outsourcing are just a few of the drivers for increased separation of duty. Oracle Database Vault separation of duty strengthens security by separating security-related administration from day-to-day DBA operations. You can tailor your Database Vault separation of duty implementation to easily adapt to current and future business requirements. Small organizations, in particular, need flexibility as they attempt to increase their security profile with limited resources.

D.1.2 Separation of Tasks in an Oracle Database Vault Environment

Oracle Database Vault defines the several main responsibilities.

These responsibilities are as follows:

- **Account management.** Account management entails creating, modifying, and dropping user accounts. The `DV_ACCTMGR` role provides these privileges. A primary day-to-day `DV_ACCTMGR` user and a backup `DV_ACCTMGR` user are created during the Oracle Database Vault registration process. As a safety measure, you keep and maintain the backup account in case the primary `DV_ACCTMGR` account owner forgets their password or leaves the company.
- **Security administration.** Security administration covers basic security tasks such as creating realms and command rules, setting security policies for database users' access, and authorizing database users for jobs they are allowed to perform. Security administrators also run security audit reports. The `DV_OWNER` and `DV_ADMIN` roles provide these privileges. A primary day-to-day `DV_OWNER` user and a backup `DV_OWNER` user are created during the Oracle Database Vault registration process.

! Important:

As a safety measure, you should keep and maintain the backup user account in case the primary `DV_OWNER` account owner forgets their password or leaves the company. It is also important that you do not lose access to all of the user accounts that have been granted the `DV_OWNER` role. There is no way to recover the `DV_OWNER` role if you lose access (such as with a lost password or a staff departure) to any account that has the `DV_OWNER` role. If you lose access to the `DV_OWNER` role, then you cannot modify any Database Vault controls or disable Database Vault. To remedy this problem, you can recover the database to the last known point where the database had possession of the Database Vault owner account.

Optionally, you can consolidate the account management and security administrative responsibilities.

- **Database management.** Database management refers to managing the database system but not accessing business data. It includes the following operations:
 - Backup operations require a predefined time to perform the backup using predefined tools.
 - Tuning and monitoring operations require ongoing performance monitoring and analysis.
 - Patching operations require temporary access only during the time the patching takes place

Oracle strongly recommends that you review database management accounts within the context of separation of duty. Different database administrators may have different responsibilities that require different privileges and roles. Similarly, more experienced database administrators may have more roles and privileges. Instead of granting users the default `DBA` role to users, consider tailoring database administrative roles for specific positions and for seniority in your organization. It is important to use only named accounts for day-to-day activities. Accounts such as `SYS` and accounts that use the `SYSDBA` administrative privilege should be managed with Privileged Account Management (PAM) systems and checked out (and audited) when they are used. You should also manage the backup Oracle Database Vault owner and account management accounts with a PAM system. Within the operating system, you should make the `root` and `oracle` accounts available only through a checkout system, because of the powerful privileges that these accounts have.

You should have separate accounts for database account management, database security administration, and additional named accounts for backup operations. Auditors check for separate database accounts for different responsibilities and being able to track the actions of each account. Less important is the number of users assigned to specific tasks. Remember that Oracle Database Vault audit events are protected and that the Database Vault reports show all attempted violations.

Related Topics

- [Oracle Database Vault Roles](#)
Oracle Database Vault provides default roles that are based on specific user tasks and adhere to separation of duty concepts.
- [Database Accounts Used by Oracle Database Vault](#)
Oracle Database Vault provides accounts that provide access to system and object privileges, and Oracle Label Security.
- [Backup Oracle Database Vault Accounts](#)
As a best practice, you should maintain backup accounts for the `DV_OWNER` and `DV_ACCTMGR` roles.

D.1.3 Separation of Duty Matrix for Oracle Database Vault

Before applying separation of duty, you must understand who performs basic administration tasks in your environment and what these administration tasks are.

Even if a single database administrator is responsible for managing both new database account provisioning and application patching, it is important to document and plan for each of these tasks. Using separate administration accounts for these types of tasks provides increased accountability and reduces associated risks if and when a single account is compromised by a malicious user. In midsize to large organizations, database administrators typically must perform common administration tasks but they do not need access to business data managed by the application. Creating a matrix for your separation of duty can help you plan your Database Vault deployment. As needed, you can include additional tasks and associated users to this list. This information should become part of the overall enterprise security documentation for your organization.

[Table D-1](#) shows an example of a separation of duty matrix.

Table D-1 Example Separation of Duty Matrix

| User, Process or Application | Account Creation | Database Administration | | | | | Security Administrator |
|------------------------------|------------------|-------------------------|--------|--------|-----------------------|------------|------------------------|
| | | SYSDBA | Backup | Tuning | Patching | Monitoring | |
| JSMITH | Yes | No | No | No | No | No | No |
| SHARDY | No | No | No | No | No | No | Yes |
| PKESTNER | No | No | Yes | No | No | No | No |
| RTYLER | No | No | No | No | Yes | No | No |
| SANDERSON | No | No | No | Yes | No | Yes | No |
| SYSTEM | No | No | No | No | Yes, for EBS patching | No | No |
| RMAN | No | Yes | Yes | No | No | No | No |

In some cases, system management tasks may require temporary access to data through specific tools and programs. When this happens, build provisions for this temporary or emergency access into the Oracle Database Vault rules and rule sets.

D.1.4 Identification and Documentation of the Tasks of Database Users

You should document the areas of the tasks that your organization needs.

These areas are as follows:

- The responsibilities of each administrative user
- The kind of access users need. For example, application owners should have data access and developers need access to development instances only.
- Who must manage the system without accessing business data (for example, users who perform backup, patching, tuning, and monitoring operations)
- The duties of each category of tasks (for example, the files that must be backed up, the applications that require patching, what exactly is monitored). Include the alternate user accounts for each of these tasks.
- The databases and applications that must be protected. This includes Oracle applications, partner applications, and custom applications.
- Who must be authorized to access business data, including the following:
 - Application owners through middle tier processes
 - Business users through an application interface
- Emergency "what if" scenarios, such as how to handle a security breach
- Reporting in a production environment, which should include the following:
 - Who runs the reports
 - Which reports must be run
 - The frequency with which each report is run
 - The users who must receive a copy of each report
- In addition to a separation of duty matrix, the creation of the following matrices:

- An Oracle Database Vault-specific matrix, which can cover the names and tasks of users who have been granted Database Vault roles
- An application protection matrix, which can cover the applications to be protected and the types of protections you have put in place.

Table D-2 shows an example of protections Oracle created for PeopleSoft Applications. SYSADM, PSFTDBA, SYSTEM, and DBA have all been authorized for the appropriate rule sets.

Table D-2 Example Application Protection Maxtrix

| Protection Type | SYSADM | PSFTDBA | SYSTEM | DBA |
|------------------------------|---------------------------|-----------------------|-------------------|-------------------|
| PeopleSoft Realm | Owner | Owner | No Access | No Access |
| SELECT Command Rule | Not Restricted | Limit PSFTDB Rule Set | No Access | No Access |
| CONNECT Command Rule | PeopleSoftAccess Rule Set | Not Restricted | Not Restricted | Not Restricted |
| DROP TABLESPACE Command Rule | Disabled Rule Set | Disabled Rule Set | Disabled Rule Set | Disabled Rule Set |

D.2 Managing Oracle Database Administrative Accounts

Oracle provides guidelines for managing security for administrative accounts such as SYSTEM or users who have the SYSDBA administrative privilege.

