# Oracle® Label Security Administrator's Guide





Oracle Label Security Administrator's Guide, 12c Release 2 (12.2)

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#### **Preface**

Oracle Label Security enables access control to reach specific (labeled) rows of a database. With Oracle Label Security in place, users with varying privilege levels automatically have (or are excluded from) the right to see or alter labeled rows of data.

*Oracle Label Security Administrator's Guide* describes how to use Oracle Label Security to protect sensitive data. It explains the basic concepts behind label-based security and provides examples to show how it is used.

- Audience
- Documentation Accessibility
- Related Documentation
- Conventions

#### **Audience**

*Oracle Label Security Administrator's Guide* is intended for database administrators (DBAs), application programmers, security administrators, system operators, and other Oracle users who perform the following tasks:

- Analyze application security requirements
- Create label-based security policies
- Administer label-based security policies
- Use label-based security policies

To use this document, you need a working knowledge of SQL and Oracle fundamentals. You should also be familiar with Oracle security features described in Related Documentation. To use SQL\*Loader, you must know how to use the file management facilities of your operating system.

## **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.

#### **Access to Oracle Support**

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info or visit http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs if you are hearing impaired.



#### **Related Documentation**

For more information, see these Oracle resources:

- Oracle Database Concepts
- Oracle Database Security Guide
- Oracle Database 2 Day + Security Guide
- Oracle Database Enterprise User Security Administrator's Guide
- Oracle Database Development Guide
- Oracle Database Administrator's Guide
- Oracle Database SQL Language Reference
- Oracle Database Reference
- Oracle Database Utilities
- Oracle Database Performance Tuning Guide

Many of the examples in this book use the sample schemas, which are installed by default when you select the Basic Installation option with an Oracle Database installation. See *Oracle Database Sample Schemas* for information on how these schemas were created and how you can use them yourself.

To download free release notes, installation documentation, white papers, or other collateral, please visit the Oracle Technology Network (OTN) at

http://www.oracle.com/technetwork/index.html

For the latest version of the Oracle documentation, including this guide, visit

http://www.oracle.com/technetwork/documentation/index.html

#### 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.         |
| italic     | 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 Label Security Administrator's Guide

#### This preface contains:

• Changes in Oracle Database 12c Release 2 (12.2.0.1)

## Changes in Oracle Database 12c Release 2 (12.2.0.1)

The following are changes in *Oracle Label Security Administrator's Guide* for Oracle Database 12c release 2 (12.2.0.1).

New Features

#### **New Features**

#### This section contains:

- Oracle Label Security Support for Oracle Database Real Application Security Users
  - Starting with this release, Oracle Label Security provides support for the Oracle Database Real Application Security user account.
- Oracle Label Security Support for Data Guard Rolling Upgrades
   Oracle Label Security now supports rolling upgrades for Oracle Data Guard.
- Enhancements for Oracle Label Security in a Multitenant Environment
   Starting with this release, Oracle Label Security supports the use of Oracle Label Security policies in application containers.

## Oracle Label Security Support for Oracle Database Real Application Security Users

Starting with this release, Oracle Label Security provides support for the Oracle Database Real Application Security user account.

This feature enables Oracle Label Security policies to be enforced for Real Application Security users by assigning labels and privileges to Real Application Security users.

To configure the Oracle Database Real Application Security user for Oracle Label Security, you can set the user\_name parameter in the SA\_USER\_ADMIN.SET\_USER\_LABELS procedure and in the SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure.



#### **Related Topics**

SA USER ADMIN.SET USER LABELS

The SA\_USER\_ADMIN.SET\_USER\_LABELS procedure sets the user's levels, compartments, and groups using a set of labels, instead of the individual components.

SA\_USER\_ADMIN.SET\_USER\_PRIVS
 The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure sets policy-specific privileges for users.

#### Oracle Label Security Support for Data Guard Rolling Upgrades

Oracle Label Security now supports rolling upgrades for Oracle Data Guard.

You can perform Oracle Data Guard rolling upgrades to new database releases or patch sets in a rolling fashion, which reduces the planned downtime. The total database downtime for a rolling upgrade is limited to the small amount of time that is required to execute an Oracle Data Guard switchover operation.



Oracle Data Guard Concepts and Administration for more information about Oracle Data Guard rolling upgrades

#### Enhancements for Oracle Label Security in a Multitenant Environment

Starting with this release, Oracle Label Security supports the use of Oracle Label Security policies in application containers.

In addition to application container support, there are changes in how you can use Oracle Label Security in a CDB environment. As part of this enhancement, you can query the CDB\_OLS\_STATUS to check the enablement status of Oracle Label Security in a multitenant environment.

#### **Related Topics**

- Oracle Label Security Integration in a Multitenant Environment
   You can use Oracle Label Security in a multitenant environment.
- CDB OLS STATUS

The CDB\_OLS\_STATUS data dictionary view shows the configuration status of Oracle Label Security in the database in a multitenant environment.



## Part I

## Getting Started with Oracle Label Security

Part I introduces the terms, concepts, and relationships that constitute the basic elements of Oracle Label Security.

- Introduction to Oracle Label Security
   Oracle Label Security provides fine-grained access to individual table rows.
- Understanding Data Labels and User Labels
   You should understand fundamental concepts of data labels and user labels.
- Access Controls and Privileges
  Oracle provides access controls and privileges that determine the *type* of access users can have to labeled rows.



1

## Introduction to Oracle Label Security

Oracle Label Security provides fine-grained access to individual table rows.

- About Oracle Label Security
  Oracle Label Security controls the display of individual table rows using labels that are assigned to individual table rows and application users.
- Benefits of Oracle Label Security
   Oracle Label Security provides several benefits for controlling row level
   management.
- Who Has Privileges to Use Oracle Label Security?
  When you register Oracle Label Security with a database, the registration process creates an administrative user named LBACSYS, who has the LBAC DBA role.
- Duties of Oracle Label Security Administrators
   Oracle Label Security administrators have a set of package- and role-based privileges.
- Components of Oracle Label Security
   An Oracle Label Security policy has a standard set of components.
- Oracle Label Security Architecture
   The Oracle Label Security works with Oracle Database authentication to perform row level security.
- Oracle Label Security Administrative Interfaces
  You can perform Oracle Label Security development and administrative tasks
  using either of two interfaces.
- How Oracle Label Security Works with Other Oracle Products
   You can integrate Oracle Label Security with Oracle Internet Directory (OID) and
   in a multitenant environment.

## **About Oracle Label Security**

Oracle Label Security controls the display of individual table rows using labels that are assigned to individual table rows and application users.

Oracle Label Security is based on multi-level security (MLS) requirements that are found in government and defense organizations. You can easily restrict sensitive information to only authorized users. Oracle Label Security is based on Oracle Virtual Private Database (VPD). However, unlike VPD, Oracle Label Security provides the access mediation functions, data dictionary tables, and policy based architecture out of the box, eliminating customized coding and providing a consistent label based access control model that can be used by multiple applications. Oracle Label Security policies can be applied to one or more application tables. Oracle Label Security works by comparing the row label with a user's label authorizations. Oracle Label Security software is installed by default, but not automatically enabled. You can easily enable Oracle Label Security in either SQL\*Plus or by using the Oracle Database Configuration Assistant (DBCA). To manage Oracle Label Security, you can use either Oracle Enterprise Manager Cloud Control or a set of PL/SQL packages and

standalone functions at the command line level. The default administrator for Oracle Label Security is the user LBACSYS. To find information about Oracle Label Security policies, you can query ALL\_SA\_\*, DBA\_SA\_\*, or USER\_SA\_\* data dictionary views.

## Benefits of Oracle Label Security

Oracle Label Security provides several benefits for controlling row level management.

- It enables row level data classification and provides out of the box access mediation based on the data classification and the user label authorization or security clearance.
- It enables you to assign label authorizations or security clearances to both database users and application users.
- It provides both a graphical user interface and APIs for defining and storing data classification labels and user label authorizations.
- It integrates with Oracle Database Vault and Oracle Advanced Security Data Redaction, enabling security clearances to be use in both Database Vault command rules and Data Redaction policy definitions.

## Who Has Privileges to Use Oracle Label Security?

When you register Oracle Label Security with a database, the registration process creates an administrative user named LBACSYS, who has the LBAC\_DBA role.

You can grant this role to any database user who will be responsible for managing Oracle Label Security policies. In addition, you can grant Oracle Label Security administrators the EXECUTE privilege for the Oracle Label Security packages, and privileges to manage individual Oracle Label Security policies.

### **Duties of Oracle Label Security Administrators**

Oracle Label Security administrators have a set of package- and role-based privileges.

These privileges are:

- Package-specific privileges: Most of the Oracle Label Security PL/SQL packages, except for the public SA\_SESSION and SA\_UTL packages, require the EXECUTE privilege.
- Role-based privileges: The Oracle Label Security-specific roles are:
  - The policy\_DBA role, which is created and granted to the user when he or she creates a policy. For example, for a policy named ols\_hr\_pol, the role created is named ols\_hr\_pol\_DBA. This role adds a layer of granularity for access control for your site's Oracle Label Security policies.
  - The LBAC\_DBA role, which provides the EXECUTE privilege for the SA\_SYSDBA package. This role is owned by the LBACSYS user account. The SA\_SYSDBA package enables the user to create, alter, enable, disable, and drop Oracle Label Security policies.

You can use the Oracle Label Security package EXECUTE privilege grants along with grants of the <code>policy\_DBA</code> role to achieve additional separation of duty. The packages are categorized based on different tasks. For example, you could grant the <code>EXECUTE</code>



privilege on the SA\_COMPONENTS and SA\_LABEL\_ADMIN packages to one user or role to manage label definitions, and then grant EXECUTE on SA\_USER\_ADMIN to a different user or role to manage user labels and privileges. Both of these users or roles must also be granted the <code>policy\_DBA</code> role for the policies for which they are responsible. In this way, different users can be responsible for the management of different aspects of the policies for which they are responsible. For example, user <code>psmith</code> could be responsible for the label definitions of the <code>ols\_hr\_pol</code> policy, and user <code>tjones</code> could be responsible for the label definitions of the <code>ols\_oe\_pol</code> policy. However, user <code>psmith</code> cannot modify label definitions for the <code>ols\_oe\_pol</code> policy, nor can <code>tjones</code> modify the <code>ols\_hr\_pol</code> policy label definitions.

#### **Related Topics**

Oracle Label Security Packages
Oracle Label Security packages provide a direct, command-line interface for ease of administration.

## Components of Oracle Label Security

An Oracle Label Security policy has a standard set of components.

These components are as follows:

- Labels. Labels for data and users, along with authorizations for users and program units, govern access to specified protected objects. Labels are composed of the following:
  - Levels. Levels indicate the type of sensitivity that you want to assign to the row, for example, SENSITIVE or HIGHLY SENSITIVE.
  - Compartments. (Optional) Data can have the same level (Public, Confidential and Secret), but can belong to different projects inside a company, for example ACME Merger and IT Security. Compartments represent the projects in this example, that help define more precise access controls. They are most often used in government environments.
  - Groups. (Optional) Groups identify organizations owning or accessing the data, for example, UK, US, Asia, Europe. Groups are used both in commercial and government environments, and frequently used in place of compartments due to their flexibility.
- Policy. A policy is a name associated with these labels, rules, authorizations, and protected tables.

For example, assume that a user has the SELECT privilege on an application table. As illustrated in Figure 1-1, when the user runs a SELECT statement, Oracle Label Security evaluates each row selected to determine whether the user can access using the privileges and labels assigned to the user and the label on the row. You can configure Oracle Label Security to perform security checks on UPDATE, DELETE, and INSERT statements as well.



Levels
Compartments
Groups
Highly Sensitive
Sensitive

+ ALPHA
BETA
GAMMA
+ Global
NATO
Europe

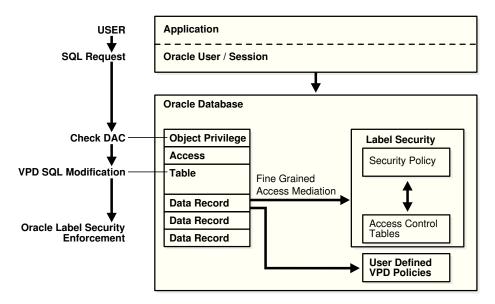
Figure 1-1 Oracle Label Security Label-Based Security

### **Oracle Label Security Architecture**

The Oracle Label Security works with Oracle Database authentication to perform row level security.

Figure 1-2 shows how data is accessed under Oracle Label Security and the sequence of label security checks.

Figure 1-2 Oracle Label Security Architecture



In this scenario, the following actions take place:

- An application user in an Oracle Database session sends a SQL request to query a table.
- 2. Oracle Database checks the user's data access control (DAC) privileges for performing a SELECT statement on the table.
- 3. If the user does have the appropriate privileges, then Oracle Database checks if there are any Oracle Virtual Private Database (VPD) policies attached to the table.
- **4.** Oracle Database then checks if there are any Oracle Label Security policies that are assigned to the table.



5. Oracle Label Security then compares the labels that are assigned to individual rows with the users' label authorizations, allowing or denying access. The session label is based on label authorizations that are assigned to the user.

## Oracle Label Security Administrative Interfaces

You can perform Oracle Label Security development and administrative tasks using either of two interfaces.

- Oracle Label Security Packages
   Oracle Label Security packages provide a direct, command-line interface for ease
   of administration.
- Oracle Label Security Demonstration File
   The olsdemo.sql file provides a demonstration on using Oracle Label Security.
- Oracle Enterprise Manager Cloud Control
   The Oracle Enterprise Manager Cloud Control Web interface can be used to administer Oracle Label Security.

#### **Oracle Label Security Packages**

Oracle Label Security packages provide a direct, command-line interface for ease of administration.

Table 1-1 lists the available Oracle Label Security administrative packages.

Table 1-1 Oracle Label Security Administrative Packages

| Package         | Purpose   |
|-----------------|---|
| SA_SYSDBA       | To create, alter, and drop Oracle Label Security policies   |
|                 | See SA_SYSDBA Policy Management PL/SQL Package  |
| SA_COMPONENTS   | To define the levels, compartments, and groups for the policy   |
|                 | See SA_COMPONENTS Label Components PL/SQL Package   |
| SA_LABEL_ADMIN  | To perform standard label policy administrative functions, such as creating labels  |
|                 | See SA_LABEL_ADMIN Label Management PL/SQL Package  |
| SA_POLICY_ADMIN | To apply policies to schemas and tables   |
|                 | See SA_POLICY_ADMIN Policy Administration PL/SQL Package  |
| SA_USER_ADMIN   | To manage user authorizations for levels, compartments, and groups, as well as program unit privileges. Also to administer user privileges. |
|                 | See SA_USER_ADMIN.SET_USER_PRIVS and SA_USER_ADMIN.SET_PROG_PRIVS   |
| SA_AUDIT_ADMIN  | To set options to audit administrative tasks and use of privileges  |
|                 | See SA_AUDIT_ADMIN Oracle Label Security Auditing PL/SQL Package  |
| SA_SESSION      | To change labels during a during a session within the authorizations set by the administrator   |
|                 | See SA_SESSION Session Management PL/SQL Package  |



Table 1-1 (Cont.) Oracle Label Security Administrative Packages

| Package | Purpose   |
|---------|---|
| SA_UTL  | A set of utility functions designed for use within PL/SQL programs to return information about the current values of the session security attributes, as numeric label values  See SA_UTL PL/SQL Utility Functions and Procedures |

#### Oracle Label Security Demonstration File

The olsdemo.sql file provides a demonstration on using Oracle Label Security.

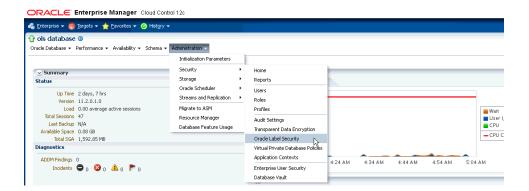
This file show to create and develop an Oracle Label Security policy using the supplied packages. You can install this script from the <code>ORACLE\_HOME/rdbms/demo</code> directory.

#### Oracle Enterprise Manager Cloud Control

The Oracle Enterprise Manager Cloud Control Web interface can be used to administer Oracle Label Security.

Figure 1-3 illustrates the Oracle Enterprise Manager interface.

Figure 1-3 Using Enterprise Manager to Configure Oracle Label Security Policies



#### **Related Topics**

- Logging in to Cloud Control or SQL\*Plus for Oracle Label Security
   After you complete the Oracle Label Security registration and enablement process, you can begin using it.
- Getting Started with Oracle Label Security
  Before using Oracle Label Security, you must register it with the database and
  then enable the LBACSYS Oracle Label Security account.



## How Oracle Label Security Works with Other Oracle Products

You can integrate Oracle Label Security with Oracle Internet Directory (OID) and in a multitenant environment.

- Oracle Label Security Integration with Oracle Internet Directory
   Sites that integrate their use of Oracle Label Security with Oracle Internet
   Directory gain significant efficiencies of label security operation and administration.
- Oracle Label Security Integration in a Multitenant Environment
   You can use Oracle Label Security in a multitenant environment.

#### Oracle Label Security Integration with Oracle Internet Directory

Sites that integrate their use of Oracle Label Security with Oracle Internet Directory gain significant efficiencies of label security operation and administration.

You can create and manage directly policies and user authorization profiles in the directory by means of the commands that are described in Command-line Tools for Label Security Using Oracle Internet Directory . Changes are automatically propagated to the associated directories.

A complete introduction to this integration is presented in Oracle Label Security Using Oracle Internet Directory.

#### Oracle Label Security Integration in a Multitenant Environment

You can use Oracle Label Security in a multitenant environment.

In a multitenant environment, pluggable databases (PDBs) can be plugged in and out of a multitenant container database (CDB) or an application container.

Note the following:

- Each PDB has its own Oracle Label Security metadata, such as policies, labels, and user authorizations. The LBACSYS schema is a common user schema. See Enabling the LBACSYS Oracle Label Security for more information about the LBACSYS account.
- Before you plug a PDB into a CDB, if the database does not have Oracle Label Security installed, then ensure that you have run the \$ORACLE\_HOME/rdbms/admin/catols.sql script on the database. See Oracle Database Administrator's Guide for more information about creating CDBs.
- Because Oracle Label Security policies are scoped to individual PDBs, you can create individual policies for each PDB. A policy defined for a PDB can be enforced on the local tables and schema objects contained in the PDB.
- In a single CDB, there can be multiple PDBs, each configured with Oracle Label Security.
- You cannot create Oracle Label Security policies in the CDB root or the application root.



- You cannot enforce a local Oracle Label Security policy on a common CDB object or a common application object.
- You cannot assign Oracle Label Security policy labels and privileges to common users and application common users in a pluggable database.
- You cannot assign Oracle Label Security privileges to common procedures or functions and application common procedures or functions in a pluggable database.
- If you are configuring Oracle Label Security with Oracle Internet Directory, be aware that the same configuration must be used throughout with all PDBs contained in the CDB. You can determine if your database is configured for Oracle Internet Directory by querying the DBA\_OLS\_STATUS data dictionary view as follows from within any PDB:

SELECT STATUS FROM DBA\_OLS\_STATUS WHERE NAME = 'OLS\_DIRECTORY\_STATUS';

If it returns TRUE, then Oracle Label Security is Internet Directory-enabled. Otherwise, it returns FALSE.

#### See Also:

- *Oracle Database Security Guide* for information on how the multitenant architecture affects privileges
- Oracle Label Security Integration with Oracle Internet Directory for information about Internet Directory-enabled Oracle Label Security



2

## Understanding Data Labels and User Labels

You should understand fundamental concepts of data labels and user labels.

#### About Label-Based Security

Label-based security provides a flexible way of controlling access to sensitive data.

#### About User Label and Privilege Management

To manage user labels and privileges, you must have the EXECUTE privilege for the SA\_USER\_ADMIN package and the policy\_DBA role.

#### Label Components

You should understand the elements that are used in labels.

#### Label Syntax and Type

After label components are defined, you can create data labels by combining particular sets of level, compartments, and groups.

#### How Data Labels and User Labels Work Together

A user can access data only within the range of his or her own label authorizations.

#### Administration of Labels

Oracle Label Security provides administrative interfaces to define and manage the labels used in a database.

## **About Label-Based Security**

Label-based security provides a flexible way of controlling access to sensitive data.

Oracle Label Security controls data access based on the identity and label of the user, and the sensitivity and label of the data. Label security adds protections beyond the discretionary access controls that determine the operations users can perform upon data in an *object*, such as a table or view.

Table 2-1 shows the three dimensions with which an Oracle Label Security policy controls access to data.

**Table 2-1 Oracle Label Security Data Dimensions** 

| Data Dimension | Explanation  |
|----------------|--|
| Data Labels    | A data row label indicates the level and nature of the row's sensitivity and specifies the additional criteria that a user must meet to gain access to that row. |



Table 2-1 (Cont.) Oracle Label Security Data Dimensions

| Data Dimension    | Explanation  |
|-------------------|--|
| User Labels       | A user label specifies that user's sensitivity level plus any compartments and groups that constrain the user's access to labeled data. Each user is assigned a range of levels, compartments, and groups, and each session can operate within that authorized range to access labeled data within that range. |
| Policy Privileges | Users can be given specific rights (privileges) to perform special operations or to access data beyond their label authorizations.   |

Note that the discussion here concerns access to data. The particular *type* of access, such as reading or writing the data, is covered in Access Controls and Privileges.

When an Oracle Label Security policy is applied to a database table, a column is added to the table to contain each row's label. The administrator can choose to display or hide this column.

## About User Label and Privilege Management

To manage user labels and privileges, you must have the EXECUTE privilege for the SA\_USER\_ADMIN package and the policy\_DBA role.

The SA\_USER\_ADMIN package provides the functions to manage the Oracle Label Security user security attributes. It contains several procedures to manage user labels by component: that is, specifying user levels, compartments, and groups. For convenience, there are additional procedures that accept character string representations of full labels, rather than components. Note that the level, compartment and group parameters use the short name defined for each component.

All of the label and privilege information is stored in Oracle Label Security data dictionary tables. When a user connects to the database, his session labels are established based on the information stored in the Oracle Label Security data dictionary.

Note that a user can be authorized under multiple policies.

#### **Related Topics**

- SA\_USER\_ADMIN PL/SQL Package
   The SA\_USER\_ADMIN PL/SQL package manages user labels by label component.
- SA\_USER\_ADMIN.SET\_USER\_PRIVS
   The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure sets policy-specific privileges for users.
- Duties of Oracle Label Security Administrators
   Oracle Label Security administrators have a set of package- and role-based privileges.

## **Label Components**

You should understand the elements that are used in labels.



- Label Component Definitions and Valid Characters
   A sensitivity label is a single attribute with multiple components.
- Level Sensitivity Components
  A *level* is a ranking that denotes the sensitivity of the information it labels.
- Compartment Components
  Compartments identify areas that describe the sensitivity of the labeled data, providing a finer level of granularity within a level.
- Group Components
   Groups identify organizations owning or accessing the data, such as EASTERN\_REGION, WESTERN\_REGION, WR\_SALES.
- Industry Examples of Levels, Compartments, and Groups
   Oracle Label Security levels, compartments, groups are designed to be implemented in various industries.

#### Label Component Definitions and Valid Characters

A sensitivity label is a single attribute with multiple components.

All data labels must contain a level component, but the compartment and group components are optional. An administrator must define the label components before creating labels.



Although the administrator defines both long and short names for the label components, only the short form of the name is displayed upon retrieval. When users manipulate the labels, they use only the short form of the component names. Examples of short forms are illustrated in component-specific example tables below.

**Table 2-2 Sensitivity Label Components** 

| Component    | Description  | Examples  |
|--------------|--|---|
| Level        | A single specification of the sensitivity of labeled data within the ordered ranks established | CONFIDENTIAL (1),<br>SENSITIVE (2),<br>HIGHLY_SENSITIVE (3) |
| Compartments | Zero or more categories associated with the labeled data                                       | FINANCIAL, STRATEGIC,<br>NUCLEAR                            |
| Groups       | Zero or more identifiers for organizations owning or accessing the data                        | EASTERN_REGION,<br>WESTERN_REGION                           |

Valid characters for specifying all label components include alphanumeric characters, underscores, and spaces. (Leading and trailing spaces are ignored.)

The following figure illustrates the three dimensions in which data can be logically classified, using levels, compartments, and groups.



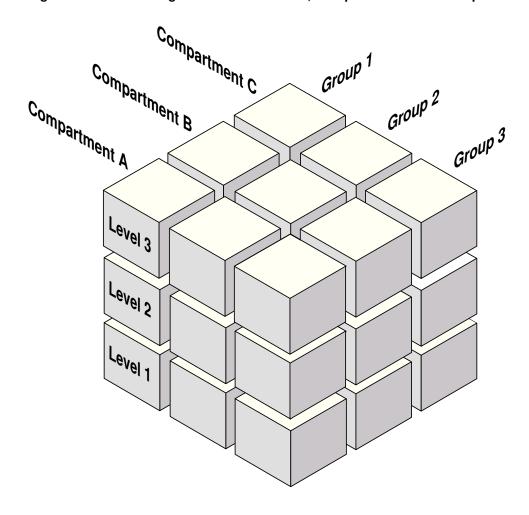


Figure 2-1 Data Categorization with Levels, Compartments and Groups

#### Level Sensitivity Components

A *level* is a ranking that denotes the sensitivity of the information it labels.

The more sensitive the information, the higher its level. The less sensitive the information, the lower its level.

The more sensitive the information, the higher its level. The less sensitive the information, the lower its level.

Every label must include one level. Oracle Label Security permits defining up to 10,000 levels in a policy. For each level, the Oracle Label Security administrator defines a numeric form, a long character form, and the required short character form.

For example, you can define a set of levels such as the following'

Table 2-2 shows examples of levels.

Table 2-3 Level Example

| Numeric Form | Long Form        | Short Form |  |
|--------------|------------------|------------|--|
| 40           | HIGHLY_SENSITIVE | HS         |  |
| 30           | SENSITIVE        | S          |  |
| 20           | CONFIDENTIAL     | С          |  |
| 10           | PUBLIC           | P          |  |

Table 2-4 shows different ways of specifying levels.

Table 2-4 Forms of Specifying Levels

| Form                            | Explanation   |
|---------------------------------|---|
| Numeric form, also called "tag" | The numeric form of the level can range from 0 to 9999. Sensitivity is ranked by this numeric value, so you must assign higher numbers to levels that are more sensitive, and lower numbers to levels that are less sensitive. In Table 2-3, 40 (HIGHLY_SENSITIVE) is a higher level than 30, 20, and 10. |
|                                 | Administrators should avoid using sequential numbers for the numeric form of levels. A good strategy is to use even increments (such as 50 or 100) between levels. You can then insert additional levels between two preexisting levels, at a later date.   |
| Long form                       | The long form of the level name can contain up to 80 characters.  |
| Short form                      | The short form can contain up to 30 characters.   |

Although the administrator defines both long and short names for the level (and for each of the other label components), only the short form of the name is displayed upon retrieval of the records when the Oracle Label Security policy is in effect. When users manipulate the labels, they use only the short form of the component names.

Other sets of levels that users commonly define include TOP\_SECRET, SECRET, CONFIDENTIAL, and UNCLASSIFIED or TRADE\_SECRET, PROPRIETARY, COMPANY\_CONFIDENTIAL, PUBLIC\_DOMAIN.

If only levels are used, a level 40 user (in this example) can access or alter any data row whose level is 40 or less.



All levels and labels (including  $top\_secret$ , secret, confidential, and so on) in this guide, are used as illustrations only.

#### **Compartment Components**

Compartments identify areas that describe the sensitivity of the labeled data, providing a finer level of granularity within a level.



Compartments associate the data with one or more security areas. All data related to a particular project can be labeled with the same compartment. For example, you can define a set of compartments like the following.

Table 2-5 shows examples of compartments.

**Table 2-5 Compartment Example** 

| Numeric Form | Long Form   | Short Form |
|--------------|-------------|------------|
| 85           | FINANCIAL   | FINCL      |
| 65           | CHEMICAL    | CHEM       |
| 45           | OPERATIONAL | OP         |

Table 2-6 shows different ways of specifying compartments.

**Table 2-6 Forms of Specifying Compartments** 

| Form         | Explanation   |
|--------------|---|
| Numeric form | The numeric form can range from 0 to 9999. It is unrelated to the numbers used for the levels. The numeric form of the compartment does not indicate greater or less sensitivity. Instead, it controls the display order of the short form compartment name in the label character string. For example, assume a label is created that has all three compartments listed in Table 2-5, and a level of SENSITIVE. When this label is displayed in string format, it looks like this: |
|              | 5 Of (CIE.) (1 1102   |
|              | meaning SENSITIVE: OPERATIONAL, CHEMICAL, FINANCIAL   |
|              | The display order follows the order of the numbers assigned to the compartments: 45 is lower than 65, and 65 is lower than 85. By contrast, if the number assigned to the FINCL compartment were 5, the character string format of the label would look like this:  |
|              | S:FINCL,OP,CHEM   |
| Long form    | The long form of the compartment name scan have up to 80 characters.  |
| Short form   | The short form can contain up to 30 characters.   |

Compartments are optional. A label can contain zero or more compartments. Oracle Label Security permits defining up to 10,000 compartments.

Not all labels need to have compartments. For example, you can specify <code>HIGHLY\_SENSITIVE</code> and <code>CONFIDENTIAL</code> levels with no compartments, and a <code>SENSITIVE</code> level that does contain compartments.

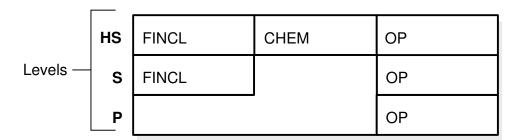
When you analyze the sensitivity of data, you may find that some compartments are only useful at specific levels.

Figure 2-2 shows how compartments can be used to categorize data.



Figure 2-2 Label Matrix

#### **Compartments**



Here, compartments FINCL, CHEM, and OP are used with the level HIGHLY\_SENSITIVE (40). The label HIGHLY\_SENSITIVE:FINCL, CHEM indicates a level of 40 with the two named compartments. Compartment FINCL is not more sensitive than CHEM, nor is CHEM more sensitive than FINCL. Note also that some data in the protected table may not belong to any compartment.

If compartments are specified, then a user whose level would normally permit access to a row's data will nevertheless be prevented from such access unless the user's label also contains all the compartments appearing in that row's label.

### **Group Components**

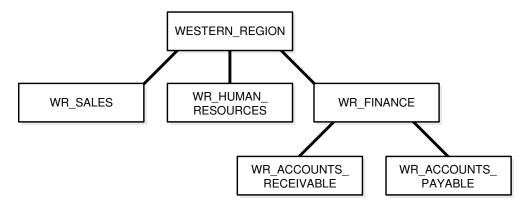
Groups identify organizations owning or accessing the data, such as <code>EASTERN\_REGION</code>, <code>WESTERN\_REGION</code>, <code>WR\_SALES</code>.

All data pertaining to a certain department can have that department's group in the label. Groups are useful for the controlled dissemination of data and for timely reaction to organizational change. When a company reorganizes, data access can change right along with the reorganization.

Groups are hierarchical. You can label data based upon your organizational infrastructure. A group can thus be associated with a parent group.

Figure 2-3 shows how you can define a set of groups corresponding to the following organizational hierarchy.

Figure 2-3 Group Example





The WESTERN\_REGION group includes three subgroups: WR\_SALES, WR\_HUMAN\_RESOURCES, and WR\_FINANCE. The WR\_FINANCE subgroup is subdivided into WR ACCOUNTS RECEIVABLE and WR ACCOUNTS PAYABLE.

Table 2-7 shows how the organizational structure in this example can be expressed in the form of Oracle Label Security groups. Notice that the numeric form assigned to the groups affects display order only. The administrator specifies the hierarchy (that is, the parent/child relationships) separately.

**Table 2-7 Group Example** 

| Numeric Form | Long Form              | Short Form | Parent Group |
|--------------|------------------------|------------|--------------|
| 1000         | WESTERN_REGION         | WR         |              |
| 1100         | WR_SALES               | WR_SAL     | WR           |
| 1200         | WR_HUMAN_RESOURCES     | WR_HR      | WR           |
| 1300         | WR_FINANCE             | WR_FIN     | WR           |
| 1310         | WR_ACCOUNTS_PAYABLE    | WR_AP      | WR_FIN       |
| 1320         | WR_ACCOUNTS_RECEIVABLE | WR_AR      | WR_FIN       |

Table 2-8 shows different ways of specifying groups.

**Table 2-8 Forms of Specifying Groups** 

| Form         | Explanation  |
|--------------|--|
| Numeric form | The numeric form of the group can range from 0 to 9999, and it must be unique for each policy.   |
|              | The numeric form does not indicate any kind of ranking. It does not indicate a parent-child relationship, or greater or less sensitivity. It only controls the display order of the short form group name in the label character string.     |
|              | For example, assume that a label is created that has the level SENSITIVE, the compartment CHEMICAL, and the groups WESTERN_REGION and WR_HUMAN_RESOURCES as listed in Table 2-7. When displayed in string format, the label looks like this: |
|              | S:CHEM:WR,WR_HR  |
|              | $\mathtt{WR}$ is displayed before $\mathtt{WR\_HR}$ because 1000 comes before 1200.  |
| Long form    | The long form of the group name can contain up to 80 characters.   |
| Short form   | The short form can contain up to 30 characters.  |

Groups are optional; a label can contain zero or more groups. Oracle Label Security permits defining up to 10,000 groups.

All labels need not have groups. When you analyze the sensitivity of data, you may find that some groups are only used at specific levels. For example, you can specify <code>HIGHLY\_SENSITIVE</code> and <code>CONFIDENTIAL</code> labels with no groups, and a <code>SENSITIVE</code> label that does contain groups.



#### **Related Topics**

Releasability Using Inverse Groups
 Oracle Label Security can implement the releasability using inverse groups.

### Industry Examples of Levels, Compartments, and Groups

Oracle Label Security levels, compartments, groups are designed to be implemented in various industries.

Table 2-9 illustrates the flexibility of Oracle Label Security levels, compartments, and groups, by listing typical ways in which they can be implemented in various industries.

Table 2-9 Typical Levels, Compartments, and Groups, by Industry

| Industry             | Levels               | Compartments        | Groups         |
|----------------------|----------------------|---------------------|----------------|
| Business to Business | TRADE_SECRET         | MARKETING           | AJAX_CORP      |
|                      | PROPRIETARY          | FINANCIAL           | BILTWELL_CO    |
|                      | COMPANY_CONFIDENTIAL | SALES               | ACME_INC       |
|                      | PUBLIC               | PERSONNEL           | ERSATZ_LTD     |
| Financial Services   | ACQUISITIONS         | INSURANCE           | CLIENT         |
|                      | CORPORATE            | EQUITIES            | TRUSTEE        |
|                      | CLIENT               | TRUSTS              | BENEFICIARY    |
|                      | OPERATIONS           | COMMERCIAL_LOANS    | MANAGEMENT     |
|                      |                      | CONSUMER_LOANS      | STAFF          |
| Judicial             | NATIONAL_SECURITY    | CIVIL               | ADMINISTRATION |
|                      | SENSITIVE            | CRIMINAL            | DEFENSE        |
|                      | PUBLIC               |                     | PROSECUTION    |
|                      |                      |                     | COURT          |
| Health Care          | PRIMARY_PHYSICIAN    | PHARMACEUTICAL      | CDC            |
|                      | PATIENT_CONFIDENTIAL | INFECTIOUS_DISEASES | RESEARCH       |
|                      | PATIENT_RELEASE      |                     | NURSING_STAFF  |
|                      |                      |                     | HOSPITAL_STAFF |
| Defense              | TOP_SECRET           | ALPHA               | UK             |
|                      | SECRET               | DELTA               | NATO           |
|                      | CONFIDENTIAL         | SIGMA               | SPAIN          |
|                      | UNCLASSIFIED         |                     |                |

### Label Syntax and Type

After label components are defined, you can create data labels by combining particular sets of level, compartments, and groups.

You can use the Oracle Enterprise Manager graphical user interface or a command line procedure. Character string representations of labels use the following syntax:

LEVEL: COMPARTMENT1, ..., COMPARTMENTn: GROUP1, ..., GROUPn



The text string specifying the label can have a maximum of 4,000 characters, including alphanumeric characters, spaces, and underscores. The labels are case-insensitive. You can enter them in uppercase, lowercase, or mixed case, but the string is stored in the data dictionary and displayed in uppercase. A colon is used as the delimiter between components. It is not necessary to enter trailing delimiters in this syntax.

For example, you can create valid labels such as these:

SENSITIVE:FINANCIAL, CHEMICAL:EASTERN\_REGION, WESTERN\_REGION
CONFIDENTIAL:FINANCIAL:VP\_GRP
SENSITIVE
HIGHLY\_SENSITIVE:FINANCIAL
SENSITIVE::WESTERN\_REGION

When a valid data label is created, two additional things occur:

- The label is automatically designated as a valid data label. This functionality limits
  the labels that can be assigned to data. Oracle Label Security can also create
  valid data labels dynamically at run time, from those that are predefined in Oracle
  Internet Directory. Most users, however, prefer to create the labels manually in
  order to limit data label proliferation.
- A numeric label tag is associated with the text string representing the label. It is
  this label tag, rather than the text string, that is stored in the policy label column of
  the protected table.



For Oracle Label Security installations that do not use Oracle Internet Directory, dynamic creation of valid data labels uses the <code>TO\_DATA\_LABEL</code> function. Its usage should be tightly controlled.

#### **Related Topics**

- Inserting Labels Using TO\_DATA\_LABEL
   The TO\_DATA\_LABEL function can generate new labels dynamically.
- How Policy Label Column and Label Tags Work
   You should understand how policy label columns in a table or schema are created
   and filled.
- Label Tags
   You can create label tags, either manually or automatically generating them, that define the label components.

### How Data Labels and User Labels Work Together

A user can access data only within the range of his or her own label authorizations.

A user has the following:

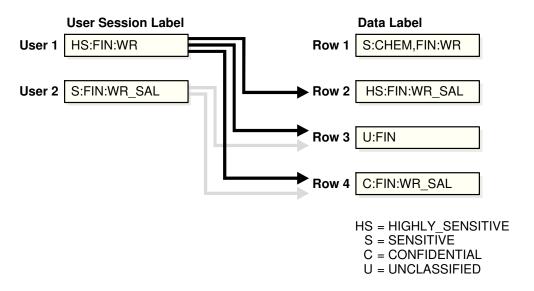
- Maximum and minimum levels
- A set of authorized compartments
- A set of authorized groups (and, implicitly, authorization for any subgroups)



For example, if a user is assigned a maximum level of SENSITIVE, then the user potentially has access to SENSITIVE, CONFIDENTIAL, and UNCLASSIFIED data. The user has no access to HIGHLY\_SENSITIVE data.

Figure 2-4 shows how data labels and user labels work together to provide access control in Oracle Label Security. While data labels are discrete, user labels are inclusive. Depending upon authorized compartments and groups, a user can potentially access data corresponding to all levels within his or her range.

Figure 2-4 Example: Data Labels and User Labels



As shown in the figure, User 1 can access the rows 2, 3, and 4 because her maximum level is HS. She has access to the FIN compartment, and her access to group WR hierarchically includes group WR\_SAL. She cannot access row 1 because she does not have the CHEM compartment. (A user must have authorization for *all* compartments in a row's data label to be able to access that row.)

User 2 can access rows 3 and 4. His maximum level is S, which is less than HS in row 2. Although he has access to the FIN compartment, he only has authorization for group WR SAL. So, he cannot access row 1.

Figure 2-5 shows how data pertaining to an organizational hierarchy fits into data levels and compartments.



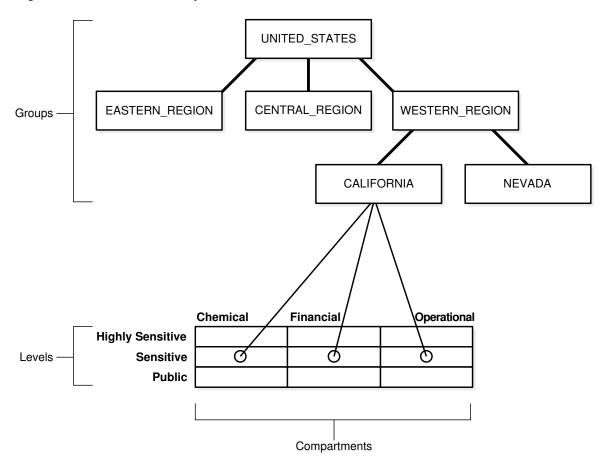


Figure 2-5 How Label Components Interrelate

For example, the UNITED\_STATES group includes three subgroups: EASTERN\_REGION, CENTRAL\_REGION, and WESTERN\_REGION. The WESTERN\_REGION subgroup is further subdivided into CALIFORNIA and NEVADA. For each group and subgroup, there may be data belonging to some of the valid compartments and levels within the database. So, there may be SENSITIVE data that is FINANCIAL, within the CALIFORNIA subgroup.

Note that data is generally labeled with a single group whereas users' labels form a hierarchy. If users have a particular group, then that group may implicitly include child groups. This way a user associated with the UNITED\_STATES group has access to all data, but a user associated with CALIFORNIA would have access to data pertaining to only that subgroup.

### Administration of Labels

Oracle Label Security provides administrative interfaces to define and manage the labels used in a database.

You define labels in Oracle Database using Oracle Label Security packages or by using Oracle Enterprise Manager. Initially, an administrator must define the levels, compartments, and groups that compose the labels, and then, the user can define the set of valid data labels for the contents of the database.



An administrator can apply a policy to individual tables in the database or to entire application schemas. Finally, the administrator assigns to each database user the label components (and privileges, if needed) required for the user's job function.



### Access Controls and Privileges

Oracle provides access controls and privileges that determine the *type* of access users can have to labeled rows.

#### Access Mediation

To access data protected by an Oracle Label Security policy, a user must have authorizations based on the labels defined for the policy.

- How the Session Label and Row Label Work
   It is important to understand session labels and row labels.
- How User Authorizations Work
   Oracle Label Security provides authorizations set by the Oracle Label Security administrator and authorizations set by computed session labels.
- Evaluation of Labels for Access Mediation
   Oracle Label Security evaluates labels by comparing the user's label components to the row's label components.
- Oracle Label Security Privileges
  Oracle Label Security provides a set of database and row label privileges.
- Working with Multiple Oracle Label Security Policies
   You can use multiple Oracle Label Security policies in both a single database
   environments and in a distributed environments.

#### **Related Topics**

Understanding Data Labels and User Labels
 You should understand fundamental concepts of data labels and user labels.

### **Access Mediation**

To access data protected by an Oracle Label Security policy, a user must have authorizations based on the labels defined for the policy.

Figure 3-1 illustrates the relationships between users, data, and labels.

- Data labels specify the sensitivity of data rows.
- User labels provide the appropriate authorizations to users.
- Access mediation between users and rows of data depends on users' labels.

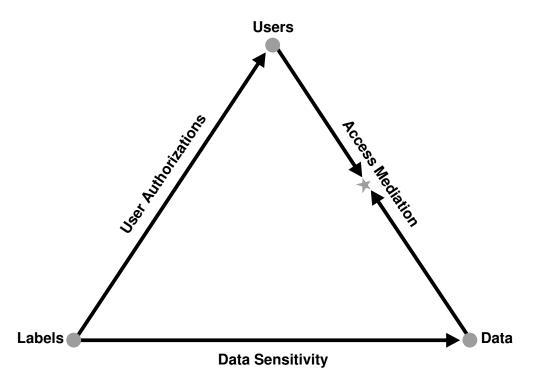


Figure 3-1 Relationships Between Users, Data, and Labels

Note:

Oracle Label Security enforcement options affect how access controls apply to tables and schemas. This chapter assumes that all policy enforcement options are in effect.