- [SYSTEM User Account for General Administrative Uses](#)
Ideally, the SYSTEM account should only be available as a backup that is checked out and audited while being used.
- [SYSTEM Schema for Application Tables](#)
If you have application tables in the SYSTEM schema, then you should add the SYSTEM account to your realm authorizations for these tables.
- [Limitation of the SYSDBA Administrative Privilege](#)
Limit the SYSDBA administrative privilege to users who must connect using this privilege when absolutely necessary and for applications that still require SYSDBA access.
- [Root and Operating System Access to Oracle Database Vault](#)
For better security, you should carefully monitor root and operating system access to Oracle Database Vault.

D.2.1 SYSTEM User Account for General Administrative Uses

Ideally, the SYSTEM account should only be available as a backup that is checked out and audited while being used.

Only named accounts should be used for normal database administration tasks - not shared accounts. Doing so increases accountability for administrative actions in the database.

D.2.2 SYSTEM Schema for Application Tables

If you have application tables in the SYSTEM schema, then you should add the SYSTEM account to your realm authorizations for these tables.

This enables these applications to continue to work normally.

You can place restrictions on the `SYSTEM` account to increase or fine-tune security for these applications. For example, you can create a Database Vault rule set to restrict the `SYSTEM` user's access to specific IP addresses.

D.2.3 Limitation of the SYSDBA Administrative Privilege

Limit the `SYSDBA` administrative privilege to users who must connect using this privilege when absolutely necessary and for applications that still require `SYSDBA` access.

For example, mandatory patching processes require `SYSDBA` access.

For all other cases, create named database accounts to perform daily database administration. Members of the `OSDBA` user group are also given the `SYSDBA` administrative privilege. The database `SYS` account and accounts with `SYSDBA` privilege along with the operating system `root` and `oracle` accounts should be managed in a Privileged Account Management (PAM) system and checked out only when required.

Related Topics

- [Management of SYSDBA Access](#)
You should avoid using the `SYS` account and the `SYSDBA` privilege for normal database maintenance tasks.

D.2.4 Root and Operating System Access to Oracle Database Vault

For better security, you should carefully monitor root and operating system access to Oracle Database Vault.

Oracle Database Vault prevents highly privileged database users from accessing sensitive data. In addition, if you are using Oracle Database itself, then you can use Transparent Data Encryption to prevent the most highly privileged operating system users from accessing sensitive data. Transparent data encryption enables you to encrypt tablespaces and table columns. This prevents operating system users from browsing through the operating system database files and finding sensitive data. As a best practice, always carefully review and restrict direct access to the operating system.

You should have personalized accounts access the operating system. These personalized accounts should, in the Linux or UNIX environments, login using `sudo` to the `oracle` software owner when needed. With `sudo`, you can control which specific command each personalized user can run. Be sure to prevent the use of the `make`, `relink`, `gdb`, or other commands that could potentially harm the database, for these users. However, if an administrative user must install a patch or perform some other emergency operation, you can enable the `make` and `relink` commands for a limited time, and audit their actions during this period.

Related Topics

- [Oracle Database Advanced Security Guide](#)

D.3 Accounts and Roles Trusted by Oracle Database Vault

Oracle Database Vault restricts access to application data from many privileged users and roles in the database.

However, in some cases, Oracle Database Vaults trusts certain roles and privileges.

[Table D-3](#) lists the trusted roles and privileges that are created when you install Oracle Database Vault.

Table D-3 Trusted Oracle Database Vault Roles and Privileges

| Role or Privilege | Status | Description |
|-------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DV_ACCTMGR role | Open | <p>Role created during registration and used for creating new database accounts. As a safety measure, maintain a backup user who has the DV_ACCTMGR role and manage this account using a Privileged Account Management (PAM) system.</p> <p>Users who have the DV_OWNER role cannot alter this user.</p> <p>Loss of all accounts with the DV_ACCTMGR role (such as due to lost passwords or people leaving the organization) is not recoverable. Ensure that a backup DV_ACCTMGR account is created for this purpose.</p> |
| DV_OWNER role | Open | <p>Role created during registration and used for managing realms, factors and command rules. This user can add himself or herself to realm authorizations. As a safety measure, maintain a backup user who has the DV_OWNER role and manage this account using a Privileged Account Management (PAM) system.</p> <p>Users who have the DV_OWNER role cannot alter this user.</p> <p>Loss of all accounts with the DV_OWNER role (such as due to lost passwords or people leaving the organization) is not recoverable. Ensure that a backup DV_OWNER account is created for this purpose.</p> |
| SYSDBA privilege | Enabled | <p>Privilege created during Oracle Database installation. Required by some Oracle features.</p> |
| SYSOPER privilege | Enabled | <p>Privilege created during Oracle Database installation. Database startup and shutdown. Granted to SYS only by default.</p> |

Related Topics

- [Backup Oracle Database Vault Accounts](#)
As a best practice, you should maintain backup accounts for the DV_OWNER and DV_ACCTMGR roles.
- [Management of SYSDBA Access](#)
You should avoid using the SYS account and the SYSDBA privilege for normal database maintenance tasks.
- [Management of SYSOPER Access](#)
By default, Oracle Database limits SYSOPER access to operating system users in the OSOPER group and to the user SYS.

D.4 Accounts and Roles That Should be Limited to Trusted Individuals

You should limit powerful accounts and roles only to trusted individuals.

- [Management of Users with Root Access to the Operating System](#)
Users who have root user access have full control over the system.
- [Management of the Oracle Software Owner](#)
Users who have access to a system as the Oracle software owner have control over the Oracle software.

- **Management of SYSDBA Access**
You should avoid using the `SYS` account and the `SYSDBA` privilege for normal database maintenance tasks.
- **Management of SYSOPER Access**
By default, Oracle Database limits `SYSOPER` access to operating system users in the `OSOPER` group and to the user `SYS`.

D.4.1 Management of Users with Root Access to the Operating System

Users who have root user access have full control over the system.

Activities that these users can perform include the following:

- Reading unencrypted files
- Moving and deleting any files
- Starting or stopping any program on the system
- Logging in as any user, including the user who owns the Oracle Database installation

Oracle Database Vault does not provide protection against the operating system root access. Manage the `root` and `oracle` accounts in a Privileged Account Management (PAM) system. Only check these accounts out when they are required for certain tasks. Enhance audit levels when highly privileged operating system accounts are being used, up to an including keystroke capture and video capture.

D.4.2 Management of the Oracle Software Owner

Users who have access to a system as the Oracle software owner have control over the Oracle software.

Activities these users can perform include the following:

- Reading unencrypted database files
- Moving and deleting database files
- Starting or stopping Oracle programs in the system

Oracle Database Vault does not provide protection against the operating system access of the Oracle software owner. Manage the Oracle software owner account in a Privileged Account Management (PAM) system. Only check this account out when it is required for certain tasks. Enhance audit levels when highly privileged operating system accounts are being used, up to an including keystroke capture and video capture.