#### **Related Topics**

Oracle Label Security Policy Enforcement Options
 Oracle Label Security provides a set of policy enforcement options.

### How the Session Label and Row Label Work

It is important to understand session labels and row labels.

- The Session Label Each Oracle Label Security user has authorizations that include special components.
- The Row Label
   When a user writes data without specifying its label, a row label is assigned automatically, using the user's session label.
- Session Label Example
   The session label and the row label can fall anywhere within the range of the user's level, compartment, and group authorizations.

#### The Session Label

Each Oracle Label Security user has authorizations that include special components.

- A maximum and minimum level
- A set of authorized compartments
- A set of authorized groups
- For each compartment and group, a specification of read-only access, or read/ write access

The administrator also specifies the user's initial session label when setting up these authorizations for the user.

The session label is the particular combination of level, compartments, and groups at which a user works at any given time. The user can change the session label to any combination of components for which the user is authorized.

#### **Related Topics**

SA\_SESSION Session Management PL/SQL Package
 The SA\_SESSION PL/SQL package manages session behavior for user
 authorizations.

#### The Row Label

When a user writes data without specifying its label, a *row label* is assigned automatically, using the user's session label.

However, the user can set the label for the written row, within certain restrictions on the components of the label he specifies. The level of this label can be set to any level within the range specified by the administrator. For example, it can be set to the level of the user's current session label down to the user's minimum level. However, the compartments and groups for this row's new label are more restricted. The new label can include only those compartments and groups contained in the current session label and, among those, only the ones for which the user has write access.

When the administrator sets up the user authorizations, he or she also specifies an initial default row label.

### See Also

- SA\_USER\_ADMIN PL/SQL Package
- SA\_SESSION Session Management PL/SQL Package

### Session Label Example

The session label and the row label can fall anywhere within the range of the user's level, compartment, and group authorizations.



In Figure 3-2, the user's maximum level is SENSITIVE and the minimum level is UNCLASSIFIED. However, his default session label is C:FIN,OP:WR. In this example, the administrator has set the user's session label so that the user connects to the database at the CONFIDENTIAL level.

Similarly, although the user is authorized for compartments FIN and OP, and group WR, the administrator could set the session label so that the user connects with only compartment FIN and group WR.

**Default Session Label** C:FIN,OP:WR Data **Data Label UNCLASSIFIED** :FIN **UNCLASSIFIED** :FIN **UNCLASSIFIED** :CHEM :WR **SENSITIVE** :FIN :HR CONFIDENTIAL :OP :WR TOP SECRET :OP :WR

Figure 3-2 User Session Label

#### **Related Topics**

SA\_USER\_ADMIN.SET\_COMPARTMENTS

The SA\_USER\_ADMIN.SET\_COMPARTMENTS procedure assigns compartments to a user and identifies default values for the user's session label and row label.

Levels

SA USER ADMIN.ALTER COMPARTMENTS

The SA\_USER\_ADMIN.ALTER\_COMPARTMENTS procedure changes the write access, default label indicator, and row label indicator for the specified compartments.



Groups

Compartments

### How User Authorizations Work

Oracle Label Security provides authorizations set by the Oracle Label Security administrator and authorizations set by computed session labels.

- Authorizations Set by the Administrator
   The administrator explicitly sets authorizations for levels, compartments, and groups.
- Computed Session Labels
   Oracle Label Security automatically computes a number of labels based on the
   value of the session label.

### Authorizations Set by the Administrator

The administrator explicitly sets authorizations for levels, compartments, and groups.

Authorized Levels

The administrator explicitly sets the level authorization for an Oracle Label Security policy.

Authorized Compartments

The administrator specifies the list of compartments that a user can place in their session label.

Authorized Groups

You must specify a list of groups that a user can place in a session label and grant write access for each group.

#### **Authorized Levels**

The administrator explicitly sets the level authorization for an Oracle Label Security policy.

Table 3-1 Authorized Levels Set by the Administrator

| Authorization          | Meaning  |
|------------------------|--|
| User Max Level         | The maximum ranking of sensitivity that a user can access during read and write operations   |
| User Min Level         | The minimum ranking of sensitivity that a user can access during write operations. The User Max Level must be equal to or greater than the User Min Level. |
| User Default Level     | The level that is assumed by default when connecting to Oracle Database  |
| User Default Row Level | The level that is used by default when inserting data into Oracle Database   |

For example, in Oracle Enterprise Manager, the administrator might set the following level authorizations for user Joe:

| Туре    | Short Name | Long Name        | Description          |
|---------|------------|------------------|----------------------|
| Maximum | HS         | HIGHLY_SENSITIVE | User's highest level |



| Туре    | Short Name | Long Name    | Description          |
|---------|------------|--------------|----------------------|
| Minimum | Р          | PUBLIC       | User's lowest level  |
| Default | C          | CONFIDENTIAL | User's default level |
| Row     | C          | CONFIDENTIAL | Row level on INSERT  |

### **Authorized Compartments**

The administrator specifies the list of compartments that a user can place in their session label.

Write access must be explicitly given for each compartment. A user cannot directly insert, update, or delete a row that contains a compartment that she does not have authorization to write.

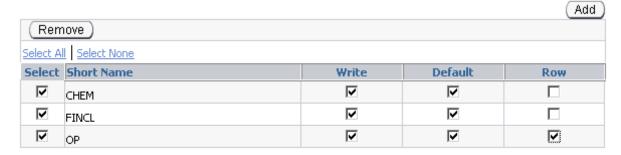
For example, in Oracle Enterprise Manager, the administrator might set the following compartment authorizations for user Joe:

| Short Name | Long Name   | WRITE | DEFAULT | ROW |
|------------|-------------|-------|---------|-----|
| CHEM       | CHEMICAL    | YES   | YES     | NO  |
| FINCL      | FINANCIAL   | YES   | YES     | NO  |
| OP         | OPERATIONAL | YES   | YES     | YES |

Figure 3-3 Setting Up Authorized Compartments In Enterprise Manager

#### Compartments

Specify zero or more compartments to be assigned to the user.



In Figure 3-3, the row designation indicates whether the compartment should be used as part of the default row label for newly inserted data. Note also that the policy option must be in effect for this setting to be valid.

### **Authorized Groups**

You must specify a list of groups that a user can place in a session label and grant write access for each group.

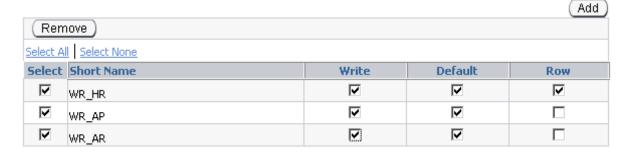
For example, in Oracle Enterprise Manager, the administrator might set the following group authorizations:

| Short Name | Long Name              | WRITE | DEFAULT | ROW | Parent |
|------------|------------------------|-------|---------|-----|--------|
| WR_HR      | WR_HUMAN_RESOURCES     | YES   | YES     | YES | WR     |
| WR_AP      | WR_ACCOUNTS_PAYABLE    | YES   | YES     | NO  | WR_FIN |
| WR_AR      | WR_ACCOUNTS_RECEIVABLE | YES   | YES     | NO  | WR_FIN |

Figure 3-4 Setting Up Authorized Groups in Enterprise Manager

#### Groups

Specify zero or more groups to be assigned to the user.



In this figure, the row designation indicates whether the group should be used as part of the default row label for newly inserted data. Note also that the LABEL\_DEFAULT policy option must be in effect for this setting to be valid.

#### **Related Topics**

LABEL\_DEFAULT: Using the Session's Default Row Label
 A user can update a row without specifying a label value, because the updated row uses its original label.

### **Computed Session Labels**

Oracle Label Security automatically computes a number of labels based on the value of the session label.

These include:

**Table 3-2 Computed Session Labels** 

| Computed Label      | Definition   |
|---------------------|--|
| Maximum Read Label  | The user's maximum level combined with any combination of compartments and groups for which the user is authorized.  |
| Maximum Write Label | The user's maximum level combined with the compartments and groups for which the user has been granted write access. |
| Minimum Write Label | The user's minimum level.  |
| Default Read Label  | The single default level combined with compartments and groups that have been designated as default for the user.    |



Table 3-2 (Cont.) Computed Session Labels

| <b>Computed Label</b> | Definition   |
|-----------------------|--|
| Default Write Label   | A subset of the default read label, containing the compartments and groups to which the user has been granted write access. The level component is equal to the level default in the read label. This label is automatically derived from the read label based on the user's write authorizations. |
| Default Row Label     | The combination of components between the user's minimum write label and the maximum write label, which has been designated as the default value for the data label for inserted data.   |

#### **Related Topics**

Computed Labels with Inverse Groups
 Inverse groups affect computed label values.

### Evaluation of Labels for Access Mediation

Oracle Label Security evaluates labels by comparing the user's label components to the row's label components.

This way, the Oracle Label Security policy can determine whether the user can access the data. This enables Oracle Label Security to evaluate whether the user is authorized to perform the requested operation on the data in the row.

- About Read and Write Access
   Although data labels are stored in a column within data records, information about user authorizations is stored in relational tables.
- How Oracle Label Security Algorithm for Read Access Works
   The READ\_CONTROL enforcement determines the ability to read data in a row.
- How the Oracle Label Security Algorithm for Write Access Works
   In the context of Oracle Label Security, WRITE\_CONTROL enforcement determines
   the ability to insert, update, or delete data in a row.

### **About Read and Write Access**

Although data labels are stored in a column within data records, information about user authorizations is stored in relational tables.

When a user logs on, the tables are used to dynamically generate user labels for use during the session.

- Difference Between Read and Write Operations
   Two fundamental types of access mediation on Data Manipulation language
   (DML) operations exist within protected tables: read access and write access.
- Propagation of Read/Write Authorizations on Groups
   When groups are organized hierarchically, a user's assigned groups include all subgroups that are subordinate to the group to which the user belongs.



### Difference Between Read and Write Operations

Two fundamental types of access mediation on Data Manipulation language (DML) operations exist within protected tables: read access and write access.

The user has a maximum authorization for the data he or she can read; the user's write authorization is a subset of that. The minimum write level controls the user's ability to disseminate data by lowering its sensitivity. The user cannot write data with a level lower than the minimum level the administrator assigned to this user.

In addition, there are separate lists of compartments and groups for which the user is authorized; that is, for which the user has at least read access. An access flag indicates whether the user can also write to individual compartments or groups.

### Propagation of Read/Write Authorizations on Groups

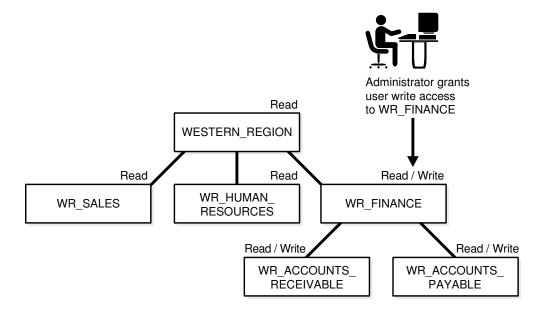
When groups are organized hierarchically, a user's assigned groups include all subgroups that are subordinate to the group to which the user belongs.

In this case, the user's read/write authorizations on a parent group flow down to all the subgroups.

Consider the parent group WESTERN\_REGION, with three subgroups as illustrated in Figure 3-5. If the user has read access to WESTERN\_REGION, then the read access is also granted to the three subgroups. The administrator can give the user write access to subgroup WR\_FINANCE, without granting write access to the WESTERN\_REGION parent group (or to the other subgroups). On the other hand, if the user has read/write access on WESTERN\_REGION, then read/write access is also granted on all of the subgroups subordinate to it in the tree.

Write authorization on a group does not give a user write authorization on the parent group. If a user has read-only access to <code>WESTERN\_REGION</code> and <code>WR\_FINANCE</code>, then the administrator can grant write access to <code>WR\_ACCOUNTS\_RECEIVABLE</code>, without affecting the read-only access to the higher-level groups.

Figure 3-5 Subgroup Inheritance of Read/Write Access



#### **Related Topics**

How Inverse Groups Work
 Inverse groups are implemented in a special way and are organized to suit the needs of Oracle Label Security.

### How Oracle Label Security Algorithm for Read Access Works

The READ\_CONTROL enforcement determines the ability to read data in a row.

The following rules are used, in the sequence listed, to determine a user's read access to a row of data:

- 1. The user's level must be *greater than or equal to* the level of the data.
- 2. The user's label must include *at least one of the groups* that belong to the data (or the parent group of one such subgroup).
- 3. The user's label must include all the compartments that belong to the data.

If the user's label passes these tests, then it is said to dominate the row's label.

Note that there is no notion of read or write access connected with levels. This is because the administrator specifies a range of levels (minimum to maximum) within which a user can potentially read and write. At any time, the user can read all data equal to or less than the current session level. No privileges (other than FULL) allow the user to write below the minimum authorized level.

Figure 3-6 illustrates how the label evaluation process proceeds from levels to groups to compartments. Note that if the data label is null or invalid, then the user is denied access.

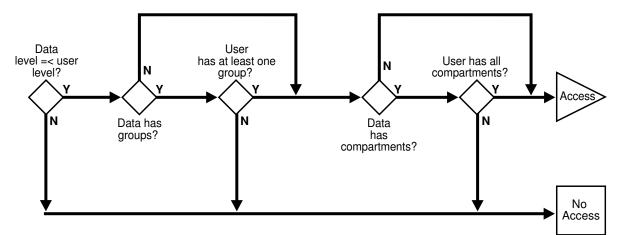


Figure 3-6 Label Evaluation Process for Read Access

As a read access request comes in, Oracle Label Security evaluates each row to determine the following:

- 1. Is the user's level equal to, or greater than, the level of the data?
- 2. If so, does the user have access to at least one of the groups present in the data label?



3. If so, does the user have access to all the compartments present in the data label? (That is, are the data's compartments a subset of the user's compartments?)

If the answer is no at any stage in this evaluation process, then Oracle Label Security denies access to the row and moves on to evaluate the next row of data.

Oracle Label Security policies allow user sessions to read rows at their label and below, which is called *reading down*. Sessions cannot read rows at labels that they do not dominate.

For example, if you are logged in at SENSITIVE: ALPHA, BETA, you can read a row labeled SENSITIVE: ALPHA because your label dominates that of the row. However, you cannot read a row labeled SENSITIVE: ALPHA, GAMMA because your label does not dominate that of the row.

Note that the user can gain access to the rows otherwise denied, if she or he has special Oracle Label Security privileges.

#### **Related Topics**

- Privileges Defined by Oracle Label Security Policies
   Oracle Label Security supports special privileges that allow authorized users to bypass certain parts of the policy.
- How the Access Control Enforcement Options Work
   Access control options limit the rows accessible for SELECT, UPDATE, INSERT, or
   DELETE operations to only those rows whose labels meet established policies.

### How the Oracle Label Security Algorithm for Write Access Works

In the context of Oracle Label Security, WRITE\_CONTROL enforcement determines the ability to insert, update, or delete data in a row.

WRITE\_CONTROL enables you to control data access with ever finer granularity. Granularity increases when compartments are added to levels. It increases again when groups are added to compartments. Access control becomes even more fine grained when you can manage the user's ability to write the data that he can read.

To determine whether a user can write a particular row of data, Oracle Label Security evaluates the following rules, in the order given:

- 1. The level in the data label must be greater than or equal to the user's minimum level and less than or equal to the user's session level.
- 2. When groups are present, the user's label must include at least one of the groups with write access that appear in the data label (or the parent of one such subgroup). In addition, the user's label must include all the compartments in the data label.
- 3. When no groups are present, the user's label must have write access on *all of the compartments* in the data label.

To state tests 2 and 3 another way:

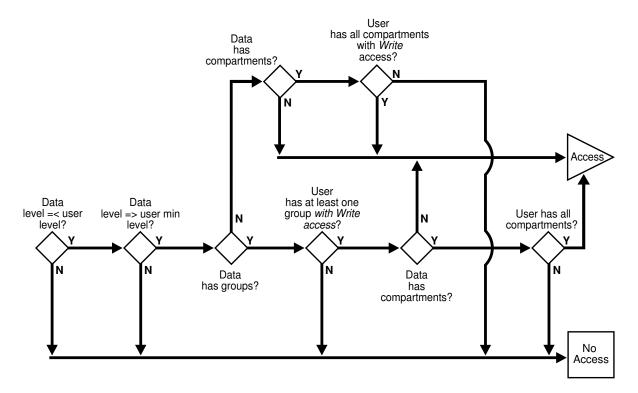
- If the label has *no* groups, then the user must have write access on all the compartments in the label in order to write the data.
- If the label *does* have groups and the user has write access to one of the groups, she only needs read access to the compartments in order to write the data.



Just as with read operations, the label evaluation process proceeds from levels to groups to compartments. Note that the user cannot write any data below the authorized minimum level, nor above the current session level. The user can always read below the minimum level.

Figure 3-7 illustrates how the process works with INSERT, UPDATE, and DELETE operations. Note that if the data label is null or invalid, then the user is denied access.

Figure 3-7 Label Evaluation Process for Write Access



As an access request comes in, Oracle Label Security evaluates each row to determine the following:

- 1. Is the data's level equal to, or less than the level of the user?
- 2. Is the data's level equal to, or greater than the user's minimum level?
- 3. If the data's level falls within the foregoing bounds, then does the user have write access to at least one of the groups present in the data label?
- 4. If so, does the user have access to all the compartments with at least read access that are present in the data label?
- 5. If there are no groups but there are compartments, then does the user have write access to all of the compartments?

If the answer is no at any stage in this evaluation process, then Oracle Label Security denies access to the row, and moves on to evaluate the next row of data.

Consider a situation in which your session label is S:ALPHA, BETA but you have write access to only compartment ALPHA. In this case, you can read a row with the label S:ALPHA, BETA but you cannot update it.

In summary, write access is enforced on INSERT, UPDATE and DELETE operations upon the data in the row.

In addition, each user may have an associated minimum level below which the user cannot write. The user cannot update or delete any rows labeled with levels below the minimum, and cannot insert a row with a row label containing a level less than the minimum.

#### **Related Topics**

How the Access Control Enforcement Options Work

Access control options limit the rows accessible for SELECT, UPDATE, INSERT, or

DELETE operations to only those rows whose labels meet established policies.

### **Oracle Label Security Privileges**

Oracle Label Security provides a set of database and row label privileges.

- Privileges Defined by Oracle Label Security Policies
   Oracle Label Security supports special privileges that allow authorized users to bypass certain parts of the policy.
- Special Access Privileges
   A user's authorizations can be modified with any of four privileges.
- Special Row Label Privileges
   Once the label on a row has been set, Oracle Label Security privileges are required to modify the label.
- System Privileges, Object Privileges, and Policy Privileges
   Oracle Label Security privileges are different from the standard Oracle Database system and object privileges.
- Access Mediation and Views
   Prior to accessing data through a view, the users must have the appropriate system and object privileges on the view.
- Access Mediation and Program Unit Execution
   The privileges with which procedures that are owned by different users are executed differently in Oracle Database and Oracle Label Security.
- Access Mediation and Policy Enforcement Options
   An administrator can choose from among a set of policy enforcement options when applying an Oracle Label Security policy to individual tables.

### Privileges Defined by Oracle Label Security Policies

Oracle Label Security supports special privileges that allow authorized users to bypass certain parts of the policy.

Table 3-3 summarizes the full set of privileges that can be granted to users or trusted stored program units. Each privilege is more fully discussed after the table.

**Table 3-3 Oracle Label Security Privileges** 

| Security Privilege | Explanation  |  |
|--------------------|--|--|
| READ               | Allows read access to all data protected by the policy |  |



Table 3-3 (Cont.) Oracle Label Security Privileges

| Security Privilege | Explanation   |
|--------------------|---|
| FULL               | Allows full read and write access to all data protected by the policy   |
| COMPACCESS         | Allows a session access to data authorized by the row's compartments, independent of the row's groups   |
| PROFILE_ACCESS     | Allows a session to change its labels and privileges to those of a different user   |
| WRITEUP            | Allows users to set or raise only the level, within a row label, up to the maximum level authorized for the user. (Active only if LABEL_UPDATE is active.)                            |
| WRITEDOWN          | Allows users to set or lower the level, within a row label, to any level equal to or greater than the minimum level authorized for the user. (Active only if LABEL_UPDATE is active.) |
| WRITEACROSS        | Allows a user to set or change groups and compartments of a row label, but does not allow changes to the level. (Active only if LABEL_UPDATE is active.)                              |

### **Special Access Privileges**

A user's authorizations can be modified with any of four privileges.

#### READ Privilege

A user with the READ privilege can read all data protected by the policy, regardless of the authorizations or session label.

#### FULL Privilege

The FULL privilege has the same effect and benefits as the READ privilege, with one difference.

#### COMPACCESS Privilege

The COMPACCESS privilege allows a user to access data based on the row label's compartments, independent of the row label's groups.

#### PROFILE ACCESS Privilege

The PROFILE\_ACCESS privilege allows a session to change its session labels and session privileges to those of a different user.

### **READ Privilege**

A user with the READ privilege can read all data protected by the policy, regardless of the authorizations or session label.

The user does not even need to have label authorizations.

Note, in addition, that a user with READ privilege can *write* to any data rows for which he or she has write access, based on any label authorizations.



Note:

Access mediation is still enforced on update, insert, and delete operations.

This privilege is useful for system administrators who need to export data but who should not be allowed to change data. It is also useful for people who must run reports and compile information but not change data. The READ privilege enables optimal performance on SELECT statements, because the system behaves as though the Oracle Label Security policy were not even present.

### **FULL** Privilege

The FULL privilege has the same effect and benefits as the READ privilege, with one difference.

A user with the FULL privilege can also write to all the data.

For a user with the FULL privilege, the READ and WRITE algorithms are not enforced.

Note that Oracle system and object authorizations are still enforced. For example, a user must still have SELECT on the application table. The FULL authorization turns off the access mediation check at the individual row level.

### **COMPACCESS** Privilege

The COMPACCESS privilege allows a user to access data based on the row label's compartments, independent of the row label's groups.

If a row label has no compartments, then access is determined by the group authorizations. However, when compartments do exist and access to them is authorized, then the group authorization is bypassed. This allows a privileged user whose label matches all the compartments of the data to access any data in any particular compartment, independent of what groups may own or otherwise be allowed access to the data.

Figure 3-8 shows the label evaluation process for read access with the COMPACCESS privilege. Note that if the data label is null or invalid, then the user is denied access.



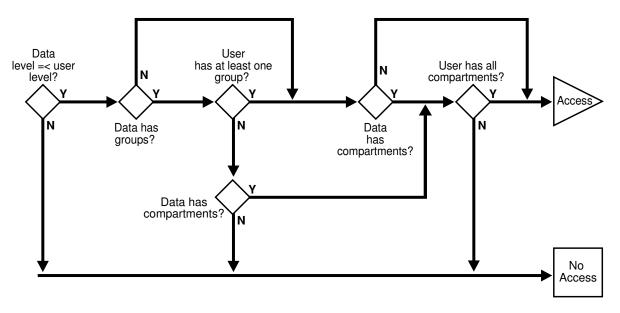
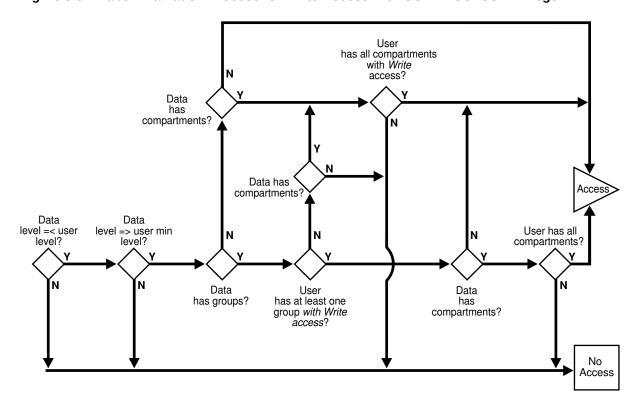


Figure 3-8 Label Evaluation Process for Read Access with COMPACCESS Privilege

Figure 3-9 shows the label evaluation process for write access with COMPACCESS privilege. Note that if the data label is null or invalid, then the user is denied access.





### PROFILE ACCESS Privilege

The PROFILE\_ACCESS privilege allows a session to change its session labels and session privileges to those of a different user.

This is a very powerful privilege, because the user can potentially become a user with FULL privileges. This privilege cannot be granted to a trusted stored program unit.

### Special Row Label Privileges

Once the label on a row has been set, Oracle Label Security privileges are required to modify the label.

Note that the LABEL\_UPDATE enforcement option must be on for these label modification privileges to be enforced. When a user updates a row label, the new label and old label are compared, and the required privileges are determined.

The special row label privileges include:

#### WRITEUP Privilege

The WRITEUP privilege enables the user to raise the level of data within a row, without compromising the compartments or groups.

#### WRITEDOWN Privilege

The WRITEDOWN privilege enables the user to lower the level of data within a row, without compromising the compartments or groups.

#### WRITEACROSS Privilege

The WRITEACROSS privilege allows the user to change the compartments and groups of data, without altering its sensitivity level.

### **WRITEUP** Privilege

The WRITEUP privilege enables the user to raise the level of data within a row, without compromising the compartments or groups.

This privilege enables a user to raise the level up to his or her maximum authorized level. You can find the privileges that users have by querying the ALL\_SA\_USER\_PRIVS data dictionary view.

For example, an authorized user can raise the level of a data row that has a level lower than his own minimum level. If a row is <code>UNCLASSIFIED</code> and the user's maximum level is <code>SENSITIVE</code>, then the row's level can be raised to <code>SENSITIVE</code>. It can be raised above the current session level, but it cannot change the compartments.

### WRITEDOWN Privilege

The WRITEDOWN privilege enables the user to lower the level of data within a row, without compromising the compartments or groups.

The user can lower the level to any level equal to or greater than his or her minimum authorized level. You can find the privileges that have been granted to a user by querying the ALL\_SA\_USER\_PRIVS data dictionary view.



### WRITEACROSS Privilege

The WRITEACROSS privilege allows the user to change the compartments and groups of data, without altering its sensitivity level.

This guarantees, for example, that SENSITIVE data remains at the SENSITIVE level, but at the same time enables the data's dissemination to be managed.

It lets the user change compartments and groups to anything that is currently defined as a valid compartment or group within the policy, while maintaining the level. With the WRITEACROSS privilege, a user with read access to one group (or more) can write to a different group without explicitly being given access to it.

You can find the privileges that have been granted to a user by querying the ALL\_SA\_USER\_PRIVS data dictionary view.

### System Privileges, Object Privileges, and Policy Privileges

Oracle Label Security privileges are different from the standard Oracle Database system and object privileges.

Table 3-4 Types of Privilege

| Source                   | Privileges        | Definition   |
|--------------------------|-------------------|--|
| Oracle Database          | System Privileges | The right to run a particular type of SQL statement              |
| Oracle Database          | Object Privileges | The right to access another user's object                        |
| Oracle Label<br>Security | Policy Privileges | The ability to bypass certain parts of the label security policy |

Oracle Database enforces the discretionary access control privileges that a user has been granted. By default, a user has no privileges except those granted to the PUBLIC user group. A user must explicitly be granted the appropriate privilege to perform an operation.

For example, to read an object in Oracle Database, you must either be the object's owner, or be granted the SELECT privilege on the object, or be granted the SELECT ANY TABLE system privilege. Similarly, to update an object, you must either be the object's owner, or be granted the UPDATE privilege on the object, or be granted the UPDATE ANY TABLE privilege.



Oracle Database Security Guide for more information about managing system privileges and object privileges



#### Access Mediation and Views

Prior to accessing data through a view, the users must have the appropriate system and object privileges on the view.

If the underlying table (on which the view is based) is protected by Oracle Label Security, then the user of the view must have authorization from Oracle Label Security to access specific rows of labeled data.

### Access Mediation and Program Unit Execution

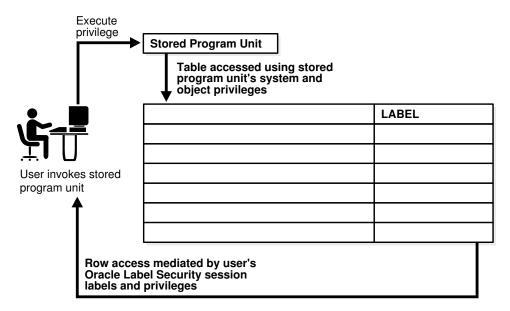
The privileges with which procedures that are owned by different users are executed differently in Oracle Database and Oracle Label Security.

For example, In Oracle Database, if user1 executes a procedure that belongs to user2, then the procedure runs with user2's system and object privileges. You can find the privileges that have been granted to a user by querying the DBA\_SYS\_PRIVS data dictionary view. However, any procedure executed by user1 runs with user1's own Oracle Label Security labels and privileges. This is true even when user1 executes stored program units owned by other users.

#### Figure 3-10 illustrates this process:

- Stored program units run with the DAC privileges of the procedure's owner (user2).
- In addition, stored program units accessing tables protected by Oracle Label Security mediate access to data rows based on the label attached to the row, and the Oracle Label Security labels and privileges of the invoker of the procedure (user1).

Figure 3-10 Stored Program Unit Execution



Stored program units can become *trusted* when an administrator assigns them Oracle Label Security privileges. A stored program unit can be run with its own autonomous

Oracle Label Security privileges rather than those of the user who calls it. For example, if you possess no Oracle Label Security privileges in your own right but run a stored program unit that has the WRITEDOWN privilege, then you can update labels. In this case, the privileges used are those of the stored program unit, and not your own.

Trusted program units can encapsulate privileged operations in a controlled manner. By using procedures, packages, and functions with assigned privileges, you may be able to access data that your own labels and privileges would not authorize. For example, to perform aggregate functions over all data in a table, not just the data visible to you, you might use a trusted program set up by an administrator. This way program units can thus perform operations on behalf of users, without the need to grant privileges directly to users.

#### **Related Topics**

Administering and Using Trusted Stored Program Units
 You can use trusted stored program units to enhance system security.

### Access Mediation and Policy Enforcement Options

An administrator can choose from among a set of policy enforcement options when applying an Oracle Label Security policy to individual tables.

These options enable enforcement to be tailored differently for each database table. In addition to the access controls based on the labels, a SQL predicate can also be associated with each table. The predicate can further define which rows in the table are accessible to the user.

In cases where the label to be associated with a new or updated row should be automatically computed, an administrator can specify a labeling function when applying the policy. That function will thereafter always be invoked to provide the data labels written under that policy, because active labeling functions take precedence over any alternative means of supplying a label.

Except where noted, this guide assumes that all enforcement options are in effect.

#### **Related Topics**

- Implementing Policy Enforcement Options and Labeling Functions
   You can customize the enforcement of Oracle Label Security policies and
   implement labeling functions.
- Labeling Functions
   Labeling functions can compute and return a label using resources such as context variables (for example, date or username) and data values.
- SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY
  The SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY procedure applies a policy to all of the tables in a schema and enables the policy for these tables.

### Working with Multiple Oracle Label Security Policies

You can use multiple Oracle Label Security policies in both a single database environments and in a distributed environments.

Multiple Oracle Label Security Policies in a Single Database
 Several Oracle Label Security policies can protect data in a single database.



Multiple Oracle Label Security Policies in a Distributed Environment
In a distributed environment that uses Oracle Label Security, remote connections
are controlled by Oracle Label Security.

### Multiple Oracle Label Security Policies in a Single Database

Several Oracle Label Security policies can protect data in a single database.

Each defined policy is associated with a set of labels used only by that policy. Data labels are constrained by the set of defined labels for each policy.

Each policy may protect a different table, but multiple policies can also apply to a single table. To access data, you must have label authorizations for all policies protecting that data. To access any particular row, you must be authorized by *all* policies protecting the table containing your desired rows. If you require privileges, then you may need privileges for all of the policies affecting your work.

### Multiple Oracle Label Security Policies in a Distributed Environment

In a distributed environment that uses Oracle Label Security, remote connections are controlled by Oracle Label Security.

#### **Related Topics**

Using Oracle Label Security with a Distributed Database
 You should understand the special considerations for using Oracle Label Security
 in a distributed configuration.



### Part II

### Using Oracle Label Security Functionality

Part II explains how to work with Oracle Label Security functionality.

- Getting Started with Oracle Label Security
   Before using Oracle Label Security, you must register it with the database and then enable the LBACSYS Oracle Label Security account.
- Working with Labeled Data You can manage labeled data, view that data of security attributes for a session, and change the value of session attributes.
- Oracle Label Security Using Oracle Internet Directory
  You can use Oracle Label Security with Oracle Internet Directory.



4

### Getting Started with Oracle Label Security

Before using Oracle Label Security, you must register it with the database and then enable the LBACSYS Oracle Label Security account.

- Registering Oracle Label Security with an Oracle Database
   You must register Oracle Label Security with the database in which you plan to
   use it.
- Enabling the LBACSYS Oracle Label Security

  After you complete the registration process, the default user account, LBACSYS, is granted the LBAC\_DBA database role, which provides the privileges necessary to manage Oracle Label Security.
- Logging in to Cloud Control or SQL\*Plus for Oracle Label Security
   After you complete the Oracle Label Security registration and enablement process, you can begin using it.

### Registering Oracle Label Security with an Oracle Database

You must register Oracle Label Security with the database in which you plan to use it.

- About Registering Oracle Label Security
   When you install Oracle Database, by default Oracle Label Security is not enabled.
- Checking if Oracle Label Security Has Been Registered and Enabled You can query the DBA\_OLS\_STATUS and CDB\_OLS\_STATUS data dictionary views to find if Oracle Label Security has already been registered and enabled.
- Registering and Enabling Oracle Label Security from SQL\*Plus
   You can both register and enable Oracle Label Security from SQL\*Plus.
- Registering and Enabling Oracle Label Security Using DBCA
   You can both register and enable Oracle Label Security using Database
   Configuration Assistant.

### About Registering Oracle Label Security

When you install Oracle Database, by default Oracle Label Security is not enabled.

You must register Oracle Label Security with the database. Afterwards, you must enable the default Oracle Label Security user account, LBACSYS. After you register Oracle Label Security, you can disable and re-enable it when necessary.

If you are using a multitenant environment, then only register Oracle Label Security in the pluggable databases (PDBs) in which you plan to create Oracle Label Security policies. Because Oracle Label Security is not designed to protect data dictionary objects, you cannot create policies in the root.



### Checking if Oracle Label Security Has Been Registered and Enabled

You can query the DBA\_OLS\_STATUS and CDB\_OLS\_STATUS data dictionary views to find if Oracle Label Security has already been registered and enabled.

 Log into the database instance as user SYS with the SYSDBA administrative privilege.

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

2. If you are using a multitenant environment, then connect to the appropriate PDB.

For example, to connect to the PDB hrpdb:

SELECT \* FROM DBA\_OLS\_STATUS;

SELECT \* FROM CDB\_OLS\_STATUS;

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

To find the available PDBs, query the DBA\_PDBS data dictionary view. To check the current PDB, run the show con name command.

- Run the appropriate query to find if Oracle Label Security has been registered (configured) and enabled.
  - If you want to find the Oracle Label Security status for a non-multitenant database, or in a multitenant environment for the root only or an individual PDB, then query DBA\_OLS\_STATUS. For example:

```
NAME STATUS DESCRIPTION

OLS_CONFIGURE_STATUS TRUE Determines if OLS is configured
OLS_DIRECTORY_STATUS FALSE Determines if OID is enabled with OLS
OLS_ENABLE_STATUS TRUE Determines if OLS is enabled
```

 If you want to find the Oracle Label Security status of all PDBs in a multitenant environment, as a common user with administrative privileges, then query CDB\_OLS\_STATUS. For example:

```
NAME STATUS DESCRIPTION

CON_ID

OLS_DIRECTORY_STATUS FALSE Determines if OLD is enabled with OLS 4

OLS_CONFIGURE_STATUS TRUE Determines if OLS is configured 4

OLS_DIRECTORY_STATUS FALSE Determines if OLD is enabled with OLS 5

OLS_ENABLE_STATUS TRUE Determines if OLD is enabled with OLS 5

OLS_ENABLE_STATUS TRUE Determines if OLS is enabled 5

OLS_CONFIGURE_STATUS TRUE Determines if OLS is configured 5
```

### Registering and Enabling Oracle Label Security from SQL\*Plus

You can both register and enable Oracle Label Security from SQL\*Plus.

 Log into the database instance as user SYS with the SYSDBA administrative privilege.

For example:



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

2. If you are using a multitenant environment, then connect to the appropriate PDB.

For example, to connect to the PDB hrpdb:

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

To find the available PDBs, query the DBA\_PDBS data dictionary view. To check the current PDB, run the show con\_name command.

3. Register and enable Oracle Label Security as follows.

```
EXEC LBACSYS.CONFIGURE_OLS; -- This procedure registers Oracle Label Security. EXEC LBACSYS.OLS_ENFORCEMENT.ENABLE_OLS; -- This procedure enables it.
```

Connect as user SYS with the SYSOPER privilege.

```
CONNECT SYS AS SYSOPER -- Or, CONNECT SYS@hrpdb AS SYSOPER Enter password: password
```

Restart the database.

For example:

SHUTDOWN IMMEDIATE STARTUP

### Registering and Enabling Oracle Label Security Using DBCA

You can both register and enable Oracle Label Security using Database Configuration Assistant.

- Start Database Configuration Assistant (DBCA).
  - UNIX: Run the following command:

```
$ORACLE HOME/bin/dbca
```

Windows: From the Start menu, click All Programs. Then click Oracle -ORACLE\_HOME, then Configuration and Migration Tools, and then Database Configuration Assistant.

The Welcome screen appears.

Click Next.

The Operations screen appears.

3. Select Configure Database Options. Click Next.

The Database screen appears.

From the list, select the database where you need to configure and enable OLS. Click Next.

The Database Content screen appears.

Select Oracle Label Security. Click Next.

The Connection Mode screen appears.

Select either Dedicated Server Mode or Shared Server Mode. Click Finish.



A dialog box is displayed informing you that the operation will require the database to be restarted.

7. Click OK.

A confirmation dialog box is displayed.

8. Click OK.

The DBCA progress screen is displayed.

After the operation is complete, you are prompted to perform another operation. Click No to exit DBCA.

### **Enabling the LBACSYS Oracle Label Security**

After you complete the registration process, the default user account, LBACSYS, is granted the LBAC\_DBA database role, which provides the privileges necessary to manage Oracle Label Security.

LBACSYS is created as a locked account with its password expired.

1. Log into the database instance as a user who has been granted the ALTER USER system privilege (for example, the SYSTEM user).

#### For example:

sqlplus system -- Or, sqlplus system@hrpdb for the hrpdb pluggable database (PDB) Enter password: password

If Oracle Database Vault is enabled, then log in as a user who has been granted the  $DV\_ACCTMGR$  role.

2. Enter this statement:

ALTER USER LBACSYS ACCOUNT UNLOCK IDENTIFIED BY password;

Replace *password* with a password that is secure. See *Oracle Database Security Guide* for the minimum requirements for creating passwords.

After you unlock user LBACSYS and provide a password, as a good practice, you may want to reserve this account as a back-up user account. For day-to-day use, consider granting the LBAC\_DBA database role to trusted users who you want to administer Oracle Label Security.

If you plan to use Enterprise Manager Cloud Control to administer Oracle Label Security, then ensure that any users to whom you have granted the LBAC\_DBA role also have the SELECT ANY DICTIONARY privilege. By default, the LBACSYS user already has this privilege.

# Logging in to Cloud Control or SQL\*Plus for Oracle Label Security

After you complete the Oracle Label Security registration and enablement process, you can begin using it.

Logging in to Oracle Label Security from Enterprise Manager Cloud Control
From Enterprise Manager Cloud Control, you use the Oracle Label Security pages
to create and manage Oracle Label Security policies.



Logging in to Oracle Label Security from SQL\*Plus
 You can log in to Oracle Label Security from SQL\*Plus if you have been granted the LBAC DBA database role.

## Logging in to Oracle Label Security from Enterprise Manager Cloud Control

From Enterprise Manager Cloud Control, you use the Oracle Label Security pages to create and manage Oracle Label Security policies.

1. Ensure that you have configured the Cloud Control target databases that you plan to use with Oracle Label Security.

See the Oracle Enterprise Manager online help and *Oracle Database Enterprise User Security Administrator's Guide* for more information about configuring target databases.

2. Point your browser to the Cloud Control login page.

For example:

https://myserver.example.com:7799/em

- 3. Log into Cloud Control as user SYSMAN.
- 4. In the Cloud Control home page, from the **Targets** menu, select **Databases**.
- In the Databases page, select the link for the database to which you want to connect.

The Database home page appears.

6. From the Security menu, select Label Security.

The Database Login page appears.

- **7.** Enter the following information:
  - **Username:** Enter the user name of a user who has been granted the LBAC\_DBA database role, or enter LBACSYS.
  - Password: Enter the 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 secured manner. Access to these credentials depends on the user who is currently logged in.

### Logging in to Oracle Label Security from SQL\*Plus

You can log in to Oracle Label Security from SQL\*Plus if you have been granted the LBAC DBA database role.

To use Oracle Label Security from SQL\*Plus, connect as user LBACSYS or as a
user who has been granted the LBAC\_DBA database role. To find if a user has been
granted this role, query the GRANTEE and GRANTED\_ROLE columns of the
DBA\_ROLE\_PRIVS data dictionary view.

For example:



sqlplus psmith\_ols -- Or, sqlplus psmith\_ols@hrpdb for a PDB named hrpdb Enter password: password

To find the available PDBs, query the  $DBA\_PDBS$  data dictionary view. To check the current PDB, run the show con\_name command.



# Creating an Oracle Label Security Policy

An Oracle Label Security policy is a named set of commands that implements Oracle Label Security.

- About Creating Oracle Label Security Policies
   When you create an Oracle Label Security policy, you must follow a set of general steps.
- Step 1: Create the Label Security Policy Container
   The Oracle Label Security policy container is a storage place for the policy settings.
- Step 2: Create Data Labels for the Label Security Policy
   After you create a policy container, you are ready to create data labels for each database table row.
- Step 3: Authorize Users for the Label Security Policy
  Before users can have access to data that is protected by an Oracle Label
  Security policy, they must be authorized.
- Step 4: Grant Privileges to Users and Trusted Stored Program Units You can grant privileges to users, such as READ so that users can read data protected an Oracle Label Security policy protects.
- Step 5: Apply the Policy to a Database Table or Schema
   After you create grant authorizations and privileges to an Oracle Label Security policy, you can apply it to a database table or schema.
- Step 6: Add Policy Labels to Table Rows You must add policy labels to table rows.
- Step 7: (Optional) Configure Auditing
   You can audit Oracle Label Security policies by using the SA\_USER\_ADMIN P/L SQL
   package.
- Using Enterprise Manager Cloud Control to Create an OLS Policy
   You can create Oracle Label Security policies in Oracle Enterprise Manager Cloud
   Control.

# **About Creating Oracle Label Security Policies**

When you create an Oracle Label Security policy, you must follow a set of general steps.

- Create a policy container that defines the policy name, the name of a column that Oracle Label Security will add to the tables to be protected, whether to hide this column, whether to enable the policy, and default enforcement options for the policy.
  - See Step 1: Create the Label Security Policy Container for more information.
- 2. Define the following attributes for the label: level of sensitivity, and optionally, compartments and groups to further filter the label sensitivity. Once you have the

attributes defined, create the label itself and then associate these attributes with the label.

See Step 2: Create Data Labels for the Label Security Policy.

**3.** Authorize users for the policy.

See Step 3: Authorize Users for the Label Security Policy for more information.

4. Grant privileges to these users or to trusted program units.

See Step 4: Grant Privileges to Users and Trusted Stored Program Units for more information.

**5.** Apply the policy to a database table. Alternatively, you can apply the policy to an entire schema.

See Step 5: Apply the Policy to a Database Table or Schema for more information.

**6.** Add the policy labels to the table rows. You must update the table that is being used for the policy.

See Step 6: Add Policy Labels to Table Rows for more information.

7. Optionally, configure audit settings for users.

See Step 7: (Optional) Configure Auditing for more information.

# Step 1: Create the Label Security Policy Container

The Oracle Label Security policy container is a storage place for the policy settings.

- About the Label Security Policy Container
   The Oracle Label Security policy container stores metadata that describes how the policy behaves.
- Creating a Label Policy Container
   You can use the SA\_SYSDBA.CREATE\_POLICY procedure to create an Oracle Label
   Security policy container.

#### About the Label Security Policy Container

The Oracle Label Security policy container stores metadata that describes how the policy behaves.

This container defines the policy name, the name of a column that Oracle Label Security will add to the tables to be protected, whether to hide this column, and default enforcement options for the policy.

The column that you add to the tables that you want to protect will include data labels (which you create later on) that are assigned to specific rows in a the table, based on values in a specific column. The policy creation process creates a special role for the policy and grants this role to the user who creates the policy. The role name is in the format <code>policy\_DBA</code>. For example, for a policy named <code>EMP\_OLS\_POL</code>, the role name is <code>EMP\_OLS\_POL\_DBA</code>. This role becomes effective only after a new user session begins.

You can create the policy container in Oracle Enterprise Manager Cloud Control, or use the SA\_SYSDBA.CREATE\_POLICY procedure.



# Creating a Label Policy Container

You can use the SA\_SYSDBA.CREATE\_POLICY procedure to create an Oracle Label Security policy container.

• To create the policy, run SA\_SYSDBA.CREATE\_POLICY, specifying the policy name, column name, and default options.

#### For example:

#### **Related Topics**

SA\_SYSDBA.CREATE\_POLICY

The SA\_SYSDBA.CREATE\_POLICY procedure creates a new Oracle Label Security policy, defines a policy-specific column name, and specifies default policy options.

# Step 2: Create Data Labels for the Label Security Policy

After you create a policy container, you are ready to create data labels for each database table row.

About Data Labels

A data label indicates the sensitivity of a database table row.

- About Policy Level Sensitivity Components
   A level is a ranking that denotes the sensitivity of the information it labels.
- Creating a Policy Level Component
   The SA\_COMPONENTS.CREATE\_LEVEL procedure creates a policy level component.
- About Policy Compartment Components
   Compartments identify areas that describe the sensitivity of the labeled data, providing a finer level of granularity within a level.
- Creating a Policy Compartment Component
   The SA\_COMPONENTS.CREATE\_COMPARTMENT procedure creates an Oracle Label Security compartment.
- About Policy Group Components
   Groups identify organizations owning or accessing the data, such as EASTERN\_REGION, WESTERN\_REGION, WR\_SALES.
- Creating a Policy Data Label Group
   The SA\_COMPONENTS.CREATE\_GROUP procedure creates a data label group.
- About Associating the Policy Components with a Named Data Label
   After defining the data label components, you can create a data label itself by
   associating it with an existing level.
- Associating the Policy Components with a Named Data Label
   The SA\_LABEL\_ADMIN.CREATE\_LABEL procedure creates a data label.

#### **About Data Labels**

A data label indicates the sensitivity of a database table row.

Each label is a single attribute with multiple components that control the types of filtering to be used for user access.

Table 5-1 describes the different components of a data label.

**Table 5-1** Sensitivity Data Label Components

| Component    | Description  | Examples  |
|--------------|--|---|
| Level        | A single specification of the sensitivity of labeled data within the ordered ranks established | CONFIDENTIAL (1),<br>SENSITIVE (2),<br>HIGHLY_SENSITIVE (3) |
| Compartments | Zero or more categories associated with the labeled data                                       | FINANCIAL, STRATEGIC,<br>NUCLEAR                            |
| Groups       | Zero or more identifiers for organizations owning or accessing the data                        | EASTERN_REGION,<br>WESTERN_REGION                           |

All data labels must contain a level component, but the compartment and group components are optional. Compartments and groups are a way of fine tuning access that users will have to the data. Valid characters for specifying all label components include alphanumeric characters, underscores, and spaces. (Leading and trailing spaces are ignored.) You must define the label components before you can create the data label itself.

You can use Cloud Control to create the label and its components for an existing policy. Alternatively, you can use the SA\_COMPONENTS PL/SQL package to create the components, and the SA\_LABEL\_ADMIN package to create the data label.

#### **Related Topics**

SA\_COMPONENTS Label Components PL/SQL Package
 The SA\_COMPONENTS PL/SQL package manages the component definitions of an
 Oracle Label Security label.

# About Policy Level Sensitivity Components

A *level* is a ranking that denotes the sensitivity of the information it labels.

The more sensitive the information, the higher its level. The less sensitive the information, the lower its level.

Every label must include one level. Oracle Label Security permits up to 10,000 levels in a policy. For each level, you must define a numeric form, a long character form, and the required short character form.

Table 5-2 shows examples of levels.



Table 5-2 Policy Level Example

| Numeric Form | Long Form        | Short Form |  |
|--------------|------------------|------------|--|
| 40           | HIGHLY_SENSITIVE | HS         |  |
| 30           | SENSITIVE        | S          |  |
| 20           | CONFIDENTIAL     | С          |  |
| 10           | PUBLIC           | Р          |  |

Table 5-2 explains the numeric form, long form, and short form for levels.

Table 5-3 Forms of Specifying Levels

| Form                            | Explanation  |
|---------------------------------|--|
| Numeric form, also called "tag" | The numeric form of the level can range from 0 to 9999.  Sensitivity is ranked by this numeric value, so you must assign higher numbers to levels that are more sensitive, and lower numbers to levels that are less sensitive. In Table 5-2, 40 (HIGHLY_SENSITIVE) is a higher level than 30, 20, and 10. |
|                                 | Administrators should avoid using sequential numbers for the numeric form of levels. A good strategy is to use even increments (such as 50 or 100) between levels. You can then insert additional levels between two preexisting levels, at a later date.  |
| Long form                       | The long form of the level name can contain up to 80 characters.   |
| Short form                      | The short form can contain up to 30 characters.  |

Although you define both long and short names for the level (and for each of the other label components), only the short form of the name is displayed upon retrieval. When users manipulate the labels, they use only the short form of the component names.

Examples of levels can be names such as TOP\_SECRET, SECRET, CONFIDENTIAL, and UNCLASSIFIED or TRADE\_SECRET, PROPRIETARY, COMPANY\_CONFIDENTIAL, PUBLIC DOMAIN.

If you use only levels, a level 40 user (in this example) can access or alter any data row whose level is 40 or less.

# Creating a Policy Level Component

The SA\_COMPONENTS.CREATE\_LEVEL procedure creates a policy level component.

• To create the policy level component, run SA\_COMPONENTS.CREATE\_LEVEL, specifying the policy name and details about the component.

#### For example:

```
BEGIN
SA_COMPONENTS.CREATE_LEVEL (
  policy_name => 'emp_ols_pol',
  level_num => 40,
  short_name => 'HS',
  long_name => 'HIGHLY_SENSITIVE');
```



END;

#### **Related Topics**

SA COMPONENTS.CREATE LEVEL

The SA\_COMPONENTS.CREATE\_LEVEL procedure creates a level and specify its short name and long name.

# **About Policy Compartment Components**

Compartments identify areas that describe the sensitivity of the labeled data, providing a finer level of granularity within a level.

Compartments associate the data with one or more security areas. All data related to a particular project can be labeled with the same compartment.

Table 5-4 shows an example set of compartments.

**Table 5-4 Policy Compartment Example** 

| Numeric Form | Long Form   | Short Form |
|--------------|-------------|------------|
| 85           | FINANCIAL   | FINCL      |
| 65           | CHEMICAL    | CHEM       |
| 45           | OPERATIONAL | OP         |

Table 5-5 shows different ways to specify compartments.

**Table 5-5** Forms of Specifying Compartments

| Form         | Explanation   |
|--------------|---|
| Numeric form | The numeric form can range from 0 to 9999. It is unrelated to the numbers used for the levels. The numeric form of the compartment does not indicate greater or less sensitivity. Instead, it controls the display order of the short form compartment name in the label character string. For example, assume a label is created that has all three compartments listed in Table 5-4, and a level of SENSITIVE. When this label is displayed in string format, it looks like this: |
|              | S:OP,CHEM,FINCL   |
|              | meaning SENSITIVE: OPERATIONAL, CHEMICAL, FINANCIAL The display order follows the order of the numbers assigned to the compartments: 45 is lower than 65, and 65 is lower than 85. By contrast, if the number assigned to the FINCL compartment were 5, the character string format of the label would look like this: S:FINCL,OP,CHEM  |
| Long form    | The long form of the compartment name scan have up to 80 characters.  |
| Short form   | The short form can contain up to 30 characters.   |



Compartments are optional. You can include up to 10,000 compartments for a label.

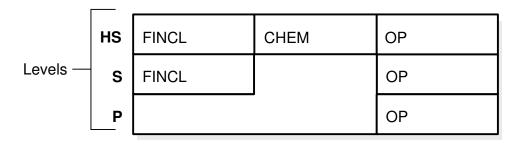
Not all labels must have compartments. For example, you can specify HIGHLY\_SENSITIVE and CONFIDENTIAL levels with no compartments, and a SENSITIVE level that does contain compartments.

When you analyze the sensitivity of data, you may find that some compartments are only useful at specific levels.

Figure 5-1 shows how compartments can be used to categorize data.

Figure 5-1 Compartments in a Label

#### Compartments



Here, compartments FINCL, CHEM, and OP are used with the level HIGHLY\_SENSITIVE (HS). The label HIGHLY\_SENSITIVE:FINCL, CHEM indicates a level of 40 with the two named compartments. Compartment FINCL is not more sensitive than CHEM, nor is CHEM more sensitive than FINCL. Note also that some data in the protected table may not belong to any compartment.

If you specify compartments, then a user whose level would normally permit access to a row's data will nevertheless be prevented from such access unless the user's label also contains all the compartments appearing in that row's label. For example, user hpreston, who is granted access to the HS level, could be granted access only to FINCL and CHEM but not to OP.

# Creating a Policy Compartment Component

The SA\_COMPONENTS.CREATE\_COMPARTMENT procedure creates an Oracle Label Security compartment.

• To create the compartment, run the SA\_COMPONENTS.CREATE\_COMPARTMENT procedure to create a compartment, specifying the policy name and details about the compartment.

#### For example:



#### **Related Topics**

SA COMPONENTS.CREATE COMPARTMENT

The SA\_COMPONENTS.CREATE\_COMPARTMENT procedure creates a compartment and specify its short name and long name.

#### **About Policy Group Components**

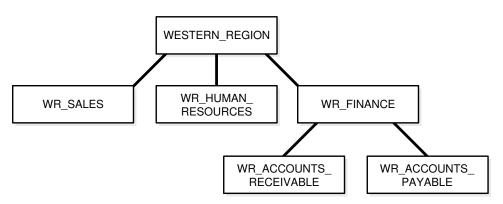
Groups identify organizations owning or accessing the data, such as EASTERN\_REGION, WESTERN REGION, WR SALES.

All data pertaining to a certain department can have that department's group in the label. Groups are useful for the controlled dissemination of data and for timely reaction to organizational change. When a company reorganizes, data access can change right along with the reorganization.

Groups are hierarchical. You can label data based upon your organizational infrastructure. A group can thus be associated with a parent group.

Figure 5-2 shows how you can define a set of groups corresponding to the following organizational hierarchy.

Figure 5-2 Group Example



The WESTERN\_REGION group includes three subgroups: WR\_SALES, WR\_HUMAN\_RESOURCES, and WR\_FINANCE. The WR\_FINANCE subgroup is subdivided into WR ACCOUNTS RECEIVABLE and WR ACCOUNTS PAYABLE.

Table 5-6 shows how the organizational structure in this example can be expressed in the form of Oracle Label Security groups. The numeric form assigned to the groups affects display order only. You specify the hierarchy (that is, the parent and child relationships) separately. The first group listed, WESTERN\_REGION, is the parent group of the remaining groups in the table.

Table 5-6 Group Example

| Numeric Form | Long Form      | Short Form | Parent Group |
|--------------|----------------|------------|--------------|
| 1000         | WESTERN_REGION | WR         | _            |
| 1100         | WR_SALES       | WR_SAL     | WR           |



Table 5-6 (Cont.) Group Example

| Numeric Form | Long Form              | Short Form | Parent Group |
|--------------|------------------------|------------|--------------|
| 1200         | WR_HUMAN_RESOURCES     | WR_HR      | WR           |
| 1300         | WR_FINANCE             | WR_FIN     | WR           |
| 1310         | WR_ACCOUNTS_PAYABLE    | WR_AP      | WR_FIN       |
| 1320         | WR_ACCOUNTS_RECEIVABLE | WR_AR      | WR_FIN       |

Table 5-7 shows the forms that you must use when you specify groups.

Table 5-7 Forms of Specifying Groups

| Form         | Explanation  |
|--------------|--|
| Numeric form | The numeric form of the group can range from 0 to 9999, and it must be unique for each policy.   |
|              | The numeric form does not indicate any kind of ranking. It does not indicate a parent-child relationship, or greater or less sensitivity. It only controls the display order of the short form group name in the label character string.     |
|              | For example, assume that a label is created that has the level SENSITIVE, the compartment CHEMICAL, and the groups WESTERN_REGION and WR_HUMAN_RESOURCES as listed in Table 5-6. When displayed in string format, the label looks like this: |
|              | S:CHEM:WR,WR_HR  |
|              | $\mathtt{WR}$ is displayed before $\mathtt{WR\_HR}$ because 1000 comes before 1200.  |
| Long form    | The long form of the group name can contain up to 80 characters.   |
| Short form   | The short form can contain up to 30 characters.  |

Groups are optional. A label can contain up to 10,000 groups.

All labels do not need to have groups. When you analyze the sensitivity of data, you may find that some groups are only used at specific levels. For example, you can specify <code>HIGHLY\_SENSITIVE</code> and <code>CONFIDENTIAL</code> labels with no groups, and a <code>SENSITIVE</code> label that does contain groups.

# Creating a Policy Data Label Group

The SA\_COMPONENTS.CREATE\_GROUP procedure creates a data label group.

• Run the SA\_COMPONENTS.CREATE\_GROUP procedure for each data label group that you need.

In the following example, the first CREATE\_GROUP procedure creates the parent group, WR, and the second procedure associates a second group with the WR group by using the  $parent_name$  parameter.

```
BEGIN
SA_COMPONENTS.CREATE_GROUP (
  policy_name => 'emp_ols_pol',
```



#### **Related Topics**

SA\_COMPONENTS.CREATE\_GROUP

The SA\_COMPONENTS.CREATE\_GROUP procedure creates a group and specify its short name and long name, and optionally a parent group.

# About Associating the Policy Components with a Named Data Label

After defining the data label components, you can create a data label itself by associating it with an existing level.

Optionally, you can include compartments and groups in this association.

You can use Oracle Enterprise Manager Cloud Control or the SA\_LABEL\_ADMIN.CREATE\_LABEL procedure. Character string representations of labels use the following syntax:

```
level:compartment1,...,compartmentn:group1,...,groupn
```

The text string that specifies the label can have a maximum of 4,000 characters, including alphanumeric characters, spaces, and underscores. The label names are case-insensitive. You can enter them in uppercase, lowercase, or mixed case, but the string is stored in the data dictionary and displayed in uppercase. Separate each set of components with a colon. You do not need to enter trailing delimiters in this syntax.

For example, you can create valid labels such as these:

```
SENSITIVE:FINANCIAL, CHEMICAL:EASTERN_REGION, WESTERN_REGION
CONFIDENTIAL:FINANCIAL:VP_GRP
SENSITIVE
HIGHLY_SENSITIVE:FINANCIAL
SENSITIVE::WESTERN_REGION
```

# Associating the Policy Components with a Named Data Label

The SA\_LABEL\_ADMIN.CREATE\_LABEL procedure creates a data label.

• Run SA\_LABEL\_ADMIN.CREATE\_LABEL, specifying the policy name and details about the policy components.

#### For example:

```
BEGIN
SA_LABEL_ADMIN.CREATE_LABEL (
policy_name => 'emp_ols_pol',
```



When you create a data label, two additional actions occur:

- The label is automatically designated as a valid data label. This functionality limits
  the labels that can be assigned to data. Oracle Label Security can also create
  valid data labels dynamically at run time, from those that are predefined in Oracle
  Internet Directory. Most users, however, prefer to create the labels manually in
  order to limit data label proliferation.
- A numeric label tag is associated with the text string representing the label. It is
  this label tag, rather than the text string, that is stored in the policy label column of
  the protected table.



For Oracle Label Security installations that do not use Oracle Internet Directory, dynamic creation of valid data labels uses the <code>TO\_DATA\_LABEL</code> function. Its usage should be tightly controlled.

#### **Related Topics**

- Inserting Labels Using TO\_DATA\_LABEL
   The TO\_DATA\_LABEL function can generate new labels dynamically.
- SA\_LABEL\_ADMIN.CREATE\_LABEL
   The SA\_LABEL\_ADMIN.CREATE\_LABEL procedure creates data labels.

# Step 3: Authorize Users for the Label Security Policy

Before users can have access to data that is protected by an Oracle Label Security policy, they must be authorized.

- About Authorizing Users for Label Security Policies
   When you authorize users, you enable them to have access to row data based on how the data labels are defined.
- About Authorizing Levels
   You can explicitly set default, minimum, and mazimum authorization levels.
- Authorizing a Level
   The SA\_USER\_ADMIN.SET\_LEVELS procedure authorizes users for policy levels components.
- About Authorizing Compartments
   After you authorize the user for a specific level, optionally you can specify compartments to be added to a session label.
- Authorizing a Compartment
  The SA\_USER\_ADMIN.SET\_COMPARTMENTS procedure authorizes a user for the compartments component.

- About Authorizing Groups
  - You can specify the list of groups that a user can place in session label.
- Authorizing a Group

The SA\_USER\_ADMIN.SET\_GROUPS procedure authorizes users for a policy group.

#### About Authorizing Users for Label Security Policies

When you authorize users, you enable them to have access to row data based on how the data labels are defined.

First, you set the user's authorization for each level, compartment, and group that is associated with the label. You can find the currently granted privileges for a user by querying the DBA\_SA\_USER\_PRIVS data dictionary view.

# **About Authorizing Levels**

You can explicitly set default, minimum, and mazimum authorization levels.

Table 5-8 Authorized Levels Set by the Administrator

| Authorization          | Meaning  |
|------------------------|--|
| User Max Level         | The maximum ranking of sensitivity that a user can access during read and write operations   |
| User Min Level         | The minimum ranking of sensitivity that a user can access during write operations. The User Max Level must be equal to or greater than the User Min Level. |
| User Default Level     | The level that is assumed by default when connecting to Oracle Database  |
| User Default Row Level | The level that is used by default when inserting data into Oracle Database   |

For example, you might set the following level authorizations for user hpreston:

| Туре    | Short Name | Long Name        | Description          |
|---------|------------|------------------|----------------------|
| Maximum | HS         | HIGHLY_SENSITIVE | User's highest level |
| Minimum | P          | PUBLIC           | User's lowest level  |
| Default | C          | CONFIDENTIAL     | User's default level |
| Row     | C          | CONFIDENTIAL     | Row level on INSERT  |

# Authorizing a Level

The SA\_USER\_ADMIN.SET\_LEVELS procedure authorizes users for policy levels components.

Note that when you specify the levels, you must always use the short names, not the long names.

 Run SA\_USER\_ADMIN.SET\_LEVELS to authorize the level, specifying the policy name, user name, and levels.



#### For example:

#### **Related Topics**

SA USER ADMIN.SET LEVELS

The SA\_USER\_ADMIN.SET\_LEVELS procedure assigns a user minimum and maximum levels and identifies default values for the user's session label and row label.

# **About Authorizing Compartments**

After you authorize the user for a specific level, optionally you can specify compartments to be added to a session label.

Write access must be explicitly given for each compartment. A user cannot directly insert, update, or delete a row that contains a compartment that the user does not have authorization to write.

For example, you could set the following compartment authorizations for user hpreston:

| Short Name | Long Name   | WRITE | DEFAULT | ROW |
|------------|-------------|-------|---------|-----|
| CHEM       | CHEMICAL    | YES   | YES     | NO  |
| FINCL      | FINANCIAL   | YES   | YES     | NO  |
| OP         | OPERATIONAL | YES   | YES     | YES |

# Authorizing a Compartment

The SA\_USER\_ADMIN.SET\_COMPARTMENTS procedure authorizes a user for the compartments component.

When you specify the compartments, you must use their short names, not their long names.

• Run SA\_USER\_ADMIN.SET\_COMPARTMENTS to authorize a user for a compartment, specifying the policy name, user name, and compartment details.

#### For example:

```
BEGIN

SA_USER_ADMIN.SET_COMPARTMENTS (

policy_name => 'ols_admin_pol',

user_name => 'hpreston',

read_comps => 'FINCL',

write_comps => 'FINCL',

def_comps => 'FINCL',
```



```
row_comps => 'FINCL');
END;
/
```

After you have run this procedure, you can authorize the user for additional compartments by running the SA\_USER\_ADMIN.ADD\_COMPARTMENTS procedure.

#### **Related Topics**

SA\_USER\_ADMIN.SET\_COMPARTMENTS

The SA\_USER\_ADMIN.SET\_COMPARTMENTS procedure assigns compartments to a user and identifies default values for the user's session label and row label.

SA\_USER\_ADMIN.ADD\_COMPARTMENTS

The SA\_USER\_ADMIN.ADD\_COMPARTMENTS procedure adds (assigns) compartments to a user's authorizations, indicating if the compartments are authorized for write and read privileges.

# **About Authorizing Groups**

You can specify the list of groups that a user can place in session label.

Write access must be explicitly given for each group listed.

For example, you could set the following group authorizations:

| Short Name | Long Name              | WRITE | DEFAULT | ROW | Parent |
|------------|------------------------|-------|---------|-----|--------|
| WR_HR      | WR_HUMAN_RESOURCES     | YES   | YES     | YES | WR     |
| WR_AP      | WR_ACCOUNTS_PAYABLE    | YES   | YES     | NO  | WR_FIN |
| WR_AR      | WR_ACCOUNTS_RECEIVABLE | YES   | YES     | NO  | WR_FIN |

# Authorizing a Group

The SA\_USER\_ADMIN.SET\_GROUPS procedure authorizes users for a policy group.

 Run SA\_USER\_ADMIN.SET\_GROUPS to authorize the user, specifying the policy name, user name, and authorizations that you want. When you specify the groups, you must use the short name, not the long name.

#### For example:

```
BEGIN
SA_USER_ADMIN.SET_GROUPS (
  policy_name => 'ols_admin_pol',
  user_name => 'hpreston',
  read_groups => 'WR_AP',
  write_groups => 'WR_AP',
  def_groups => 'WR_AP',
  row_groups => 'WR_AP');
END;
//
```



#### **Related Topics**

SA USER ADMIN.SET GROUPS

The SA\_USER\_ADMIN.SET\_GROUPS procedure assigns groups to a user and identifies default values for the user's session label and row label.

# Step 4: Grant Privileges to Users and Trusted Stored Program Units

You can grant privileges to users, such as READ so that users can read data protected an Oracle Label Security policy protects.

- About Granting Privileges to Users and Trusted Program Units for the Policy
  After you have authorized users for policy levels, compartments, and groups, you
  are ready to grant the user privileges.
- Granting Privileges to a User
  The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure grants users privileges.
- Granting Privileges to a Trusted Program Unit
   The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure grants privileges to trusted program units.

# About Granting Privileges to Users and Trusted Program Units for the Policy

After you have authorized users for policy levels, compartments, and groups, you are ready to grant the user privileges.

Trusted program units are functions, procedures, or packages that are granted Oracle Label Security privileges. You create a trusted stored program unit in the same way that you create a standard procedure, function, or package, that is by using the CREATE PROCEDURE, CREATE FUNCTION, OR CREATE PACKAGE and CREATE PACKAGE BODY statements. The program unit becomes trusted when you grant Oracle Label Security privileges to it.

Table 5-9 summarizes the privileges that can be granted to users or trusted stored program units.

**Table 5-9 Oracle Label Security Privileges** 

| Security Privilege | Explanation   |
|--------------------|---|
| READ               | Allows read access to all data protected by the policy  |
| FULL               | Allows full read and write access to all data protected by the policy                                 |
| COMPACCESS         | Allows a session access to data authorized by the row's compartments, independent of the row's groups |
| PROFILE_ACCESS     | Allows a session to change its labels and privileges to those of a different user                     |



Table 5-9 (Cont.) Oracle Label Security Privileges

| Security Privilege | Explanation   |
|--------------------|---|
| WRITEUP            | Allows users to set or raise only the level, within a row label, up to the maximum level authorized for the user. (Active only if LABEL_UPDATE is active.)                            |
| WRITEDOWN          | Allows users to set or lower the level, within a row label, to any level equal to or greater than the minimum level authorized for the user. (Active only if LABEL_UPDATE is active.) |
| WRITEACROSS        | Allows a user to set or change groups and compartments of a row label, but does not allow changes to the level. (Active only if LABEL_UPDATE is active.)                              |

#### Granting Privileges to a User

The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure grants users privileges.

• Run SA\_USER\_ADMIN.SET\_USER\_PRIVS, specifying the policy name, user name, and privileges that you want to grant.

#### For example:

```
BEGIN
SA_USER_ADMIN.SET_USER_PRIVS(
  policy_name => 'ols_admin_pol',
  user_name => 'hpreston',
  privileges => 'WRITEDOWN');
END;
//
```

#### **Related Topics**

SA USER ADMIN.SET USER PRIVS

The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure sets policy-specific privileges for users.

#### Granting Privileges to a Trusted Program Unit

The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure grants privileges to trusted program units.

• Run SA\_USER\_ADMIN.SET\_PROG\_PRIVS to grant the privileges, specifying the policy name, schema name, program unit name, and privileges that you want to grant.

#### For example:



#### **Related Topics**

SA\_USER\_ADMIN.SET\_PROG\_PRIVS
 The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure sets policy-specific privileges for program units.

# Step 5: Apply the Policy to a Database Table or Schema

After you create grant authorizations and privileges to an Oracle Label Security policy, you can apply it to a database table or schema.

- About Applying the Policy to a Database Table or Schema
   When you apply a policy to a table, the policy is automatically enabled.
- Applying a Policy to a Schema
  The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure applies a policy to either a table within a schema or an entire schema.

# About Applying the Policy to a Database Table or Schema

When you apply a policy to a table, the policy is automatically enabled.

To disable a policy is to turn off its protections, although it is still applied to the table. To enable a policy is to turn on and enforce its protections for a particular table or schema.

To remove a policy is to take it entirely away from the table or schema. Note, however, that the policy label column and the labels remain in the table unless you explicitly drop them.

You can alter the default policy enforcement options for future tables that may be created in a schema. This does not, however, affect policy enforcement options on existing tables in the schema.

To change the enforcement options on an existing table, you must first *remove* the policy from the table, make the desired changes, and then reapply the policy to the table.

Be aware that you cannot enforce Oracle Label Security policies on external tables.

After you have created the policy components and configured user authorizations, privileges, and auditing for them, you can apply the policy to a database table or to an entire schema.

When you apply the policy to a database table, in addition to the policy name and target schema table, you must specify the following information:

- table\_options: A comma-delimited list of policy enforcement options to be used for the table. If NULL, then the policy's default options are used.
- label\_function: A string calling a function to return a label value to use as the default. For example, my\_label(:new.dept,:new.status) computes the label based on the new values of the DEPT and STATUS columns in the row.
- predicate: An additional predicate to combine (using AND or OR) with the labelbased predicate for READ\_CONTROL

Note the following aspects of using Oracle Label Security policies with schemas:



- If you apply a policy to an empty schema, then every time you create a table within that schema, the policy is applied. Once the policy is applied to the schema, the default options you choose are applied to every table added.
- If you remove the policy from a table so that it is unprotected, and then run SA\_POLICY\_ADMIN.ENABLE\_SCHEMA\_POLICY, then the table will remain unprotected. If you wish to protect the table once again, then you must apply the policy to the table, or re-apply the policy to the schema.

If you apply a policy to a schema that already contains tables protected by the policy, then all future tables will have the new options that were specified when you applied the policy. The existing tables will retain the options they already had.

# Applying a Policy to a Schema

The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure applies a policy to either a table within a schema or an entire schema.

 Run Sa\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY to apply the policy to a schema, specifying the policy name, schema name, and necessary options.

The following example shows how to use the SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure to apply the ols\_admin\_pol policy to the HR.EMPLOYEES table.

This example shows how to use the SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY procedure to apply a policy to an entire schema.

#### **Related Topics**

SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY

The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure adds the specified policy to a table.

SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY procedure applies a policy to all of the tables in a schema and enables the policy for these tables.

# Step 6: Add Policy Labels to Table Rows

You must add policy labels to table rows.

About Adding Policy Labels to Table Rows

After you have applied a policy to a table, you must add data labels to the rows in the table.

Adding a Policy Label to a Table Row
 You must update the table to which you are adding a policy label.

#### About Adding Policy Labels to Table Rows

After you have applied a policy to a table, you must add data labels to the rows in the table.

These labels are stored in the policy label column that you created earlier in the table. The user updating the table must have the FULL security privilege for the policy. This user is normally the owner of the table.

# Adding a Policy Label to a Table Row

You must update the table to which you are adding a policy label.

 To add data labels to a table, in SQL\*Plus, enter an UPDATE statement using the following syntax:

```
UPDATE table_name
SET ols_column = CHAR_TO_LABEL('ols_policy','data_label')
WHERE UPPER(table_column) IN (column_data);
```

For example, suppose LABCSYS has created a policy called ACCESS\_LOCATIONS and wants to add the label SENS to the cities Beijing, Tokyo, and Singapore in the HR.LOCATIONS table. The policy label column is called ROW\_LABEL. The UPDATE statement is as follows:

```
UPDATE LOCATIONS
SET ROW_LABEL = CHAR_TO_LABEL('ACCESS_LOCATIONS','SENS')
WHERE UPPER(city) IN ('BEIJING', 'TOKYO', 'SINGAPORE');
```

2. Run the following SELECT statement to ensure that the policy was added to the table:

```
SELECT LABEL_TO_CHAR (ROW_LABEL) FROM LOCATIONS;
```

# Step 7: (Optional) Configure Auditing

You can audit Oracle Label Security policies by using the SA\_USER\_ADMIN P/L SQL package.

About Configuring Auditing

After you authorize users for the policy and grant them privileges, you can configure auditing for each user and for the policy itself.

Configuring Auditing

The SA\_USER\_ADMIN.AUDIT procedure configures auditing for users in a non-unified auditing environment.



# **About Configuring Auditing**

After you authorize users for the policy and grant them privileges, you can configure auditing for each user and for the policy itself.

If unified auditing is not enabled, then use the procedures in this section to configure the auditing. If it is enabled, then you must create a unified audit policy, as described in *Oracle Database Security Guide*.

Table 5-10 describes the available auditing options.

Table 5-10 Auditing Options for Oracle Label Security

| Option     | Description  |
|------------|--|
| APPLY      | Audits application of specified Oracle Label Security policies to tables and schemas |
| REMOVE     | Audits removal of specified Oracle Label Security policies from tables and schemas   |
| SET        | Audits the setting of user authorizations, and user and program privileges           |
| PRIVILEGES | Audits use of all policy-specific privileges   |

# **Configuring Auditing**

The SA\_USER\_ADMIN.AUDIT procedure configures auditing for users in a non-unified auditing environment.

 Run SA\_USER\_ADMIN.AUDIT to configure user auditing, specifying the policy name, one or more users, and the appropriate audit options.

#### For example:

```
BEGIN
SA_USER_ADMIN.AUDIT(
  policy_name => 'ols_admin_pol',
  users => 'hpreston',
  audit_option => 'REMOVE',
  audit_type => 'BY ACCESS',
  success => NULL);
END;
//
```

#### **Related Topics**

SA\_AUDIT\_ADMIN.AUDIT

The SA\_AUDIT\_ADMIN.AUDIT procedure enables policy-specific auditing.

# Using Enterprise Manager Cloud Control to Create an OLS Policy

You can create Oracle Label Security policies in Oracle Enterprise Manager Cloud Control.

- Creating the Label Security Policy Container Using Cloud Control
  You can create the Oracle Label Security policy container in Cloud Control.
- Creating Policy Components Using Cloud Control
   After you create a container for the policy and set enforcement options for it, you can create components for the policy.
- Creating Data Labels for the Policy Using Cloud Control
   You can create data labels for an Oracle Label Security policy in Cloud Control.
- Authorizing, Granting Privileges, and Auditing Users for a Policy Using Cloud Control
  - You can authorize, grant privileges to, and set up auditing for users for a policy during the user creation process.
- Granting Privileges to Trusted Program Units Using Cloud Control You can grant privileges to trusted program units in Cloud Control.
- Applying a Policy to a Database Table with Cloud Control
  You can apply an Oracle Label Security policy to a database table in Cloud
  Control.
- Applying Policy Labels to Table Rows Using Cloud Control
   You can apply Oracle Label Security policy labels to table rows in Cloud Control.
- Auditing Oracle Label Security Policies Using Cloud Control
   You can audit Oracle Label Security policies in Cloud Control, except if you are
   using unified auditing.

# Creating the Label Security Policy Container Using Cloud Control

You can create the Oracle Label Security policy container in Cloud Control.

- Log in to Cloud Control as the SYSTEM user.
- 2. To navigate to your database, select **Databases** from the **Targets** menu.
- 3. Click the database name in the list that appears.
  - The database page appears.
- 4. Under the **Administration** menu, select **Security, Oracle Label Security.** The Label Security Policies page appears.
  - You may be required to log in to the database with appropriate credentials. You can use the LBACSYS account credentials that you create in Enabling the LBACSYS Oracle Label Security.
- 5. Click **Create** to start creating a new label security policy. The Create Label Security Policy page appears.
- 6. Define the policy's name, label column, and the default policy enforcement options.
  - Name: Enter a name for the policy, for example, ACCESS\_LOCATIONS.
  - **Label Column**: (Optional) Enter a name for the label column, for example, OLS\_COLUMN. If you create an OLS policy without specifying the column name, the column name is auto-generated as <code>Pol\_name\_COL.Later</code> on, when you apply the policy to a table, the label column is added to that table. By default, the data type of the policy label column is <code>NUMBER(10)</code>. You can also specify an existing table column of the <code>NUMBER(10)</code> data type as the label column.



- Hide Label Column: Select to hide the column. When you first create the
  policy, you may want to disable Hide Label Column during the development
  phase of the policy. When the policy is satisfactory and ready for use by users,
  hide the column so that it is transparent to applications.
- Enabled: Toggle to enable or disable the policy.
- Default Policy Enforcement Options: The default policy enforcement options
  are used when the policy is applied. Ensure that these meet the needs of the
  application to which you are applying the policy.

Select from the following options:

- Apply No Policy Enforcements (NO\_CONTROL)
- Apply Policy Enforcements

For all gueries (READ CONTROL)

For Insert operations (INSERT\_CONTROL)

For Update Operations (UPDATE\_CONTROL)

Use session's default label for label column update (LABEL\_DEFAULT)

Operations that update the label column (LABEL\_UPDATE)

Update and Insert operations so that they are read accessible (CHECK CONTROL)

Click OK.

The new policy appears in the Oracle Label Security Policies page.

# Creating Policy Components Using Cloud Control

After you create a container for the policy and set enforcement options for it, you can create components for the policy.

- In the Oracle Label Security Policies page, select the policy you just created. Click
   Edit
- 2. In the Edit Label Security Policy page, select the **Label Components** tab.
- 3. Click **Add 5** Rows under Levels to add levels for the policy. Enter a Long Name, Short Name, and Numeric Tag for each level that you create. The numeric tag corresponds to the sensitivity of the level. To create more levels, you can click **Add 5** Rows again. Use the same steps to create compartments and rows. For compartments and groups, the numeric tags do not correspond to sensitivity.

At a minimum, you must create one level, such as  ${\tt SECRET}$ . Creating compartments and groups is optional.

The level numbers indicate the level of sensitivity for their corresponding labels. A greater number implies greater sensitivity. Select a numeric range that can be expanded later on, in case your security policy needs more levels. For example, if you have created levels PUBLIC (7000) and SENSITIVE (8000), and you now want to create an intermediate level called CONFIDENTIAL, then you can assign the numeric value 7500 to this level.

Compartments identify categories associated with data, providing a finer level of granularity within a level. For example, a single table might have data



corresponding to different departments that you might like to separate using compartments. Compartments are optional.

Groups identify organizations owning or accessing the data. Groups are useful for the controlled dissemination of data and for timely reaction to organizational change. Groups are optional.

4. Click Apply.

# Creating Data Labels for the Policy Using Cloud Control

You can create data labels for an Oracle Label Security policy in Cloud Control.

- In the Label Security Policies page, select the policy that needs to have labels linked to levels.
- 2. In the Actions box, select Data Labels. Click Go.

The Data Labels page appears.

Click Add.

The Create Data Label page appears.

- 4. Enter the following information:
  - Numeric Tag: Enter a number that uniquely identifies the label. This number should be unique across all policies.
  - Level: Select a level from the list.
- You can optionally select Compartments to add to the label. To add compartments, click Add under Compartments. Select the compartments to be added to the label. Click Select to add the compartments.
- Optionally, to add groups, click Add under Groups. Select the groups to be added to the label. Click Select to add the groups.
- 7. Click **OK** in the Create Data Label page.

The data label appears in the Data Labels page.

Repeat steps 3 to 7 to create more data labels.

Alternatively, you can use the SA\_LABEL\_ADMIN package to define label components for a policy.



SA\_LABEL\_ADMIN Label Management PL/SQL Package

# Authorizing, Granting Privileges, and Auditing Users for a Policy Using Cloud Control

You can authorize, grant privileges to, and set up auditing for users for a policy during the user creation process.

In the Label Security Policies page, select the policy that needs authorization.



2. In the Actions box, select Authorization. Click Go.

The Create User page appears.

- 3. Add users as follows:
  - Under Database Users, click Add. In the Search and Select window, select users that you want and then click Select.
  - Under Non Database Users, click Add 5 Rows, and then add the user names of the non-database users that you want to add. Most application users are considered non-database users. A non-database user does not exist in the database. This can be any user name that meets the Oracle Database naming standards and can fit into the VARCHAR2(30) length field. However, be aware that Oracle Database does not automatically configure the associated security information for the non-database user when the application connects to the database. In this case, the application needs to call an Oracle Label Security function to assume the label authorizations of the specified user who is not a real database user.
- 4. In the Create User page, select the user that you want to authorize. Click Next. If you have multiple users that need the same authorizations, then select all users who need the same authorizations. Click Next.

The Privileges step appears.

Next, you can assign privileges to the user you selected in the preceding step.
 Privileges allow a database user to bypass certain controls enforced by the policy.
 Select the privileges you want to grant. Click Next.

If you do not want to assign any privileges to the user, then click **Next** without selecting any privileges.

The Labels, Compartments, and Groups step appears.

- 6. Next, to create the user label for the user: under Levels, use the flashlight icon to select data to enter for the following fields:
  - Maximum Level: Enter the highest level for read and write access for this
    user.
  - Minimum Level: Enter the lowest level for write access.
  - Default Level: Enter the default level when the user logs in.

This value is equal to or greater than the minimum level and equal to or less than the maximum level.

- Row Level: Enter the level given to the row when user writes to the table.
- Click Add under Compartments, to add compartments to the user label. Select the compartments to add. Click Select.
- 8. For each compartment that you add, you can select the following properties:
  - Write: Allows the user to write to data that has the compartment as part of its label
  - **Default**: Adds the compartment to the user's default session label
  - Row: Adds the compartment to the data label when the user writes to the table
- Click Add under Groups, to add groups to the user label. Select the groups and click Select.
- **10.** For each group that you add, you can select the following properties:



- Write: Allows the user to write to data that has the group as part of its label
- Default: Adds the group to the user's default session label
- **Row**: Adds the group to the data label when the user writes to the table

#### 11. Click Next.

The Audit step appears.

- **12.** Select from the following audit options:
  - Policy Applied:

**Audit On Success By** audits successful application of the policy to a table or schema. Select ACCESS to audit by access or SESSION to audit by session.

**Audit On Failure By** audits failed application of the policy to a table or schema. Select ACCESS to audit by access or SESSION to audit by session.

Policy Removed:

**Audit On Success By** audits successful removal of the policy from a table or schema. Select ACCESS to audit by access or SESSION to audit by session.

**Audit On Failure By** audits failed removal of the policy from a table or schema. Select ACCESS to audit by access or SESSION to audit by session.

Labels And Privileges Set:

**Audit On Success By** audits successful setting of user authorizations and privileges. Select ACCESS to audit by access or SESSION to audit by session.

**Audit On Failure By** audits failed setting of user authorizations and privileges. Select ACCESS to audit by access or SESSION to audit by session.

All Policy Specific Privileges:

**Audit On Success By** audits successful use of policy privileges. Select ACCESS to audit by access or SESSION to audit by session.

**Audit On Failure By** audits failed use of policy privileges. Select ACCESS to audit by access or SESSION to audit by session.

- 13. Click Next.
- **14.** You can review the policy authorization settings. Click **Finish** to create the policy authorization. Alternatively, you can click **Back** to modify the authorization settings.

Alternatively, you can use the SA\_USER\_ADMIN package to authorize users.

#### Granting Privileges to Trusted Program Units Using Cloud Control

You can grant privileges to trusted program units in Cloud Control.

- 1. In the Label Security Policies page, select the policy that needs authorization.
- 2. In the **Actions** box, select Authorization. Click **Go**.

The Authorization page appears.

- 3. Click the Trusted Program Units tab.
- Click Add to add Oracle Label Security privileges for a procedure, function, or package.



The Create Program Unit page appears.

- **5.** Enter the name of the procedure, function, or package, for which the privileges need to be granted, in the **Program Unit** field. You can also use the **Search** icon to search for the procedure, function, or package.
- **6.** Select one or more policy-specific privileges that need to be granted to the program unit. Click **OK**.

The trusted program unit is added to the Authorizations page.

Alternatively, you can use the **SA\_USER\_ADMIN** package to authorize trusted program units.

#### **Related Topics**

Administering and Using Trusted Stored Program Units
 You can use trusted stored program units to enhance system security.

# Applying a Policy to a Database Table with Cloud Control

You can apply an Oracle Label Security policy to a database table in Cloud Control.

- 1. In the Label Security Policies page, select the policy that needs to be applied to a table.
- 2. Select Apply from the **Actions** box. Click **Go**.

The Apply page appears.

3. Select the **Tables** tab to apply the policy to a table.

Select the **Schemas** tab if you are applying the policy to a schema. The process is same as applying the policy to a table.

4. Click Create.

The Add Table page appears.

- 5. Next to the **Table** box, click the flashlight icon.
- **6.** In the Search and Select window, enter the following information under Search:
  - **Schema**: Enter the name of the schema in which the table appears. Leaving this field empty displays tables in all schemas.
  - **Name**: Optionally, enter the name of the table. Leaving this box empty displays all the tables within the schema.

To narrow the search by using wildcards, use the percent (%) sign. For example, enter 0% to search for all tables beginning with the letter O.

Select the table and click Select.

The Add Table page appears.

- **8.** Enter the following information:
  - Policy Enforcement Options: Select enforcement options as needed. These
    options will apply to the table on top of the enforcement options that you
    selected when you created the policy in Step 1: Create the Label Security
    Policy Container.

To make no change from those enforcement options, that is, to use the same enforcement options created earlier, select **Use Default Policy Enforcement**. To add more enforcement options, select from the other options listed.