D.4.3 Management of SYSDBA Access

You should avoid using the `SYS` account and the `SYSDBA` privilege for normal database maintenance tasks.

Instead, use named accounts that have the required system privileges or a specific administrative privilege such as `SYSBACKUP`, `SYSDG`, or `SYSKM`. However, there are cases where the `SYSDBA` privilege is required to perform a patch, upgrade of the database or troubleshoot issues (for example, connecting to a down database).

Because users with the `SYSDBA` privilege could have access to sensitive application data either directly or indirectly (for example, through diagnostics, database upgrades, and patching), use of the `SYSDBA` privilege and accounts must be highly restricted. The list of highly privileged

accounts include `SYS` and user accounts with the `SYSDBA` privilege in the database, and the `root` and `oracle` accounts in the operating system. Access to highly privileged accounts in the database and the operating system should be on an exception basis and require the user to go through a process to unlock access to these accounts and privileges. Oracle recommends that you manage these accounts with a Privileged Account Management (PAM) system. Only check these accounts out when they are required for certain tasks. Enhance audit levels when highly privileged operating system accounts (`root` and `oracle`) and database accounts (`SYS` account and `SYSDBA` administrative privilege) are being used, up to an including keystroke capture and video capture. When these highly privileged accounts access the database, audit the `SYS` account to monitor their activities. Oracle recommends that you use the `ENABLE_DV_PATCH_ADMIN_AUDIT` procedure during patching operations when the `DV_PATCH_ADMIN` role is granted to `SYS` (or to users who have the with `SYSDBA` administrative privilege).

Related Topics

- [ENABLE_DV_PATCH_ADMIN_AUDIT Procedure](#)
The `ENABLE_DV_PATCH_ADMIN_AUDIT` procedure enables realm, command rule, and rule set auditing of the actions by users who have the `DV_PATCH_ADMIN` role.

D.4.4 Management of SYSOPER Access

By default, Oracle Database limits `SYSOPER` access to operating system users in the `OSOPER` group and to the user `SYS`.

This prevents `SYSOPER` from modifying the Oracle data dictionary directly. The `SYSOPER` privilege has limited privileges within the database, but individuals with this role can start and shut down the Oracle database. Only grant the `SYSOPER` privilege to trusted individuals.

D.5 Guidelines for Using Oracle Database Vault in a Production Environment

You should follow special guidelines when you run Oracle Database Vault in a production environment.

These guidelines are as follows:

- Run a full test of your applications to ensure that the Database Vault policies you have created are working as expected
- Monitor the performance of your applications, and if necessary, tune your rule expressions
- Assign responsibilities to the appropriate production support and security groups, as follows:
 - Assign security responsibilities to the database security administrator.
 - Assign account management to the database account manager.
 - Assign resource management tasks to database administrators.
- Back up your Database Vault API scripts to a secure server.

D.6 Secure Configuration Guidelines

You should be aware of security considerations for special PL/SQL packages, privileges, and the recycle bin.

- [General Secure Configuration Guidelines](#)
General secure configuration guidelines involved patches and revoke operations.
- [UTL_FILE and DBMS_FILE_TRANSFER Package Security Considerations](#)
You should carefully restrict access to the UTL_FILE and DBMS_FILE_TRANSFER PL/SQL packages.
- [CREATE ANY JOB Privilege Security Considerations](#)
The CREATE ANY JOB privilege has been revoked from the DBA and the SCHEDULER_ADMIN roles.
- [CREATE EXTERNAL JOB Privilege Security Considerations](#)
The CREATE EXTERNAL JOB privilege was introduced in Oracle Database 10g release 2 (10.2).
- [LogMiner Package Security Considerations](#)
The role EXECUTE_CATALOG_ROLE no longer has the EXECUTE privilege granted by default on the several LogMiner packages.
- [ALTER SYSTEM and ALTER SESSION Privilege Security Considerations](#)
You should be aware of ways to secure the powerful ALTER SYSTEM and ALTER SESSION system privileges.

D.6.1 General Secure Configuration Guidelines

General secure configuration guidelines involved patches and revoke operations.

- Installing patches and new applications might re-grant some of the privileges that Oracle recommends that you revoke in this section. Check these privileges after you install patches and new applications to verify that they are still revoked.
- When you revoke EXECUTE privileges on packages, ensure that you grant EXECUTE on the packages to the owner, check the package dependencies, and recompile any invalid packages after the revoke.

To find users who have access to the package, log into the database instance as a named database administrator and issue the following query.

```
SELECT * FROM DBA_TAB_PRIVS WHERE TABLE_NAME = package_name;
```

package_name is the name of the package you are looking for.

To find the users, packages, procedures, and functions that are dependent on the package, issue this query:

```
SELECT OWNER, NAME, TYPE FROM ALL_DEPENDENCIES  
WHERE REFERENCED_NAME = package_name;
```

Note that these two queries do not identify references to packages made through dynamic SQL.

D.6.2 UTL_FILE and DBMS_FILE_TRANSFER Package Security Considerations

You should carefully restrict access to the UTL_FILE and DBMS_FILE_TRANSFER PL/SQL packages.

- [About Security Considerations for the UTL_FILE and DBMS_FILE_TRANSFER Packages](#)
The UTL_FILE package is owned by SYS and granted to PUBLIC.

- [Securing Access to the DBMS_FILE_TRANSFER Package](#)
You can secure access to the `DBMS_FILE_TRANSFER` PL/SQL package in a variety of ways.
- [Example: Creating a Command Rule to Deny Access to CREATE DATABASE LINK](#)
The `DBMS_MACADM.CREATE_COMMAND_RULE` enables you to create command rules to deny access to the `CREATE DATABASE LINK` SQL statement.
- [Example: Creating a Command Rule to Enable Access to CREATE DATABASE LINK](#)
The `DBMS_MACADM.UPDATE_COMMAND_RULE` procedure can be used to modify an existing command rule.
- [Example: Command Rules to Disable and Enable Access to CREATE DIRECTORY](#)

D.6.2.1 About Security Considerations for the UTL_FILE and DBMS_FILE_TRANSFER Packages

The `UTL_FILE` package is owned by `SYS` and granted to `PUBLIC`.

However, a user must have access to the directory object to manipulate the files in that operating system directory.

The `DBMS_FILE_TRANSFER` package is owned by `SYS` and granted to the `EXECUTE_CATALOG_ROLE`. Users with `EXECUTE` access on this package can move files from one location to another on the same file system. They also can move files between database instances, including databases on remote systems.

Related Topics

- *Oracle Database PL/SQL Packages and Types Reference*

D.6.2.2 Securing Access to the DBMS_FILE_TRANSFER Package

You can secure access to the `DBMS_FILE_TRANSFER` PL/SQL package in a variety of ways.

- Use any of the following methods to secure the `DBMS_FILE_TRANSFER` PL/SQL package:
 - Revoke the `EXECUTE` privilege from the `DBMS_FILE_TRANSFER` package and grant the `EXECUTE` privilege only to trusted users who need it.
 - Create command rules to control the `CREATE DATABASE LINK` and `CREATE DIRECTORY` SQL statements. See [Creating a Command Rule](#) for information on creating command rules by using Oracle Database Vault Administrator.
 - Create Oracle Database Vault command rules to limit and enable access to the `CREATE DATABASE LINK` and `CREATE DIRECTORY` statements, which are used to establish connections to remote databases.