- Labeling Function: Optionally, specify a labeling function to automatically compute the label to be associated with a new or updated row. That function is always invoked thereafter to provide the data labels written under that policy, because active labeling functions take precedence over any alternative means of supplying a label.
- Predicate: Optionally, specify an additional predicate to combine (using AND or OR) with the label-based predicate for READ\_CONTROL.
- 9. Click OK.

# Applying Policy Labels to Table Rows Using Cloud Control

You can apply Oracle Label Security policy labels to table rows in Cloud Control.

- 1. In the Label Security Policies page, select the policy, for example, ACCESS\_LOCATIONS.
- 2. Select Authorization from the **Actions** box. Click **Go**.

The Authorization page appears.

3. Click Add.

The Create User page appears.

4. Under Database Users, click Add.

The Search and Select window appears.

**5.** Select the check box corresponding to the user that owns the table. Click **Select**.

The Create User page lists the user that was added.

6. Click Next.

The Privileges step appears.

7. Select the appropriate privileges for the user, and then click **Next**.

The Labels, Compartments, and Groups page appears.

8. Click Next.

The Audit step appears.

9. Click Next.

The Review step appears.

10. Click Finish.

#### Auditing Oracle Label Security Policies Using Cloud Control

You can audit Oracle Label Security policies in Cloud Control, except if you are using unified auditing.

- 1. In the Label Security Policies page, select the policy that you need to configure.
- 2. Click Edit.

The Edit Label Security Policy Settings page appears.

3. Click the **Advanced** tab. You can edit the audit settings under the Audit section.



- **4.** Select **Include Label In Audit trail** under Audit Labels, if you wish to include user session labels in the audit table.
- **5.** Select the **Operation**, to audit, under Audit Settings. You can choose from the following operations:
  - Policy Applied: Audits application of the policy to a table or schema.
  - Policy Removed: Audits removal of the policy from a table or schema.
  - Labels And Privileges Set: Audits setting of user authorizations and privileges.
  - All Policy Specific Privileges: Audits use of policy privileges.
- 6. Click **Add** under Policy Applied to add users that will be audited for the **Operation** you selected in the preceding step.
  - The Search and Select window appears.
- 7. Select the users that you need to add. Click **Select**.
- 8. Select values for **Audit on Success By** and **Audit on Failure By**, for each user that you added.
  - For each user that you added, you can choose to audit successful and failed instances of the chosen operation. You can also choose to audit by access or session.
- 9. Repeat steps 5 to 8 for each operation that you choose to audit.

#### **Related Topics**

Auditing Under Oracle Label Security
 You can use Oracle Label Security auditing if you have not configured your
 database to use unified auditing.



6

# Working with Labeled Data

You can manage labeled data, view that data of security attributes for a session, and change the value of session attributes.



Many of the examples in this guide use the <code>HUMAN\_RESOURCES</code> sample policy. Its policy name is <code>HR</code> and its policy label column is <code>HR\_LABEL</code>. Unless otherwise noted, the examples assume that the SQL statements are performed on rows within the user's authorization and with full Oracle Label Security policy enforcement in effect.

How Policy Label Column and Label Tags Work

You should understand how policy label columns in a table or schema are created and filled.

Assignments of Labels to Data Rows

For existing data rows, labels can be assigned by a labeling function that you create.

Presenting the Label

When you retrieve labels, you do not automatically obtain the character string value.

Filtration of Data Using Labels

When SQL statements are processed, Oracle Label Security makes calls to the security policies defined in the database by create-and-apply procedures.

Inserting Labeled Data

You can insert labeled data in a variety of situations.

Changing Session and Row Labels

During a session, a user can change labels based on the authorizations an administrator sets.

# How Policy Label Column and Label Tags Work

You should understand how policy label columns in a table or schema are created and filled.

The Policy Label Column

You should understand how to use policy label columns.

Label Tags

You can create label tags, either manually or automatically generating them, that define the label components.

#### The Policy Label Column

You should understand how to use policy label columns.

- About the Policy Label Column
   Each policy that is applied to a table creates a column in the database.
- Hiding the Policy Label Column
   You can choose not to display the column representing a policy.

#### About the Policy Label Column

Each policy that is applied to a table creates a column in the database.

By default, the data type of the NUMBER.

Each row's label for that policy is represented by a tag in that column, using the numeric equivalent of the character-string label value. The label tag is automatically generated when the label is created, unless the administrator specifies the tag manually at that time.

The automatic label generation follows the rules established by the administrator while defining the label components, as described in Understanding Data Labels and User Labels.



The act of creating a policy does not in itself have any effect on tables or schemas. It only applies the policy to a table or schema.

#### Hiding the Policy Label Column

You can choose not to display the column representing a policy.

To hide the display of a column, apply the HIDE option to the table.

After a policy using HIDE is applied to a table, a user executing a SELECT \* or performing a DESCRIBE operation will not see the policy label column. If the policy label column is not hidden, then the label tag is displayed as data type NUMBER.

#### **Example 1: Numeric Column Data Type (NUMBER)**

| DESCRIBE | EMP; |      |              |             |
|----------|------|------|--------------|-------------|
| Name     |      | Null | l?           | Type        |
|          |      |      |              |             |
| EMPNO    |      | NOT  | ${\tt NULL}$ | NUMBER (4)  |
| ENAME    |      |      |              | CHAR(10)    |
| JOB      |      |      |              | CHAR(9)     |
| MGR      |      |      |              | NUMBER (4)  |
| SAL      |      |      |              | NUMBER(7,2) |
| DEPTNO   |      | NOT  | NULL         | NUMBER(2)   |
| HR_LABE  | _    |      |              | NUMBER(10)  |



#### **Example 2: Numeric Column Data Type with Hidden Column**

Notice that in this example, the HR\_LABEL column is *not* displayed.

| DESCRIBE EMP;<br>Name | Null?      | Туре                  |
|-----------------------|------------|-----------------------|
| EMPNO<br>ENAME        | NOT NULL   | NUMBER(4)<br>CHAR(10) |
| JOB                   |            | CHAR(9)               |
| MGR                   |            | NUMBER (4)            |
| SAL                   |            | NUMBER (7,2)          |
| DEPTNO                | NO.L. NOPP | NUMBER (2)            |

#### **Related Topics**

How the HIDE Policy Column Option Works

You can specify the HIDE policy configuration option when you add an Oracle Label Security policy column to a table.

# Label Tags

You can create label tags, either manually or automatically generating them, that define the label components.

- About Label Tags
  - The administrator first defines a set of label components to be used in a policy.
- Manually Defined Label Tags to Order Labels
   By manually defining label tags, you can implement a data manipulation strategy that permits labels to be meaningfully sorted and compared.
- Manually Defined Label Tags to Manipulate Data
   An administratively defined label tag is a convenient way to reference a complete label string (that is, a combination of label components).
- Automatically Generated Label Tags
   Dynamically generated label tags have 10 digits, with no relationship to numbers assigned to any label component.

#### About Label Tags

The administrator first defines a set of label components to be used in a policy.

When creating labels, the administrator specifies the set of valid combinations of components that can make up a label, that is, a level optionally combined with one or more groups or compartments.

Each such valid label within a policy is uniquely identified by an associated numeric tag assigned by the administrator or generated automatically upon its first use. Manual definition has the advantage of allowing the administrator to control the ordering of label values when they are sorted or logically compared.

However, label tags must be unique across all policies in the database. When you use multiple policies in a database, you cannot use the same numeric label tag in different policies. Remember that each label tag uniquely identifies one label, and that numeric tag is what is stored in the data rows, not the label's character-string representation.



#### Manually Defined Label Tags to Order Labels

By manually defining label tags, you can implement a data manipulation strategy that permits labels to be meaningfully sorted and compared.

To do this, you must predefine all of the labels to be associated with protected data, and assigns to each label a meaningful label tag value. Manually assigned label tags can have up to eight digits. The value of a label tag must be greater than zero.

It may be advantageous to implement a strategy in which label tag values are related to the numeric values of label components. In this way, you can use the tags to group data rows in a meaningful way. This approach, however, is not mandatory. It is good practice to set tags for labels of higher sensitivity to a higher numeric value than tags for labels of lower sensitivity.

Table 6-1 illustrates a set of label tags that have been assigned. Notice that, in this example, the administrator has based the label tag value on the numeric form of the levels, compartments, and rows that were discussed in Understanding Data Labels and User Labels.

Table 6-1 Administratively Defined Label Tags (Example)

| Label Tag | Label String |
|-----------|--------------|
| 10000     | Р            |
| 20000     | С            |
| 21000     | C:FNCL       |
| 21100     | C:FNCL,OP    |
| 30000     | S            |
| 31110     | S:OP:WR      |
| 40000     | HS           |
| 42000     | HS:OP        |

In this example, labels with a level of PUBLIC begin with "1", labels with a level of CONFIDENTIAL begin with "2", labels with a level of SENSITIVE begin with "3", and labels with a level of HIGHLY\_SENSITIVE begin with "4".

Labels with the FINANCIAL compartment then come in the 1000 range, labels with the compartment op are in the 1100 range, and so on. The tens place is used to indicate the group WR, for example.

Another strategy might be completely based on groups, where the tags might be 3110, 3120, 3130, and so on.

Note, however, that label tags identify the *whole* label, independent of the numeric values assigned for the individual label components. The label tag is used as a whole integer, not as a set of individually evaluated numbers.

# Manually Defined Label Tags to Manipulate Data

An administratively defined label tag is a convenient way to reference a complete label string (that is, a combination of label components).



As illustrated in Table 6-1, for example, the tag "31110" could stand for the complete label string "S:OP:WR".

Label tags can be used as a convenient way to partition data. For example, all data with labels in the range 1000 - 1999 could be placed in tablespace A, all data with labels in the range 2000 - 2999 could be placed in tablespace B, and so on.

This simplified notation also comes in handy when there is a finite number of labels and you need to perform various operations upon them. Consider a situation in which one company hosts a human resources system for many other companies. Assume that all users from Company Y have the label "C:ALPHA:CY", for which the tag "210" has been set. To determine the total number of application users from Company Y, the host administrator can enter:

```
SELECT * FROM tab1
WHERE hr_label = 210;
```

#### **Automatically Generated Label Tags**

Dynamically generated label tags have 10 digits, with no relationship to numbers assigned to any label component.

You cannot group the data by label.

Table 6-2 describes how automatically generated label tags work.

**Table 6-2 Generated Label Tags (Example)** 

| Label Tag | Label String |
|-----------|--------------|
| 100000020 | P            |
| 100000052 | C            |
| 100000503 | C:FNCL       |
| 100000132 | C:FNCL,OP    |
| 100000003 | S            |
| 100000780 | S:OP:WR      |
| 100000035 | HS           |
| 100000036 | HS:OP        |

# Assignments of Labels to Data Rows

For existing data rows, labels can be assigned by a labeling function that you create.

In such a function, you specify the exact table and row conditions defining what label to insert. The function can be named in the call to apply a policy to a table or schema, or in an update by the administrator.

#### **Related Topics**

Inserting Labeled Data
 You can insert labeled data in a variety of situations.



Labeling Functions

Labeling functions can compute and return a label using resources such as context variables (for example, date or username) and data values.

- SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY
  The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure adds the specified policy to a table.
- SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY
  The SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY procedure applies a policy to all of the tables in a schema and enables the policy for these tables.

# Presenting the Label

When you retrieve labels, you do not automatically obtain the character string value.

By default, the label tag value is returned. Two label manipulation functions enable you to convert the label tag value to and from its character string representation.

- Converting a Character String to a Label Tag with CHAR\_TO\_LABEL
   The CHAR\_TO\_LABEL function converts character strings to a label tag, returning the label tag for the specified character string.
- Conversion of a Label Tag to a Character String, with LABEL\_TO\_CHAR
  You can convert label tags to character strings.

# Converting a Character String to a Label Tag with CHAR\_TO\_LABEL

The CHAR\_TO\_LABEL function converts character strings to a label tag, returning the label tag for the specified character string.

• To convert a character string to a label tab, use the following syntax for the CHAR\_TO\_LABEL function:

#### For example:

```
INSERT INTO emp (empno,hr_label)
VALUES (999, CHAR_TO_LABEL('HR','S:A,B:G5');
```

Here,  ${\tt HR}$  is the label policy name,  ${\tt S}$  is a sensitivity level,  ${\tt A}, {\tt B}$  compartments, and  ${\tt G5}$  a group.

Here,  ${\tt HR}$  is the label policy name,  ${\tt S}$  is a sensitivity level,  ${\tt A}$ ,  ${\tt B}$  compartments, and  ${\tt G5}$  a group.



# Conversion of a Label Tag to a Character String, with LABEL\_TO\_CHAR

You can convert label tags to character strings.

- Converting a Label Tag to a Character String with LABEL\_TO\_CHAR
   The LABEL\_TO\_CHAR function returns a VARCHAR2 string when it converts a label tag to a character string.
- LABEL\_TO\_CHAR Examples
   Oracle provides examples that illustrate the use of LABEL\_TO\_CHAR.
- Retrieving All Columns from a Table When the Policy Label Column Is Hidden
  If the policy label column is hidden, then it is not automatically returned when you
  execute SELECT \* on the table.

#### Converting a Label Tag to a Character String with LABEL\_TO\_CHAR

The LABEL\_TO\_CHAR function returns a VARCHAR2 string when it converts a label tag to a character string.

When you query a table or view, you automatically retrieve all of the rows in the table or view that satisfy the qualifications of the query and are dominated by your label. If the policy label column is not hidden, then the label tag value for each row is displayed. You must use the LABEL\_TO\_CHAR function to display the character string value of each label.

Note that all conversions must be explicit. There is no automatic casting to and from tag and character string representations.

 To convert a label tag to a character string, use the following syntax for the LABEL\_TO\_CHAR function:

```
FUNCTION LABEL_TO_CHAR (
          label IN NUMBER)
RETURN VARCHAR2;
```

# LABEL\_TO\_CHAR Examples

Oracle provides examples that illustrate the use of LABEL TO CHAR.

#### Example: Retrieving a Row Label from a Table or a View

To retrieve the label of a row from a table or view, specify the policy label column in the SELECT statement.

#### For example:

```
SELECT label_to_char (hr_label) AS label, ename FROM tabl;
WHERE ename = 'RWRIGHT';
```

#### This statement returns the following:



#### **Example: Retrieving a Policy Label Column**

You can also specify the policy label column in the WHERE clause of a SELECT statement.

The following statement displays all rows that have the policy label S:A,B:G1

```
SELECT label_to_char (hr_label) AS label,ename FROM emp
WHERE hr_label = char_to_label ('HR', 'S:A,B:G1');
```

This statement returns the following:

| LABEL    | ENAME    |  |  |
|----------|----------|--|--|
|          |          |  |  |
| S:A,B:G1 | RWRIGHT  |  |  |
| S:A,B:G1 | ESTANTON |  |  |

Alternatively, you could use a more flexible statement to look up data that contains the string "S:A,B:G1" anywhere in the text of the  $HR_LABEL$  column:

```
SELECT label_to_char (hr_label) AS label,ename FROM emp
WHERE label_to_char (hr_label) like '%S:A,B:G1%';
```

If you do not use the LABEL\_TO\_CHAR function, then you will see the label tag.

#### **Example: Retrieving a Numeric Column Data Type**

The following example is with the numeric column data type (NUMBER) and dynamically generated label tags, but without using the LABEL\_TO\_CHAR function. If you do not use the LABEL\_TO\_CHAR function, then you will see the label tag.

#### Retrieving All Columns from a Table When the Policy Label Column Is Hidden

If the policy label column is hidden, then it is not automatically returned when you execute SELECT \* on the table.

To explicitly specify that you want to retrieve a label, use the LABEL\_TO\_CHAR function in the SELECT statement.

For example, to retrieve all columns from the DEPT table (including the policy label column in its character representation), enter the following:

```
COLUMN LABEL FORMAT a10 SELECT LABEL_TO_CHAR (hr_label) AS LABEL, DEPT.* FROM DEPT;
```

Running these SQL statements returns the following data:

Table 6-3 Data Returned from Sample SQL Statements re Hidden Column

| LABEL | DEPTNO | DNAME      | LOC      |
|-------|--------|------------|----------|
| L1    | 10     | ACCOUNTING | NEW YORK |



Table 6-3 (Cont.) Data Returned from Sample SQL Statements re Hidden Column

| LABEL | DEPTNO | DNAME      | LOC     |
|-------|--------|------------|---------|
| L1    | 20     | RESEARCH   | DALLAS  |
| L1    | 30     | SALES      | CHICAGO |
| L1    | 40     | OPERATIONS | BOSTON  |

By contrast, if you do not explicitly specify the  $\mbox{HR\_LABEL}$  column, the label is not displayed at all. Note that while the policy column name is on a policy basis, the  $\mbox{HIDE}$  option is on a table-by-table basis.

#### **Related Topics**

How the HIDE Policy Column Option Works
 You can specify the HIDE policy configuration option when you add an Oracle
 Label Security policy column to a table.

## Filtration of Data Using Labels

When SQL statements are processed, Oracle Label Security makes calls to the security policies defined in the database by create-and-apply procedures.

For SELECT statements, the policy filters the data rows that the user is authorized to see. For INSERT, UPDATE, and DELETE statements, Oracle Label Security permits or denies the requested operation, based on the user's authorizations.

- Use of Numeric Label Tags in WHERE Clauses
   There are different techniques of using numeric label tags in WHERE clauses of SELECT statements.
- Ordering Labeled Data Rows
   The ORDER BY clause of a SELECT statement can be used to order rows by the numeric label tag.
- Ordering by Character Representation of Label
   The LABEL\_TO\_CHAR function orders data rows by the character representation of the label.
- Determination of the Upper and Lower Bounds of Labels
   Oracle Label Security provides functions that determine the least upper bound or the greatest lower bound of two or more labels.
- Merging Labels with the MERGE\_LABEL Function
   The MERGE LABEL function merges two labels together.

## Use of Numeric Label Tags in WHERE Clauses

There are different techniques of using numeric label tags in where clauses of Select statements.

When using labels in the NUMBER format, you can set up labels so that a list of your label tags distinguishes the different levels. Comparisons of these numeric label tags can be used for ORDER BY processing, and with the logical operators.

For example, if you have assigned all <code>UNCLASSIFIED</code> labels to the 1000 range, all <code>SENSITIVE</code> labels to the 2000 range, and all <code>HIGHLY\_SENSITIVE</code> labels to the 3000 range, then you can list all <code>SENSITIVE</code> records.

```
SELECT * FROM emp
WHERE hr_label BETWEEN 2000 AND 2999;
```

To list all SENSITIVE and UNCLASSIFIED records, you can enter:

```
SELECT * FROM emp
WHERE hr_label <3000;</pre>
```

To list all HIGHLY\_SENSITIVE records, you can enter:

```
SELECT * FROM emp
WHERE hr_label=3000;
```



Remember that such queries have meaning only if the administrator has applied a numeric ordering strategy to the label tags that he or she originally assigned to the labels. In this way, the administrator can provide for convenient dissemination of data. If, however, the label tag values are generated automatically, then there is no intrinsic relationship between the value of the tag and the order of the labels.

Alternatively, you can use dominance relationships to set up an ordering strategy.

#### **Related Topics**

Using Dominance Functions
 Oracle Label Security provides functions to control dominance.

### Ordering Labeled Data Rows

The ORDER BY clause of a SELECT statement can be used to order rows by the numeric label tag.

 To perform the ORDER BY operation, use a SELECT statement similar to the following:

```
SELECT * from emp
ORDER BY hr_label;
```

Notice that no functions were necessary in this statement. The statement made use of label tags set up by the administrator.



Again, such queries have meaning only if the administrator has applied a numeric ordering strategy to the label tags originally assigned to the labels.



## Ordering by Character Representation of Label

The LABEL\_TO\_CHAR function orders data rows by the character representation of the label.

• To order data rows by the character representation of a label, use a statement similar to the following, which returns all rows sorted by the text order of the label:

```
SELECT * FROM emp
ORDER BY label_to_char (hr_label);
```

### Determination of the Upper and Lower Bounds of Labels

Oracle Label Security provides functions that determine the least upper bound or the greatest lower bound of two or more labels.

Two single-row functions operate on each row returned by a query. They return one result for each row.



In all functions that take multiple labels, the labels must all belong to the same policy.

- Finding Least Upper Bound with LEAST\_UBOUND
  The OLS\_LEAST\_UBOUND (OLS\_LUBD) function returns a character string label that is the least upper bound of label1 and label2:.
- Finding Greatest Lower Bound with GREATEST\_LBOUND

  The OLS\_GREATEST\_LBOUND (OLS\_GLBD) standalone function determines the lowest label of the data that can be involved in an operation, given two different labels.

## Finding Least Upper Bound with LEAST\_UBOUND

The OLS\_LEAST\_UBOUND (OLS\_LUBD) function returns a character string label that is the least upper bound of <code>label1</code> and <code>label2</code>:.

That is, the one label that dominates both. The least upper bound is the highest level, the union of the compartments in the labels, and the union of the groups in the labels.

For example, the least upper bound of <code>HIGHLY\_SENSITIVE:ALPHA</code> and <code>SENSITIVE:BETA</code> is <code>HIGHLY\_SENSITIVE:ALPHA</code>, <code>BETA</code>.

To find the least upper bound, use the following syntax:

The OLS\_LEAST\_UBOUND function is useful when joining rows with different labels, because it provides a high water mark label for joined rows.

The following query compares each employee's label with the label of his or her department, and returns the higher label, whether it be in the EMP table or the DEPT table.

```
SELECT ename,dept.deptno,
  OLS_LEAST_UBOUND(emp.hr_label,dept.hr_label) as label
FROM emp, dept
WHERE emp.deptno=dept.deptno;
```

This query returns the following data:

Table 6-4 Data Returned from Sample SQL Statements re Least\_UBound

| ENAME  | DEPTNO | LABEL    |
|--------|--------|----------|
| KING   | 10     | L3:M:D10 |
| BLAKE  | 30     | L3:M:D30 |
| CLARK  | 10     | L3:M:D10 |
| JONES  | 20     | L3:M:D20 |
| MARTIN | 30     | L2:E:D30 |



The old OLS functions, LEAST\_UBOUND and LUBD have been deprecated in Oracle Database 12c release 1 (12.1).

You can still use the old functions in this release, but Oracle recommends that you use the <code>OLS\_LEAST\_UBOUND</code> and <code>OLS\_LUBD</code> functions instead. Using the new function names avoids potential name conflicts with other database components.

### Finding Greatest Lower Bound with GREATEST\_LBOUND

The OLS\_GREATEST\_LBOUND (OLS\_GLBD) standalone function determines the lowest label of the data that can be involved in an operation, given two different labels.

This function returns a character string label that is the greatest lower bound of <code>label1</code> and <code>label2</code>. The greatest lower bound is the lowest level, the intersection of the compartments in the labels and the groups in the labels. For example, the greatest lower bound of <code>HIGHLY\_SENSITIVE:ALPHA</code> and <code>SENSITIVE</code> is <code>SENSITIVE</code>.

To find the greatest lower bound, use the following syntax:



#### Note:

The old OLS functions, GREATEST\_LBOUND and GLBD were deprecated in Oracle Database 12c release 1 (12.1).

You can still use the old functions in this release, but Oracle recommends that you use the <code>OLS\_GREATEST\_LBOUND</code> and <code>OLS\_GLBD</code> functions instead. Using the new function names avoids potential name conflicts with other database components.

## Merging Labels with the MERGE\_LABEL Function

The MERGE\_LABEL function merges two labels together.

It accepts the character string form of two labels and the three-character specification of a merge format.

To merge labels, use the following syntax:

The valid merge format is specified with a three-character string:

<highest level or lowest level><union or intersection of
compartments><union or intersection of groups>

- The first character indicates whether to merge using the highest level or the lowest level of the two labels.
- The second character indicates whether to merge using the union or the intersection of the compartments in the two labels.
- The third character indicates whether to merge using the union or the intersection of the groups in the two labels.

Table 6-5 defines the MERGE\_LABEL format constants.

Table 6-5 MERGE\_LABEL Format Constants

| Format<br>Specification | Data Type            | Consta<br>nt | Meaning                 | Positions in<br>Which Format Is<br>Used           |
|-------------------------|----------------------|--------------|-------------------------|---|
| max_lvl_fmt             | CONSTANT varchar2(1) | H            | Maximum level           | First (level)                                     |
| min_lvl_fmt             | CONSTANT varchar2(1) | L            | Minimum level           | First (Level)                                     |
| union_fmt               | CONSTANT varchar2(1) | ΰ            | Union of the two labels | Second<br>(compartments)<br>and Third<br>(groups) |



Table 6-5 (Cont.) MERGE\_LABEL Format Constants

| Format<br>Specification | Data Type               | Consta<br>nt | Meaning   | Positions in<br>Which Format Is<br>Used           |
|-------------------------|-------------------------|--------------|---|---|
| inter_fmt               | CONSTANT<br>varchar2(1) | I            | Intersection of the two labels  | Second<br>(compartments)<br>and Third<br>(groups) |
| minus_fmt               | CONSTANT<br>varchar2(1) | М            | Remove second label from first label  | Second<br>(compartments)<br>and Third<br>(groups) |
| null_fmt                | CONSTANT<br>varchar2(1) | N            | If specified in compartments column, returns no compartments. If specified in groups column, returns no groups. | Second<br>(compartments)<br>and Third<br>(groups) |

For example,  ${\tt HUI}$  specifies the highest level of the two labels, union of the compartments, intersection of the groups.

The MERGE\_LABEL function is particularly useful to developers if the LEAST\_UBOUND function does not provide the intended result. The LEAST\_UBOUND function, when used with two labels containing groups, may result in a less sensitive data label than expected. The MERGE\_LABEL function enables you to compute an intersection on the groups, instead of the union of groups that is provided by the LEAST\_UBOUND function.

For example, if the label of one data record contains the group UNITED\_STATES, and the label of another data record contains the group UNITED\_KINGDOM, and the LEAST\_UBOUND function is used to compute the least upper bound of these two labels, then the resulting label would be accessible to users authorized for either the UNITED\_STATES or the UNITED\_KINGDOM.

If, by contrast, the MERGE\_LABEL function is used with a format clause of HUI, then the resulting label would contain the highest level, the union of the compartments, and no groups. This is because UNITED STATES and UNITED KINGDOM do not intersect.

## **Inserting Labeled Data**

You can insert labeled data in a variety of situations.

- About Inserting Labeled Data
   When you insert data into a table protected by an Oracle Label Security policy, you must supply a numeric label value tag.
- Inserting Labels Using CHAR\_TO\_LABEL
   To insert a row label, you can specify the label character string and then transform it into a label using the CHAR\_TO\_LABEL function.
- Inserting Labels Using Numeric Label Tag Values
   You can insert data using the numeric label tag value of a label, rather than using the CHAR\_TO\_LABEL function.



- Inserting Data Without Specifying a Label

  There are two situations in which you do not need to specify a label.

  There are two situations in which you do not need to specify a label.
  - There are two situations in which you do not need to specify a label in INSERT statements.
- Inserting Data When the Policy Label Column Is Hidden
  If the label column is hidden, then the existence of the column is transparent to the
  insertion of data.
- Inserting Labels Using TO\_DATA\_LABEL
   The TO\_DATA\_LABEL function can generate new labels dynamically.

## About Inserting Labeled Data

When you insert data into a table protected by an Oracle Label Security policy, you must supply a numeric label value tag.

Usually, you can insert this value in the INSERT statement itself.

To do this, you must explicitly specify the tag for the desired label or explicitly convert the character string representation of the label into the correct tag. Note that this does not mean generating new label tags, but referencing the correct tag. When Oracle Label Security is using Oracle Internet Directory, the only permissible labels (and corresponding tags) are those pre-defined by the administrator and already in Oracle Internet Directory.

The only times an INSERT statement may omit a label value are:

- If the LABEL\_DEFAULT enforcement option was specified when the policy was applied, or
- If no enforcement options were specified when the policy was applied and LABEL\_DEFAULT was specified when the policy was created
- If the statement applying the policy named a labeling function.

In the first two cases, the user's session default row label is used as the inserted row's label. In the third case, the inserted row's label is created by that labeling function.

#### **Related Topics**

- Labeling Functions
  - Labeling functions can compute and return a label using resources such as context variables (for example, date or username) and data values.
- Implementing Policy Enforcement Options and Labeling Functions
   You can customize the enforcement of Oracle Label Security policies and implement labeling functions.

## Inserting Labels Using CHAR\_TO\_LABEL

To insert a row label, you can specify the label character string and then transform it into a label using the CHAR\_TO\_LABEL function.

The CHAR\_TO\_LABEL function automatically creates a valid data label.

To insert labels, use an INSERT INTO statement.

Using the definition for table emp, the following example shows how to insert data with explicit labels:



```
INSERT INTO emp (ename,empno,hr_label)
VALUES ('ESTANTON',10,char_to_label ('HR', 'SENSITIVE'));
```

### Inserting Labels Using Numeric Label Tag Values

You can insert data using the numeric label tag value of a label, rather than using the CHAR\_TO\_LABEL function.

To insert labels using numeric label tag values, use an INSERT INTO statement.

For example, if the numeric label tag for SENSITIVE is 3000, it would appear as follows:

```
INSERT INTO emp (ename, empno, hr_label)
VALUES ('ESTANTON', 10, 3000);
```

## Inserting Data Without Specifying a Label

There are two situations in which you do not need to specify a label in INSERT statements.

If LABEL\_DEFAULT is set, or if there is a labeling function applied to the table, then you do not need to specify a label in your INSERT statements. The label will be provided automatically.

To insert data without specifying a label, use an INSERT INTO statement.

#### For example:

```
INSERT INTO emp (ename, empno)
VALUES ('ESTANTON', 10);
```

The resulting row label is set according to the default value (or by a labeling function).

### Inserting Data When the Policy Label Column Is Hidden

If the label column is hidden, then the existence of the column is transparent to the insertion of data.

INSERT statements can be written that do not explicitly list the table columns and do not include a value for the label column.

The session's row label is used to label the data, or a labeling function is used if one was specified when the policy was applied to the table or schema.

You can insert into a table without explicitly naming the columns, as long as you specify a value for each non-hidden column in the table. The following example shows how to insert a row into the table described in Example 2: Numeric Column Data Type with Hidden Column:

To insert data when the policy label column is hidden, use the following syntax:

```
INSERT INTO emp
VALUES ('196','ESTANTON',Technician,RSTOUT,50000,10);
```

Its label will be one of the following three possibilities:

- The label you specify
- The label established by the LABEL DEFAULT option of the policy being applied
- The label created by a labeling function named by the policy being applied





If the policy label column is *not* hidden, then you must explicitly include a label value (possibly null, indicated by a comma) in the INSERT statement.

## Inserting Labels Using TO\_DATA\_LABEL

The TO\_DATA\_LABEL function can generate new labels dynamically.

This approach guarantees that the data labels are valid. However, be aware that when Oracle Label Security is installed to work with Oracle Internet Directory, dynamic label generation is not allowed, because labels are managed centrally in Oracle Internet Directory, using olsadmintool commands. Therefore, when Oracle Label Security is directory-enabled, this function, TO\_DATA\_LABEL, is not available and will generate an error message if used.

- 1. Ensure that you have the EXECUTE privilege on the TO\_DATA\_LABEL function.
- Use the TO\_DATA\_LABEL as necessary, for example, in an INSERT INTO statement.

#### For example:

```
INSERT INTO emp (ename, empno, hr_label)
VALUES ('ESTANTON', 10, to_data_label ('HR', 'SENSITIVE'));
```



The  ${\tt TO\_DATA\_LABEL}$  function must be explicitly granted to individuals, in order to be used. Its usage should be tightly controlled.

#### **Related Topics**

Command-line Tools for Label Security Using Oracle Internet Directory
 Oracle Label Security provides command-line tools for using Oracle Internet
 Directory.

## Changing Session and Row Labels

During a session, a user can change labels based on the authorizations an administrator sets.

#### **Related Topics**

SA\_SESSION Session Management PL/SQL Package
 The SA\_SESSION PL/SQL package manages session behavior for user authorizations.



7

# Oracle Label Security Using Oracle Internet Directory

You can use Oracle Label Security with Oracle Internet Directory.

- About Label Management on Oracle Internet Directory
   Managing Oracle Label Security metadata in a centralized LDAP repository
   provides many benefits.
- Configuring Oracle Internet Directory-Enabled Label Security
  You can configure Oracle Internet Directory-enabled Oracle Label Security.
- Removing Directory-Enabled Oracle Label Security from Database
   You can remove Oracle Internet Directory-enabled Oracle Label Security from a database.
- Oracle Label Security Profiles
   A user profile is a set of user authorizations and privileges.
- Integrated Capabilities When Label Security Uses the Directory
  The integration of Oracle Label Security and Oracle Internet Directory enables the several capabilities.
- Oracle Label Security Policy Attributes in Oracle Internet Directory
   In Oracle Internet Directory, Oracle-related metadata is stored under cn=OracleContext.
- Subscription of Policies in Directory-Enabled Label Security
  In an Oracle Internet Directory-enabled Oracle Label Security, you must subscribe
  a policy before it can be applied (by SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY or
  SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY).
- Restrictions on New Data Label Creation
   When Oracle Label Security is used with Oracle Internet Directory, data labels must be pre-defined in the directory.
- Administrator Duties for Oracle Internet Directory and Oracle Label Security
   Administrators listed within a policy are those individuals authorized to do the
   olicy-specific administrative tasks.
- Bootstrapping Databases
   After you register a new database with Oracle Internet Directory, you can install
   Oracle Internet Directory enabled Oracle Label Security on that database.
- Synchronizing the Database and Oracle Internet Directory
   After you have installed and configured Oracle Internet Directory with Oracle Label Security, you should synchronize the database with OID and OLS.
- Security Roles and Permitted Actions
   Oracle Label Security permits specific tasks and access levels for Oracle Internet Directory, including restrictions on directory-enabled OLS policy creators.
- Superseded PL/SQL Statements When OID Is Enabled with OLS
   When Oracle Internet Directory is enabled with Oracle Label Security, there are several procedures that are superseded.

Oracle Label Security Procedures for Policy Administrators
 Several procedures in the SA\_POLICY\_ADMIN PL/SQL package are allowed to be
 run only by policy administrators (enterprise users defined in Oracle Internet
 Directory).

## About Label Management on Oracle Internet Directory

Managing Oracle Label Security metadata in a centralized LDAP repository provides many benefits.

- You can easily provision policies and user label authorizations, and distribute them throughout the enterprise.
- When employees are terminated, you can revoke their label authorizations in one place and the change automatically propagates throughout the enterprise.

Previous releases of Oracle Label Security relied on the Oracle Database as the central repository for policy and user label authorizations. This leveraged the scalability and high availability of the Oracle Database, but not the identity management infrastructure, which includes the Oracle Internet Directory (OID). Integrating your installation of Oracle Label Security with Oracle Internet Directory allows label authorizations as part of your standard provisioning process.

These advantages apply also to directory-stored information about policies, user labels, and privileges that Oracle Label Security assigns to users. These labels and privileges are specific to the installation policies defining access control on tables and schemas. If a site is not using Oracle Internet Directory, then such information is stored locally in the database.

The following Oracle Label Security information is stored in the directory:

- Policy information, specifically policy name, column name, policy enforcement options, and audit options
- User profiles identifying their labels and privileges
- Policy label components: levels, compartments, and groups
- Policy data labels

Database-specific metadata, such as the following, is not stored in the directory:

- · Lists of schemas or tables, with associated policy information
- Program units, with associated policy privileges

Note the following important aspects of integrating an Oracle Label Security installation with Oracle Internet Directory (OID):



Oracle will continue to support both the database and directory-based (OID) architectures for Oracle Label Security. However, a single database environment cannot host both architectures. Administrators must decide whether to use the centralized LDAP administration model or the database-centric model.



#### Note:

You can manage Oracle Label Security policies directly in the directory using the Oracle Label Security administration tool (olsadmintool).

You can also use the graphical user interface provided by Oracle Enterprise Manager to manage Oracle Label Security. The Oracle Enterprise Manager help contains detailed documentation.

For sites that use Oracle Internet Directory, databases retrieve Oracle Label Security policy information from the directory. Administrators use the <code>olsadmintool</code> policy administration tool or the Enterprise Manager graphical user interface to operate directly on the directory to insert, alter, or remove metadata as needed. Because enterprise users can log in to multiple databases using the credentials stored in Oracle Internet Directory, it is logical to store their Oracle Label Security policy authorizations and privileges there as well. An administrator can then modify these authorizations and privileges by updating such metadata in the directory.

For distributed databases, centralized policy management removes the need for replicating policies, because the appropriate policy information is available in the directory. Changes are effective without further effort, synchronized with policy information in the databases by means of the Directory Integration Platform.

#### See Also:

Synchronization using the Directory Integration Platform is described in the Oracle Identity Management Integration Guide

Figure 7-1 illustrates the structure of metadata storage in Oracle Internet Directory.



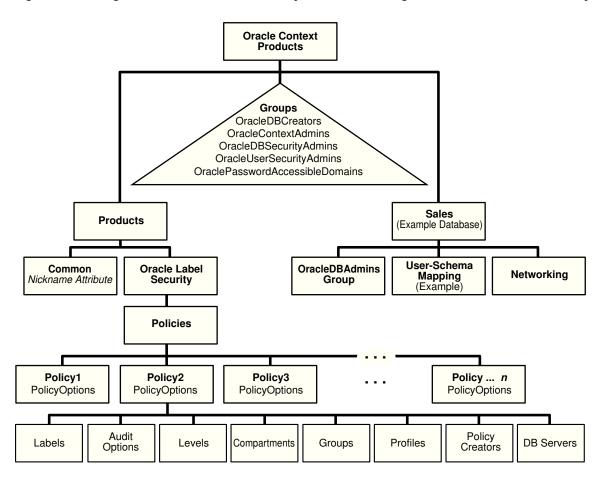


Figure 7-1 Diagram of Oracle Label Security Metadata Storage in Oracle Internet Directory

Figure 7-2 illustrates how different policies stored in Oracle Internet Directory apply to the databases accessed by different enterprise users. Directory entries corresponding to the user and the accessed database determine the policy to be applied.

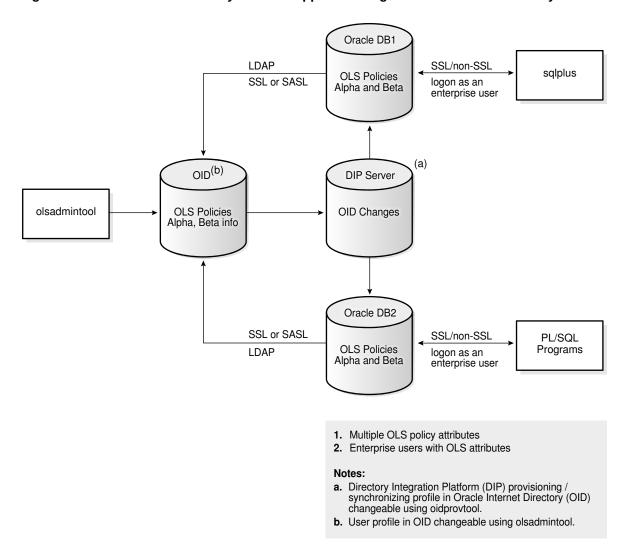


Figure 7-2 Oracle Label Security Policies Applied through Oracle Internet Directory

In this figure, the directory has information about two Oracle Label Security policies, Alpha, applying to database DB1, and Beta, applying to database DB2 Although both policies are known to each database, only the appropriate one is applied in each case. In addition, enterprise users who are to access rows protected by Oracle Label Security are listed in profiles within the Oracle Label Security attributes in Oracle Internet Directory.

As Figure 7-2 shows, the connections between different databases and the directory are established over either SSL or SASL. The database always binds to the directory as a known identity using password-based authentication. Links between databases and their clients (such as a SQL\*Plus session, any PL/SQL programs, and so on) can use either SSL or non-SSL connections. The example of Figure 7-2 assumes that users are logged on through password authentication. The choice of connection type depends on the enterprise user model.

The Oracle Label Security policy administration tool operates directly on metadata in Oracle Internet Directory. Changes in the directory are then propagated to the Oracle Directory Integration and Provisioning server, which is configured to send changes to the databases at specific time intervals.

The databases update the policy information in Oracle Internet Directory only when policies are being applied to tables or schemas. These updates ensure that policies that are in use will not be dropped from the directory.

#### See Also:

- Oracle Database Enterprise User Security Administrator's Guide for more information on enterprise domains, user models and authentication activities
- Oracle Fusion Middleware Administrator's Guide for Oracle Internet Directory for detailed information on Oracle Internet Directory

# Configuring Oracle Internet Directory-Enabled Label Security

You can configure Oracle Internet Directory-enabled Oracle Label Security.

- About Configuring Oracle Internet Directory-Enabled Label Security
   You can configure a database for Oracle Internet Directory-enabled Label Security
   after database creation or during custom database creation.
- Granting Permissions for Configuring OID-Enabled Oracle Label Security
   Users who perform Oracle Internet Directory-enabled Oracle Label Security using
   the Database Configuration Assistant (DBCA) must have additional privileges.
- Registering a Database and Configuring OID-Enabled Oracle Label Security
  The registration and configuration process entails configuring an Oracle home for
  the directory, performing the configuration, and setting a password and connect
  data.
- Unregisteration of a Database with OID-Enabled Oracle Label Security
   To unregister a database with Oracle Internet Directory-enabled Oracle Label Security, you can use DBCA.

## About Configuring Oracle Internet Directory-Enabled Label Security

You can configure a database for Oracle Internet Directory-enabled Label Security after database creation or during custom database creation.

Oracle Internet Directory-enabled label security relies on the Enterprise User security feature.



#### See Also:

- Oracle Database Enterprise User Security Administrator's Guide for prerequisites and steps to configure a database for directory usage
- Oracle Database Enterprise User Security Administrator's Guide for information about Database Configuration Assistant (DBCA).

# Granting Permissions for Configuring OID-Enabled Oracle Label Security

Users who perform Oracle Internet Directory-enabled Oracle Label Security using the Database Configuration Assistant (DBCA) must have additional privileges.

The following steps describe what permissions are needed, and how to grant them:

- Use Enterprise Manager to add the user to the OracleDBCreators group.
   Oracle Database Enterprise User Security Administrator's Guide describes how to add a user to an administrative group.
- 2. Add the user to the Provisioning Admins group.

This is necessary because DBCA creates a DIP provisioning profile for Oracle Label Security. Use <code>ldapmodify</code> command with the following <code>.ldif</code> file to add a user to the Provisioning Admins group:

```
dn: cn=Provisioning Admins,cn=changelog subscriber, cn=oracle internet directory
changetype: modify
add: uniquemember
uniquemember: DN of the user who is to be added
```

- Add the user to the policyCreators group using the olsadmintool command line tool.
  - DBCA bootstraps the database with the Oracle Label Security policy information from Oracle Internet Directory, and only policyCreators can perform this bootstrap.
- 4. If the database is already registered with the Oracle Internet Directory using DBCA, use Enterprise Manager to add the user to the OracleDBAdmins group of that database.

Note that the permissions specified earlier are also needed by the administrator who unregisters the database that has Oracle Internet Directory enabled Oracle Label Security configuration.

# Registering a Database and Configuring OID-Enabled Oracle Label Security

The registration and configuration process entails configuring an Oracle home for the directory, performing the configuration, and setting a password and connect data.



- Step 1: Configure Your Oracle Home for Directory Usage
   First, you must configure your Oracle home directory so that you can use Oracle
   Internet Directory.
- Step 2: Configure Oracle Internet Directory for Oracle Label Security
  Next, you are ready to configure Oracle Internet Directory for Oracle Label
  security.
- Step 2 Alternate: Configuring Database for OID-Enabled Oracle Label Security Registering the database and configuring Oracle Label Security can be done in one invocation of DBCA.
- Step 3: Set the DIP Password and Connect Data
   The DIP user manages Oracle Internet Directory.

### Step 1: Configure Your Oracle Home for Directory Usage

First, you must configure your Oracle home directory so that you can use Oracle Internet Directory.

Follow the instructions in Oracle Database Enterprise User Security
 Administrator's Guide to configure your Oracle home for directory usage.

### Step 2: Configure Oracle Internet Directory for Oracle Label Security

Next, you are ready to configure Oracle Internet Directory for Oracle Label security.

- Register your database in the directory using Database Configuration Assistant (DBCA).
  - See Oracle Database Enterprise User Security Administrator's Guide .
- 2. After your database is registered in the directory, configure Label Security:
  - Start DBCA, select Configure database options in a database, and click Next.
  - b. Select a database and click Next.
  - c. Regarding the option of unregistering the database or keeping it registered, select Keep the database registered.
  - d. If the database is registered with Oracle Internet Directory, the **Database** options screen shows a customize button beside the Label Security check box. Select the **Label Security** option and click **Customize**.
  - e. This customize dialog has two configuration options, for standalone Oracle Label Security or for Oracle Internet Directory-enabled Oracle Label Security. Click OID-enabled Label security configuration and enter the Oracle Internet Directory credentials of an appropriate administrator. Click Ok.
  - Continue with the remaining DBCA steps and click Finish when it appears.



You can configure a standalone Oracle Label Security on a database that is registered with Oracle Internet Directory. Select the standalone option in step  ${\bf e}$ .



When configuring for Oracle Internet Directory-enabled Oracle Label Security, DBCA does the following actions in addition to registering the database:

- Creates a provisioning profile for propagating Label Security policy changes to the database.
- Installs the required packages on the database side for Oracle Internet Directoryenabled Oracle Label Security.
- 3. Bootstraps the database with all the existing Label Security policy information in the Oracle Internet Directory.

#### **Related Topics**

Bootstrapping Databases

After you register a new database with Oracle Internet Directory, you can install Oracle Internet Directory enabled Oracle Label Security on that database.

### Step 2 Alternate: Configuring Database for OID-Enabled Oracle Label Security

Registering the database and configuring Oracle Label Security can be done in one invocation of DBCA.

- Start DBCA.
- 2. Select Configure database options in a database and click Next.
- Select a database and click Next.
- 4. Click Register the database.
- Enter the Oracle Internet Directory credentials of an appropriate administrator, and the corresponding password for the database wallet that will be created.
- 6. Enter an optional Custom Database Name for the database.
  - The ability to specify a custom database name is new in Oracle Database 12c. By default, the database CN (first part of the DN or the distinguished name) in the directory is the DB UNIQUE NAME. You can change this to a custom value.
- The Database options screen shows a Customize button beside the Label Security check box. Select the Label Security option and click Customize.
  - The Customize dialog box is displayed, showing two configuration options, for standalone Oracle Label Security or for Oracle Internet Directory-enabled Oracle Label Security.
- 8. Click OID-enabled Label Security Configuration.
- Continue with the remaining DBCA steps and click Finish.

### Step 3: Set the DIP Password and Connect Data

The DIP user manages Oracle Internet Directory.

After you configure this user's password, you must update the interface connect information in the DIP provisioning profile.

1. Use the command line tool oidprovtool to set the password for the DIP user and update the interface connect information in the DIP provisioning profile for that database with the new password.



2. Upon creation, the DIP profile uses a schedule value of 3600 seconds by default, meaning that Oracle Label Security changes are propagated to the database every hour. You can use oidprovtool to change this value if deployment considerations require that.

Once the database is configured for Oracle Internet Directory-enabled Oracle Label Security, further considerations regarding enterprise user security may apply.

#### See Also:

- Oracle Directory Integration and Provisioning (DIP) Provisioning Profiles
- Oracle Database Enterprise User Security Administrator's Guide for further concepts, tools, steps, and procedures

## Unregisteration of a Database with OID-Enabled Oracle Label Security

To unregister a database with Oracle Internet Directory-enabled Oracle Label Security, you can use DBCA.

DBCA does the following in this process:

- 1. Deletes the DIP provisioning profile for the database created for Oracle Label Security.
- Installs the required packages for standalone Oracle Label Security, so that after unregistering, Oracle Internet Directory enabled Oracle Label Security becomes standalone Oracle Label Security.

#### Note:

- Specific instructions for database unregistration appear in the Oracle
   Database Enterprise User Security Administrator's Guide. No special
   steps are required when Oracle Internet Directory-enabled Oracle
   Label Security is configured.
- If a database has standalone Oracle Label Security, it cannot be converted to Oracle Internet Directory-enabled Oracle Label Security. You need to drop Oracle Label Security from the database and then use DBCA again to configure Oracle Internet Directoryenabled Oracle Label Security.

# Removing Directory-Enabled Oracle Label Security from Database

You can remove Oracle Internet Directory-enabled Oracle Label Security from a database.

Unregister the database by using DBCA.



#### 2. Run the following script:

\$ORACLE\_HOME/rdbms/admin/catnools.sql

## **Oracle Label Security Profiles**

A user profile is a set of user authorizations and privileges.

Profiles are maintained as part of each Oracle Label Security policy stored in the Directory. If a user is added to a profile, then the authorizations and privileges defined in that profile for that particular policy are acquired by the user, which include the following attributes:

- Five label authorizations:
  - maximum read label
  - maximum write label
  - minimum write label
  - default read label
  - default row label
- Privileges
- The list of enterprise users to whom these authorizations apply

An enterprise user can belong to only one profile, or none.

### See Also:

- Oracle Label Security Policy Attributes in Oracle Internet Directory
- Oracle Database Enterprise User Security Administrator's Guide for more information on creating and managing enterprise users
- Oracle Enterprise Manager help for information on creating and administering Oracle Label Security profiles and policies

# Integrated Capabilities When Label Security Uses the Directory

The integration of Oracle Label Security and Oracle Internet Directory enables the several capabilities.

- User/administrator actions
  - Storing multiple Oracle Label Security policies in Oracle Internet Directory
  - Managing Oracle Label Security policies and options in the directory, including
    - creating or dropping a policy
    - \* changing policy options
    - changing audit settings



- Creating label components for any Oracle Label Security policies by
  - creating or removing levels, compartments, or groups
  - assigning numeric values to levels, compartments, or groups
  - \* changing long names of levels, compartments, or groups
  - \* creating children groups
- Managing enterprise users configured as users of any Oracle Label Security policies, including
  - \* assigning or removing enterprise users to/from profiles within policies
  - \* assigning policy-specific privileges to enterprise users, or removing them
  - \* changing policy label authorizations assigned to enterprise users
- Managing all user/administrator actions and capabilities by means of an integrated set of command line tools that monitor and manage Oracle Label Security policies in Oracle Internet Directory.
- Automatic results of Oracle Label Security
  - Limiting database policy usage to directory-defined policies only (no local policies defined or applied)
  - Synchronizing changes to policies in the directory with the databases using Oracle Label Security (to apply after enterprise users reconnect)
  - After changes are propagated by the Directory Integration Platform, having immediate access to enterprise users' Oracle Label Security attributes when these users log on to any database using Oracle Label Security, assuming they are configured within any Oracle Label Security policies. These attributes include users' label authorizations and users' privileges.

# Oracle Label Security Policy Attributes in Oracle Internet Directory

In Oracle Internet Directory, Oracle-related metadata is stored under cn=OracleContext.

Within Label Security, each policy holds the information and parameters shown in Figure 7-1:

When Oracle Label Security is used without Oracle Internet Directory, it supports automatic creation of data labels by means of a label function. However, when Oracle Label Security is used with Oracle Internet Directory, such functions can create labels only using data labels that are already defined in the directory.

**Table 7-1** Contents of Each Policy

| Type of Entry | Contents   | Meaning/Sample Usage/References   |
|---------------|--|---|
| Policy Name   | The name assigned to this policy at its creation | Used in olsadmintool commands such<br>as olsadmintool createpolicy (refer<br>to Command-line Tools for Label<br>Security Using Oracle Internet<br>Directory ) |



Table 7-1 (Cont.) Contents of Each Policy

| Type of Entry       | Contents  | Meaning/Sample Usage/References  |
|---------------------|---|--|
| Column Name         | The name of the column that will hold the label values relevant to this policy  | Column is added to database. Refer to<br>How Policy Label Column and Label<br>Tags Work  |
|                     |   | Inserting Labeled Data   |
|                     |   | How the HIDE Policy Column Option Works  |
|                     |   | Oracle Label Security Reference.   |
|                     |   | Used in  |
|                     |   | olsadmintool createpolicy  |
| Enforcement Options | Any combination of the following entries:  LABEL_DEFAULT, LABEL_UPDATE,  CHECK_CONTROL, READ_CONTROL,  WRITE_CONTROL, INSERT_CONTROL,                     | Refer to the discussions in Implementing Policy Enforcement Options and Labeling Functions and Oracle Label Security Reference.  |
|                     | DELETE_CONTROL, UPDATE_CONTROL,   | Used in  |
|                     | ALL_CONTROL, or NO_CONTROL  | olsadmintool createpolicy  |
| Ontions             | Full Impre  | and olsadmintool alterpolicy   |
| Options             | Enabled:TRUE or FALSE, Type: ACCESS or SESSION. Success:  | Used in olsadmintool audit   |
|                     | SUCCESSFUL, UNSUCCESSFUL, or BOTH.  | oisadmintooi audit   |
| Levels              | Name and number for each level  | Used in olsadmintool create/<br>alter/droplevel  |
| Compartments        | Name and number for each compartment  | Used in olsadmintool create/<br>alter/drop compartment   |
| Groups              | Name, number, and parent for each group   | Used in olsadmintool create/<br>alter/dropgroup  |
| Profiles            | Maximum and default read labels, maximum and minimum write labels, default row label, list of users, and a set of privileges from this list:  READ, FULL, | Policies can have one or more profiles, each of which can be assigned to many users. Profiles reduce the need to set up label authorizations for individual users.   |
|                     | WRITEUP, WRITEDOWN, WRITEACROSS,  | All users with the same set of labels and  |
|                     | PROFILE_ACCESS, or COMPACCESS   | privileges are grouped in a single profile.<br>Each profile represents a different set of<br>labels, privileges, and users. Each profile<br>in a policy is unique.   |
| Data Labels         | Full name and number for each valid data label  | Refer to Restrictions on New Data Label Creation.  |
| Administrators      | Name of each administrator authorized to modify the parameters within this policy.  | Policy administrators can modify parameters within a policy. They are not necessarily also policy creators, who have the right to create or remove policies or policy administrators. Refer to Security Roles and Permitted Actions. |



## Subscription of Policies in Directory-Enabled Label Security

In an Oracle Internet Directory-enabled Oracle Label Security, you must subscribe a policy before it can be applied (by SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY or SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY).

In a standalone Oracle Label Security installation, the SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY or SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY functions can be used directly without the need to subscribe.

#### **Related Topics**

- SA\_POLICY\_ADMIN Policy Administration PL/SQL Package
   The SA\_POLICY\_ADMIN PL/SQL package manages Oracle Label Security policies as a whole.
- Step 5: Apply the Policy to a Database Table or Schema
   After you create grant authorizations and privileges to an Oracle Label Security policy, you can apply it to a database table or schema.

### Restrictions on New Data Label Creation

When Oracle Label Security is used with Oracle Internet Directory, data labels must be pre-defined in the directory.

They cannot be created dynamically by a label function, as is possible when label security is not integrated with the directory.

# Administrator Duties for Oracle Internet Directory and Oracle Label Security

Administrators listed within a policy are those individuals authorized to do the olicy-specific administrative tasks.

- Modify existing policy options and audit settings.
- Enable or disable auditing for a policy.
- Create or remove levels, compartments, groups or children groups.
- Modify full/long names for levels, compartment, or groups.
- Define or modify enterprise user settings, in this policy, for:
  - Privileges
  - Maximum or minimum levels
  - Read, write, or row access for levels, compartments, or groups
  - Label profiles
- Remove enterprise users from a policy.

There is a higher level of administrators, called policy creators, who can create and remove Oracle Label Security policies and the policy administrators named within them.



## **Bootstrapping Databases**

After you register a new database with Oracle Internet Directory, you can install Oracle Internet Directory enabled Oracle Label Security on that database.

This installation process automatically creates a Directory Integration Platform (DIP) provisioning profile enabling policy information to be periodically refreshed in the future by downloading it to the database.

When configuring the database for Oracle Internet Directory enabled Oracle Label Security, the DBCA tool puts all the policy information in Oracle Internet Directory into the database.

 To bootstrap the database, run the bootstrap utility script at \$ORACLE\_HOME/bin/ olsoidsync using the following parameters:

```
olsoidsync --dbconnectstring <"database connect string in host:port:sid format">
--dbuser <database user> --dbuserpassword <database user password> [-c] [-r]
[-b <admin context>] -h <OID host> [-p <port>] -D <bind DN> -w <bind password>
```

#### For example:

```
olsoidsync --dbconnectstring yippee:1521:ora101 --dbuser lbacsys --dbuserpassword lbacsys -c --b "ou=Americas,o=Oracle,c=US" -h yippee -D cn=policycreator -w Easy2rem
```

The olsoidsync command pulls policy information from Oracle Internet Directory and populates the information in the database. You must provide the database TNS name, the database user name, the database user's password, the administrative context (if any), the Oracle Internet Directory host name, the bind DN and bind password, and optionally the Oracle Internet Directory port number.

The optional -c switch causes the command to drop all the existing policies in the database and refresh it with policy information from Oracle Internet Directory.

The optional -r switch causes the command to drop all the policy metadata (without dropping the policies themselves) and refresh the policies with new metadata from Oracle Internet Directory.

Without these two switches, the command will only create new policies from Oracle Internet Directory, and will halt on any errors encountered during the refresh.

#### **Related Topics**

Oracle Directory Integration and Provisioning (DIP) Provisioning Profiles
 The DIP server synchronizes policy changes in the directory with the connected databases, using a separate DIP provisioning profile created for each database.

## Synchronizing the Database and Oracle Internet Directory

After you have installed and configured Oracle Internet Directory with Oracle Label Security, you should synchronize the database with OID and OLS.

About Synchronizing the Database and Oracle Internet Directory
 The Directory Integration Platform Oracle Directory Provisioning Service
 synchronizes Oracle Label Security metadata in the OID directory with the
 databases.



- Oracle Directory Integration and Provisioning (DIP) Provisioning Profiles
   The DIP server synchronizes policy changes in the directory with the connected databases, using a separate DIP provisioning profile created for each database.
- Modifying a Provisioning Profile
   The oidprovtool modify command changes the password for the interface\_connect\_info connect string.
- Changing the Database Connection Information for a Provisioning Profile
   You can change the database connection information in the DIP profile.
- Configuring OID-Enabled Oracle Label Security with Oracle Data Guard
   To configure Oracle Directory-Enabled Oracle Label Security to work with Oracle
   Data Guard, first you configure the primary database, then the secondary
   database.

## About Synchronizing the Database and Oracle Internet Directory

The Directory Integration Platform Oracle Directory Provisioning Service synchronizes Oracle Label Security metadata in the OID directory with the databases.

Changes to the label security data in the directory are conveyed by the provisioning integration service in the form of provisioning events. A software agent receives these events and generates appropriate SQL or PL/SQL statements to update the database. After these statements are processed, Oracle Label Security data dictionaries are updated to match the changes already made in the directory.

Oracle Label Security subscribes itself to the Provisioning Integration Service automatically during installation. The provisioning service stores the information associated with each database in the form of a provisioning profile. The software agent uses the identity of the user DIP, which is created as for Oracle Label Security, to connect to the database, when synchronizing the changes in Oracle Internet Directory with the database.

If the password for the user DIP is changed, then you must update this password in the provisioning profile of the provisioning integration service.

# Oracle Directory Integration and Provisioning (DIP) Provisioning Profiles

The DIP server synchronizes policy changes in the directory with the connected databases, using a separate DIP provisioning profile created for each database.

This profile is created automatically as part of the installation process for Oracle Internet Directory-enabled Oracle Label Security. The administrator can use the provisioning tool oidprovtool to modify the password for a database profile, using the script \$ORACLE\_HOME/bin/oidprovtool. Each such profile contains the following information:

**Table 7-2** Elements in a DIP Provisioning Profile

| Element            | Name for This Element<br>When Invoking oidprovtool |
|--------------------|--|
| The LDAP host name | ldap_host  |



Table 7-2 (Cont.) Elements in a DIP Provisioning Profile

| Element   | Name for This Element<br>When Invoking oidprovtool |
|---|--|
| The LDAP port number  | ldap_port  |
| The user DN and password to bind to Oracle Internet   | ldap_user  |
| Directory to retrieve policy information  | ldap_user_password                                 |
| The database DN   | application_dn                                     |
| The organization DN, that is, the administrative context in which changes are being made  | organization_dn                                    |
| The callback function to be invoked, that is, LBACSYS.OLS_DIP_NTFY  | interface_name                                     |
| The database connect information, which is the host name of<br>the database, the port number used to connect to the<br>database, the database SID, the database user name and<br>password | interface_connect_info                             |
| Event subscriptions, including all MODIFY, ADD and DELETE events under cn=LabelSecurity in Oracle Internet Directory  | operation  |
| The time interval between synchronizations  | schedule   |

Here is an example of using oidprovtool, followed by an explanation of the parameters in this example:

oidprovtool operation=modify ldap\_host=yippee ldap\_port=389 ldap\_user=cn=defense\_admin ldap\_user\_password=Easy2rem application\_dn="cn=db1,cn=OracleContext,ou=Americas,o=Oracle,c=US" organization\_dn="ou=Americas,o=Oracle,c=US" interface\_name=LBACSYS.OLS\_DIP\_NTFY interface\_type=PLSQL interface\_connect\_info=yippee:1521:db1:dip:newdip schedule=60 event\_subscription= "ENTRY:cn=LabelSecurity,cn=Products,cn=OracleContext,ou=Americas,o=Oracle,c=US:ADD(\*)" event\_subscription= "ENTRY:cn=LabelSecurity,cn=Products, cn=OracleContext,ou=Americas,o=Oracle,c=US:MODIFY(\*)" event\_subscription="ENTRY:cn=LabelSecurity,cn=Products, cn=OracleContext, ou=Americas,o=Oracle,c=US:DELETE"

This sample oidprovtool command creates and enables a new DIP provisioning profile with the following attributes:

- Oracle Internet Directory in host yippee using port 389
- Oracle Internet Directory user bind DN: cn=defense\_admin with password Easy2rem
- Database DN: cn=db1, cn=OracleContext, ou=Americas, o=Oracle, c=US
- Organization DN (administrative context): ou=Americas, o=Oracle, c=US
- Database on host yippee, listening on port 1521
- Oracle SID: db1
- Database user: dip with new password newdip
- Interval to synchronize directory with connected databases: 60 seconds
- All the ADD, MODIFY and DELETE events under cn=LabelSecurity to be sent to DIP



To start the DIP server, use \$ORACLE\_HOME/bin/oidctl. For example:

oidctl server=odisrv connect=db2 config=0 instance=0 start

This command will start the DIP server by connecting to db2 (the Oracle Internet Directory database) with config set to 0 and instance number 0.



#### See also:

Oracle Identity Management Integration Guide for more information on DIP provisioning profiles

## Modifying a Provisioning Profile

The oidprovtool modify command changes the password for the interface\_connect\_info connect string.

Before you change the password, you must temporarily disable the profile. After changing the password, you then reenable the profile.

Disable the profile by using theoidprovtool.

#### The syntax is as follows:

oidprovtool operation=disable ldap\_host=host ldap\_port=port ldap\_user\_dn=ldap\_user\_dn ldap\_user\_password=password application\_dn=app\_dn organization\_dn=org\_dn

#### For example:

oidprovtool operation=disable ldap\_host=yippee ldap\_port=389

ldap\_user=cn=defense\_admin ldap\_user\_password=password
application\_dn="cn=db1,cn=OracleContext,ou=Americas,o=Oracle,c=US"
organization\_dn="ou=Americas,o=Oracle,c=US"

2. Modify the password and connection information by using the following syntax:

oidprovtool operation=modify  $ldap_host=ldap_host\ ldap_port=port$ 

 $\label{lap_user_dn} $$ ldap_user_dn $ ldap_user_password=password application_dn=app_dn $$ organization_dn=org_dn $ interface\_connect\_info=new\_connect\_info $$$ 

#### For example:

oidprovtool operation=modify ldap\_host=yippee ldap\_port=389

ldap\_user=cn=defense\_admin ldap\_user\_password=Easy2rem
application\_dn="cn=db1,cn=OracleContext,ou=Americas,o=Oracle,c=US"
organization\_dn="ou=Americas,o=Oracle,c=US"
interface\_connect\_info=yippee:1521:db1:dip:NewestDIPpassword

3. Reenable the profile by using the following syntax:

oidprovtool operation=enable ldap\_host=host ldap\_port=port ldap\_user\_dn=ldap\_user\_dn ldap\_user\_password=password application\_dn=app\_dn organization\_dn=org\_dn



#### For example

oidprovtool operation=enable ldap\_host=yippee ldap\_port=389

ldap\_user=cn=defense\_admin ldap\_user\_password=password
application\_dn="cn=db1,cn=OracleContext,ou=Americas,o=Oracle,c=US"
organization\_dn="ou=Americas,o=Oracle,c=US"

# Changing the Database Connection Information for a Provisioning Profile

You can change the database connection information in the DIP profile.

1. Disable the provisioning profile.

This step temporarily stops the propagation of label security changes in the directory to the database, but no data is lost. Once the profile is enabled, any label security changes that happened in the directory since the profile was disabled are synchronized with the database.

- 2. Update the database connection information in the profile.
- Enable the profile.



The database character set must be compatible with Oracle Internet Directory for Oracle Internet Directory-enabled Oracle Label Security to work correctly. Only then can there be successful synchronization of the Label Security metadata in Oracle Internet Directory with the Database.

### See Also:

- Oracle Database Globalization Support Guide for more information about character sets and Globalization Support parameters
- Modifying a Provisioning Profile
- Oracle Identity Management Integration Guide for more information about enabling and disabling of provisioning profiles

# Configuring OID-Enabled Oracle Label Security with Oracle Data Guard

To configure Oracle Directory-Enabled Oracle Label Security to work with Oracle Data Guard, first you configure the primary database, then the secondary database.

 Step 1: Set Up Directory-Enabled Oracle Label Security with Data Guard You must set up the directory-enabled Oracle Label Security with Oracle Data Guard.



Step 2: After the Switchover, Update the OID Provisioning Profile
 Once you complete the switchover operation, you must update the Oracle Internet
 Directory provisioning profile.

### Step 1: Set Up Directory-Enabled Oracle Label Security with Data Guard

You must set up the directory-enabled Oracle Label Security with Oracle Data Guard.

- 1. Configure Oracle Data Guard for your database.
  - See Oracle Data Guard Broker for information about installing Oracle Data Guard.
- Register Oracle Label Security in Oracle Internet Directory on the primary database.

See Registering a Database and Configuring OID-Enabled Oracle Label Security for more information.

- **3.** Verify the that the policies have been propagated to the primary database.
  - a. Create the Oracle Label Security policies in an Oracle Internet Directory using the olsadmintool utility or in Oracle Enterprise Manager Cloud Control.
    - See Command-line Tools for Label Security Using Oracle Internet Directory for more information about using the olsadmintool utility.
  - b. Connect to the primary database as user LBACSYS.
  - **c.** Query the DBA\_SA\_POLICIES data dictionary view to confirm that the policies were propagated to the primary database.

```
SELECT POLICY_NAME FROM DBA_SA_POLICIES;
```

- 4. Connect to the standby database as user LBACSYS and then perform the SELECT POLICY\_NAME FROM DBA\_SA\_POLICIES; query to ensure that the policies that were propagated on the primary database are on the standby database, though the redo log apply process.
- 5. Copy the ewallet.p12, sqlnet.ora, and ldap.ora files from the primary database to the standby database after the OLS-OID registration is complete.

This step is useful in case of failover and the primary database is not accessible. By default, these files are in the following locations:

- ewallet.p12, the wallet file, is in either the \$ORACLE\_BASE/admin/Oracle\_SID/wallet directory or the \$ORACLE\_HOME/admin/Oracle\_SID/wallet directory.
- sqlnet.ora is in the \$ORACLE\_HOME/dbs directory. (Back up this file before copying it to the standby database.)
- ldap.ora is in the \$ORACLE\_HOME/dbs directory.
- 6. Go to the directory where you copied the ewallet.p12 file.
- 7. Create SSO wallet file (cwallet.sso) associated to PKCS#12 wallet (ewallet.p12) by using the following syntax:

orapki wallet create -wallet wallet\_location -auto\_login [-pwd password]



### Step 2: After the Switchover, Update the OID Provisioning Profile

Once you complete the switchover operation, you must update the Oracle Internet Directory provisioning profile.

In this step, after you have you have performed the switchover and completed steps 5, 6, and 7 under Step 1: Set Up Directory-Enabled Oracle Label Security with Data Guard, you are ready to update the provisioning profile in Oracle Internet Directory with the connection information of the new primary database.

If you do not complete the following procedure, then the policies will continue to be propagated to the new standby database, and the old primary database will fail with an ORA-16000 database open for read-only access error. After you have updated the provisioning profile with the new primary database connection information, then policy propagation takes place in the new primary database. In addition, these policies are propagated to the new standby through the redo apply process.

1. On either the primary or the standby computer, run the following oidprovtool utility command for the new primary database.

```
oidprovtool operation=modify \
ldap_host=OID_Server_hostname ldap_port=OID_Server_Port \
ldap_user_dn="cn=orcladmin" \
application_dn="LDAP_distinguised_name_of_application" \
```

The application\_dn setting can be derived from dn=dbname, cn=oraclecontext, default\_admin\_context. The ldap.ora file lists the default\_admin\_context setting.

2. When prompted, enter the LDAP user password.

```
Please enter the LDAP password:
```

3. When prompted, enter the interface connection information in the following format:

```
host:port:service_name:dip:password
```

DIP is the Oracle Directory Integration and Provisioning (DIP) account that is installed with Oracle Label Security. This account is created automatically as part of the installation process for Oracle Internet Directory-enabled Oracle Label Security.

To specify no interface connection information, omit any settings and press **Return**.

**4.** After you complete the provisioning profile, then restart the DIP server.

# Security Roles and Permitted Actions

Oracle Label Security permits specific tasks and access levels for Oracle Internet Directory, including restrictions on directory-enabled OLS policy creators.

- Permitted Tasks and Access Levels for Oracle Internet Directory
   To manage Oracle Label Security policies in Oracle Internet Directory, certain entities are given access control rights in the directory.
- Restriction on Policy Creators for Directory-Enabled Oracle Label Security
  A member of the Policy Creators group can only create, browse, and delete Oracle
  Label Security policies.



## Permitted Tasks and Access Levels for Oracle Internet Directory

To manage Oracle Label Security policies in Oracle Internet Directory, certain entities are given access control rights in the directory.

The access control mechanisms are provided by Oracle Internet Directory.

Table 7-3 describes, in abstract terms, these entities and the tasks they are enabled to perform.

Table 7-3 Tasks That Certain Entities Can Perform

| Entity                | Tasks This Entity Can Perform   |
|-----------------------|---|
| Policy creators       | Create new (or delete existing) policies, create new (or remove existing) policy administrators.  |
| Policy administrators | For Policies: modify existing policy options and audit settings, enable or disable auditing for a policy.   |
|                       | For Label components: create, modify, or remove levels, compartments and groups, such as by changing their full or long names or (for groups) by creating or deleting their children groups.  |
|                       | For enterprise users: remove enterprise users from a policy, modify enterprise users' maximum or minimum levels, their read, write, and row access for compartments or groups, their privileges for a policy, and their label profiles. |

Table 7-4 lists the specific access level operations permitted or disallowed for policy creators, policy administrators, and label security users.

Table 7-4 Access Levels Allowed by Users in OID

| Entries                                    | <b>Policy Creators</b> | <b>Policy Administrators</b> | Databases  |
|--|------------------------|------------------------------|------------|
| cn=Policies                                | can modify             | no access                    | no access  |
| cn=Admins, cn=Policy1                      | can modify             | no access                    | no access  |
| uniqueMember: cn=Policy1                   | can browse             | can browse                   | can modify |
| cn=PolicyCreators                          | no access <sup>1</sup> | no access                    | no access  |
| cn=Levels, cn=Policy1                      | can browse and delete  | can modify                   | no access  |
| <pre>cn=Compartments,<br/>cn=Policy1</pre> | can browse and delete  | can modify                   | no access  |
| cn=Groups, cn=Policyl                      | can browse and delete  | can modify                   | no access  |
| cn=AuditOptions,cn=Policy1                 | can browse and delete  | can modify                   | no access  |
| cn=Profiles,cn=Policy1                     | can browse and delete  | can modify                   | no access  |
| cn=Labels,cn=Policy1                       | can browse and delete  | can modify                   | no access  |
| cn=DBServers                               | no access <sup>2</sup> | no access                    | no access  |

<sup>1</sup> The group cn=OracleContextAdmins is the owner of the group cn=PolicyCreators, so members in cn=OracleContextAdmins can modify cn=PolicyCreators.



<sup>2</sup> The group cn=OracleDBCreators is the owner of the group cn=DBServers, so members in cn=OracleDBCreators can modify cn=DBServers.

# Restriction on Policy Creators for Directory-Enabled Oracle Label Security

A member of the Policy Creators group can only create, browse, and delete Oracle Label Security policies.

This user cannot perform policy administrative tasks, such as creating label components and adding users, even if explicitly added to the Policy Admins group of that policy. In short, a policy creator cannot be the administrator of any policy.

# Superseded PL/SQL Statements When OID Is Enabled with OLS

When Oracle Internet Directory is enabled with Oracle Label Security, there are several procedures that are superseded.

Only user LBACSYS is allowed to run these procedures.

For some of the procedures listed in the table, the functionality they provided is replaced by the olsadmintool command named in the second column (and explained in Oracle Label Security Reference).

Table 7-5 Procedures Superseded by olsadmintool When Using Oracle Internet Directory

| Disabled Procedure               | Replaced by olsadmintool Command |
|----------------------------------|----------------------------------|
| SA_SYSDBA.CREATE_POLICY          | olsadmintool createpolicy        |
| SA_SYSDBA.ALTER_POLICY           | olsadmintool alterpolicy         |
| SA_SYSDBA.DROP_POLICY            | olsadmintool droppolicy          |
| SA_COMPONENTS.CREATE_LEVEL       | olsadmintool createlevel         |
| SA_COMPONENTS.ALTER_LEVEL        | olsadmintool alterlevel          |
| SA_COMPONENTS.DROP_LEVEL         | olsadmintool droplevel           |
| SA_COMPONENTS.CREATE_COMPARTMENT | olsadmintool createcompartment   |
| SA_COMPONENTS.ALTER_COMPARTMENT  | olsadmintool altercompartment    |
| SA_COMPONENTS.DROP_COMPARTMENT   | olsadmintool dropcompartment     |
| SA_COMPONENTS.CREATE_GROUP       | olsadmintool creategroup         |
| SA_COMPONENTS.ALTER_GROUP        | olsadmintool altergroup          |
| SA_COMPONENTS.ALTER_GROUP_PARENT | olsadmintool altergroup          |
| SA_COMPONENTS.DROP_GROUP         | olsadmintool dropgroup           |
| SA_USER_ADMIN.SET_LEVELS         | None                             |
| SA_USER_ADMIN.SET_COMPARTMENTS   | None                             |
| SA_USER_ADMIN.SET_GROUPS         | None                             |
| SA_USER_ADMIN.ADD_COMPARTMENTS   | None                             |
| SA_USER_ADMIN.ALTER_COMPARTMENTS | None                             |



Table 7-5 (Cont.) Procedures Superseded by olsadmintool When Using Oracle Internet Directory

| Disabled Procedure                  | Replaced by olsadmintool Command  |
|-------------------------------------|---|
| SA_USER_ADMIN.DROP_COMPARTMENTS     | None  |
| SA_USER_ADMIN.DROP_ALL_COMPARTMENTS | None  |
| SA_USER_ADMIN.ADD_GROUPS            | None  |
| SA_USER_ADMIN.ALTER_GROUPS          | None  |
| SA_USER_ADMIN.DROP_GROUPS           | None  |
| SA_USER_ADMIN.DROP_ALL_GROUPS       | None  |
| SA_USER_ADMIN.SET_USER_LABELS       | <pre>olsadmintool createprofile; olsadmintool adduser; olsadmintool dropprofile; olsadmintool dropuser;</pre> |
| SA_USER_ADMIN.SET_DEFAULT_LABEL     | None  |
| SA_USER_ADMIN.SET_ROW_LABEL         | None  |
| SA_USER_ADMIN.DROP_USER_ACCESS      | olsadmintool dropuser   |
| SA_USER_ADMIN.SET_USER_PRIVS        | <pre>olsadmintool createprofile; olsadmintool adduser; olsadmintool dropprofile; olsadmintool dropuser;</pre> |
| SA_AUDIT_ADMIN.AUDIT                | olsadmintool audit  |
| SA_AUDIT_ADMIN.NOAUDIT              | olsadmintool noaudit  |
| SA_AUDIT_ADMIN.AUDIT_LABEL          | None  |
| SA_AUDIT_ADMIN.NOAUDIT_LABEL        | None  |

# Oracle Label Security Procedures for Policy Administrators

Several procedures in the SA\_POLICY\_ADMIN PL/SQL package are allowed to be run only by policy administrators (enterprise users defined in Oracle Internet Directory).

#### These procedures are as follows:

- SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY
- SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY
- SA\_POLICY\_ADMIN.DISABLE\_SCHEMA\_POLICY
- SA\_POLICY\_ADMIN.DISABLE\_TABLE\_POLICY
- SA\_POLICY\_ADMIN.ENABLE\_SCHEMA\_POLICY
- SA\_POLICY\_ADMIN.ENABLE\_TABLE\_POLICY
- SA\_POLICY\_ADMIN.GRANT\_PROG\_PRIVS
- SA\_POLICY\_ADMIN.POLICY\_SUBSCRIBE
- SA\_POLICY\_ADMIN.POLICY\_UNSUBSCRIBE
- SA\_POLICY\_ADMIN.REMOVE\_SCHEMA\_POLICY



- SA\_POLICY\_ADMIN.REMOVE\_TABLE\_POLICY
- SA\_POLICY\_ADMIN.SET\_PROG\_PRIVS
- SA\_POLICY\_ADMIN.REVOKE\_PROG\_PRIVS



# Part III

# Administering an Oracle Label Security Application

Part III describes how to administer an Oracle Label Security application.

- Implementing Policy Enforcement Options and Labeling Functions
   You can customize the enforcement of Oracle Label Security policies and
   implement labeling functions.
- Administering and Using Trusted Stored Program Units
   You can use trusted stored program units to enhance system security.
- Auditing Under Oracle Label Security
   You can use Oracle Label Security auditing if you have not configured your
   database to use unified auditing.
- Using Oracle Label Security with a Distributed Database
   You should understand the special considerations for using Oracle Label Security
   in a distributed configuration.
- Performing DBA Functions Under Oracle Label Security
   Oracle Label Security supports the standard Oracle Database utilities, but certain restrictions apply, which may require extra steps to get the expected results.
- Releasability Using Inverse Groups
   Oracle Label Security can implement the releasability using inverse groups.



# Implementing Policy Enforcement Options and Labeling Functions

You can customize the enforcement of Oracle Label Security policies and implement labeling functions.

- Oracle Label Security Policy Enforcement Options
   Oracle Label Security provides a set of policy enforcement options.
- Labeling Functions
   Labeling functions can compute and return a label using resources such as context variables (for example, date or username) and data values.
- Inserting Labeled Data Using Policy Options and Labeling Functions
   It is important to understand how enforcement options and labeling functions affect
   the insertion of labeled data.
- Updating Labeled Data Using Policy Options and Labeling Functions
  Users must be authorized to change rows that are protected by Oracle Label
  Security.
- Deletion of Labeled Data Using Policy Options and Labeling Functions You can delete labeled data.
- SQL Predicates with an Oracle Label Security Policy
   You can use a SQL predicate to provide extensibility for selective enforcement of
   data access rules.

## Oracle Label Security Policy Enforcement Options

Oracle Label Security provides a set of policy enforcement options.

- About Policy Enforcement Options
   Of all the enforcement controls that Oracle Label Security permits, the
   administrator must choose those that meet the needs of the given application.
- Levels of Policy Enforcement Options
   You can set policy, schema, and table levels of policy enforcement.
- Categories of Policy Enforcement Options
   Oracle Label Security enforces policies using three categories: label management
   options, access control options, and overriding options.
- Relationships of Policy Enforcement Options
   Oracle Label Security has a set of policy enforcement options.
- How the HIDE Policy Column Option Works
   You can specify the HIDE policy configuration option when you add an Oracle
   Label Security policy column to a table.
- How the Label Management Enforcement Options Work
   The three label enforcement options control the data label written when a row is inserted or updated.

- How the Access Control Enforcement Options Work
   Access control options limit the rows accessible for SELECT, UPDATE, INSERT, or
   DELETE operations to only those rows whose labels meet established policies.
- How the Overriding Enforcement Options Work
   Whereas ALL\_CONTROL applies all of the label management and access control
   enforcement options, NO CONTROL applies none of them.
- Guidelines for Using the Policy Enforcement Options
   You can customize policy enforcement for a schema or table through the Oracle
   Enterprise Manager.
- Exemptions from Oracle Label Security Policy Enforcement
   Oracle Label Security has several exceptions from OLS policy enforcement.
- Data Dictionary Views for Viewing Policy Options on Tables and Schemas
   Oracle Label Security provides data dictionary views that describe the policy
   enforcement options currently applied to tables and schemas.

## **About Policy Enforcement Options**

Of all the enforcement controls that Oracle Label Security permits, the administrator must choose those that meet the needs of the given application.

This means identifying levels of data sensitivity to exposure, alteration, or misuse, as well as identifying which users have the need or the right to access or alter such data. The policy enforcement options enable administrators to fine-tune users' abilities to read or write data or labels.

## Levels of Policy Enforcement Options

You can set policy, schema, and table levels of policy enforcement.

Table 8-1 lists the levels on which policy enforcement options can operate.

Table 8-1 When Policy Enforcement Options Take Effect

| Level at which option set | Options set at this level affect user operations             |
|---------------------------|--|
| Policy Ivel               | only when the policy has been applied to the table or schema |
| Schema Ivel               | whenever a user acts in this schema                          |
| Table Ivel                | whenever a user acts in this table                           |

When you apply a policy to a table or schema, you can specify the enforcement options that are to constrain use of that table or schema. If you do not specify enforcement options at that time, then the default enforcement options you specified when you created that policy are used automatically.

These options customize your policy enforcement to meet your security requirements as to READ access, WRITE access, and label changes. You can also specify whether the label column should be displayed or hidden. You can choose to enforce some or all of the policy options for any protected table by specifying only those you want.

Optionally, you can assign each table a labeling function, which determines the label of any row inserted or updated in that table. You can also specify, optionally, a *SQL* predicate for a table, to control which rows are accessible to users, based on their labels.



When Oracle Label Security policy enforcement options are applied, they control which rows are accessible to view or to insert, update, or delete.

#### **Related Topics**

- Labeling Functions
   Labeling functions can compute and return a label using resources such as context variables (for example, date or username) and data values.
- SQL Predicates with an Oracle Label Security Policy
   You can use a SQL predicate to provide extensibility for selective enforcement of
   data access rules.

# Categories of Policy Enforcement Options

Oracle Label Security enforces policies using three categories: label management options, access control options, and overriding options.

Table 8-2 lists the categories of policy enforcement options.

- Label management options ensure that data labels written for inserted or updated rows do not violate policies set for such labels
- Access control options ensure that only rows whose labels meet established policies are accessible for SELECT, UPDATE, INSERT, or DELETE operations.
- Overriding options can suspend or apply all other enforcement options.

**Table 8-2 Policy Enforcement Options** 

| Type of<br>Enforcement                                     | Option         | Description   |
|--|----------------|---|
| How the Label<br>Management<br>Enforcement<br>Options Work | LABEL_DEFAULT  | Uses the session's default row label value unless the user explicitly specifies a label on INSERT.  |
| -  | LABEL_UPDATE   | Applies policy enforcement to UPDATE operations that set or change the value of a label attached to a row. The WRITEUP, WRITEDOWN, and WRITEACROSS privileges are enforced only if the LABEL_UPDATE option is active. |
| -  | CHECK_CONTROL  | Applies READ_CONTROL policy enforcement to INSERT and UPDATE statements to assure that the new row label is read-accessible.  |
| How the Access<br>Control<br>Enforcement<br>Options Work   | READ_CONTROL   | Applies policy enforcement to all queries. Only authorized rows are accessible for SELECT, UPDATE, and DELETE operations. See INSERT_CONTROL, UPDATE_CONTROL, and DELETE_CONTROL.                                     |
| -  | WRITE_CONTROL  | Determines the ability to INSERT, UPDATE, and DELETE data in a row. If this option is active, it enforces INSERT_CONTROL, UPDATE_CONTROL, and DELETE_CONTROL.   |
| -  | INSERT_CONTROL | Applies policy enforcement to INSERT operations, according to the algorithm for write access described in the figure in How Oracle Label Security Algorithm for Read Access Works.                                    |



Table 8-2 (Cont.) Policy Enforcement Options

| Type of<br>Enforcement                            | Option         | Description   |
|---|----------------|---|
| -   | DELETE_CONTROL | Applies policy enforcement to DELETE operations, according to the algorithm for write access described in the figure in How Oracle Label Security Algorithm for Read Access Works.                                  |
| -   | UPDATE_CONTROL | Applies policy enforcement to UPDATE operations on the data columns within a row, according to the algorithm for write access described in the figure in How Oracle Label Security Algorithm for Read Access Works. |
| How the Overriding<br>Enforcement<br>Options Work | ALL_CONTROL    | Applies all enforcement options.  |
| -   | NO_CONTROL     | Applies no enforcement options. A labeling function or a SQL predicate can nonetheless be applied.  |

Remember that even when Oracle Label Security is applicable to a table, some DML operations may not be covered by the policies being applied. The policy enforcement options set by the administrator determine both the SQL processing behavior and what an authorized user can actually see in response to a query on a protected table. Except where noted, this chapter assumes that ALL\_CONTROL is active, meaning that all enforcement options are in effect. If users attempt to perform an operation for which they are not authorized, then an error message is raised and the SQL statement fails.

Understanding the relationships among these policy enforcement options, and what SQL statements they control, is essential to their effective use in designing and implementing your Oracle Label Security policies.

#### **Related Topics**

Implementation of Inverse Groups with INVERSE\_GROUP Enforcement
 When creating an Oracle Label Security policy, you can specify whether the policy can use inverse group functionality to implement releasability.

# Relationships of Policy Enforcement Options

Oracle Label Security has a set of policy enforcement options.

Table 8-3 describes the relationships between policy enforcement options.