 **See Also:**

The following sections for examples of command rules that you can create to protect use of the `CREATE DATABASE LINK` statement:

- [Example: Creating a Command Rule to Deny Access to CREATE DATABASE LINK](#)
- [Example: Creating a Command Rule to Enable Access to CREATE DATABASE LINK](#)
- [Example: Command Rules to Disable and Enable Access to CREATE DIRECTORY](#)

D.6.2.3 Example: Creating a Command Rule to Deny Access to CREATE DATABASE LINK

The `DBMS_MACADM.CREATE_COMMAND_RULE` enables you to create command rules to deny access to the `CREATE DATABASE LINK SQL` statement.

[Example D-1](#) shows how to create a command rule to deny access to the `CREATE DATABASE LINK` privilege.

Example D-1 Creating a Command Rule to Deny Access to CREATE DATABASE LINK

```
BEGIN
DBMS_MACADM.CREATE_COMMAND_RULE (
  command      => 'CREATE DATABASE LINK',
  rule_set_name => 'Disabled',
  object_owner  => '%',
  object_name   => '%',
  enabled       => DBMS_MACUTL.G_YES);
END;
/
COMMIT;
```

D.6.2.4 Example: Creating a Command Rule to Enable Access to CREATE DATABASE LINK

The `DBMS_MACADM.UPDATE_COMMAND_RULE` procedure can be used to modify an existing command rule.

[Example D-2](#) shows how to create a command rule that enables access to the `CREATE DATABASE LINK` privilege.

When a valid user must use the `CREATE DATABASE LINK` statement, the Oracle Database Vault owner can reenale it from Oracle Database Vault Administrator or issue the following commands in SQL*Plus.

Example D-2 Creating a Command Rule to Enable Access to CREATE DATABASE LINK

```
BEGIN
DBMS_MACADM.UPDATE_COMMAND_RULE (
  command      => 'CREATE DATABASE LINK',
  rule_set_name => 'Enabled',
  object_owner  => '%',
  object_name   => '%',
```



```

    enabled      => DBMS_MACUTL.G_YES);
END;
/
COMMIT;

```

D.6.2.5 Example: Command Rules to Disable and Enable Access to CREATE DIRECTORY

[Example D-3](#) shows command rules that disable and enable access to `CREATE DIRECTORY`.

Example D-3 Command Rules to Disable and Enable Access to CREATE DIRECTORY

```

-- Disable access to CREATE DIRECTORY
BEGIN
  DBMS_MACADM.CREATE_COMMAND_RULE (
    command      => 'CREATE DIRECTORY',
    rule_set_name => 'Disabled',
    object_owner  => '%',
    object_name   => '%',
    enabled       => dbms_macutl.g_yes);
END;
/
COMMIT;

-- Enable access to CREATE DIRECTORY
BEGIN
  dbms_macadm.update_command_rule (
    command      => 'CREATE DIRECTORY',
    rule_set_name => 'Enabled',
    object_owner  => '%',
    object_name   => '%',
    enabled       => dbms_macutl.g_yes);
END;
/
COMMIT;

```

D.6.3 CREATE ANY JOB Privilege Security Considerations

The `CREATE ANY JOB` privilege has been revoked from the `DBA` and the `SCHEDULER_ADMIN` roles. Ensure that this change does not affect your applications.

Related Topics

- [Using Oracle Scheduler with Oracle Database Vault](#)
Users who are responsible for scheduling database jobs must have Oracle Database Vault-specific authorization.

D.6.4 CREATE EXTERNAL JOB Privilege Security Considerations

The `CREATE EXTERNAL JOB` privilege was introduced in Oracle Database 10g release 2 (10.2).

This privilege is required for database users who want to run jobs that run on the operating system outside the database. By default, the `CREATE EXTERNAL JOB` privilege is granted to all users who have been granted the `CREATE JOB` privilege. For greater security, revoke this privilege from users who do not need it and then grant it only to those users who do need it.

D.6.5 LogMiner Package Security Considerations

The role `EXECUTE_CATALOG_ROLE` no longer has the `EXECUTE` privilege granted by default on the several LogMiner packages.

These packages are as follows:

- `SYS.DBMS_LOGMNR_D`
- `SYS.DBMS_LOGMNR_LOGREP_DICT`
- `SYS.DBMS_LOGMNR_FILE_TRANSFER`
- `SYS.DBMS_LOGMNR`

You should ensure that this change does not affect your applications.

D.6.6 ALTER SYSTEM and ALTER SESSION Privilege Security Considerations

You should be aware of ways to secure the powerful `ALTER SYSTEM` and `ALTER SESSION` system privileges.

- [About ALTER SYSTEM and ALTER SESSION Privilege Security Considerations](#)
Be aware that trace and debug commands have the potential to show Oracle database memory information.
- [Example: Adding Rules to the Existing ALTER SYSTEM Command Rule](#)
You can create a rule that prevents users with the `ALTER SYSTEM` privilege from issuing `ALTER SYSTEM` statements.

D.6.6.1 About ALTER SYSTEM and ALTER SESSION Privilege Security Considerations

Be aware that trace and debug commands have the potential to show Oracle database memory information.

Oracle Database Vault does not protect against these commands. To help secure the Oracle database memory information, Oracle recommends that you strictly control access to the `ALTER SYSTEM` and `ALTER SESSION` privileges. These privileges can be granted by the user `SYS` when connected as `SYSDBA` and by any user granted the `DBA` role.

Oracle also recommends that you add rules to the existing command rule for `ALTER SYSTEM` statement. You can use Oracle Database Vault Administrator to create a rule and add it to a rule set. You should grant the `ALTER SESSION` privilege only to trusted users. (For example, the `ALTER SESSION` statement can enable tracing.)

D.6.6.2 Example: Adding Rules to the Existing ALTER SYSTEM Command Rule

You can create a rule that prevents users with the `ALTER SYSTEM` privilege from issuing `ALTER SYSTEM` statements.

[Example D-4](#) shows how to create a rule that prevents users with `ALTER SYSTEM` privilege from issuing the `ALTER SYSTEM DUMP` statement. Log into the database instance as the Oracle Database Vault Owner when you create this command rule.

Alternatively, you can use Oracle Database Vault Administrator to create and add this rule to the rule set. See [Creating a Rule to Add to a Rule Set](#) for more information.

Example D-4 Adding Rules to the Existing ALTER SYSTEM Command Rule

```
CONNECT accts_admin_ace
Enter password: password

BEGIN
  DBMS_MACADM.CREATE_RULE('NO_SYSTEM_DUMP',
    '(INSTR(UPPER(DV_SQL_TEXT), 'DUMP') = 0)');
  END;
/
EXEC DBMS_MACADM.ADD_RULE_TO_RULE_SET
  ('Allow Fine Grained Control of System Parameters', 'NO_SYSTEM_DUMP');

COMMIT;
```

E

Troubleshooting Oracle Database Vault

You can troubleshoot Oracle Database Vault by using tools such as trace files or checking certain Oracle Database Vault reports.