**Table 8-3 What Policy Enforcement Options Control** 

| Specifying This<br>Option in a Policy | Controls These SQL Operations | Using These Criteria and with These Effects  |
|---------------------------------------|-------------------------------|--|
| READ_CONTROL                          | SELECT, UPDATE, and DELETE    | Only authorized rows (*) are accessible.   |
| WRITE_CONTROL                         | INSERT, UPDATE, and DELETE    | <ul><li>(a) Only authorized rows (**) are accessible</li><li>(b) Data labels writable unless LABEL_UPDATE is active.</li></ul> |



Table 8-3 (Cont.) What Policy Enforcement Options Control

| Specifying This<br>Option in a Policy  | Controls These SQL Operations | Using These Criteria and with These Effects   |
|--|-------------------------------|---|
| WRITE_CONTROL (necessary for INSERT_CONTROL, UPDATE_CONTROL, and DELETE_CONTROL) | -                             | -   |
| INSERT_CONTROL   | INSERT                        | -   |
| UPDATE_CONTROL   | UPDATE                        | -   |
| DELETE_CONTROL   | DELETE                        | -   |
| CHECK_CONTROL  | -                             | Applies READ_CONTROL policy enforcement to INSERT and UPDATE statements to assure that the new row label is read-accessible.  |
| How the Access<br>Control<br>Enforcement<br>Options Work                         | -                             | Applies policy enforcement to all queries. Only authorized rows are accessible for operations.  |
| INSERT_CONTROL   | INSERT_CONTROL                | Applies policy enforcement to INSERT operations, according to the algorithm for write access described in the figure in How Oracle Label Security Auditing Is Enabled or Disabled.                                  |
| DELETE_CONTROL   | DELETE_CONTROL                | Applies policy enforcement to DELETE operations, according to the algorithm for write access described in the figure in How Oracle Label Security Auditing Is Enabled or Disabled.                                  |
| UPDATE_CONTROL   | UPDATE_CONTROL                | Applies policy enforcement to UPDATE operations on the data columns within a row, according to the algorithm for write access described in the figure in How Oracle Label Security Auditing Is Enabled or Disabled. |
| How the Overriding Enforcement Options Work                                      | ALL_CONTROL                   | Applies all enforcement options.  |
| NO_CONTROL   | NO_CONTROL                    | Applies no enforcement options. A labeling function or a SQL predicate can nonetheless be applied.  |

(\*) A row is authorized for READ access if the following three criteria are all met:(user-minimum-level) < = (data-row-level) < = (session-level)(any-data-group) is a child of (any-user-group-or-childgroup) (every-data-compartment) is also in (the user's compartments). Refer to the figure in How Oracle Label Security Algorithm for Read Access Works

(\*\*) A row is authorized for READ access if the following three criteria are all met: (user-minimum-level) < = (data-row-level) < = (session-level)(any-data-group) is a child of (any-user-group-or-childgroup) (every-data-compartment) is also in (the user's compartments). Refer to the figure in How Oracle Label Security Algorithm for Read Access Works.



# How the HIDE Policy Column Option Works

You can specify the  ${\tt HIDE}$  policy configuration option when you add an Oracle Label Security policy column to a table.

This prevents display of the column containing the policy's labels.

Once the policy has been applied, the hidden (or not hidden) status of the column cannot be changed unless the policy is removed with the DROP\_COLUMN parameter set to TRUE. Then, the policy can be reapplied with a new hidden status.

INSERT statements doing all-column inserts do not require the values for hidden label columns.

SELECT statements do not automatically return the values of hidden label columns. Such values must be explicitly retrieved.

A DESCRIBE on a table may or may not display the label column. If the administrator sets the HIDE option, then the label column will not be displayed. If HIDE is not specified for a policy, then the label column is displayed in response to a SELECT.

#### **Related Topics**

- SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY
  The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure adds the specified policy to a table.
- Retrieving All Columns from a Table When the Policy Label Column Is Hidden
  If the policy label column is hidden, then it is not automatically returned when you
  execute SELECT \* on the table.

## How the Label Management Enforcement Options Work

The three label enforcement options control the data label written when a row is inserted or updated.

- About the Label Management Enforcement Options
   When a policy specifies the options and is applied to a table or schema, these
   options apply to special situations.
- LABEL\_DEFAULT: Using the Session's Default Row Label
   A user can update a row without specifying a label value, because the updated row uses its original label.
- LABEL\_UPDATE: Changing Data Labels
   A user updating a row can normally change its label to any label within his authorized label range.
- CHECK\_CONTROL: Checking Data Labels
   If an inserted or updated row gets its label from a labeling function, the label could be outside the user's authorizations.

### About the Label Management Enforcement Options

When a policy specifies the options and is applied to a table or schema, these options apply to special situations.



A user inserting a row can specify any data label within the range of the user's label authorizations. If the user does not specify a label for the row being written, LABEL\_DEFAULT can do so. Updates can be restricted by LABEL\_UPDATE. Inserts or updates that use a labeling function need CHECK\_CONTROL to prevent assigning a data label outside the user's authorizations. Such a label would prevent the user from accessing the row just written, and could enable the user to make data available inappropriately.

Any labeling function in force on a table overrides these options. Such a function can be named in the call that applies the policy to the table. If the administrator named such a function when applying a policy, but then disables or removes that policy, then that function is no longer applied.

#### **Related Topics**

SA\_SYSDBA.DISABLE\_POLICY
 The SA\_SYSDBA.DISABLE\_POLICY procedure turns off enforcement of a policy, without removing it from the database.

### LABEL DEFAULT: Using the Session's Default Row Label

A user can update a row without specifying a label value, because the updated row uses its original label.

However, to insert a new row, the user must supply a valid label unless a labeling function is in force or LABEL\_DEFAULT applies for the table. LABEL\_DEFAULT causes the user's session default row label to be used as the new row label.

If neither LABEL\_DEFAULT nor a labeling function is in force and the user attempts to INSERT a row, then an error occurs.

Note that any labeling function in force on a table overrides the LABEL DEFAULT option.

## LABEL\_UPDATE: Changing Data Labels

A user updating a row can normally change its label to any label within his authorized label range.

However, if LABEL\_UPDATE applies, then to modify a label, the user must have one or more of these privileges: WRITEUP, WRITEDOWN, and WRITEACROSS.

The LABEL\_UPDATE option uses an Oracle after-row trigger which is called only on an update operation affecting the label. Note that any labeling function in force on a table overrides the LABEL\_UPDATE option.

#### **Related Topics**

Special Row Label Privileges
 Once the label on a row has been set, Oracle Label Security privileges are required to modify the label.

### CHECK CONTROL: Checking Data Labels

If an inserted or updated row gets its label from a labeling function, the label could be outside the user's authorizations.

This prevents this user from being able to read or update the row. To prevent this problem, use the CHECK\_CONTROL setting to allow READ\_CONTROL to apply to the new



label. This ensures that this user will be authorized to read the inserted or updated row after the operation. If not, then the insert or update operation is canceled and has no effect.

In other words, if CHECK\_CONTROL is included as an option in a policy being enforced on a row, then the user modifying that row must still be able to access it after the operation. CHECK\_CONTROL prevents a user or a labeling function from modifying a row's label to include a level, group, or compartment that the modifying user would be prevented from accessing.

Note that CHECK\_CONTROL overrides any labeling function in force on a table.

## How the Access Control Enforcement Options Work

Access control options limit the rows accessible for SELECT, UPDATE, INSERT, or DELETE operations to only those rows whose labels meet established policies.

- READ\_CONTROL: Reading Data
   READ\_CONTROL limits the set of records accessible to a session for SELECT, UPDATE
   and DELETE operations.
- WRITE\_CONTROL: Writing Data
   When an Oracle Label Security policy specifying the WRITE\_CONTROL option is applied to a table, triggers are generated and the algorithm is enforced.
- INSERT\_CONTROL, UPDATE\_CONTROL, and DELETE\_CONTROL
   The INSERT\_CONTROL, UPDATE\_CONTROL, and DELETE\_CONTROL options control policy enforcement during the corresponding operations on the data columns in a row.

### READ\_CONTROL: Reading Data

READ\_CONTROL limits the set of records accessible to a session for SELECT, UPDATE and DELETE operations.

If READ\_CONTROL is not active, then even rows in the table protected by the policy are accessible to all users.

READ\_CONTROL uses Oracle virtual private database (VPD) technology to enforce the read access mediation algorithm illustrated in Figure 3-6.

### WRITE CONTROL: Writing Data

When an Oracle Label Security policy specifying the WRITE\_CONTROL option is applied to a table, triggers are generated and the algorithm is enforced.

WRITE\_CONTROL uses Oracle after-row triggers to enforce the write access mediation algorithm illustrated in Figure 3-7.



#### Note:

The protection implementation for WRITE\_CONTROL is the same for all write operations, but you need not apply all write options across the board. You can apply WRITE\_CONTROL selectively for INSERT, UPDATE, and DELETE operations by using the corresponding policy enforcement option (INSERT\_CONTROL, UPDATE\_CONTROL, and DELETE\_CONTROL) instead of WRITE\_CONTROL.

If WRITE\_CONTROL is on but LABEL\_UPDATE is not specified, then the user can change both data and labels. If you want to control updating the row labels, then specify the LABEL\_UPDATE option in addition to WRITE\_CONTROL when creating your policies.

### INSERT\_CONTROL, UPDATE\_CONTROL, and DELETE\_CONTROL

The INSERT\_CONTROL, UPDATE\_CONTROL, and DELETE\_CONTROL options control policy enforcement during the corresponding operations on the data columns in a row.

These options apply according to the algorithm for write access described in Figure 3-7.

Specifying WRITE\_CONTROL limits all INSERT, UPDATE, and DELETE operations. However,

- Specifying INSERT\_CONTROL limits insertions but not updates or deletes.
- Specifying UPDATE\_CONTROL limits updates but not insertions or deletes.
- Specifying DELETE\_CONTROL limits deletes but not insertions or updates.

#### **Related Topics**

- Inserting Labeled Data Using Policy Options and Labeling Functions
   It is important to understand how enforcement options and labeling functions affect
   the insertion of labeled data.
- Updating Labeled Data Using Policy Options and Labeling Functions
   Users must be authorized to change rows that are protected by Oracle Label Security.
- Deletion of Labeled Data Using Policy Options and Labeling Functions You can delete labeled data.

# How the Overriding Enforcement Options Work

Whereas All\_control applies all of the label management and access control enforcement options, NO CONTROL applies none of them.

In either case, labeling functions and SQL predicates can be applied. Note that the ALL\_CONTROL option can be used only on the command line. If you apply a policy with NO\_CONTROL specified, then a policy label column is added to the table, but the label values are NULL. Because no access controls are operating on the table, you can proceed to enter labels as desired. You can then set the policy enforcement options as you want. NO\_CONTROL can be a useful option if you have a labeling function in force to label the data correctly, but want to let all users access all the data.



# Guidelines for Using the Policy Enforcement Options

You can customize policy enforcement for a schema or table through the Oracle Enterprise Manager.

This functionality is described in Creating an Oracle Label Security Policy or you can use the SA\_POLICY\_ADMIN package as described in SA\_POLICY\_ADMIN Policy Administration PL/SQL Package.

This section documents the supported keywords.

Note that when you create a policy, you can specify a string of default options to be used whenever the policy is applied without schema or table options being specified.

If a policy is first applied to a table, and then also applied to the schema containing that table, then the options on the table are not affected by the schema policy. The options of the policy originally applied to the table remain in force.

In general, administrators use the LABEL\_DEFAULT policy option, causing data written by a user to be labeled with that user's row label. Alternatively, a labeling function can be used to label the data. If neither of these two choices is used, then a label must be specified in every INSERT statement. (Updates retain the row's original label.)

The following table suggests that certain combinations of policy enforcement options are useful when implementing an Oracle Label Security policy. As the table indicates, you might typically enforce READ\_CONTROL and WRITE\_CONTROL, choosing from among several possible combinations for setting the data label on writes.

**Table 8-4 Suggested Policy Enforcement Option Combinations** 

| Options  | Access Enforcement  |
|--|---|
| READ_CONTROL, WRITE_CONTROL, LABEL_DEFAULT     | Read and write access based on session label. Default label provided; users can insert/update both data and labels.                           |
| READ_CONTROL, WRITE_CONTROL, Labeling Function | Read and write access based on session label. Users can set/change only row data; all row labels are set explicitly by the labeling function. |
|  | Add CHECK_CONTROL to restrict new labels (on insert or update) to visible range of labels.  |
| READ_CONTROL, WRITE_CONTROL, LABEL_UPDATE      | Read and write access based on session label. Users cannot change labels without privileges.  |
|  | Add CHECK_CONTROL to restrict new labels (on insert or update) to visible range.  |

#### **Related Topics**

Authorized Levels

The administrator explicitly sets the level authorization for an Oracle Label Security policy.



# **Exemptions from Oracle Label Security Policy Enforcement**

Oracle Label Security has several exceptions from OLS policy enforcement.

These exemptions are as follows:

- Oracle Label Security is not enforced during DIRECT path export.
- By design, Oracle Label Security policies cannot be applied to objects in schema SYS. As a consequence, the SYS user, and users making a DBA-privileged connection to the database (such as CONNECT AS SYSDBA) do not have Oracle Label Security policies applied to their actions. DBAs need to be able to administer the database. It would make no sense, for example, to export part of a table due to an Oracle Label Security policy being applied. The database user SYS is thus always exempt from Oracle Label Security enforcement, regardless of the export mode, application, or utility used to extract data from the database.
- Similarly, database users granted the EXEMPT ACCESS POLICY privilege, either
  directly or through a database role, are exempted from some Oracle Label
  Security policy enforcement controls such as READ\_CONTROL and CHECK\_CONTROL,
  regardless of the export mode, application or utility used to access the database or
  update its data. The following policy enforcement options remain in effect even
  when EXEMPT ACCESS POLICY is granted:
  - INSERT\_CONTROL, UPDATE\_CONTROL, DELETE\_CONTROL, WRITE\_CONTROL, LABEL\_UPDATE, and LABEL\_DEFAULT.
  - If the Oracle Label Security policy specifies the ALL\_CONTROL option, then all enforcement controls are applied except READ\_CONTROL and CHECK\_CONTROL.

EXEMPT ACCESS POLICY is a very powerful privilege and should be carefully managed.

Note that this privilege does not affect the enforcement of standard Oracle Database object privileges such as <code>SELECT</code>, <code>INSERT</code>, <code>UPDATE</code>, and <code>DELETE</code>. These privileges are enforced even if a user has been granted the <code>EXEMPT</code> ACCESS <code>POLICY</code> privilege.

#### **Related Topics**

Categories of Policy Enforcement Options
 Oracle Label Security enforces policies using three categories: label management options, access control options, and overriding options.

# Data Dictionary Views for Viewing Policy Options on Tables and Schemas

Oracle Label Security provides data dictionary views that describe the policy enforcement options currently applied to tables and schemas.

- DBA\_SA\_TABLE\_POLICIES
- DBA\_SA\_SCHEMA\_POLICIES



# **Labeling Functions**

Labeling functions can compute and return a label using resources such as context variables (for example, date or username) and data values.

- Labeling Data Rows under Oracle Label Security
   There are three ways to label data that is being inserted or updated.
- How Labeling Functions in Oracle Label Security Policies Works
   Labeling functions enable you to consider, in your rules for assigning labels, information drawn from the application context.
- Creating a Labeling Function for a Policy
   You can use the CREATE OR REPLACE FUNCTION SQL statement to create a labeling
   function.
- Specifying a Labeling Function in a Policy
   You can use the SA\_POLICY\_ADMIN package to specify a labeling function.

# Labeling Data Rows under Oracle Label Security

There are three ways to label data that is being inserted or updated.

- You can explicitly specify a label in every INSERT or UPDATE to the table.
- You can set the LABEL\_DEFAULT option, which causes the session's row label to be used if an explicit row label is not included in the INSERT or UPDATE statement.
- You can create a labeling function, automatically calls on every INSERT or UPDATE statement and independently of any user's authorization.

The recommended approach is to write a labeling function to implement your rules for labeling data. If you specify a labeling function, then Oracle Label Security embeds a call to that function in INSERT and UPDATE triggers to compute a label.

For example, you could create a labeling function named  $my\_label$  to use the contents of COL1 and COL2 of the new row to compute and return the appropriate label for the row. Then, you could insert, into your INSERT or UPDATE statements, the following reference:

```
my label(:new.col1,:new.col2)
```

If you do not specify a labeling function, then specify the LABEL\_DEFAULT option. Otherwise, you must explicitly specify a label on every INSERT or UPDATE statement.

## How Labeling Functions in Oracle Label Security Policies Works

Labeling functions enable you to consider, in your rules for assigning labels, information drawn from the application context.

For example, you can use as a labeling consideration the IP address to which the user is attached. There are many opportunities to use SYS\_CONTEXT in this way.



#### Note:

If the SQL statement is invalid, then an error will occur when you apply the labeling function to the table or policy. You should thoroughly test a labeling function before using it with tables.

Labeling functions override the LABEL\_DEFAULT and LABEL\_UPDATE options.

A labeling function is called in the context of a before-row trigger. This enables you to pass in the old and new values of the data record, as well as the old and new labels.

You can construct a labeling function to permit an explicit label to be passed in by the user.

All labeling functions must have return types of the LBACSYS.LBAC\_LABEL data type. The TO\_LBAC\_DATA\_LABEL function can be used to convert a label in character string format to a data type of LBACSYS.LBAC\_LABEL. Note that LBACSYS must have the EXECUTE privilege on your labeling function. The owner of the labeling function must have the EXECUTE privilege on the TO\_LBAC\_DATA\_LABEL function, with the GRANT option.



 ${\tt LBACSYS}$  is a unique schema providing opaque types for Oracle Label Security.

#### **Related Topics**

Performing DBA Functions Under Oracle Label Security
 Oracle Label Security supports the standard Oracle Database utilities, but certain restrictions apply, which may require extra steps to get the expected results.

# Creating a Labeling Function for a Policy

You can use the CREATE OR REPLACE FUNCTION SQL statement to create a labeling function.

• To use the CREATE OR REPLACE FUNCTION statement to create a labeling function for a policy, set the return value to LBACSYS.LBAC LABEL.

#### For example:



```
i_label := 'L2:';
else
i_label := 'L1:';
end if;

/************* Determine Compartment *********/
IF Job in ('MANAGER','PRESIDENT') then
i_label := i_label||'M:';
else
i_label := i_label||'E:';
end if;
/************* Determine Groups **********/
i_label := i_label||'D'||to_char(deptno);
return TO_LBAC_DATA_LABEL('human_resources',i_label);
End;
//
```

#### Note:

When Oracle Label Security is configured to work directly with Oracle Internet Directory, dynamic label generation is disabled, because labels are managed centrally in Oracle Internet Directory, using olsadmintool commands. So, if the label function generates a data label using a string value that is not already established in Oracle Internet Directory, then an error message results.

#### **Related Topics**

Command-line Tools for Label Security Using Oracle Internet Directory
 Oracle Label Security provides command-line tools for using Oracle Internet
 Directory.

# Specifying a Labeling Function in a Policy

You can use the SA\_POLICY\_ADMIN package to specify a labeling function.

• Use Sa\_POLICY\_ADMIN.REMOVE\_TABLE\_POLICY and Sa\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY to specify the labeling function.

#### For example:



# Inserting Labeled Data Using Policy Options and Labeling Functions

It is important to understand how enforcement options and labeling functions affect the insertion of labeled data.

- Outcome of Insert or Updates Operations on Data Based on Authorizations
  When you attempt to insert or update data based on your authorizations, the
  outcome depends upon what policy enforcement controls are active.
- Label Insertions When a Labeling Function Is Specified
   A labeling function takes precedence over labels entered by the user.
- Child Row Insertions in Tables with Declarative Referential Integrity
  If declarative referential integrity protects a parent table, then the parent row must
  be visible before a child row can be inserted.

# Outcome of Insert or Updates Operations on Data Based on Authorizations

When you attempt to insert or update data based on your authorizations, the outcome depends upon what policy enforcement controls are active.

- If INSERT\_CONTROL is active, then rows you insert can only have labels within your write authorizations. If you attempt to update data that you can read, but for which you do not have write authorization, an error is raised. For example, if you can read compartments A and B, but you can only write to compartment A, then if you attempt to insert data with compartment B, then the statement will fail.
- If INSERT\_CONTROL is not active, then you can use any valid label on rows you
  insert.
- If the CHECK\_CONTROL option is active, then rows you insert can only have labels you are authorized to read, even if the labels are generated by a labeling function.

# Label Insertions When a Labeling Function Is Specified

A labeling function takes precedence over labels entered by the user.

If the administrator has set up an automatic labeling function, then no data label a user enters will have effect (unless the labeling function itself makes use of the user's proposed label). New row labels are always determined by an active labeling function, if present.

Note that a labeling function can set the label of a row being inserted to a value outside the range that the user writing that row can see. If such a function is in use, then the user can potentially insert a row but not be authorized to see that row. You can prevent this situation by specifying the CHECK\_CONTROL option in the policy. If this option is active, then the new data label is checked against the user's read authorization, and if the user cannot read it, then the insert operation is not performed.



## Child Row Insertions in Tables with Declarative Referential Integrity

If declarative referential integrity protects a parent table, then the parent row must be visible before a child row can be inserted.

The user must be able to see the parent row for the insert operation to succeed, that is, the user must have read access to the parent row.

If READ\_CONTROL is active on the parent table, then the user's read authorization must be sufficient to authorize a SELECT operation on the parent row. For example, a user who cannot read department 20 cannot insert child rows for department 20. Note that all records will be visible if the user has FULL or READ privileges on the table or schema.

# Updating Labeled Data Using Policy Options and Labeling Functions

Users must be authorized to change rows that are protected by Oracle Label Security.

- Updating Labels Using CHAR\_TO\_LABEL

  To change a row label from SENSITIVE to CONFIDENTIAL, you can change the label by using the CHAR\_TO\_LABEL function.
- Evaluation of Enforcement Control Options and UPDATE
   When you attempt to update data based on your authorizations, the outcome depends on which enforcement controls are active.
- Updates to Labels When a Labeling Function Is Specified
   A labeling function takes precedence over labels entered by the user.
- Updates to Child Rows in Tables with Declarative Referential Integrity Enabled
  If a child row is in a table with a referential integrity constraint, then the parent row
  must be visible for the update to succeed.

# Updating Labels Using CHAR\_TO\_LABEL

To change a row label from SENSITIVE to CONFIDENTIAL, you can change the label by using the CHAR\_TO\_LABEL function.

To change a row label, use the UPDATE SQL statement.

#### For example:

```
UPDATE emp
SET hr_label = char_to_label ('HR', 'CONFIDENTIAL')
WHERE ename = 'ESTANTON';
```

### Evaluation of Enforcement Control Options and UPDATE

When you attempt to update data based on your authorizations, the outcome depends on which enforcement controls are active.

• If UPDATE\_CONTROL is active, then you can only update rows whose labels fall within your write authorizations. If you attempt to update data that you can read, but for which you do not have write authorization, then an error is raised. Assume, for example, that you can read compartments A and B, but you can only write to

compartment A. In this case, if you attempt to update data with compartment B, then the statement will fail.

- If UPDATE\_CONTROL is not active, then you can update all rows to which you have read access.
- If LABEL\_UPDATE is active, then you must have the appropriate privilege (WRITEUP, WRITEDOWN, or WRITEACROSS) to change a label by raising or lowering its sensitivity level, or altering its groups or compartments.
- If LABEL\_UPDATE is *not* active but UPDATE\_CONTROL *is* active, then you can update a label to any new label value within your write authorization.
- If CHECK\_CONTROL is active, then you can only write labels you are authorized to read.

The following figure illustrates the label evaluation process for LABEL\_UPDATE.

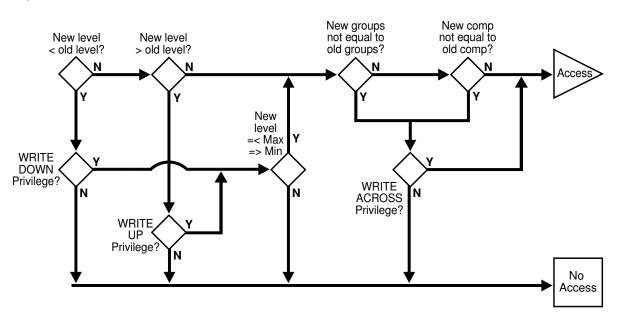


Figure 8-1 Label Evaluation Process for LABEL\_UPDATE

# Updates to Labels When a Labeling Function Is Specified

A labeling function takes precedence over labels entered by the user.

If the administrator has set up an automatic labeling function, then no label a user enters will have effect (unless the labeling function itself makes use of the user's proposed label). New row labels are always determined by an active labeling function, if present.

Note that the security administrator can establish a labeling function that sets the label of a row being updated to a value outside the range that you can see. If this is the case, then you can update a row, but not be authorized to see the row. If the CHECK\_CONTROL option is on, then you will not be able to perform such an update. The CHECK\_CONTROL option verifies your read authorization on the new label.



# Updates to Child Rows in Tables with Declarative Referential Integrity Enabled

If a child row is in a table with a referential integrity constraint, then the parent row must be visible for the update to succeed.

That is, this user must be able to see the parent row.

If the parent table has READ\_CONTROL on, then the user's read authorization must be sufficient to authorize a SELECT on the parent row.

For example, a user who cannot read department 20 in a parent table cannot update an employee's department to department 20 in a child table. (If the user has FULL or READ privilege, then all records will be visible.)



Oracle Database Development Guide

# Deletion of Labeled Data Using Policy Options and Labeling Functions

You can delete labeled data.

Note the following:

- If DELETE\_CONTROL is active, then you can delete only rows within your write authorization.
- If DELETE\_CONTROL is *not* active, then you can delete only rows that you can read.
- With DELETE\_CONTROL active, and declarative referential integrity defined with
  cascading deletes, you must have write authorization on all the rows to be deleted,
  or the statement will fail.

You cannot delete a parent row if there are any child rows attached to it, regardless of your write authorization. To delete such a parent row, you must first delete each of the child rows. If <code>DELETE\_CONTROL</code> is active on any of the child rows, then you must have write authorization to delete the child rows.

Consider, for example, a situation in which the user is <code>UNCLASSIFIED</code> and there are three rows as follows:

| Row         | Table | Sensitivity  |
|-------------|-------|--------------|
| Parent row: | DEPT  | UNCLASSIFIED |
| Child row:  | EMP   | UNCLASSIFIED |
| Child row:  | EMP   | UNCLASSIFIED |

In this case, the unclassified user cannot delete the parent row.



DELETE\_CONTROL has no effect when DELETERESTRICT is active. DELETERESTRICT is always enforced. In some cases (depending on the user's authorizations and the data's labels) it may look as though a row has no child rows, when it actually does have children but the user cannot see them. Even if a user cannot see child rows, he still cannot delete the parent row.

# SQL Predicates with an Oracle Label Security Policy

You can use a SQL predicate to provide extensibility for selective enforcement of data access rules.

- Modifications to an Oracle Label Security Policy with a SQL Predicate
   A SQL predicate is a condition, optionally preceded by AND or OR.
- How Multiple SQL Predicates Affect Oracle Label Security Policies Predicates can be appended to other predicates.

# Modifications to an Oracle Label Security Policy with a SQL Predicate

A SQL predicate is a condition, optionally preceded by AND or OR.

The SQL predicate can be appended for READ\_CONTROL access mediation. The following predicate, for example, adds an application-specific test based on COL1 to determine if the session has access to the row.

```
AND my_function(col1)=1
```

The combined result of the policy and the user-specified predicate limits the rows that a user can read. So, this combination affects the labels and data that CHECK\_CONTROL will permit a user to change. An OR clause, for example, increases the number of rows a user can read.

A SQL predicate can be useful if you want to avoid performing label-based filtering. In certain situations, a SQL predicate can easily implement row-level security on tables. Used instead of READ\_CONTROL, a SQL predicate will filter the data for SELECT, UPDATE, and DELETE operations.

Similarly, in a typical, Web-enabled human resources application, a user might have to be a manager to access rows in the employee table. In such cases, the user's user label would have to dominate the label on the employee's row. A SQL predicate like the following could be added, so that an employee could bypass label-based filtering if he wanted to view his own record in the employee table. (An OR is used so that *either* the label policy will apply, *or* this statement will apply.)

```
OR SYS_CONTEXT ('USERENV', 'SESSION_USER') = employee_name
```

This predicate enables you to have additional access controls so that each employee can access his or her own record.

You can use such a predicate in conjunction with READ\_CONTROLs or as a standalone predicate even if READ\_CONTROL is not implemented.



#### Note:

Verify that the predicate accomplishes your security goals before you implement it in an application.

If a syntax error occurs in a predicate under Oracle Label Security, then an error will *not* arise when you try to apply the policy to a table. Rather, a predicate error message will arise when you first attempt to reference the table.

# How Multiple SQL Predicates Affect Oracle Label Security Policies

Predicates can be appended to other predicates.

A predicate applied to a table with an Oracle Label Security policy is appended to other predicates that are applied by other Oracle Label Security policies, or by Oracle Database fine-grained access control or Oracle Virtual Private Database policies. The predicates are ANDed together.

Consider the following predicates applied to the EMP table in the SCOTT schema:

- A predicate generated by an Oracle VPD policy, such as deptno=10
- A label-based predicate generated by an Oracle Label Security policy, such as label=100, with a user-specified predicate such as

```
OR SYS_CONTEXT ('USERENV', 'SESSION_USER') = ename
```

**Correct:** These predicates would be ANDed together as follows:

```
WHERE deptno=10 AND (label=100 OR SYS_CONTEXT ('USERENV', 'SESSION_USER') = ename)
```

**Incorrect:** The predicates would *not* be combined in the following way:

```
WHERE deptno=10 AND label=100 OR SYS_CONTEXT ('USERENV', 'SESSION_USER') = ename
```



9

# Administering and Using Trusted Stored Program Units

You can use trusted stored program units to enhance system security.

- About Trusted Stored Program Units
   Oracle Database stored procedures, functions, and packages are sets of PL/SQL statements stored in a database in compiled form.
- How a Trusted Stored Program Unit Runs
   A trusted stored program unit runs using its own privileges, and the caller's labels.
- Example: Trusted Stored Program Unit
   A trusted stored program unit with the READ privilege can read all unprotected data and all data protected by this policy.
- Creating and Compiling Trusted Stored Program Units
   You can create and compile trusted stored program units for use in Oracle Label Security.
- How Setting and Returning Label Information Works
   The SA\_UTL package has functions to return information about current values of session security attributes using numeric label values.

# **About Trusted Stored Program Units**

Oracle Database stored procedures, functions, and packages are sets of PL/SQL statements stored in a database in compiled form.

The single difference between functions and procedures is that functions return a value and procedures do not. Trusted stored program units are like any other stored program units in *Oracle Database*: the underlying logic is the same.

A *package* is a set of procedures and functions, together with the cursors and variables they use, stored as a unit. There are two parts to a package, the package specification and the package body. The package specification declares the external definition of the public procedures, functions, and variables that the package contains. The package body contains the actual text of the procedures and functions, as well as any private procedures and variables.

A *trusted stored program unit* is a stored procedure, function, or package that has been granted one or more Oracle Label Security privileges. Trusted stored program units are typically used to let users perform privileged operations in a controlled manner, or update data at several labels. This is the optimal approach to permit users to access data beyond their authorization.

Trusted stored program units provide fine-grained control over the use of privileges. Although you can potentially grant privileges to many users, the granting of privileges should be done with great discretion because it might violate the security policy established for your application. Rather than assigning privileges to users, you can identify any application operations requiring privileges, and implement them as trusted

program units. When you grant privileges to these stored program units, you effectively restrict the Oracle Label Security privileges required by users. This approach employs the principle of *least privilege*.

For example, if a user with the label CONFIDENTIAL needs to insert data into SENSITIVE rows, then you can grant the WRITEUP privilege to a trusted stored program to which the user has access. In this way, the user can perform the task by means of the trusted stored program, while staying at the CONFIDENTIAL level.

The trusted program unit performs all the actions on behalf of the user. You can thus effectively encapsulate the security policy into a module that can be verified to make sure that it is valid.

# How a Trusted Stored Program Unit Runs

A trusted stored program unit runs using its own privileges, and the caller's labels.

In this way, the trusted stored program unit can perform privileged operations on the set of rows constrained by the user's labels.

Oracle Database system and object privileges are intended to be bundled into roles. Users are then granted roles as necessary. By contrast, Oracle Label Security privileges can only be assigned to users or to stored program units. These trusted stored program units provide a more manageable mechanism than roles to control the use of Oracle Label Security privileges.

# **Example: Trusted Stored Program Unit**

A trusted stored program unit with the  $\mathtt{READ}$  privilege can read all unprotected data and all data protected by this policy.

Consider, for example, a user who is responsible for creating purchasing forecast reports. The user must perform a summation operation on the amount of all purchases. Regardless of whether or not user's own labels authorize access to the individual purchase orders. The syntax for creating the summation procedure in this example is as follows:

```
CREATE FUNCTION sum_purchases RETURN NUMBER IS
  psum NUMBER;
BEGIN
  SELECT SUM(amount) INTO psum
  FROM purchase_orders;
RETURN psum;
END sum_purchases;
```

In this way, the program unit can gather information the end user is not able to gather, and can make it available by means of a summation.

Note that to run SUM\_PURCHASES, the user would need to be granted the standard Oracle Database EXECUTE object privilege upon this procedure.

#### **Related Topics**

Access Controls and Privileges
 Oracle provides access controls and privileges that determine the type of access users can have to labeled rows.



# Creating and Compiling Trusted Stored Program Units

You can create and compile trusted stored program units for use in Oracle Label Security.

#### Creation of Trusted Stored Program Units

You can create a trusted stored program unit in the same way that you create a standard procedure, function, or package.

#### Privileges for Trusted Stored Program Units

An Oracle Label Security administrator can verify the correctness of a stored program unit code before granting the privileges to it.

#### Recompiling of Trusted Stored Program Units

Recompiling a trusted stored program unit, either automatically or manually (using ALTER PROCEDURE), does not affect its Oracle Label Security privileges.

#### Re-creation of Trusted Stored Program Units

Oracle Label Security privileges are revoked if you perform a CREATE or REPLACE operation on a trusted stored program unit.

#### Execution of Trusted Stored Program Units

Under Oracle Label Security all the standard Oracle Database controls on procedure call (regarding access to tables and schemas) are still in force.

# Creation of Trusted Stored Program Units

You can create a trusted stored program unit in the same way that you create a standard procedure, function, or package.

To do this, you can use the CREATE PROCEDURE, CREATE FUNCTION, or CREATE PACKAGE and CREATE PACKAGE BODY statements.

The program unit becomes trusted when you grant it Oracle Label Security privileges.



Oracle Database SQL Language Reference

# Privileges for Trusted Stored Program Units

An Oracle Label Security administrator can verify the correctness of a stored program unit code before granting the privileges to it.

Typically another user, such as a developer, creates the stored program unit. Whenever the trusted stored program unit is re-created or replaced, Oracle Label security removes its privileges. The Oracle Label Security administrator must then verify the code again and grant the privileges once again.

The Oracle Label Security administrator should review the program unit code carefully and evaluate the privileges that are to be gratned granting to it. For example, procedures in trusted packages should not perform privileged database operations and then write result or status information into a public variable of the package. In this



way, you can make sure that no violations of your site's Oracle Label Security policy can occur.

#### **Related Topics**

SA\_USER\_ADMIN.SET\_PROG\_PRIVS
 The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure sets policy-specific privileges for program units.

## Recompiling of Trusted Stored Program Units

Recompiling a trusted stored program unit, either automatically or manually (using ALTER PROCEDURE), does not affect its Oracle Label Security privileges.

You must, however, grant the EXECUTE privilege on the program unit again after recompiling.

# Re-creation of Trusted Stored Program Units

Oracle Label Security privileges are revoked if you perform a CREATE or REPLACE operation on a trusted stored program unit.

This limits the potential for misuse of a procedure's Oracle Label Security privileges.

Note that the procedure, function, or package can still run even if the Oracle Label Security privileges have been removed.

If you re-create a procedure, function, or package, then you should carefully review its text. When you are certain that the re-created program unit does not violate your site's Oracle Label Security policy, you can then grant it the required privileges again.

In a development environment where trusted stored program units must frequently be replaced (for example, during the first few months of a live system), it is advisable to create a script that can grant the proper Oracle Label Security privileges, as required.

# **Execution of Trusted Stored Program Units**

Under Oracle Label Security all the standard Oracle Database controls on procedure call (regarding access to tables and schemas) are still in force.

Oracle Label Security complements these security mechanisms by controlling access to rows.

When a trusted stored program unit is carried out, the policy privileges in force are a union of the invoking user's privileges and the program unit's privileges. Whether a trusted stored program unit calls another trusted program unit or a non-trusted program unit, the program unit called runs with the same privileges as the original program unit.

If a sequence of non-trusted and trusted stored program units is carried out, the first trusted program unit will determine the privileges of the entire calling sequence from that point on. Consider the following sequence:

Procedure A (non-trusted)

Procedure B with WRITEUP

Procedure C with WRITEDOWN

Procedure D (non-trusted)



Here, Procedures B, C, and D all runs with the WRITEUP privilege, because B was the first trusted procedure in the sequence. When the sequence ends, the privilege pertaining to Procedure B is no longer in force for subsequent procedures.



Unhandled exceptions raised in trusted program units are caught by Oracle Label Security. This means that error messages may not be displayed to the user. For this reason, you should always thoroughly test and debug any program units before granting them privileges.

# How Setting and Returning Label Information Works

The SA\_UTL package has functions to return information about current values of session security attributes using numeric label values.

Although these functions can be used in program units that are not trusted, they are primarily for use in trusted stored program units.

Note that these are public functions; you do not need the  $policy\_DBA$  role to use them. In addition, each of the functions has a parallel SA\_SESSION function that returns the same labels in character string format.

#### **Related Topics**

Duties of Oracle Label Security Administrators
 Oracle Label Security administrators have a set of package- and role-based privileges.



10

# **Auditing Under Oracle Label Security**

You can use Oracle Label Security auditing if you have not configured your database to use unified auditing.

- About Oracle Label Security Auditing
   Oracle Label Security auditing supplements standard Oracle Database auditing by
   tracking use of its own administrative operations and policy privileges.
- Systemwide Auditing: AUDIT\_TRAIL Initialization Parameter
   If you have not yet enabled unified auditing, for Oracle Label Security to generate audit records, you must first enable system-wide auditing.
- How Oracle Label Security Auditing Is Enabled or Disabled
   After you have enabled systemwide auditing, you can enable or disable Oracle
   Label Security auditing.
- Oracle Label Security and Unified Auditing
   Oracle Database uses the unified audit trail to capture information from various
   audit sources, including Oracle Label Security.
- Oracle Label Security Auditing Tips
   Oracle provides a set of tips for auditing Oracle Label Security.

# **About Oracle Label Security Auditing**

Oracle Label Security auditing supplements standard Oracle Database auditing by tracking use of its own administrative operations and policy privileges.

You can use either the SA\_AUDIT\_ADMIN package or Oracle Enterprise Manager to set and change the auditing options for an Oracle Label Security policy.

When you create a new policy, a label column for that policy is added to the database audit trail. The label column is created regardless of whether auditing is enabled or disabled, and independent of whether database auditing or operating system auditing is used. Whenever a record is written to the audit table, each policy provides a label for that record to indicate the session label. The administrator can create audit views to display these labels. Note that in the audit table, the label does not control access to the row, instead it only records the sensitivity of the row.

The auditing options that you specify apply only to subsequent sessions, not to the current session. You can specify audit options even if auditing is disabled. No overhead is created by making only these specifications. When you do enable Oracle Label Security auditing, the options come into effect, and overhead is created beyond that created by standard Oracle Database auditing.

Note that Oracle Label Security does not provide labels for audit data written to the operating system audit trial. All Oracle Label Security audit records are written directly to the database audit trail, even if operating system auditing is enabled. If auditing is disabled, then no Oracle Label Security audit records are generated.

If you are using traditional auditing (not unified auditing), then the traditional audit trail lists only the action numbers. To find the corresponding audit action names, you can

query the LABACSYS.OLS\$AUDIT\_ACTIONS system table. You must have the AUDIT\_VIEWER, AUDIT\_ADMIN, or policy\_DBA role to query this table.

# Systemwide Auditing: AUDIT\_TRAIL Initialization Parameter

If you have not yet enabled unified auditing, for Oracle Label Security to generate audit records, you must first enable system-wide auditing.

To enable system-wide auditing, you can set the Oracle Database AUDIT\_TRAIL initialization parameter in the database's parameter file.

You can set the AUDIT\_TRAIL parameter to one of the following values:

Table 10-1 AUDIT\_TRAIL Parameter Settings

| Setting      | Explanation   |
|--------------|---|
| DB           | Enables database auditing and directs all audit records to the database audit trail. This approach is recommended by Oracle.  |
|              | Note that even with AUDIT_TRAIL set to DB, some records are always sent to the operating system audit trail. These include STARTUP and SHUTDOWN statements, as well as CONNECT AS SYSOPER or SYSDBA.  |
| DB, EXTENDED | Does all actions of AUDIT_TRAIL=DB and also populates the SqlBind and SqlText CLOB-type columns of the AUD\$ table.   |
| os           | Enables operating system auditing. This directs most of your Oracle Database audit records to the operating system, rather than to the database; the records will not contain Oracle Label Security labels. By contrast, any Oracle Label Security auditing will go to the database, with labels. |
|              | If you set AUDIT_TRAIL to OS, then the Oracle Label Security-specific audit records are written to the database audit trail and the other Oracle Database audit records are written to the operating system audit trail (with no policy column in the operating system data).                     |
| NONE         | Disables auditing. This is the default.   |

After you have edited the parameter file, restart the database instance to enable or disable database auditing as specified.

Set the AUDIT\_TRAIL parameter before you set audit options. If you do not set this parameter, then you are still able to set audit options. However, audit records are not written to the database until the parameter is set and the database instance is restarted.



#### See Also:

- Oracle Database Security Guide for information about enabling and disabling systemwide auditing, setting audit options, and managing the audit trail
- Oracle Database Reference or information about editing initialization parameter
- Oracle Database SQL Language Reference for details about systemwide AUDIT and NOAUDIT functioning

# How Oracle Label Security Auditing Is Enabled or Disabled

After you have enabled systemwide auditing, you can enable or disable Oracle Label Security auditing.

To use Oracle Label Security auditing, you must have the <code>policy\_DBA</code> role and use the <code>SA\_AUDIT\_ADMIN</code> PL/SQL package procedures.

#### **Related Topics**

SA\_AUDIT\_ADMIN Oracle Label Security Auditing PL/SQL Package
 For a non-unified auditing environment, the SA\_AUDIT\_ADMIN PL/SQL package configures auditing that is specific to Oracle Label Security.

# Oracle Label Security and Unified Auditing

Oracle Database uses the unified audit trail to capture information from various audit sources, including Oracle Label Security.

You can configure OLS auditing using audit policies. Oracle Label Security auditing in Oracle Database 12c release 1 (12.1) enables you to audit additional events such as enabling and disabling of OLS policies.

If you have upgraded your database to Oracle Database 12c release 1 (12.1), but have not configured it to use unified auditing, then you must use the pre-12c OLS auditing described in this chapter.

The Oracle Database audit facility lets you hold database users accountable for the operations they perform. It can track specific database objects, operations, users, and privileges. Oracle Label Security supplements this by tracking use of its own administrative operations and policy privileges. It provides the SA\_AUDIT\_ADMIN package to set and change the policy auditing options.

#### See Also:

Oracle Database Security Guide for instructions on configuring your upgraded database to use unified auditing. After migration, you can find the OLS unified audit information at Oracle Database Security Guide



# **Oracle Label Security Auditing Tips**

Oracle provides a set of tips for auditing Oracle Label Security.

- Strategy for Setting SA\_AUDIT\_ADMIN Options
  Before setting any audit options, you must devise an auditing strategy that
  monitors events of interest, without recording extraneous events.
- Auditing of Privileged Operations
   Consider auditing any operations that require Oracle Label Security privileges.

# Strategy for Setting SA\_AUDIT\_ADMIN Options

Before setting any audit options, you must devise an auditing strategy that monitors events of interest, without recording extraneous events.

You should periodically review this strategy, because applications, user base, configurations, and other external factors can change.

The Oracle Label Security options, and those provided by the Oracle Database audit facility, might not directly address all of your specific or application-dependent auditing requirements. However, through use of database triggers, you can audit specific events and record specific information that you cannot audit and record using the more generic audit facility.



Oracle Database Concepts for more information about using triggers for auditing

# **Auditing of Privileged Operations**

Consider auditing any operations that require Oracle Label Security privileges.

Because these privileges perform sensitive operations, and because their abuse could jeopardize security, you should closely monitor their dissemination and use.



11

# Using Oracle Label Security with a Distributed Database

You should understand the special considerations for using Oracle Label Security in a distributed configuration.

- About the Oracle Label Security Distributed Configuration
   In a network configuration that supports distributed databases, multiple Oracle
   Database (or other) servers can run on the same or different operating systems.
- How Connections to a Remote Database Under Oracle Label Security Work
   Distributed databases act in the standard way with Oracle Label Security: the local
   user ends up connected as a particular remote user.
- Session Labels and Row Labels in Remote Sessions
   When connecting remotely, you can directly control the session label and row label in effect when you establish the connection.
- Labels in a Distributed Environment
   You should use the same label component definitions and label tags on any
   database that is to be protected by the policy.
- Oracle Label Security Policies in a Distributed Environment
   Oracle Label Security supports all standard Oracle Database distributed configurations.
- Replication with Oracle Label Security
   You should understand how to use the replication option with tables protected by
   Oracle Label Security policies.

# About the Oracle Label Security Distributed Configuration

In a network configuration that supports distributed databases, multiple Oracle Database (or other) servers can run on the same or different operating systems.

Each cooperative server in a distributed system communicates with other clients and servers over a network.

Figure 11-1 illustrates a distributed database that includes clients and servers with and without Oracle Label Security. As described in this chapter, if you establish database links from the WESTERN\_REGION database to the EASTERN\_REGION database, then you can access data if your user ID on EASTERN\_REGION is authorized to see it, even if locally (on WESTERN\_REGION) you do not have this access.

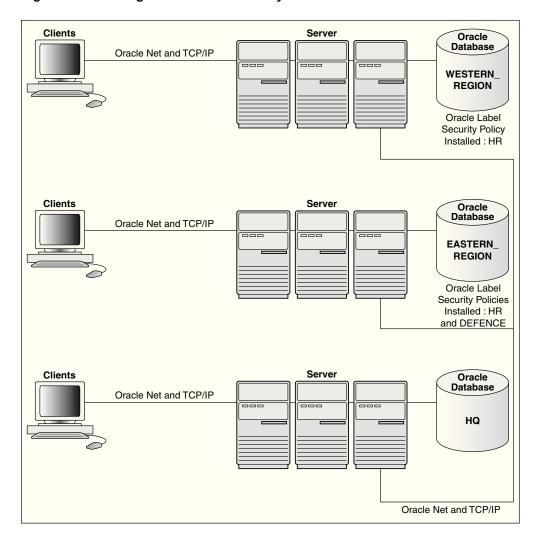


Figure 11-1 Using Oracle Label Security with a Distributed Database

# How Connections to a Remote Database Under Oracle Label Security Work

Distributed databases act in the standard way with Oracle Label Security: the local user ends up connected as a particular remote user.

Oracle Label Security protects the labeled data, whether you connect locally or remotely. If the remote user has the proper labels, then you can access the data. If not, then you cannot access the data.

The database link sets up the connection to the remote database and identifies the user who will be associated with the remote session. Your Oracle Label Security authorizations on the remote database are based on those of the remote user identified in the database link.

For example, local user JANE might connect as remote user AUSTEN, in the database referenced by the connect string sales, as follows:

```
CREATE DATABASE LINK sales

CONNECT TO austen IDENTIFIED BY pride
USING 'sales'
```

When JANE connects, her authorizations are based on the labels and privileges of remote user AUSTEN, because AUSTEN is the user identified in the database link. When JANE makes the first reference to the remote database, the remote session is actually established. For example, the remote session would be created if JANE enters:

```
SELECT * FROM emp@sales
```

You need not be an Oracle Label Security policy user in the local database. If you connect as a policy user on the remote database, you can access protected data.

## Session Labels and Row Labels in Remote Sessions

When connecting remotely, you can directly control the session label and row label in effect when you establish the connection.

When you connect, Oracle Label Security passes these values (for all policies) over to the remote database. Notice that:

- The local session label and row label are used as the default for the remote session, if they are valid for the remote user.
- The remote session is constrained by the minimum and maximum authorizations of the remote user.
- Although the local user's session labels are passed to the remote database, the local user's privileges are not passed. The privileges for the remote session are those associated with the remote user.

Consider a local user, Diana, with a maximum level of HS, and a session level of S. On the remote database, the remote user identified in the database link has a maximum level of S.

- If Diana's session label is s when the database link is established, then the s label is passed over. This is a valid label. Diana can connect and read SENSITIVE data.
- If Diana's session label is HS when the database link is established, then the HS level is passed across, but it is not valid for the remote user. Diana will pick up the remote user's default label (S).

Be aware of the label at which you are running the first time you connect to the remote database. The first time you reference a database link, your local session labels are sent across to the remote system when a connection is made. Later, you can change the label, but to do so, you must run the SA\_SESSION.SET\_LABEL procedure on the remote database.

Diana can connect at level  ${\tt HS}$ , set the label to  ${\tt S}$ , and then perform a remote access. Connection is implicitly made when the database link is established. Her default label is  ${\tt S}$  on the remote database.

On the local database, Diana can set her session label to her maximum level of  ${\tt HS}$ , but if the label of the remote user is set to  ${\tt S}$ , then she can only retrieve  ${\tt S}$  data from the remote database. If she performs a distributed query, then she will get  ${\tt HS}$  data from the local database, and  ${\tt S}$  data from the remote database.



## Labels in a Distributed Environment

You should use the same label component definitions and label tags on any database that is to be protected by the policy.

- Label Tags in a Distributed Environment
   In a distributed environment, you may choose to use the same label tags across multiple databases.
- Numeric Form of Label Components in a Distributed Environment
   In a distributed environment, the same relative ranking of the numeric form of the level component ensures that the labels are properly sorted.

# Label Tags in a Distributed Environment

In a distributed environment, you may choose to use the same label tags across multiple databases.

However, if you choose *not* to use the same tags across multiple databases, then you should retrieve the character form of the label when performing remote operations. This will ensure that the labels are consistent.

In the following example, the character string representation of the label string is the same. However, the label tag does not match. If the retrieved label tag has a value of 11 on the WESTERN\_REGION database but a tag of 2001 on the EASTERN\_REGION database, then the tags have no meaning. Serious consequences can result.

Figure 11-2 Label Tags in a Distributed Database

#### **EASTERN REGION**

| Label | Label Tag |
|-------|-----------|
| S:A   | 3001      |
| C:A   | 2001      |
| U     | 10        |

#### **WESTERN REGION**

| Label | Label Tag |
|-------|-----------|
| S:A   | 11        |
| C:A   | 6         |
| U     | 5         |

When retrieving labels from a remote system, you should return the character string representation (rather than the numeric label tag), unless you are using the same numeric labels on both databases.

If you allow Oracle Label Security to automatically generate labels on different databases, then the label tags will not be identical. Character strings will have meaning, but the numeric values will not, unless you have predefined labels with the same label tags on both instances.

To avoid the complexities of label tags, you can convert labels to strings on retrieval (using LABEL\_TO\_CHAR) and use CHAR\_TO\_LABEL when you store labels. Operations will succeed as long as the component names are the same.

## Numeric Form of Label Components in a Distributed Environment

In a distributed environment, the same relative ranking of the numeric form of the level component ensures that the labels are properly sorted.

In the following example, the levels in the two databases are effectively the same. Although the numeric form is different, the relative ranking of the levels numeric form is the same. As long as the relative order of the components is the same, the labels are perceived as identical.

Figure 11-3 Label Components in a Distributed Database

#### **EASTERN REGION**

| Level | Numeric<br>Form |
|-------|-----------------|
| S     | 30              |
| С     | 20              |
| U     | 10              |

#### **WESTERN REGION**

| Level | Numeric<br>Form |
|-------|-----------------|
| S     | 6               |
| С     | 5               |
| U     | 4               |

# Oracle Label Security Policies in a Distributed Environment

Oracle Label Security supports all standard Oracle Database distributed configurations.

Whether or not you can access protected data depends on the policies installed in each distributed database.

Be sure to take into account the relationships between databases in a distributed environment:

- If the same application runs on two databases and you want them to have the same protection, then you must apply the same Oracle Label Security policy to both the local and the remote databases.
- If the local and remote databases have a policy in common, then your local session label and row label will override the default labels for the remote user.
- If the remote database has a different policy than the local database, then the remote policy can restrict access to the data independent of your local policies. On the other hand, when you make a connection as a remote user who has authorization on the remote policy, you can access any data to which the remote user has access to, regardless of your local authorizations.

If the remote database has no policy applied to it, you can access its data just as you would with a standard distributed database.

Consider a situation in which three databases exist, with different Oracle Label Security policies in force:



Database 1 has Policy A and Policy B Database 2 has Policy A Database 3 had Policy C

Users authorized for Policy A can obtain protected data from Database 1 and Database 2. If the remote user is authorized for Policy C, then this user can obtain data from Database 3 as well.

# Replication with Oracle Label Security

You should understand how to use the replication option with tables protected by Oracle Label Security policies.

- About Replication Under Oracle Label Security
   You can replicate data in Oracle Label Security.
- Contents of a Materialized View
   Oracle Label Security can create materialized views.
- Requirements for Creating Materialized Views Under Oracle Label Security
  The requirements for creating a materialized view depend on the type of
  materialized view you are creating.
- How to Refresh Materialized Views
   If the contents or definition of a master table changes, then you should refresh the materialized view.

## About Replication Under Oracle Label Security

You can replicate data in Oracle Label Security.

- Replication Functionality Supported by Oracle Label Security
   Oracle Label Security supports replication using read-only materialized views
   (snapshots).
- Row-Level Security Restriction on Replication Under Oracle Label Security
   An Oracle Label Security policy applies Row Level Security (RLS) to a table if
   READ\_CONTROL is specified as one of the policy options.

### Replication Functionality Supported by Oracle Label Security

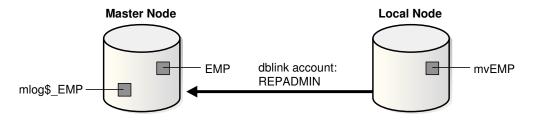
Oracle Label Security supports replication using read-only materialized views (snapshots).

Oracle Database uses materialized views for replicating data. A *materialized view* is a local copy of a local or remote master table that reflects a recent state of the master table.

As illustrated in Figure 11-4, a master table is a table you wish to replicate, on a node that you designate as the master node. Using a dblink account, you can create a materialized view of the table in a different database. (This can also be done in the same database, and on the same system.) You can select rows from the remote master table, and copy them into the local materialized view. Here, mvEMP represents the materialized view of table EMP, and mlog\$\_EMP represents the materialized view log.



Figure 11-4 Use of Materialized Views for Replication



In a distributed environment, a materialized view alleviates query traffic over the network and increases data availability when a node is not available.

### Row-Level Security Restriction on Replication Under Oracle Label Security

An Oracle Label Security policy applies Row Level Security (RLS) to a table if READ\_CONTROL is specified as one of the policy options.

Problems occur if *both* of the following conditions are true:

- The Oracle Label Security policy is applied to any table relevant to replication (such as the master table, materialized view, or materialized view log), and
- The policy returns a predicate in the WHERE clause of SELECT statements.

To avoid the additional predicate (and therefore avoid this problem), the users involved in a replication environment should be given the necessary Oracle Label Security privileges. To be specific, the designated users in the database link (such as REPADMIN and the materialized view owner) must have the READ or the FULL privilege. As a result, the queries used to perform the replication will not be modified by RLS.



### Contents of a Materialized View

Oracle Label Security can create materialized views.

- How Materialized View Contents Are Determined
   Oracle Label Security performs a set steps when creating materialized views.
- Complete Materialized Views
   Oracle Label Security supports complete materialized views.
- Partial Materialized Views
   A partial materialized view is created when you specify a WHERE clause in the materialized view definition.

#### How Materialized View Contents Are Determined

Oracle Label Security performs a set steps when creating materialized views.

The following steps determine the contents of the view:

- It reads the definition of the master table in the remote database.
- 2. It reads the rows in the master table that meet the conditions defined in the materialized view definition.
- 3. It writes these rows to the materialized view in the local database.

Because Oracle Label Security writes only those rows to which you have write access in the local database, the contents of the materialized view vary according to:

- The policy options in effect
- The privileges you have defined in the local database
- The session label

### Complete Materialized Views

Oracle Label Security supports complete materialized views.

If you read all of the rows in the master table and have write access in the local database to each label in the materialized view, then the result is a complete materialized view of the master table. To ensure that the materialized view is complete, you should have read access to all of the data in the master table and write access in the local database to all labels at which data is stored in the master table.



Never revoke privileges that you granted when you created the materialized view. If you do, then you may not be able to perform a replication refresh.

#### Partial Materialized Views

A partial materialized view is created when you specify a WHERE clause in the materialized view definition.

A partial materialized view is a convenient way to pass subsets of data to a remote database.

To create a partial materialized view, a user must have write access to all the rows being replicated. You can find the currently granted privileges for a user by querying the DBA\_SA\_USER\_PRIVS data dictionary view.

# Requirements for Creating Materialized Views Under Oracle Label Security

The requirements for creating a materialized view depend on the type of materialized view you are creating.

Requirements for a Replication Administrator
Requirements for a replication administrator, typically using a REPADMIN account,
vary depending on the configuration.



- Requirements for the Owner of the Materialized View
   The privileges that belong to the owner of the materialized view are used during the refresh of the materialized view.
- Requirements for Creating Partial Multilevel Materialized Views
   A partial materialized view can include only some of the rows in a remote master table that is protected by Oracle Label Security.
- Requirements for Creating Complete Multilevel Materialized Views
   A complete materialized view can include every row in a remote master table that is protected by Oracle Label Security.

#### Requirements for a Replication Administrator

Requirements for a replication administrator, typically using a REPADMIN account, vary depending on the configuration.

In general, however, it should meet the following requirements:

- It must have the FULL Oracle Label Security privilege (mandatory for all configurations).
- It must have the SELECT privilege on the master table.
- It must be the account that establishes the database link from the remote node to the database containing the master table.

#### Requirements for the Owner of the Materialized View

The privileges that belong to the owner of the materialized view are used during the refresh of the materialized view.

If these privileges are not sufficient, then there are two options:

- The materialized view can be created in the REPADMIN account, or
- Additional privileges must be granted to the owner of the materialized view.

Consider, for example, the following materialized view created by user SCOTT:

```
CREATE MATERIALIZED VIEW mvemp as
SELECT *
FROM EMP@link_to_master
WHERE label_to_char(sa_label) = 'HS';
```

Here, SCOTT should have permission to insert records at the HS level in the local database. If Oracle Label Security policies are applied on the materialized view, then SCOTT must have the FULL privilege to avoid the RLS restriction.

Different configurations can be set up depending on whether Oracle Label Security policies are applied on the materialized view, what privileges are granted to the owner of the materialized view, and so on. If Oracle Label Security policies are applied to the materialized view, but SCOTT should not be granted the FULL privilege, then the REPADMIN account must be used to create the materialized view. SCOTT can then be granted the SELECT privilege on that table.

If no policies are applied to the materialized view, then the view can be created in SCOTT's schema without any additional privileges. In this case, the materialized view



should be created in such a way that a where condition limits the records to those which SCOTT can read.

Finally, if SCOTT can be granted the FULL privilege, then the materialized view can be created in SCOTT's schema, and Oracle Label Security policies can also be applied on the materialized view.

Note that the master table can have Oracle Label Security policies containing any set of policy options. If SCOTT has the FULL or the READ privilege, he can select all rows, regardless of policy options.

### Requirements for Creating Partial Multilevel Materialized Views

A partial materialized view can include only some of the rows in a remote master table that is protected by Oracle Label Security.

If the partial materialized view is used in a table that Oracle Label Security protects, then you should ensure that you have sufficient privileges to WRITE in the local database at every label retrieved by your query. You can find your currently granted privileges by querying the ALL\_SA\_USER\_PRIVS data dictionary view.

#### Requirements for Creating Complete Multilevel Materialized Views

A complete materialized view can include every row in a remote master table that is protected by Oracle Label Security.

If the complete materialized view is used in a table that Oracle Label Security protects, then you must be able to have WRITE access in the local database at the labels of all of the rows retrieved by the defined materialized view query. You can find your currently granted privileges by querying the ALL SA USER PRIVS data dictionary view.

#### How to Refresh Materialized Views

If the contents or definition of a master table changes, then you should refresh the materialized view.

This ensures that the materialized view accurately reflects the contents of the master table.

To refresh a materialized view of a remote multilevel table, you must also have privileges to write in the local database at the labels of all of the rows that the materialized view query retrieves



#### **WARNING:**

A materialized view can potentially contain outdated rows if you refresh a partial or full materialized view but do not have READ access to all the rows in the master table, and consequently do not overwrite the rows in the original materialized view with the updated rows from the master table.

To ensure an accurate materialized view refresh, you should use job queues to refresh the views automatically. These processes must have sufficient privileges both to read all of the rows in the master table and to write those rows to the materialized view,

ensuring that the view is completely refreshed. Remember that the privileges used by these processes are those of the materialized view owner.



Oracle Database Data Warehousing Guide for information about job queues



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# Performing DBA Functions Under Oracle Label Security

Oracle Label Security supports the standard Oracle Database utilities, but certain restrictions apply, which may require extra steps to get the expected results.

- Oracle Data Pump Export Use with Oracle Label Security
   Oracle Data Pump enables high-speed movement of data and metadata from one database to another.
- Data Pump Import Use with Oracle Label Security
   Oracle Data Pump enables high-speed movement of data and metadata from one database to another.
- SQL\*Loader Use with Oracle Label Security SQL\*Loader moves data from external files into tables in Oracle Database.
- Performance Tips for Oracle Label Security
   You can achieve optimal performance with Oracle Label Security.
- Creation of Additional Databases After Installation
   You can create and configure additional databases after you install Oracle Label Security.
- Oracle Label Security Upgrades and Downgrades
   You should be aware of how to manage Oracle Label Security upgrades and
   downgrades.

# Oracle Data Pump Export Use with Oracle Label Security

Oracle Data Pump enables high-speed movement of data and metadata from one database to another.

- Full Database Export
  Starting with Oracle Database 12c, Oracle Label Security metadata in the LBACSYS schema can be included when doing a full database export and import operation.
- Schema and Table-Level Export
   The Data Pump export utility functions in the standard way under Oracle Label Security.

## Full Database Export

Starting with Oracle Database 12c, Oracle Label Security metadata in the LBACSYS schema can be included when doing a full database export and import operation.

The source database can be Oracle Database 11*g* release 2 (11.2.0.3), or higher, but the target database must be Oracle Database 12*c* or higher.

Before starting the Data Pump import on the target database, you must enable Oracle Label Security.

## Schema and Table-Level Export

The Data Pump export utility functions in the standard way under Oracle Label Security.

There are, however, a few differences resulting from the enforcement of Oracle Label Security policies.



You must have the EXEMPT ACCESS POLICY privilege in order to export all rows in the table, or else no rows are exported.

- For any tables protected by an Oracle Label Security policy, only rows with labels authorized for read access are exported. Unauthorized rows are not included in the export file. Consequently, to export all the data in protected tables, you must have a privilege (such as FULL or READ) that gives you complete access.
- SQL statements to reapply policies are exported along with tables and schemas
  that are exported. These statements are carried out during import to reapply
  policies with the same enforcement options as in the original database.
- The HIDE property is not exported. When protected tables are exported, the label columns in those tables are also exported (as numeric values). However, if a label column is hidden, then it is exported as a normal, unhidden column.
- The user must have EXEMPT ACCESS POLICY in order to export all rows in the table, or else no rows are exported.

# Data Pump Import Use with Oracle Label Security

Oracle Data Pump enables high-speed movement of data and metadata from one database to another.

- Full Database Import for the LBACSYS Schema Metadata
   Oracle Label Security metadata in the LBACSYS schema can be included when you perform a full database export and import operation.
- Schema and Table Level Import
   You can use the Oracle Data Pump Import utility functions under Oracle Label
   Security.

# Full Database Import for the LBACSYS Schema Metadata

Oracle Label Security metadata in the LBACSYS schema can be included when you perform a full database export and import operation.

The source database can be Oracle Database 11*g* release 2 (11.2.0.3), or higher, but the target database must be Oracle Database 12*c* release 1 (12.1) or higher.

Oracle Data Pump import utility, impdp, automatically imports Label Security metadata including policies, labels, user authorizations, schema and table policy enforcements.



You must register and enable Oracle Label Security for the target database before beginning the import operation.

#### **Related Topics**

You can query the DBA\_OLS\_STATUS and CDB\_OLS\_STATUS data dictionary views to find if Oracle Label Security has already been registered and enabled.

## Schema and Table Level Import

You can use the Oracle Data Pump Import utility functions under Oracle Label Security.

- Requirements for Import Under Oracle Label Security You can use the impdp under Oracle Label Security.
- Definition of Data Labels for Import

  The label definitions at the time of import must include all the policy labels used in the export file.
- Imports of Labeled Data Without Installing Oracle Label Security
   When data type for policy label columns is NUMBER, they can be imported into
   databases that do not have Oracle Label Security installed.
- Imports of Unlabeled Data
   You can import unlabeled data into an existing table protected by an Oracle Label Security policy.
- Importing Tables with Hidden Columns
   A hidden column is exported as a normal column, but the fact that it was hidden is lost.

#### Requirements for Import Under Oracle Label Security

You can use the impdp under Oracle Label Security.

To use the <code>impdp</code> under Oracle Label Security, you must prepare the import database and ensure that the import user has the proper authorizations.

- Preparing the Import Database
   Before you can use the Import utility with Oracle Label Security, you must prepare the import database.
- Verification of Import User Authorizations
   You must be authorized to run the import operation for labels required to insert data and labels in the export file.

#### Preparing the Import Database

Before you can use the Import utility with Oracle Label Security, you must prepare the import database.

- 1. Ensure that Oracle Label Security is enabled. See Checking if Oracle Label Security Has Been Registered and Enabled.
- Create any Oracle Label Security policies that protect the data to be imported.Ensure that the policies use the same column names as in the export database.



Define in the import database all of the label components and individual labels used in tables being imported.

Ensure that the same tag values are assigned to the policy labels in each database. (Note that if you are importing into a database from which you exported, then the components are most likely already defined.)

#### Verification of Import User Authorizations

You must be authorized to run the import operation for labels required to insert data and labels in the export file.

Errors will be raised upon import if you do not meet the following requirements.

• To import tables or schemas with Label Security policies on them, you must have execute privilege on the SA\_POLICY\_ADMIN package.

To ensure that all rows can be imported, you must have the <code>policy\_DBA</code> role for all policies with data being imported. After each schema or table is imported, any policies from the export database are reapplied to the imported objects.

You must also have the ability to write all rows that have been exported as follows:

#### **Requirement 2:**

- You can granted the FULL privilege or given sufficient authorization to write all labels contained in the import file.
- A user-defined labeling function can be applied to the table.

#### Definition of Data Labels for Import

The label definitions at the time of import must include all the policy labels used in the export file.

The DBA\_SA\_LABELS data dictionary view lists data labels. You can use the views DBA\_SA\_LEVELS, DBA\_SA\_COMPARTMENTS, DBA\_SA\_GROUPS, and in the export database to design SQL scripts that re-create the label components and labels for each policy in the import database. The following example shows how to generate a PL/SQL block that re-creates the individual labels for the HR policy:

If the individual labels do not exist in the import database with the same numeric values and the same character string representations as in the export database, then the label values in the imported tables will be meaningless. The numeric label value in

the table may refer to a different character string representation, or it may be a label value that has not been defined at all in the import database.

If a user attempts to access rows containing invalid numeric labels, then the operation will fail.

#### Imports of Labeled Data Without Installing Oracle Label Security

When data type for policy label columns is NUMBER, they can be imported into databases that do not have Oracle Label Security installed.

In this case, the values in the policy label column are imported as numbers. Without the corresponding Oracle Label Security label definitions, the numbers will not reference any specific label.

Note that errors will be raised during the import if Oracle Label Security is not installed, because the SQL statements to reapply the policy to the imported tables and schemas will fail

#### Imports of Unlabeled Data

You can import unlabeled data into an existing table protected by an Oracle Label Security policy.

Either the LABEL\_DEFAULT option or a labeling function must be specified for each table being imported, so that the labels for the rows can be automatically initialized as they are inserted into the table.

### Importing Tables with Hidden Columns

A hidden column is exported as a normal column, but the fact that it was hidden is lost.

If you want to preserve the hidden property of the label column, then you must first create the table in the import database.

- 1. Before you perform the import, create the table and apply the policy with the HIDE option. This adds the policy label column to the table as a hidden column.
- 2. Remove the policy from the table, so that the enforcement options specified in the export file can be reapplied to the table during the import operation.
- 3. Perform the import with IGNORE=Y. Setting the IGNORE parameter to Y ignores errors during import.
- 4. Manually apply the policy to the table with the HIDE option.

# SQL\*Loader Use with Oracle Label Security

SQL\*Loader moves data from external files into tables in Oracle Database.

- Requirements for Using SQL\*Loader Under Oracle Label Security
   You can use SQL\*Loader with the conventional path to load data into a database
   protected by Oracle Label Security.
- Oracle Label Security Input to SQL\*Loader
   If the policy column for a table is hidden, then you must use the HIDDEN keyword to convey this information to SQL\*Loader.



# Requirements for Using SQL\*Loader Under Oracle Label Security

You can use SQL\*Loader with the conventional path to load data into a database protected by Oracle Label Security.

Because SQL\*Loader performs INSERT operations, all of the standard requirements apply when using SQL\*Loader on tables protected by Oracle Label Security policies.

# Oracle Label Security Input to SQL\*Loader

If the policy column for a table is hidden, then you must use the HIDDEN keyword to convey this information to SQL\*Loader.

To specify row labels in the input file, you must include the policy label column in the INTO TABLE clause in the control file.

To load policy labels along with the data for each row, you can specify the CHAR\_TO\_LABEL function or the TO\_DATA\_LABEL function in the SQL\*Loader control file.



When Oracle Label Security is installed to work with Oracle Internet Directory, dynamic label generation is not allowed, because labels are managed centrally in Oracle Internet Directory, using olsadmintool commands.

When Oracle Label Security is directory-enabled, then the function TO\_DATA\_LABEL is not available and generates an error message if used.

Table 12-1 shows the variations that you can use when you load Oracle Label Security data with SQL\*Loader.

Table 12-1 Input Choices for Oracle Label Security Input to SQL\*Loader

| Form of Data                                    | Explanation of Results  |
|---|---|
| coll hidden integer external                    | Hidden column loaded with tag value of data directly from data file   |
| <pre>col2 hidden char(5) "func(:col2)"</pre>    | Hidden column loaded with character value of data from data file.func() used to translate between the character label and its tag value. Note: func() might be char_to_label(). |
| col3 hidden "func(:col3)"                       | Same as in col2, field type defaults to <b>char</b>   |
| <pre>col4 hidden expression "func(:col4)"</pre> | Hidden column not mapped to input data.func() will be called to provide the label value. This could be a user function.   |

For example, the following is a valid INTO TABLE clause in a control file that is loading data into the DEPT table:

```
INTO TABLE dept
(hr_label HIDDEN POSITION (1:22) CHAR "CHAR_TO_LABEL('HR',:hr_label)",
deptno     POSITION (23:26) INTEGER EXTERNAL,
```



```
dname POSITION (27:40) CHAR, loc POSITION(41,54) CHAR)
```

The following could be an entry in the data file specified by this control file:

HS:FN 231 ACCOUNTING REDWOOD SHORES

#### **Related Topics**

Command-line Tools for Label Security Using Oracle Internet Directory
 Oracle Label Security provides command-line tools for using Oracle Internet
 Directory.

# Performance Tips for Oracle Label Security

You can achieve optimal performance with Oracle Label Security.

- Use of ANALYZE to Improve Oracle Label Security Performance
   You can run the ANALYZE statement on the Oracle Label Security data dictionary
   tables in the LBACSYS schema.
- Creation of Indexes on the Policy Label Column
   Creating the appropriate type of index on the policy label column improves the performance of user-raised queries on protected tables.
- Label Tag Strategy Plan to Enhance Performance
   For optimal performance, you can plan a strategy for assigning values to label tags.
- Partitioned Data Based on Numeric Label Tags
   Using a numeric ordering strategy with the numeric label tags applied to the labels can a basis for Oracle Database data partitioning.

## Use of ANALYZE to Improve Oracle Label Security Performance

You can run the ANALYZE statement on the Oracle Label Security data dictionary tables in the LBACSYS schema.

This enables the cost-based optimizer to improve execution plans on queries, which improves Oracle Label Security performance.

Running ANALYZE on application tables improves the application SQL performance.



Oracle Database SQL Language Reference for the ANALYZE syntax

# Creation of Indexes on the Policy Label Column

Creating the appropriate type of index on the policy label column improves the performance of user-raised queries on protected tables.

If you have applied an Oracle Label Security policy on a database table in a particular schema, then you should compare the number of different labels to the amount of

data. Based on this information, you can decide which type of index to create on the policy label column.

- If the cardinality of data in the policy label column (that is, the number of labels compared to the number of rows) is low, then consider creating a bitmapped index.
- If the cardinality of data in the policy label column is high, then consider creating a B-tree index.

Consider the following case, in which the EMP table is protected by an Oracle Label Security policy with the READ\_CONTROL enforcement option set, and HR\_LABEL is the name of the policy label column. A user raises the following query:

```
SELECT COUNT (*) FROM SCOTT.EMP;
```

In this situation, Oracle Label Security adds a predicate based on the label column. For example:

```
SELECT COUNT (*) FROM SCOTT.EMP
WHERE hr_label=100;
```

In this way, Oracle Label Security uses the security label to restrict the rows that are processed, based on the user's authorizations. To improve performance of this query, you could create an index on the  ${\tt HR}$  LABEL column.

Consider a more complex query (once again, with  $READ\_CONTROL$  applied to the EMP table):

```
SELECT COUNT (*) FROM SCOTT.EMP
WHERE deptno=10
```

Again, Oracle Label Security adds a predicate based on the label column:

```
SELECT COUNT (*) FROM SCOTT.EMP
WHERE deptno=10
AND hr_label=100;
```

In this case, you might want to create a composite index based on the  $\tt DEPTNO$  and  $\tt HR\_LABEL$  columns, to improve application performance.

## Label Tag Strategy Plan to Enhance Performance

For optimal performance, you can plan a strategy for assigning values to label tags.

In general, it is best to assign higher numeric values to labels with higher sensitivity levels.

This is because, typically, many more users can see data at comparatively low levels and fewer users at higher levels can see many levels of data.

In addition, with READ\_CONTROL set, Oracle Label Security generates a predicate that uses a BETWEEN clause to restrict the rows to be processed by the query. As illustrated in the following example, if the higher-sensitivity labels do not have a higher label tag than the lower-sensitivity labels, then the query will potentially examine a larger set of rows. This will affect performance.

Table 12-2 shows a set of label tags assigned as follows:



Table 12-2 Label Tag Performance Example: Correct Values

| Label  | Label Tag |  |
|--------|-----------|--|
| TS:A,B | 100       |  |
| S:A    | 50        |  |
| S      | 20        |  |
| U:A    | 10        |  |

Here, a user whose maximum authorization is S:A can potentially access data at labels S:A, S, and U:A. Consider what happens when this user raises the following query:

```
SELECT COUNT (*) FROM SCOTT.EMP
```

Oracle Label Security adds a predicate that includes a BETWEEN clause (based on the maximum and minimum authorizations) to restrict the set of rows this user can see:

```
SELECT COUNT (*) FROM SCOTT.EMP
WHERE hr_label BETWEEN 10 AND 50;
```

Performance improves, because the query examines only a subset of data based on the user's authorizations. It does not fruitlessly process rows that the user is not authorized to access.

Table 12-3 shows how unnecessary work is performed if the tag values were assigned as follows:

Table 12-3 Label Tag Performance Example: Incorrect Values

| Label  | Label Tag |
|--------|-----------|
| TS:A,B | 50        |
| S:A    | 100       |
| S      | 20        |
| U:A    | 10        |

In this case, the user with S:A authorization can see only some of the labels between 100 and 10. Although the user cannot see TS:A,B labels (that is, rows with a label tag of 50). A query would nonetheless pick up and process these rows, even though the user ultimately will not have access to them.

# Partitioned Data Based on Numeric Label Tags

Using a numeric ordering strategy with the numeric label tags applied to the labels can a basis for Oracle Database data partitioning.

Depending on the application, partitioning data based on label values may or may not be useful. Consider, for example, a business-hosting CRM application to which many companies subscribe. In the same EMP table, there might be rows (and labels) for Subscriber 1 and Subscriber 2. That is, information for both companies can be stored in the same table, as long as it is labeled differently. In this case, employees of

Subscriber 1 will never need to access data for Subscriber 2, so it might make sense to partition based on label. You could put rows for Subscriber 1 in one partition, and rows for Subscriber2 in a different partition. When a query is raised, it will access only one or the other partition, depending on the label. Performance improves because partitions that are not relevant are not examined by the query.

The following example shows this is done. It places labels in the 2000 series on one partition, labels in the 3000 series on another partition, and labels in the 4000 series on a third partition.

```
CREATE TABLE EMPLOYEE(
    EMPNO NUMBER(10) CONSTRAINT PK_EMPLOYEE PRIMARY KEY,
    ENAME VARCHAR2(10),
   JOB VARCHAR2(9),
   MGR NUMBER(4),
   HIREDATE DATE,
    SAL NUMBER (7,2),
    COMM NUMBER(7,2),
    DEPTNO NUMBER(4),
    HR LABEL NUMBER(10))
    TABLESPACE PERF DATA
    STORAGE (initial 2M
    NEXT 1M
   MINEXTENTS 1
    MAXEXTENTS unlimited)
    PARTITION BY RANGE (hr_label)
    (partition sx1 VALUES LESS THAN (2000) NOLOGGING,
    partition sx2 VALUES LESS THAN (3000),
    partition sx3 VALUES LESS THAN (4000)
```

# Creation of Additional Databases After Installation

You can create and configure additional databases after you install Oracle Label Security.

- About the Creation of Additional Databases After Installation
   When you install Oracle Database Enterprise Edition and Oracle Label Security, an initial Oracle database is created.
- Creating Additional Databases When the Label Security Schema Is in the Seed You can configure Oracle Label Security if the database was installed with the label security schema is in the seed database.
- Creating Additional Databases with the Custom Installation Option
   You can configure Oracle Label Security after a custom database installation.

#### About the Creation of Additional Databases After Installation

When you install Oracle Database Enterprise Edition and Oracle Label Security, an initial Oracle database is created.

If you want to create additional databases, then you should do this using the Database Configuration Assistant. Alternatively, you can create additional databases by following the steps listed in *Oracle Database Administrator's Guide*.

Each time you create a new database, you must install the Oracle Label Security data dictionary tables, views, and packages into it, and create the LBACSYS account.

For the first database, this is done automatically when you install Oracle Label Security, regardless of whether or not you choose the custom install. If you do not choose the custom install, then you are installing the database with the label security schema in the seed.

To create additional databases, there are different processes for configuring label security, depending on whether the first database was installed with the custom install or with the label security schema in the seed.

If you initially chose custom install, but did not install label security, you can install and configure label security using either process described in this section.

# Creating Additional Databases When the Label Security Schema Is in the Seed

You can configure Oracle Label Security if the database was installed with the label security schema is in the seed database.

- 1. Select the Oracle Label Security option in DBCA.
- Select the check box to configure Oracle Label Security.

## Creating Additional Databases with the Custom Installation Option

You can configure Oracle Label Security after a custom database installation.

- Connect to the Oracle Database instance as user SYS, using the AS SYSDBA syntax.
- 2. Run the script \$ORACLE HOME/rdbms/admin/catols.sql.
  - This script installs the label-based framework, data dictionary, data types, and packages. After the script is run, the LBACSYS account exists, with the password LBACSYS. All the Oracle Label Security packages exist under this account.
- 3. Change the default password of the LBACSYS user.

# Oracle Label Security Upgrades and Downgrades

You should be aware of how to manage Oracle Label Security upgrades and downgrades.

- About Oracle Label Security Upgrades and Downgrades
   Oracle provides preprocess scripts that perform upgrade and downgrade operations.
- Oracle Label Security Upgrades
   Oracle provides a preprocess script that you must run before you perform an upgrade.
- Oracle Label Security Downgrades
   Oracle provides a preprocess script that you must run before you downgrade.

## About Oracle Label Security Upgrades and Downgrades

Oracle provides preprocess scripts that perform upgrade and downgrade operations.



As a safety measure, before you run either the upgrade or downgrade preprocess script, Oracle recommends that you back up your audit records. To do this, you can archive the audit trail as described in *Oracle Database Security Guide*.

Before they run, the preprocess scripts check that there is enough space in the audit tablespace to copy all the audit records, and will exit without processing if there is not.

You may continue running your applications on the database while OLS preprocess scripts are running.



#### See Also:

Oracle Database Upgrade Guide for requirements for upgrading databases that use Oracle Label Security and Oracle Database Vault

## **Oracle Label Security Upgrades**

Oracle provides a preprocess script that you must run before you perform an upgrade.

- About Oracle Label Security Upgrades
   You must upgrade Oracle Label Security for pre-Oracle Database 12c release 1
   (12.1) databases.
- Running the Oracle Label Security Preprocess Script Before Upgrading
   You can run the Oracle Label Security preprocess script before upgrading.

## About Oracle Label Security Upgrades

You must upgrade Oracle Label Security for pre-Oracle Database 12c release 1 (12.1) databases.



#### Note:

Running the olspreupgrade.sql script before upgrading is mandatory for upgrading databases earlier than Oracle Database 12c release (12.1) that use Oracle Label Security or Database Vault.

After you have upgraded to Oracle Database release 12c or later, you do not need to run the Oracle Label Security preprocessing script when you patch or upgrade the database.

Before performing the OLS upgrade process, you must run the Oracle Label Security preprocess upgrade script, olspreupgrade.sql, to process the AUD\$ table contents. The OLS upgrade moves the AUD\$table from the SYSTEM schema to the SYS schema. The olspreupgrade.sql script is a preprocessing script required for this move. It creates a temporary table, PREUPG\_AUD\$, in the SYS schema and moves the SYSTEM.AUD\$ records to SYS.PREUPG\_AUD\$. The moved records can no longer be viewed through the DBA\_AUDIT\_TRAIL view, but can be viewed by directly accessing the SYS.PREUPG\_AUD\$ table, until the upgrade completes. Once the upgrade completes,



the SYS.PREUPG\_AUD\$ table is permanently deleted and all audit records, can be viewed through the DBA\_AUDIT\_TRAIL view.

### Running the Oracle Label Security Preprocess Script Before Upgrading

You can run the Oracle Label Security preprocess script before upgrading.

- **1.** Copy the <code>ORACLE\_HOME/rdbms/admin/olspreupgrade.sql</code> script from the newly installed Oracle home to the Oracle home of the database to be upgraded.
- 2. Connect to the database to be upgraded. At the system prompt, enter:

```
CONNECT SYS AS SYSDBA Enter password password
```

3. Run the Oracle Label Security preprocess script:

@\$ORACLE\_HOME/rdbms/admin/olspreupgrade.sql



The upgrade status for the Oracle Label Security component will be marked INVALID if the Oracle Label Security preprocess script reports an error. If this happens, you must correct the errors and then rerun the upgrade process. See *Oracle Database Upgrade Guide* for more information about rerunning the upgrade process for Oracle Database.

# Oracle Label Security Downgrades

Oracle provides a preprocess script that you must run before you downgrade.

- About Oracle Label Security Downgrades
   You can downgrade from an Oracle Database 12c release 1 (12.1) or later
   database that uses Oracle Label Security or Oracle Database Vault.
- Running the Oracle Label Security Preprocess Script Before Downgrading You must connect as SYS wth the SYSDBA administrative privilege before running the Oracle Label Security preprocess script for a downgrade.

#### About Oracle Label Security Downgrades

You can downgrade from an Oracle Database 12c release 1 (12.1) or later database that uses Oracle Label Security or Oracle Database Vault.

To do this, you must run the OLS preprocessing script, <code>olspredowngrade.sql</code> to process the <code>AUD\$</code> table contents. The OLS downgrade script moves the <code>AUD\$</code> table from the <code>SYS</code> schema to the <code>SYSTEM</code> schema. The <code>olspredowngrade.sql</code> script is a processing script required in preparation for this move. It creates a temporary table, <code>PREDWG\_AUD\$</code>, in the <code>SYSTEM</code> schema and moves the <code>SYS.AUD\$</code> records to <code>SYSTEM.PREDWG\_AUD\$</code>. The moved records can no longer be viewed through the <code>DBA\_AUDIT\_TRAIL</code> view, but you can view them by directly accessing the <code>SYSTEM.PREDWG\_AUD\$</code> table until the downgrade completes. Once the downgrade completes, the <code>SYSTEM.PREDWG\_AUD\$</code> table is permanently deleted. At this point, all audit records are available for viewing in the <code>DBA\_AUDIT\_TRAIL</code> data dictionary view.



# Running the Oracle Label Security Preprocess Script Before Downgrading

You must connect as  $\tt SYS$  with the  $\tt SYSDBA$  administrative privilege before running the Oracle Label Security preprocess script for a downgrade.

1. Connect to the database to be downgraded. At the system prompt, enter:

CONNECT SYS AS SYSDBA Enter password password

2. Run the OLS preprocess downgrade script:

@\$ORACLE\_HOME/rdbms/admin/olspredowngrade.sql



# Releasability Using Inverse Groups

Oracle Label Security can implement the releasability using inverse groups.

- About Inverse Groups and Releasability
   Inverse groups indicate releasability of information.
- Comparison of Standard Groups and Inverse Groups
   Groups in Oracle Label Security identify organizations that own or access data.
- How Inverse Groups Work
   Inverse groups are implemented in a special way and are organized to suit the needs of Oracle Label Security.
- Algorithm for Read Access with Inverse Groups
   You should understand how the algorithm for read access with inverse groups works
- Algorithm for Write Access with Inverse Groups
   You should understand the algorithm for write access with inverse groups.
- Algorithms for COMPACCESS Privilege with Inverse Groups
   Oracle provides algorithms for read and write access with inverse groups, for
   users who have COMPACCESS privilege.
- Session Labels and Inverse Groups
   Inverse groups affect session labels and row labels.
- Changes in Behavior of Procedures with Inverse Groups
  The INVERSE\_GROUP option affects algorithms that determine the read and write access of the user to labeled data.
- Dominance Rules for Labels with Inverse Groups
   You should understand how dominance rules work for Oracle labels and inverse
   groups.

# **About Inverse Groups and Releasability**

Inverse groups indicate *releasability* of information.

They are used to mark the dissemination of data. When you add an inverse group to a data label, the data becomes less classified.

For example, a user with inverse groups UK and US cannot access data that only has inverse group UK. Adding US to that data makes it accessible to all users with the inverse groups UK and US.

When you assign releasabilities to a user, you mark the communication channel to the user. For data to flow across the communication channel, the data releasabilities must dominate the releasabilities assigned to the user. In other words, releasabilities assigned to a data record must contain all the releasabilities assigned to a user.

The advantage of releasabilities lies in their power to broadly disseminate information. Releasing data to the entire marketing organization becomes as simple as adding the Marketing releasability to the data record.

# Comparison of Standard Groups and Inverse Groups

Groups in Oracle Label Security identify organizations that own or access data.

Like standard groups, inverse groups control the dissemination of information. However, the behavior of inverse groups differs from Oracle Label Security standard group behavior. By default, all policies created in Oracle Label Security use the standard group behavior.

The term, *releasabilities* is sometimes used to refer to the behavior provided by inverse groups. When you include inverse groups in a data label, the effect is similar to assigning label compartment authorizations to a user. When Oracle Label Security evaluates whether a user can view a row of data assigned to a label with inverse groups, it checks to see whether the data, not the user, has the appropriate group authorizations. It checks whether the data has *all* the inverse groups assigned to the user. With standard groups, by contrast, Oracle Label Security checks to see whether a user is authorized for *at least one* of the groups assigned to a row of data.