- [Using Trace Files to Diagnose Oracle Database Vault Events](#)
Trace files, which the database generates, capture important information to help you debug errors.
- [General Diagnostic Tips](#)
Oracle provides general tips for diagnosing problems in realms, factors, and rule sets.
- [Configuration Problems with Oracle Database Vault Components](#)
Oracle Database Vault provides reports to check configuration problems with realms, command rules, factors, rule sets, or secure application roles.
- [Resetting Oracle Database Vault Account Passwords](#)
Backup accounts can help you reset lost passwords for users who have been granted the `DV_OWNER` and `DV_ACCTMGR` roles.

E.1 Using Trace Files to Diagnose Oracle Database Vault Events

Trace files, which the database generates, capture important information to help you debug errors.

- [About Using Trace Files to Diagnose Oracle Database Vault Events](#)
You can monitor the Oracle Database Vault database instance for server and background process events by enabling and checking the database instance trace files.
- [Types of Oracle Database Vault Trace Events That You Can and Cannot Track](#)
You can use trace files to track a variety of Oracle Database Vault activities.
- [Levels of Oracle Database Vault Trace Events](#)
You can use the several levels for Oracle Database Vault trace events.
- [Performance Effect of Enabling Oracle Database Vault Trace Files](#)
Be careful about enabling trace files.
- [Enabling Oracle Database Vault Trace Events](#)
You can use the `ALTER SESSION` or `ALTER SYSTEM SQL` statements to enable Oracle Database Vault trace events.
- [Finding Oracle Database Vault Trace File Data](#)
The Linux `grep` command and the ADR Command Interpreter (`ADRCI`) command-line utility can find Oracle Database Vault trace file data.
- [Example: Low Level Oracle Database Vault Realm Violations in a Trace File](#)
You can use trace file data to track low level realm violations.
- [Example: High Level Trace Enabled for Oracle Database Vault Authorization](#)
You can track Oracle Database Vault authorizations in a trace file with high level trace enabled.
- [Example: Highest Level Traces on Violations on Realm-Protected Objects](#)
You can track high level violations using trace files.

- [Disabling Oracle Database Vault Trace Events](#)
You can disable tracing for Oracle Database Vault events.

E.1.1 About Using Trace Files to Diagnose Oracle Database Vault Events

You can monitor the Oracle Database Vault database instance for server and background process events by enabling and checking the database instance trace files.

Trace files reveal the Oracle Database Vault policy authorization success and failures. They are useful for providing information to help resolve bug and other issues that may occur.

To set tracing for Oracle Database Vault, you must have the `DV_ADMIN` role. To perform the configuration, you use either of the `ALTER SESSION SET EVENTS` or `ALTER SYSTEM SET EVENTS` SQL statements.

Related Topics

- [Oracle Database Administrator's Guide](#)

E.1.2 Types of Oracle Database Vault Trace Events That You Can and Cannot Track

You can use trace files to track a variety of Oracle Database Vault activities.

[Table E-1](#) describes these activities.

Table E-1 Contents of Oracle Database Vault Trace Files

| Database Vault Feature | Description |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Realm authorizations | The trace file tracks cases of realm authorization with a rule set and realm authorization to a role. |
| Rule set evaluations | The trace file includes information about a rule set evaluation from a realm authorization, for a command rule, the <code>CONNECT</code> command rule, and from a factor. |
| Oracle Data Pump authorization | The trace file includes Database Vault Data Pump authorization results and other user, object, and SQL text information. |
| Oracle Scheduler job authorization | The trace file includes the Database Vault Oracle Scheduler job authorization results, job name, job owner, current statement, and so on. |
| Object privilege bypass | The trace file tracks both direct grants and grants through a role. This type of trace is useful for cases where mandatory realms are not enabled, which enables users who have an object privilege to access realm protected objects. |
| Factor loading | The trace file tracks the expression and value for each factor loaded. |
| Others | Object owner bypassed realm protection and other Database Vault failed and succeeded operations |

Related Topics

- [Example: Low Level Oracle Database Vault Realm Violations in a Trace File](#)
You can use trace file data to track low level realm violations.

E.1.3 Levels of Oracle Database Vault Trace Events

You can use the several levels for Oracle Database Vault trace events.

These levels are as follows:

- **Low** prints the information for all failed Oracle Database Vault authorizations to a trace file. This type of trace file includes failed realm authorizations, failed factor loading, failed rule set evaluating, and so on. It has a low impact on Oracle Database performance.
- **High** prints trace records that include both successful and failed authorizations. Because this type of tracing tracks all the authorizations, the overhead is larger than that of the low level tracing. In addition, the trace files are usually larger.
- **Highest** prints the PL/SQL stack and function call stack to a trace file, as well as what is traced at level high (as described in [Table E-1](#)). It has the highest impact on Oracle Database performance.

E.1.4 Performance Effect of Enabling Oracle Database Vault Trace Files

Be careful about enabling trace files.

Doing so can increase the overhead of the database instance operation, which could decrease performance.

E.1.5 Enabling Oracle Database Vault Trace Events

You can use the `ALTER SESSION` or `ALTER SYSTEM SQL` statements to enable Oracle Database Vault trace events.

- [Enabling Trace Events for the Current Database Session](#)
You can use the `ALTER SESSION SET EVENTS SQL` statement to enable trace events for the current database session.
- [Enabling Trace Events for All Database Sessions](#)
You can use the `ALTER SYSTEM SET EVENTS SQL` statement to enable Database Vault trace events for all database sessions.
- [Enabling Trace Events in a Multitenant Environment](#)
Trace events affect both the current user session and all database sessions.

E.1.5.1 Enabling Trace Events for the Current Database Session

You can use the `ALTER SESSION SET EVENTS SQL` statement to enable trace events for the current database session.

1. Log into the database instance as a user who has been granted the `DV_ADMIN` role and the `ALTER SESSION` system privilege.

For example:

```
sqlplus sec_admin_owen@pdb_name
Enter password: password
Connected.
```

2. Enter the `ALTER SESSION SET EVENTS SQL` statement to set the level of the Oracle Database Vault trace events to low, high, or highest.

- To turn on tracing for failed operations that have a low impact, enter one of the following statements:

```
ALTER SESSION SET EVENTS 'TRACE[DV] DISK=LOW';
```

```
ALTER SESSION SET EVENTS '47998 TRACE NAME CONTEXT FOREVER, LEVEL 1';
```

- To turn on tracing for both failed and successful operations that have a high impact, enter one of the following statements:

```
ALTER SESSION SET EVENTS 'TRACE[DV] DISK=HIGH';
```

```
ALTER SESSION SET EVENTS '47998 TRACE NAME CONTEXT FOREVER, LEVEL 3';
```

- To turn on tracing for both failed and successful operations with a function and PL/SQL call stack that has the highest impact, enter one of the following statements:

```
ALTER SESSION SET EVENTS 'TRACE[DV] DISK=HIGHEST';
```

```
ALTER SESSION SET EVENTS '47998 TRACE NAME CONTEXT FOREVER, LEVEL 4';
```

Related Topics

- [Levels of Oracle Database Vault Trace Events](#)
You can use the several levels for Oracle Database Vault trace events.

E.1.5.2 Enabling Trace Events for All Database Sessions

You can use the `ALTER SYSTEM SET EVENTS` SQL statement to enable Database Vault trace events for all database sessions.

Enabling Oracle Database Vault trace events generates trace files that consume disk space. Oracle recommends that you only enable trace events during the period of activity that you need to capture.

1. Log into the database instance as a user who has been granted the `DV_ADMIN` role and the `ALTER SYSTEM` system privilege.

For example:

```
sqlplus sec_admin_owen@pdb_name
Enter password: password
Connected.
```

2. Enter the `ALTER SYSTEM SET EVENTS` SQL statement to set the level of the Oracle Database Vault trace events to low, high, or highest.

- To turn on tracing for failed operations that have a low impact, enter one of the following statements:

```
ALTER SYSTEM SET EVENTS 'TRACE[DV] DISK=LOW';
```

```
ALTER SYSTEM SET EVENTS '47998 TRACE NAME CONTEXT FOREVER, LEVEL 1';
```

- To turn on tracing for both failed and successful operations that have a high impact, enter one of the following statements:

```
ALTER SYSTEM SET EVENTS 'TRACE[DV] DISK=HIGH';
```

```
ALTER SYSTEM SET EVENTS '47998 TRACE NAME CONTEXT FOREVER, LEVEL 3';
```

- To turn on tracing for both failed and successful operations with a function and PL/SQL call stack that has the highest impact, enter one of the following statements:

```
ALTER SYSTEM SET EVENTS 'TRACE[DV] DISK=HIGHEST';
```

```
ALTER SYSTEM SET EVENTS '47998 TRACE NAME CONTEXT FOREVER, LEVEL 4';
```

Another way that you can enable trace events for all database sessions is to add the following line to the `init.ora` file, and then restart the database:

```
event="47998 trace name context forever, level [trace_level]"
```

Replace `trace_level` with one of the following values:

- 1 for the lowest level of tracing
- 3 for the high level
- 4 for the highest level

For example:

```
event="47998 trace name context forever, level [1]"
```

Related Topics

- [Disabling Trace Events for All Database Sessions](#)
You can use the `ALTER SYSTEM SET EVENTS SQL` statement to disable Database Vault tracing for all database sessions.
- [Levels of Oracle Database Vault Trace Events](#)
You can use the several levels for Oracle Database Vault trace events.

E.1.5.3 Enabling Trace Events in a Multitenant Environment

Trace events affect both the current user session and all database sessions.

- **Trace events for the current user session:** Running the `ALTER SESSION SET EVENTS SQL` statement from either the root or a pluggable database (PDB) enables tracing for the current user session. If you switch from one PDB to another PDB (by using the `ALTER SESSION SET CONTAINER` statement), then tracing is still enabled for the new PDB. You cannot enable tracing for a single PDB; the tracing applies to all PDBs and the root. Remember that you must have the `ALTER SESSION SET CONTAINER` system privilege to move from one PDB to another.
- **Trace events for all database sessions:** Running the `ALTER SYSTEM SET EVENTS` statement from either the root or a specific PDB enables tracing for all PDBs in the container database.

E.1.6 Finding Oracle Database Vault Trace File Data

The Linux `grep` command and the ADR Command Interpreter (ADRCI) command-line utility can find Oracle Database Vault trace file data.

- [Finding the Database Vault Trace File Directory Location](#)
You can find the full directory location of trace files by querying the `V$DIAG_INFO` dynamic view.
- [Using the Linux grep Command to Search Trace Files for Strings](#)
To query or process the trace files, you can use the Linux `grep` command to search for strings.

- [Using the ADR Command Interpreter \(ADRCI\) Utility to Query Trace Files](#)
You can query trace files by using the ADR Command Interpreter (ADRCI) command-line utility.

E.1.6.1 Finding the Database Vault Trace File Directory Location

You can find the full directory location of trace files by querying the V\$DIAG_INFO dynamic view.

- Query the V\$DIAG_INFO dynamic view as follows:

```
SELECT VALUE FROM V$DIAG_INFO WHERE NAME = 'Default Trace File';
```

Output similar to the following appears:

```
VALUE
-----
/u01/app/oracle/product/12.1.0/log/diag/rdbms/orcl/orcl/trace/orcl_ora_7174.trc
```

E.1.6.2 Using the Linux grep Command to Search Trace Files for Strings

To query or process the trace files, you can use the Linux `grep` command to search for strings.

- For example, to find the trace files that show realm authorization failures, enter the following command:

```
grep 'Result=Realm Authorization Failed' *.trc
```

E.1.6.3 Using the ADR Command Interpreter (ADRCI) Utility to Query Trace Files

You can query trace files by using the ADR Command Interpreter (ADRCI) command-line utility.

- To use the ADRCI utility to find trace file information, use the `SHOW` command.

For example, to use ADRCI to find the trace files, enter the `SHOW TRACEFILE` command:

```
adrci --To start ACRCI from the command line
adrci> show tracefile

diag/rdbms/orcl/orcl/trace/orcl_m002_14551.trc
diag/rdbms/orcl/orcl/trace/orcl_tmon_13450.trc
diag/rdbms/orcl/orcl/trace/orcl_yktm_963.trc
diag/rdbms/orcl/orcl/trace/alert_orcl.log
...
```

To find the number of all trace incidents:

```
adrci> show incident

ADR Home = /u01/app/oracle/product/12.1.0/log/diag/rdbms/orcl/orcl:
*****
234 rows fetched
```

The following ADRCI command returns a list of all trace files whose name contains the word `ora`:

```
adrci> show tracefile %ora%

/u01/app/oracle/product/12.1.0/log/diag/rdbms/orcl/orcl/trace/orcl_ora_18841.trc
/u01/app/oracle/product/12.1.0/log/diag/rdbms/orcl/orcl/trace/orcl_ora_12017.trc
/u01/app/oracle/product/12.1.0/log/diag/rdbms/orcl/orcl/trace/orcl_ora_19372.trc
/u01/app/oracle/product/12.1.0/log/diag/rdbms/orcl/orcl/trace/orcl_ora_12221.trc
```

```
/u01/app/oracle/product/12.1.0/log/diag/rdbms/orcl/orcl/trace/orcl_ora_1600.trc
...
```

The following ADRCI command searches for trace files that contain the phrase Realm Authorization Failed:

```
adrci> show trace %trc -xp "[payload like '%Realm Authorization Failed%']"
```

Related Topics

- *Oracle Database Utilities*
- *Oracle Database Administrator's Guide*

E.1.7 Example: Low Level Oracle Database Vault Realm Violations in a Trace File

You can use trace file data to track low level realm violations.

[Example E-1](#) shows an example of tracking low lever real violations.

Example E-1 Low Level Oracle Database Vault Realm Violations in a Trace File

```
*** 2010-02-05 18:35:31.438
*** SESSION ID: (34.559) 2010-02-05 18:35:31.438
*** CLIENT ID: () 2010-02-05 18:35:31.438
*** SERVICE NAME: (SYS$USERS) 2010-02-05 18:35:31.438
*** MODULE NAME: (SQL*Plus) 2010-02-05 18:35:31.438
*** ACTION NAME: () 2010-02-05 18:35:31.438

Result=Realm Authorization Failed
      Realm_Name=realm 3      Required_Auth_Level=0
      Current_User=116
      Object_Owner=U1 Object_Name=T1 Object_Type=TABLE
      SQL_Text=INSERT INTO U1.T1 VALUES(30)

Result=Realm Authorization Failed
      Realm_Name=realm 3      Required_Auth_Level=0
      Current_User=116
      Object_Owner=U1 Object_Name=T1 Object_Type=TABLE
      SQL_Text=DELETE FROM U1.T1

Result=Realm Authorization Failed
      Realm_Name=realm 3      Required_Auth_Level=0
      Current_User=116
      Object_Owner=U1 Object_Name=T3 Object_Type=TABLE
      SQL_Text=CREATE TABLE U1.T3(C INT)

*** 2010-02-05 18:35:34.465

Result=Realm Authorization Failed
      Realm_Name=realm 3      Required_Auth_Level=0
      Current_User=116
      Object_Owner=U1 Object_Name=T1 Object_Type=TABLE
      SQL_Text=INSERT INTO U1.T1 VALUES(30)

Result=Realm Authorization Failed
      Realm_Name=realm 3      Required_Auth_Level=0
      Current_User=116
      Object_Owner=U1 Object_Name=T1 Object_Type=TABLE
      SQL_Text=DELETE FROM U1.T1
```

E.1.8 Example: High Level Trace Enabled for Oracle Database Vault Authorization

You can track Oracle Database Vault authorizations in a trace file with high level trace enabled.

[Example E-2](#) shows an example of this type of trace file.

Example E-2 High Level Trace Enabled for Oracle Database Vault Authorization

```

Result= Realm Authorization Passed
      Reason=Current user is the object owner
      Current_User=70 Command=SELECT
      Object_Owner=LBACSYS   Object_Name=LBAC$AUDIT   Object_Type=TABLE

Result= Realm Authorization Passed
      Reason=Current user is the object owner
      Current_User=70 Command=SELECT
      Object_Owner=LBACSYS   Object_Name=LBAC$AUDIT   Object_Type=TABLE

Result= Realm Authorization Passed
      Reason=Current user is the object owner
      Current_User=70 Command=SELECT
      Object_Owner=LBACSYS   Object_Name=LBAC$POL     Object_Type=TABLE

Result= Realm Authorization Passed
      Reason=Current user is the object owner
      Current_User=70 Command=SELECT
      Object_Owner=LBACSYS   Object_Name=LBAC$USER_LOGON   Object_Type=VIEW

.....

Result= Realm Authorization Passed
      Reason=Current user is the object owner
      Current_User=70 Command=SELECT
      Object_Owner=LBACSYS   Object_Name=LBAC$POL     Object_Type=TABLE

Result=Set Factor Value
      Factor_Name=Sensitive_Treatments      Factor_Expression=/SURGERY/PSYCHOLOGICAL

Result=Set Factor Value
      Factor_Name=Database_Instance
      Factor_Expression=UPPER(SYS_CONTEXT('USERENV','INSTANCE'))      Factor_Value=1

Result=Set Factor Value
      Factor_Name=Client_IP
      Factor_Expression=UPPER(SYS_CONTEXT('USERENV','IP_ADDRESS'))      Factor_Value=

Result=Set Factor Value
      Factor_Name=Authentication_Method
      Factor_Expression=UPPER(SYS_CONTEXT('USERENV','AUTHENTICATION_METHOD'))
      Factor_Value=PASSWORD

.....

*** ACTION NAME:() 2010-02-05 18:47:19.540

Result=Rule Set Evaluation Failed
      Command=SELECT RuleSet_ID=2   RuleSet_Name=Disabled
      Current_User=SYSTEM
      Object_Owner=U1 Object_Name=T1 Object_Type=TABLE
      SQL_Text=SELECT * FROM U1.T1

```

```
Result=Rule Set Evaluation Succeeded
  Command=SELECT RuleSet_ID=1 RuleSet_Name=Enabled
  Current_User=SYSTEM
  Object_Owner=U1 Object_Name=T1 Object_Type=TABLE
  SQL_Text=SELECT * FROM U1.T1
```

E.1.9 Example: Highest Level Traces on Violations on Realm-Protected Objects

You can track high level violations using trace files.

[Example E-3](#) shows how highest level violations that involve Oracle Scheduler jobs authorization can appear in a trace file when trace is enabled at the highest level.

Example E-3 Highest Level Traces on Violations on Realm-Protected Objects

```
----- Call Stack Trace -----
kzvdvechk<-kzvdvegau<-kksfbc<-opiexe<-kpoal8<-opiodr<-ttcpip<-opitsk<-opiino<-opiodr<-
opidrv<-sou2o<-opimai_real<-ssthmain<-main<-__libc_start_main<-_start

Result=Object Privilege check passed
  Current_User=INVOKER2 Used_Role=1
  Object_Owner=SYSTEM Object_Name=PRODUCT_PRIVS Object_Type=VIEW
  SQL_Text=SELECT CHAR_VALUE FROM SYSTEM.PRODUCT_PRIVS WHERE (UPPER('SQL*PLUS')
LIKE UPPER(PRODUCT)) AND ((USER LIKE USERID) OR (USERID = 'PUBLIC')) AND
(UPPER(ATTRIBUTE) = 'ROLES')
*** MODULE NAME:(SQL*Plus) 2010-02-05 18:57:53.973
*** ACTION NAME:() 2010-02-05 18:57:53.973

----- Current SQL Statement for this session (sql_id=2sr63rjm45yfh) -----
UPDATE INVOKER1.T1 SET A = 20
----- PL/SQL Stack -----
----- PL/SQL Call Stack -----
  object      line object
  handle      number name
0x26a00e34      1 anonymous block
0x2495b000     185 package body SYS.DBMS_ISCHED
0x24958fb8     486 package body SYS.DBMS_SCHEDULER
0x247bbb34      1 anonymous block

----- Call Stack Trace -----
kzvdvechk<-kzvdvegau<-kksfbc<-opiexe<-opipls<-opiodr<-__PGOSF151_rpidrus<-skgmstack<-
rpidru<-rpiwu2<-rpidrv<-psddr0<-psdnal<-pevm_EXECC<-pfrinstr_EXECC<-pfrun_no_tool<-
pfrun<-plsqli_run<-peicnt<-kkxexe<-opiexe<-kpoal8<-opiodr<-kpoodr<-upirttrc<-kpurcsc<-
kpuexec
<-OCIStmtExecute<-jsslvec_execcb<-jsslvsuw<-jsslve_execute0<-jskaJobRun<-jsiRunJob<-
jsaRunJob<-spefcmpa<-spefmccallstd<-pextproc<-__PGOSF495_pegtrusted<-__PGOSF522_psdexsp<-
rpiwu2<-psdextp<-pefccal<-pefcac<-pevm_FCAL<-pfrinstr_FCAL<-pfrun_no_tool<-pfrun<-
plsqli_run
<-peicnt<-kkxexe<-opiexe<-kpoal8<-opiodr<-ttcpip<-opitsk<-opiino<-opiodr<-opidrv<-sou2o<-
opimai_real<-ssthmain<-main<-__libc_start_main<-_start

Result=Realm Authorization Succeeded
  Realm_Name=jobowner realm Used_Auth_Level=0
  Current_User=119
  Object_Owner=INVOKER1 Object_Name=T1 Object_Type=TABLE
  SQL_Text=UPDATE INVOKER1.T1 SET A = 20

Result=Scheduler Job Authorization Succeeded
  Current_User=JOBOWNER Logon_User=INVOKER2
```

```
Job_Owner=JOBOWNER      Job_Name=DMLJOB1
Object_Owner=INVOKER1  Object_Name=T1      Object_Type=TABLE
SQL_Text=UPDATE INVOKER1.T1 SET A = 20
```

E.1.10 Disabling Oracle Database Vault Trace Events

You can disable tracing for Oracle Database Vault events.

- [Disabling Trace Events for the Current Database Session](#)
You can use the `ALTER SESSION SET EVENTS SQL` statement to disable Database Vault tracing for the current database session.
- [Disabling Trace Events for All Database Sessions](#)
You can use the `ALTER SYSTEM SET EVENTS SQL` statement to disable Database Vault tracing for all database sessions.
- [Disabling Trace Events in a Multitenant Environment](#)
Disabling trace events affects both the current user session and all database sessions.

E.1.10.1 Disabling Trace Events for the Current Database Session

You can use the `ALTER SESSION SET EVENTS SQL` statement to disable Database Vault tracing for the current database session.

1. Log into the database instance as a user who has been granted the `DV_ADMIN` role and the `ALTER SESSION` system privilege.

For example:

```
sqlplus sec_admin_owen@pdb_name
Enter password: password
Connected.
```

2. Enter both of the following SQL statements to disable tracing:

```
ALTER SESSION SET EVENTS 'TRACE[DV] OFF';
ALTER SESSION SET EVENTS '47998 trace name context off';
```

E.1.10.2 Disabling Trace Events for All Database Sessions

You can use the `ALTER SYSTEM SET EVENTS SQL` statement to disable Database Vault tracing for all database sessions.

1. Log into the database instance as a user who has been granted the `DV_ADMIN` role and the `ALTER SYSTEM` system privilege.

For example:

```
sqlplus sec_admin_owen@pdb_name
Enter password: password
Connected.
```

2. Enter the following `ALTER SYSTEM SET EVENTS SQL` statements.

```
ALTER SYSTEM SET EVENTS 'TRACE[DV] OFF';
ALTER SYSTEM SET EVENTS '47998 trace name context off';
```

Another way that you can disable trace events for all database sessions is to add the following line to the `init.ora` file, and then restart the database:

```
event="47998 trace name context off"
```

Ensure that the `init.ora` file does not have any conflicting 47998 lines, such as `event="47998 trace name context forever, level [1]"`.

E.1.10.3 Disabling Trace Events in a Multitenant Environment

Disabling trace events affects both the current user session and all database sessions.

- **Trace events for the current user session:** Running the `ALTER SESSION SET EVENTS` SQL statement from either the root or a PDB disables tracing for the current user session. If you switch from one PDB to another PDB (by using the `ALTER SESSION SET CONTAINER` statement), then tracing is still disabled for the new PDB. You cannot disable tracing for a single PDB; the tracing applies to all PDBs and the root. Remember that you must have the `ALTER SESSION SET CONTAINER` system privilege to move from one PDB to another.
- **Trace events for all database sessions:** Running the `ALTER SYSTEM SET EVENTS` statement from either the root or a specific PDB disables tracing for all PDBs in the CDB.

E.2 General Diagnostic Tips

Oracle provides general tips for diagnosing problems in realms, factors, and rule sets.

These guidelines are as follows:

- For realm protections, verify that a user has the underlying system or object privileges (granted directly or through a role) that might affect the command.
- If a realm authorization is not working, verify that the account roles are set correctly.
- For PL/SQL expressions used in factors and rule sets, grant the `EXECUTE` privilege on the PL/SQL package functions used in these expressions directly to the account and determine if the results appear to be correct.
- Use the auditing reports to diagnose problems in general.

Related Topics

- [Oracle Database Vault Reports](#)
Oracle Database Vault provides reports that track activities, such as the Database Vault configuration settings.

E.3 Configuration Problems with Oracle Database Vault Components

Oracle Database Vault provides reports to check configuration problems with realms, command rules, factors, rule sets, or secure application roles.

See the following sections for more information:

- [Command Rule Configuration Issues Report](#)
- [Factor Configuration Issues Report](#)
- [Factor Without Identities Report](#)
- [Identity Configuration Issues Report](#)
- [Realm Authorization Configuration Issues Report](#)
- [Rule Set Configuration Issues Report](#)

- [Secure Application Configuration Issues Report](#)

To run these reports, see [Running the Oracle Database Vault Reports](#).

E.4 Resetting Oracle Database Vault Account Passwords

Backup accounts can help you reset lost passwords for users who have been granted the `DV_OWNER` and `DV_ACCTMGR` roles.

- [Resetting the DV_OWNER User Password](#)
You can use the `DV_OWNER` backup account to reset the `DV_OWNER` user password.
- [Resetting the DV_ACCTMGR User Password](#)
You can use the `DV_ACCTMGR` backup account to reset the `DV_ACCTMGR` user password.

E.4.1 Resetting the DV_OWNER User Password

You can use the `DV_OWNER` backup account to reset the `DV_OWNER` user password.

To reset the `DV_OWNER` user password, you must temporarily revoke the `DV_OWNER` role from this user, reset the password, and then re-grant the role back to the user.

1. Log in to the database instance as the backup user for the `DV_OWNER` user account.

For example:

```
sqlplus dbv_owner_backup  
Enter password: password
```

2. Revoke the `DV_OWNER` role from the `DV_OWNER` user who has lost the password.

For example:

```
REVOKE DV_OWNER FROM sec_admin_owen;
```

3. Connect as a user who has been granted the `DV_ACCTMGR` role.

For example:

```
CONNECT accts_admin_ace  
Enter password: password
```

4. Reset the password for the `DV_OWNER` user.

```
ALTER USER sec_admin_owen IDENTIFIED BY password;
```

Replace `password` with a password that meets the password complexity requirements of the user's profile.

5. Connect as the backup `DV_OWNER` user.

```
CONNECT dbv_owner_backup  
Enter password: password
```

6. Grant the `DV_OWNER` role back to the `DV_OWNER` user.

```
GRANT DV_OWNER TO sec_admin_owen WITH ADMIN OPTION;
```

Note:

Ensure that the backup `DV_OWNER` account is safely stored in case it is needed again.

Related Topics

- *Oracle Database Security Guide*

E.4.2 Resetting the DV_ACCTMGR User Password

You can use the DV_ACCTMGR backup account to reset the DV_ACCTMGR user password.

To reset the DV_ACCTMGR user password, you can use the backup DV_ACCTMGR account to reset this user's password.

1. Log in to the database instance as the backup user for the DV_ACCTMGR user account.

For example:

```
sqlplus dbv_acctmgr_backup  
Enter password: password
```

2. Reset the password for the DV_ACCTMGR user.

For example:

```
ALTER USER accts_admin_ace IDENTIFIED BY password;
```

Replace *password* with a password that meets the password complexity requirements of the user's profile.



Note:

Ensure that the backup DV_ACCTMGR account is safely stored in case it is needed again.

Related Topics

- *Oracle Database Security Guide*

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