Consider a policy that contains three standard groups such as, Eastern, Western, and Southern. User1's label authorizations include the groups Eastern and Western. Assuming that User1 has been assigned the appropriate level and compartment authorizations in the policy, then:

- With standard Oracle Label Security groups, User1 can view *all* data records that have the group Eastern, or the group Western, or both Eastern and Western.
- With inverse groups, User1 can only view data records that have, at a minimum, all the groups assigned to the user, that is, both Eastern and Western. User1 cannot view records that have only the Eastern group, only the Western group, or that have no groups at all.

Table 13-1 shows all the rows that User1 can potentially access, given the type of group that is used in the policy.

Table 13-1 Access to Standard Groups and Inverse Groups

| If row label contains groups: | User1 access with standard groups? | User1 access with inverse groups? |
|-------------------------------|------------------------------------|-----------------------------------|
| None                          | Υ                                  | N                                 |
| Eastern                       | Υ                                  | N                                 |
| Western                       | Υ                                  | N                                 |
| Southern                      | N                                  | N                                 |
| Eastern, Western              | Υ                                  | Υ                                 |
| Eastern, Southern             | Υ                                  | N                                 |
| Western, Southern             | Υ                                  | N                                 |
| Eastern, Western, Southern    | Υ                                  | Υ                                 |

Standard groups indicate *ownership* of information. In this way, all data pertaining to a certain department can have that department's group in the label. When you add a



group to a data label, the data becomes more classified. For example, a user with no groups can access data that has no groups in its label. If you add the group US to the data label, the user can no longer access the data.

See Also:

**Group Components** 

# How Inverse Groups Work

Inverse groups are implemented in a special way and are organized to suit the needs of Oracle Label Security.

- Implementation of Inverse Groups with INVERSE\_GROUP Enforcement
   When creating an Oracle Label Security policy, you can specify whether the policy can use inverse group functionality to implement releasability.
- Inverse Groups and Label Components
   An Oracle Label Security policy created with the inverse group option uses the same policy label components as standard groups.
- Computed Labels with Inverse Groups
   Inverse groups affect computed label values.
- Inverse Groups and Hierarchical Structure
   Standard groups in Oracle Label Security are hierarchical, so that a group can be associated with a parent group.
- Inverse Groups and User Privileges
   With inverse groups implemented, the meaning of user privileges remains the same.

# Implementation of Inverse Groups with INVERSE\_GROUP Enforcement

When creating an Oracle Label Security policy, you can specify whether the policy can use inverse group functionality to implement releasability.

To do this, you must specify INVERSE\_GROUP as one of the default\_options in the CREATE\_POLICY statement.

The INVERSE\_GROUP option can be set only at policy creation time. Once a policy is created, this option cannot be changed.

The INVERSE\_GROUP option is thus policywide. It cannot be turned on or off when the policy is applied to a table or schema. If you attempt to do so, using the procedure APPLY\_TABLE\_POLICY or APPLY\_SCHEMA\_POLICY, then an error will be generated.

While other policy enforcement options can be dropped from a policy, the INVERSE\_GROUP policy configuration option cannot be dropped once it is set. To remove the option, you must drop and then re-create the policy.

You can give individual users authorization for one or more inverse groups.



# Inverse Groups and Label Components

An Oracle Label Security policy created with the inverse group option uses the same policy label components as standard groups.

These components include levels, compartments, and groups.

With inverse groups, however, the user's read groups and write groups have a different meaning and role in data access.

Consider the following policy example, with three levels, one compartment, and three groups:

Table 13-2 Policy Example

| Policy Component | Abbreviation |
|------------------|--------------|
| Levels:          | -            |
| UNCLASSIFIED     | UN           |
| CONFIDENTIAL     | CON          |
| SECRET           | SE           |
| Compartments:    | -            |
| FINANCIAL        | FIN          |
| Groups:          | -            |
| EASTERN          | EAS          |
| WESTERN          | WES          |
| SOUTHERN         | SOU          |

Two user labels have been assigned, CON:FIN and SE:FIN:EAS,WES

Two data labels have been assigned, CON:FIN:EAS and SE:FIN:EAS

User access to the data differs, depending on the type of group being used:

If the policy uses standard groups, then:

The user with the label CON: FIN cannot read CON: FIN: EAS data.

The user with the label SE:FIN:EAS, WES can read SE:FIN:EAS data.

• If the policy has the INVERSE GROUPS policy enforcement option, then:

The user with the label CON: FIN can read CON: FIN: EAS data.

The user with the label SE:FIN:EAS, WES cannot read SE:FIN:EAS data.

# Computed Labels with Inverse Groups

Inverse groups affect computed label values.



- Computed Session Labels with Inverse Groups
   After the administrator assigns label authorizations to a user, Oracle Label Security automatically computes a number of labels.
- Inverse Groups and Computed Max Read Groups and Max Write Groups
   Oracle Label Security provides different inverse groups to handle read and write
   operations.

#### Computed Session Labels with Inverse Groups

After the administrator assigns label authorizations to a user, Oracle Label Security automatically computes a number of labels.

With inverse groups, these labels are as follows:

**Table 13-3 Computed Session Labels with Inverse Groups** 

| Computed Label      | Definition  |
|---------------------|---|
| Max Read Label      | The user's maximum level combined with his or her authorized compartments and the minimum set of inverse groups that should be in the user label (session label)  |
| Max Write Label     | The user's maximum level combined with the compartments for which the user has been granted write access. Contains the maximum authorized inverse groups that can be set in any label. The user has write authorizations on all these inverse groups.   |
| Min Write Label     | The user's minimum level.   |
| Default Read Label  | The default level, combined with compartments and inverse groups that have been designated as default for the user.   |
| Default Write Label | A subset of the default read label, containing the compartments and inverse groups for which the user has been granted write access. However the inverse groups component has no significance as it is the Max Write Groups that is always used for write access.                                 |
| Default Row Label   | The combination of components between the user's minimum write label and the maximum write label, which has been designated as the default for the data label for inserted data. The Inverse groups should be a superset of inverse groups in the default label and a subset of Max Write Groups. |

#### **Related Topics**

Computed Session Labels
 Oracle Label Security automatically computes a number of labels based on the
 value of the session label.

# Inverse Groups and Computed Max Read Groups and Max Write Groups

Oracle Label Security provides different inverse groups to handle read and write operations.

From the computed values in Table 13-3, two sets of groups are identified for label evaluation of read and write access.



Table 13-4 Sets of Groups for Evaluating Read and Write Access

| Sets of Groups   | Meaning  |
|------------------|--|
| Max Read Groups  | Max Read Groups are the groups contained in the Max Read Label, identifying the <i>minimum</i> set of inverse groups that can be set in any user label.  |
| Max Write Groups | Max Write Groups are the groups contained in the Max Write Label, identifying the <i>maximum</i> authorized inverse groups that can be set in any user label. This set of groups is checked at the time of write access, and also when setting session labels.  Note that Max Write Groups is a superset of Max Read Groups. |

As shown in Table 13-5, for standard groups you can have READ ONLY and READ/WRITE authorizations; for inverse groups you can have WRITE ONLY and READ/WRITE authorizations.

Table 13-5 Read and Write Authorizations for Standard Groups and Inverse Groups

| Type of<br>Group   | READ ONLY  | READ/WRITE   | WRITE ONLY   |
|--------------------|--|--|--|
| Standard<br>Groups | The group is present only in Max Read Label, not in Max Write Label. | The group is present in both Max Read Label and Max Write Label. | Not supported  |
| Inverse<br>Groups  | Not supported  | The group is present in both Max Read Label and Max Write Label. | The group is present only in Max Write Label, not in Max Read Label. |

Although Max Read Groups identifies the set of groups contained in the Max Read Label, this value represents the *minimum* set of inverse groups that can be set. For example:

Max Read Groups: S:C1:G1,G2

Max Write Groups: S:C1:G1,G2,G3,G4,G5

Here, the user can read data that contains at least the two groups listed in Max Read Groups.

Note that in standard groups, there can never be a situation in which there are more groups in the Max Write Label than in the Max Read Label.

## Inverse Groups and Hierarchical Structure

Standard groups in Oracle Label Security are hierarchical, so that a group can be associated with a parent group.

For example, the Eastern region can be the parent of two subordinate groups: Eas\_sales, and Eas\_hr.

In a policy with standard groups, if the user label has the parent group, then it can access all data of the subordinate groups.

With inverse groups, parent-child relationships are not supported.



## Inverse Groups and User Privileges

With inverse groups implemented, the meaning of user privileges remains the same.

When the user has no special privileges, then the read algorithm and the write algorithm are different for standard groups and inverse groups. The differences are described later, in Algorithm for Read Access with Inverse Groups and Algorithm for Write Access with Inverse Groups.

The effect of inverse groups on the COMPACCESS privilege is described later, in Algorithms for COMPACCESS Privilege with Inverse Groups.

Inverse groups have no impact upon the following user privileges:

- PROFILE\_ACCESS
- WRITEUP
- WRITEDOWN
- WRITEACROSS

# Algorithm for Read Access with Inverse Groups

You should understand how the algorithm for read access with inverse groups works.

To read data in a table with the INVERSE GROUP option in effect, the label evaluation process proceeds from levels to groups to compartments, as illustrated in Figure 13-1. (Note that the current session label is the label being evaluated.)

- 1. The user's level must be greater than or equal to the level of data.
- 2. The user's label must include all the compartments assigned to the data
- 3. The groups in the data label must be a superset of the groups in the user label.

If the user's label passes these tests, then the user can access the data. If not, the user is denied access. Note that if the data label is null or invalid, then the user is denied access.



This flow diagram is true only when the user has no special privileges.



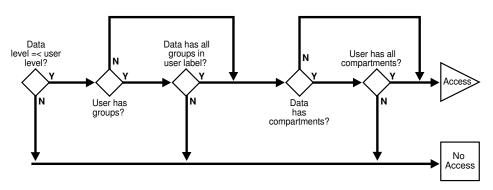


Figure 13-1 Read Access Label Evaluation with Inverse Groups

#### **Related Topics**

How Oracle Label Security Algorithm for Read Access Works
 The READ\_CONTROL enforcement determines the ability to read data in a row.

# Algorithm for Write Access with Inverse Groups

You should understand the algorithm for write access with inverse groups.

To write data in a table with the INVERSE GROUP option, the label evaluation process proceeds from levels to groups to compartments, as illustrated in Figure 13-2. (Note that the current session label is the label being evaluated.)

- 1. The level in the data label must be greater than or equal to the user's minimum level, and less than or equal to the user's session level.
- 2. One of the following conditions must be met:

The groups in the data label must be a superset of the groups in the user label. or

The user has READ access privilege on the policy.

- 3. The user's Max Write Groups must be a superset of the data label groups.
- **4.** The user label must have write access on all of the compartments in the data label.

Note that if the data label is null or invalid, then the user is denied access.



This flow diagram is true only when the user has no special privileges.



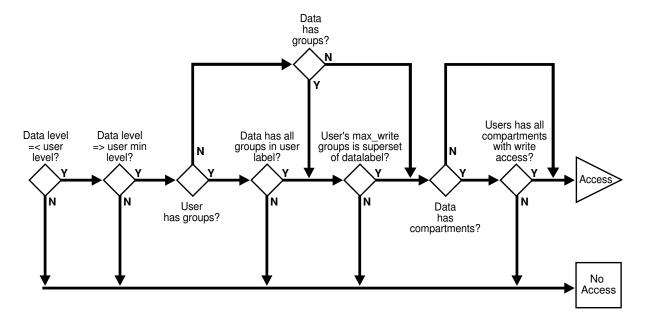


Figure 13-2 Write Access Label Evaluation with Inverse Groups

See Also:

How the Oracle Label Security Algorithm for Write Access Works

# Algorithms for COMPACCESS Privilege with Inverse Groups

Oracle provides algorithms for read and write access with inverse groups, for users who have COMPACCESS privilege.

The COMPACCESS privilege allows a user to access data based on the row's compartments, independent of the row's groups.

- When compartments exist and access to them is authorized, then the group authorization is bypassed.
- If a row has no compartments, then access is determined by the inverse group authorizations.

Figure 13-3 and Figure 13-4 show the label evaluation process for read access and write access for a user with the COMPACCESS privilege. If the data label is null or invalid, then the user is denied access.

(Note that the current session label is the label being evaluated.)



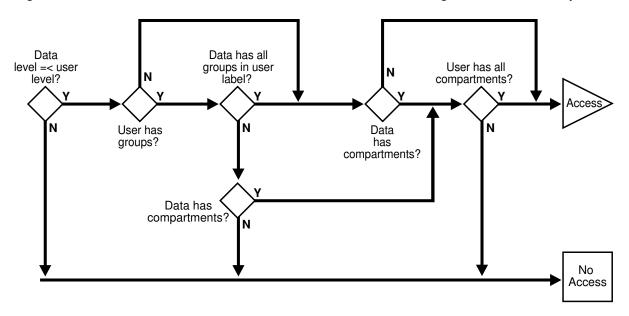
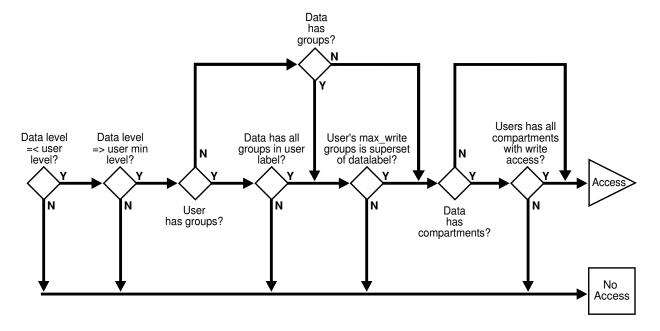


Figure 13-3 Read Access Label Evaluation: COMPACCESS Privilege and Inverse Groups

Figure 13-4 Write Access Label Evaluation: COMPACCESS Privilege and Inverse Groups



# Session Labels and Inverse Groups

Inverse groups affect session labels and row labels.

- Initial Session and Row Labels for Standard or Inverse Groups
   Oracle provides initial session and row labels for standard and inverse groups.
- Setting Current Session or Row Labels for Standard or Inverse Groups
  You can set the current session or row labels for standard or inverse groups.

Examples of Session Labels and Inverse Groups
 Oracle provides examples of using inverse groups.

# Initial Session and Row Labels for Standard or Inverse Groups

Oracle provides initial session and row labels for standard and inverse groups.

- About the Initial Session and Row Labels for Standard or Inverse Groups
   The use of inverse groups affects the behavior of Oracle Label Security
   procedures that determine the session label.
- Standard Groups: Rules for Changing Initial Session/Row Labels
   A user's default session label can be changed using
   SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL.
- Inverse Groups: Rules for Changing Initial Session/Row Labels
   The default session label can include groups in the authorized list if the new write label dominates the current default row label.

#### About the Initial Session and Row Labels for Standard or Inverse Groups

The use of inverse groups affects the behavior of Oracle Label Security procedures that determine the session label.

The Sa\_USER\_ADMIN.SET\_DEFAULT\_LABEL and Sa\_USER\_ADMIN.SET\_ROW\_LABEL procedures set the user's initial session label and row label, respectively, to the one specified.

#### Standard Groups: Rules for Changing Initial Session/Row Labels

A user's default session label can be changed using SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL.

In the case of standard groups, the default session label can be set to include any groups in the authorized list, as long as the current default row label will still be dominated by the new write label. That is, the row label will have *the same or fewer standard groups* than the new write label.

The same rule applies for SA\_USER\_ADMIN.SET\_ROW\_LABEL.

## Inverse Groups: Rules for Changing Initial Session/Row Labels

The default session label can include groups in the authorized list if the new write label dominates the current default row label.

That is, the row label will have *the same or more inverse groups* than the new write label. The same rule applies for SA USER ADMIN. SET ROW LABEL.

#### **Related Topics**

- SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL
  The SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL procedure sets the user's initial session label to the one specified.
- SA\_USER\_ADMIN.SET\_ROW\_LABEL
  The SA\_USER\_ADMIN.SET\_ROW\_LABEL procedure sets a user's initial row label to the one specified.



Dominance Rules for Labels with Inverse Groups
 You should understand how dominance rules work for Oracle labels and inverse
 groups.

# Setting Current Session or Row Labels for Standard or Inverse Groups

You can set the current session or row labels for standard or inverse groups.

- About Setting Current Session or Row Labels for Standard or Inverse Groups
   The use of inverse groups affects the behavior of the SA\_SESSION.SET\_LABEL and SA\_SESSION.SET\_ROW\_LABEL procedures.
- Standard Groups: Rules for Changing Current Session/Row Labels
  With standard groups, the SA\_SESSION.SET\_LABEL procedure can set the session
  label to include groups in the user's authorized group list.
- Inverse Groups: Rules for Changing Current Session/Row Labels
   With inverse groups, the addition of groups to the session label decreases a user's ability to access sensitive data with fewer groups.

#### About Setting Current Session or Row Labels for Standard or Inverse Groups

The use of inverse groups affects the behavior of the SA\_SESSION.SET\_LABEL and SA\_SESSION.SET\_ROW\_LABEL procedures.

These procedures can be used to set the user's current session label and row label, respectively.

### Standard Groups: Rules for Changing Current Session/Row Labels

With standard groups, the SA\_SESSION.SET\_LABEL procedure can set the session label to include groups in the user's authorized group list.

Subgroups of authorized groups are implicitly included in the authorized list.

Note that if you change the session label, then this may affect the value of the session's row label.

Use the SET\_ROW\_LABEL procedure to set the row label value for the current database session. The compartments and groups in the label must be a subset of compartments and groups in the session label to which the user has write access.

#### Inverse Groups: Rules for Changing Current Session/Row Labels

With inverse groups, the addition of groups to the session label *decreases* a user's ability to access sensitive data with fewer groups.

The removal of groups enables the user to access *more* sensitive information. So, the user should be allowed to add groups to the session label, as long as Max Read Groups is a subset of the groups in the session label, and Max Write Groups is a superset of groups in the session label. The same restriction applies when a user removes groups from the session label.

Note that there are no subgroups of authorized groups when using inverse groups. This is because parent groups are not allowed in policies using inverse groups.



Use the SET\_ROW\_LABEL procedure to set the row label value for the current database session. The compartments in the label must be a subset of compartments in the session label to which the user has write access.

The user is allowed to add inverse groups to the row label, as long as the session label inverse groups are a subset of the row label inverse groups, and Max Write Groups is a superset of inverse groups in the row label.

#### For example:

- If the user has the inverse groups UK and US as his Max Read Groups, and UK,US,CAN as his Max Write Groups. The user can set his session label to C:ALPHA:UK,US,CAN but not to C:ALPHA:UK.
- If the user has the inverse group UK as his Max Read Groups, and UK,CAN as his Max Write Groups.assigned to him. The user can set the session label to C:ALPHA:UK,CAN but cannot change it to either C:ALPHA or C:ALPHA:UK,US,CAN.

#### **Related Topics**

SA SESSION.SET LABEL

The SA\_SESSION.SET\_LABEL procedure sets the label of the current database session.

SA\_SESSION.SET\_ROW\_LABEL

The SA\_SESSION.SET\_ROW\_LABEL procedure sets the default row label value for the current database session.

# Examples of Session Labels and Inverse Groups

Oracle provides examples of using inverse groups.

• Example: Simple Inverse Groups

You can create a simple policy that implements inverse groups with a set of special labels.

Example: Complex Inverse Groups

You can create a more complex policy that implements inverse groups with a set of special labels.

## **Example: Simple Inverse Groups**

You can create a simple policy that implements inverse groups with a set of special labels.

Table 13-6 Labels for Inverse Groups Example 1

| Name                | Definition          |
|---------------------|---------------------|
| Max Read Label      | SE:ALPHA,BETA:G1,G2 |
| Max Write Label     | SE:ALPHA:G1,G2,G3   |
| Default Read Label  | SE:ALPHA,BETA:G1,G2 |
| Default Write Label | SE:ALPHA:G1,G2      |
| Default Row Label   | SE:ALPHA:G1,G2      |



Table 13-6 (Cont.) Labels for Inverse Groups Example 1

| Name   | Definition |
|--|------------|
| From which the following values are derived: | -          |
| Max Read Groups                              | G1,G2      |
| Max Write Groups                             | G1,G2,G3   |

#### The following conclusions can be drawn:

- User01 can update data with label SE:ALPHA:G1,G2 as well as data with label SE:ALPHA:G1,G2,G3. User1 cannot, however, update label SE:ALPHA:G1.
  - If standard groups were being used, rather than inverse groups, then User1 could update data with label SE:ALPHA:G1.
- Data that User01 inserts has the label SE:ALPHA:G1,G2. (This is the same as with standard groups.)
- If User01 leaves the default label as is, and sets the row label to SE:ALPHA:G1,G2,G3, then user1 will insert SE:ALPHA:G1,G2,G3 in new rows of data that is written. (In standard groups, User1 can never set more groups in the row label than in the default label.)

#### **Example: Complex Inverse Groups**

You can create a more complex policy that implements inverse groups with a set of special labels.

Table 13-7 Labels for Inverse Groups Example 2

| Name   | Definition       |
|--|------------------|
| Max Read Label                               | C:ALPHA:         |
| Max Write Label                              | C:ALPHA:G1,G2,G3 |
| Default Read Label                           | C:ALPHA:         |
| Default Write Label                          | C:ALPHA:         |
| Default Row Label                            | C:ALPHA:         |
| From which the following values are derived: | -                |
| Max Read Groups                              | (an empty set)   |
| Max Write Groups                             | G1,G2,G3         |

#### The following conclusions can be drawn:

• User01 can update any data with level C, compartment ALPHA, and any combination of groups G1, G2, G3, or no groups. User01 inserts the label C:ALPHA: in new data that User01 writes.



- User02, who has Max Read Groups of G1,G2 or G1,G3, and so on, will not be able to view the data written by User01. This is because User01's Default Row Label contains no groups.
- User01 can choose to set inverse groups in the row label, as long as the inverse groups in the session label dominates the row label (that is, User01's session label contains the same or fewer groups than contained in the row label).
  - This is true because the row label must have at least the groups in the session label, and can at most have the Maximum Write Groups. If the session label is G1, then you can set the groups in the row label from G1 to the Max Write Groups (G1,G2,G3).
- If User01 sets his session label and row label to C:ALPHA:G1:G2:G3, then his data becomes accessible to anyone who has any combination of G1,G2,G3 in his Max Read Groups.

# Changes in Behavior of Procedures with Inverse Groups

The INVERSE\_GROUP option affects algorithms that determine the read and write access of the user to labeled data.

- SA\_SYSDBA.CREATE\_POLICY with Inverse Groups
  The SA\_SYSDBA.CREATE\_POLICY procedure creates the policy, defines an optional policy-specific column name, and specifies policy options.
- SA\_SYSDBA.ALTER\_POLICY with Inverse Groups
  The SA\_SYSDBA.ALTER\_POLICY procedure changes a policy's default enforcement options, except for the INVERSE GROUP option.
- SA\_USER\_ADMIN.ADD\_GROUPS with Inverse Groups
  The SA\_USER\_ADMIN.ADD\_GROUPS procedure adds groups to a user, indicating whether the groups are authorized for write as well as read.
- SA\_USER\_ADMIN.ALTER\_GROUPS with Inverse Groups
  The SA\_USER\_ADMIN.ALTER\_GROUPS procedure changes the write access, default label indicator, and row label indicator for each group.
- SA\_USER\_ADMIN.SET\_GROUPS with Inverse Groups
  The SA\_USER\_ADMIN.SET\_GROUPS procedure assigns groups to a user and identifies default values for the user's session label and row label.
- SA\_USER\_ADMIN.SET\_USER\_LABELS with Inverse Groups
   The SA\_USER\_ADMIN.SET\_USER\_LABELS procedure sets the user's levels, compartments, and groups using a set of labels, instead of the individual components.
- SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL with Inverse Groups
  The SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL procedure sets the user's initial session label.
- SA\_USER\_ADMIN.SET\_ROW\_LABEL with Inverse Groups
   The SA\_USER\_ADMIN.SET\_ROW\_LABEL procedure sets the user's initial row label.
- SA\_COMPONENTS.CREATE\_GROUP with Inverse Groups
  The SA\_COMPONETS.CREATE\_GROUP procedure create a group, including its short
  name and long name, and optionally a parent group.



SA\_COMPONENTS.ALTER\_GROUP\_PARENT with Inverse Groups
 The SA\_COMPONENTS.ALTER\_GROUP\_PARENT function is disabled for policies with the inverse group option.

SA\_SESSION.SET\_LABEL with Inverse Groups

The SA\_SESION.SET\_LABEL procedure sets the label of the current database session.

SA\_SESSION.SET\_ROW\_LABEL with Inverse Groups

The SET\_ROW\_LABEL procedure sets the default row label value for the current database session.

LEAST UBOUND with Inverse Groups

The LEAST\_UBOUND (LUBD) function returns a character string label that is the least upper bound of label1 and label2.

GREATEST LBOUND with Inverse Groups

The GREATEST\_LBOUND (GLBD) function determines the lowest label of the data that can be involved in an operation, given two different labels.

# SA\_SYSDBA.CREATE\_POLICY with Inverse Groups

The SA\_SYSDBA.CREATE\_POLICY procedure creates the policy, defines an optional policy-specific column name, and specifies policy options.

With inverse group support the, user has one more policy enforcement option,  ${\tt INVERSE\_GROUP}$ . For example:

```
PROCEDURE CREATE_POLICY (
HR IN VARCHAR2,
SA_LABEL IN VARCHAR2 DEFAULT NULL,
INVERSE_GROUP IN VARCHAR2 DEFAULT NULL);
```

#### **Related Topics**

SA SYSDBA.CREATE POLICY

The SA\_SYSDBA.CREATE\_POLICY procedure creates a new Oracle Label Security policy, defines a policy-specific column name, and specifies default policy options.

## SA SYSDBA.ALTER POLICY with Inverse Groups

The SA\_SYSDBA.ALTER\_POLICY procedure changes a policy's default enforcement options, except for the INVERSE GROUP option.

Once a policy is configured for inverse groups, it cannot be changed. You can also change the column names associated with an OLS policy.

#### **Related Topics**

SA\_SYSDBA.ALTER\_POLICY

The SA\_SYSDBA.ALTER\_POLICY procedure sets and modifies column names that are associated with the policy.

# SA\_USER\_ADMIN.ADD\_GROUPS with Inverse Groups

The SA\_USER\_ADMIN.ADD\_GROUPS procedure adds groups to a user, indicating whether the groups are authorized for write as well as read.

The type of access authorized depends on the access\_mode parameter.

Table 13-8 Access Authorized by Values of access\_mode Parameter

| Access_Mode Parameter | Meaning   |
|-----------------------|---|
| READ_WRITE            | Indicates that write is authorized. (That is, the group is contained in both Max Read Groups and Max Write Groups.) |
| WRITE_ONLY            | Indicates that the group is contained in Max Write Groups and not in Max Read Groups                                |
| access_mode           | If access_mode is set to READ_WRITE, then the group is added to both Max Read Groups and Max Write Groups.          |
|                       | If access_mode is set to ${\tt SA\_UTL.WRITE\_ONLY},$ then the group is added only to the Max Write Groups.         |
|                       | If access_mode is NULL, then it is set to SA_UTL.READ_WRITE.  |
| in_def                | Specifies whether these groups should be in the default groups $(Y/N)$ .  |
|                       | If $in\_def$ is NULL, then it will be set to Y or N as follows:   |
|                       | If access mode is READ_WRITE, in_def is set to Y.   |
|                       | If access mode is $\mathtt{WRITE\_ONLY}$ , $\mathtt{in\_def}$ is set to $\mathtt{N}$ .                              |
| in_row                | Specifies whether these groups should be in the row label (Y/N), using the identical criteria as for $in\_def$ .    |
|                       | However, if in_def is Y, then in_row must also be Y.  |

Note that if  $in\_def$  is Y in a row, then  $in\_row$  must also be set to Y, but not the other way round.

The same is the case with the in\_row field.

#### See Also:

- Syntax for SA\_USER\_ADMIN.ADD\_GROUPS
- Inverse Groups and Computed Max Read Groups and Max Write Groups

# SA\_USER\_ADMIN.ALTER\_GROUPS with Inverse Groups

The SA\_USER\_ADMIN.ALTER\_GROUPS procedure changes the write access, default label indicator, and row label indicator for each group.

The behavior of inverse groups is the same as described in the case of ADD\_GROUPS.



Syntax for SA\_USER\_ADMIN.ALTER\_GROUPS



# SA\_USER\_ADMIN.SET\_GROUPS with Inverse Groups

The SA\_USER\_ADMIN.SET\_GROUPS procedure assigns groups to a user and identifies default values for the user's session label and row label.

Inverse groups are handled differently than standard groups, as follows:

Table 13-9 Assigning Groups to a User

| <b>Group Set Name</b> | Meaning  |
|-----------------------|--|
| read_groups           | A comma-delimited list of groups that would be Max Read<br>Groups  |
| write_groups          | A comma-delimited list of groups that would be Max Write Groups. It must be a superset of read_groups.                           |
|                       | If write_groups is NULL, then they are set to read_groups.   |
| def_groups            | Specifies the default groups. It should at least have read_groups, and write_groups should be a superset of def_groups.          |
|                       | If def_groups is NULL, then they are set to the read_groups.   |
| row_groups            | Specifies the row groups. It should at least have the def_groups and should be a subset of max write groups.                     |
|                       | If row_groups is NULL, then they are set to the def_groups, because for inverse groups, all def_groups are also in write_groups. |

See Also:

Syntax for SA\_USER\_ADMIN.SET\_GROUPS

# SA\_USER\_ADMIN.SET\_USER\_LABELS with Inverse Groups

The SA\_USER\_ADMIN.SET\_USER\_LABELS procedure sets the user's levels, compartments, and groups using a set of labels, instead of the individual components.

Inverse groups are handled differently than standard groups, as follows:

**Table 13-10 Inverse Group Label Definitions** 

| Name           | Definition   |
|----------------|--|
| max_read_label | Specifies the label string to be used to initialize the user's maximum authorized read label. Composed of the user's maximum level, compartments authorized for read access, and if inverse groups, minimum set of groups that can be set in any label.(Max Read Groups) |



Table 13-10 (Cont.) Inverse Group Label Definitions

| Name            | Definition   |
|-----------------|--|
| max_write_label | Specifies the label string to be used to initialize the user's maximum authorized write label. Composed of the user's maximum level, compartments authorized for write access, and if inverse groups, the maximum authorized groups that can be set in any label (Max Write Groups). All the inverse groups in this have write authorization also. It should be a superset of groups in max_read_label. If max_write_label is not specified, then it is set to max_read_label.   |
| def_label       | Specifies the label string to be used to initialize the user's session label, including level, compartments, and groups (a subset of max_read_label). If default_label is not specified, then it is set to max_read_label. For inverse groups, component it should at least have the groups in max_read_label, and groups in max_write_label should be a superset of the groups in the def_label.  |
| row_label       | Specifies the label string to be used to initialize the program's row label. Includes levels, compartments, and groups: subsets of max_write_label and def_label. If row_label is not specified, then it is set to def_label, with only the compartments and groups authorized for write access. The inverse groups component is set to the same as that in def_label if the row_label is not specified. The inverse groups in row label should at least be those in default label and should be a subset of Max Write Groups. |

See Also:

Syntax for SA\_USER\_ADMIN.SET\_USER\_LABELS

# SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL with Inverse Groups

The  ${\tt SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL}$  procedure sets the user's initial session label.

All the rules mentioned for setting inverse groups component of session label mentioned in Session Labels and Inverse Groups are applicable here.

See Also:

Syntax for SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL

# SA\_USER\_ADMIN.SET\_ROW\_LABEL with Inverse Groups

The SA\_USER\_ADMIN.SET\_ROW\_LABEL procedure sets the user's initial row label.

When specifying the row\_label, the inverse groups component must contain at least all the inverse groups in def\_label and should be a subset of Max Write Groups.

See Also:

- Syntax for SA\_USER\_ADMIN.SET\_ROW\_LABEL
- Initial Session and Row Labels for Standard or Inverse Groups

# SA\_COMPONENTS.CREATE\_GROUP with Inverse Groups

The SA\_COMPONETS.CREATE\_GROUP procedure create a group, including its short name and long name, and optionally a parent group.

With inverse groups, the parent\_name field should always be NULL. If the user specifies a value for this field, then an error message is displayed, indicating that the group hierarchy is disabled.

See Also:

Syntax for SA\_COMPONENTS.CREATE\_GROUP

# SA\_COMPONENTS.ALTER\_GROUP\_PARENT with Inverse Groups

The SA\_COMPONENTS.ALTER\_GROUP\_PARENT function is disabled for policies with the inverse group option.

An error message is displayed if the user calls this function.

See Also:

Syntax for SA\_COMPONENTS.ALTER\_GROUP

# SA\_SESSION.SET\_LABEL with Inverse Groups

The SA\_SESION.SET\_LABEL procedure sets the label of the current database session.

For the current user, this procedure follows the same rules for setting the session label as does the SA\_USER\_ADMIN.SET\_USER\_LABEL function.



#### See Also:

- Syntax for SA\_SESSION.SET\_LABEL.
- Setting Current Session or Row Labels for Standard or Inverse Groups

### SA\_SESSION.SET\_ROW\_LABEL with Inverse Groups

The SET\_ROW\_LABEL procedure sets the default row label value for the current database session.

For the current user, this procedure follows the same rules for setting the row label as does the sa\_user\_admin.set\_row\_label function.

#### See Also:

- Syntax for SA\_SESSION.SET\_ROW\_LABEL
- Initial Session and Row Labels for Standard or Inverse Groups

### LEAST\_UBOUND with Inverse Groups

The LEAST\_UBOUND (LUBD) function returns a character string label that is the least upper bound of label1 and label2.

With *standard* groups, the least upper bound is the highest level, the union of the compartments in the labels, and the union of the groups in the labels.

With *inverse* groups, the least upper bound is the highest level, the union of the compartments in the labels, and *the intersection of the inverse groups* in the labels.

For example, with inverse groups, the least upper bound of HIGHLY\_SENSITIVE:ALPHA:G1,G2 and SENSITIVE:BETA:G1 is HIGHLY SENSITIVE:ALPHA,BETA:G1.

### GREATEST\_LBOUND with Inverse Groups

The GREATEST\_LBOUND (GLBD) function determines the lowest label of the data that can be involved in an operation, given two different labels.

This function returns a character string label that is the greatest lower bound of label1 and label2.

With *standard* groups, the greatest lower bound is the lowest level, and the *intersection of the compartments in the labels and the groups* in the labels.

With *inverse* groups, the greatest lower bound is the lowest level, and the *intersection* of the compartments in the labels and the union of inverse groups in the labels.



For example, with inverse groups the greatest lower bound of HIGHLY\_SENSITIVE:ALPHA:G1,G3 and SENSITIVE::G1 is SENSITIVE:G1,G3

#### **Related Topics**

 Determination of the Upper and Lower Bounds of Labels
 Oracle Label Security provides functions that determine the least upper bound or the greatest lower bound of two or more labels.

# Dominance Rules for Labels with Inverse Groups

You should understand how dominance rules work for Oracle labels and inverse groups.

Dominance rules for Oracle Label Security with standard groups can be summarized as follows:

A user label dominates a data label if:

- User level is greater than or equal to the data level
- User compartments are a superset of the data compartments
- User groups intersects (have at least one group from) the data groups

Dominance rules for Oracle Label Security with inverse groups can be summarized as follows:

A user label dominates a data label if:

- User level is greater than or equal to the data level
- User compartments are a superset of the data compartments
- Data groups are a superset of user groups

#### **Related Topics**

About Dominant and Dominated Labels
 The relationship between two labels can be described in terms of dominance.



# Part IV

# **Appendixes**

Part IV contains reference material for using Oracle Label Security.

- Disabling and Enabling Oracle Label Security
   You can disable and enable Oracle Label Security as necessary.
- Advanced Topics in Oracle Label Security
   Oracle provides advanced functionality for Oracle Label Security, such as the
   ability to analyze relationships between labels.
- Command-line Tools for Label Security Using Oracle Internet Directory
   Oracle Label Security provides command-line tools for using Oracle Internet
   Directory.
- Oracle Label Security in an Oracle RAC Environment
   You can use Oracle Label Security in an Oracle Real Application Clusters (Oracle
   RAC) environment.
- Oracle Label Security PL/SQL Packages
   Oracle Label Security provides a set of PL/SQL packages.
- Oracle Label Security Reference
   Oracle Label Security provides data dictionary tables and views. You should also be aware of Oracle Label Security restrictions.
- Frequently Asked Questions about Oracle Label Security
   Customers have frequently asked questions about Oracle Label Security.

A

# Disabling and Enabling Oracle Label Security

You can disable and enable Oracle Label Security as necessary.



Oracle does not support the deinstallation of Oracle Label Security.

- When You Must Disable Oracle Label Security You may need to disable Oracle Label Security to perform upgrade tasks or correct erroneous configurations.
- Disabling Oracle Label Security
   If Oracle Database Vault has been enabled, then do not disable Oracle Label Security.
- Enabling Oracle Label Security
   You can enable Oracle Label Security in SQL\*Plus.

# When You Must Disable Oracle Label Security

You may need to disable Oracle Label Security to perform upgrade tasks or correct erroneous configurations.

Another reason for disabling Oracle Label Security is if you want to test an application without enforcing Oracle Label Security. You can reenable Oracle Label Security after you complete the tasks.

#### **Related Topics**

Checking if Oracle Label Security Has Been Registered and Enabled
You can query the DBA\_OLS\_STATUS and CDB\_OLS\_STATUS data dictionary views to
find if Oracle Label Security has already been registered and enabled.

# **Disabling Oracle Label Security**

If Oracle Database Vault has been enabled, then do not disable Oracle Label Security.

See Oracle Database Vault Administrator's Guide to find if Database Vault has been enabled.

To disable Oracle Label Security:

 Log into the database instance as user SYS or a user who has been granted the LBAC\_DBA role.

For example:



sqlplus  $psmith_ols -- Or$ ,  $psmith_ols@hrpdb$  for the hrpdb pluggable database (PDB) Enterp password: password

2. Run the following procedure:

EXEC LBACSYS.OLS\_ENFORCEMENT.DISABLE\_OLS;

3. Restart the database.

#### For example:

```
CONNECT SYS AS SYSOPER
Enter password: password
SHUTDOWN IMMEDIATE
STARTUP
```

4. For Oracle Real Application Cluster (Oracle RAC) environment or a multitenant environment, repeat these steps for each Oracle RAC node or PDB on which you enabled Oracle Label Security.

# **Enabling Oracle Label Security**

You can enable Oracle Label Security in SQL\*Plus.

1. Log into the database instance as user SYS or a user who has been granted the LBAC\_DBA role.

#### For example:

```
sqlplus psmith_ols -- Or, psmith_ols@hrpdb for the hrpdb PDB Enterp password: password
```

**2.** Run the following procedure:

```
EXEC LBACSYS.OLS_ENFORCEMENT.ENABLE_OLS;
```

3. Restart the database.

#### For example:

```
CONNECT SYS AS SYSOPER
Enter password: password
SHUTDOWN IMMEDIATE
STARTUP
```

4. For Oracle Real Application Cluster (Oracle RAC) environment or a multitenant environment, repeat these steps for each Oracle RAC node or PDB on which you disabled Oracle Label Security.



B

# Advanced Topics in Oracle Label Security

Oracle provides advanced functionality for Oracle Label Security, such as the ability to analyze relationships between labels.

- Analyzing the Relationships Between Labels
   You can analyze the relationships between labels.
- Queries for Audited Oracle Label Security Session Labels
   You can use the unified audit trail to capture information from various audit
   sources, including Oracle Label Security.
- Oracle Call Interface for Setting Session Labels
   You can use an Oracle Call Interface (OCI) to set session labels.

# Analyzing the Relationships Between Labels

You can analyze the relationships between labels.

- About Dominant and Dominated Labels
   The relationship between two labels can be described in terms of dominance.
- Non-Comparable Labels
   It is important to understand how labels can be compared with regard to dominance.
- Using Dominance Functions
   Oracle Label Security provides functions to control dominance.

### About Dominant and Dominated Labels

The relationship between two labels can be described in terms of dominance.

A user's ability to access an object depends on whether the user's label dominates the label of the object. If a user's label does not dominate the object's label, then the user is not allowed to access the object.

Label dominance is analyzed in terms of all its components: levels, compartments, and groups.

Table B-1 Dominance in the Comparison of Labels

| Factor      | Criteria for Dominance  |
|-------------|---|
| Level       | For label1 to dominate label2, the level of label1 must be greater than or equal to that of label2.           |
| Compartment | For label1 to dominate label2, the compartments of label1 must contain <i>all</i> the compartments of label2. |
| Group       | For label1 to dominate label2, label1 must contain at least one of the groups of label2.                      |



One label *dominates* another label if all of its components dominate the components of the other label. For example, the label <code>HIGHLY\_SENSITIVE:FINANCE,OPERATIONS</code> dominates the label <code>HIGHLY\_SENSITIVE:FINANCE</code>. Similarly, the label <code>HIGHLY\_SENSITIVE::WR AP dominates</code> the label <code>HIGHLY\_SENSITIVE::WR AP, WR AR.</code>

#### **Related Topics**

Dominance Rules for Labels with Inverse Groups
 You should understand how dominance rules work for Oracle labels and inverse groups.

### Non-Comparable Labels

It is important to understand how labels can be compared with regard to dominance.

The relationship between two labels cannot always be defined by dominance. Two labels are *non-comparable* if neither label dominates the other.

If any compartments differ between the two labels (as with  $\mathtt{HS:A}$  and  $\mathtt{HS:B}$ ), then they are non-comparable. Similarly, the labels  $\mathtt{HS:A}$  and  $\mathtt{S:B}$  are non-comparable.

You can find existing labels by querying the DBA\_SA\_LABELS data dictionary view.

# **Using Dominance Functions**

Oracle Label Security provides functions to control dominance.

- About the Dominance Functions
   You can use dominance functions to specify ranges in queries.
- OLS\_DOMINATES Standalone Function
   The OLS\_DOMINATES (OLS\_DOM) function returns 1 (TRUE) if label1 dominates label2, or 0 (FALSE) if it does not.
- OLS\_LABEL\_DOMINATES Standalone Function
   The standalone OLS\_LABEL\_DOMINATES function checks the dominance of session labels.
- OLS\_STRICTLY\_DOMINATES Standalone Function
  The OLS\_STRICTLY\_DOMINATES (OLS\_S\_DOM) function returns 1 (TRUE) if label1
  dominates label2 and is not equal to it.
- OLS\_DOMINATED\_BY Standalone Function
  The OLS\_DOMINATED\_BY (OLS\_DOM\_BY) function returns 1 (TRUE) if label1 is dominated by label2.
- OLS\_STRICTLY\_DOMINATED\_BY Standalone Function
  The OLS\_STRICTLY\_DOMINATED\_BY (OLS\_S\_DOM\_BY) function returns 1 (TRUE) if
  label1 is dominated by label2 and is not equal to it.
- SA UTL.DOMINATES

The SA\_UTL.DOMINATES function returns TRUE if label1 dominates label2 or if the session label for the given OLS policy dominates label.

- SA\_UTL.STRICTLY\_DOMINATES

  The SA\_UTL.STRICTLY\_DOMINATES function returns TRUE if label1 dominates label2 and is not equal to it.
- SA\_UTL.DOMINATED\_BY
  The SA\_UTL.DOMINATED\_BY function returns TRUE if label1 is dominated by label2.

#### SA\_UTL.STRICTLY\_DOMINATED\_BY

The SA\_UTL.STRICTLY\_DOMINATED\_BY function returns TRUE if label1 is dominated by label2 and is not equal to it.

#### **Related Topics**

#### Ordering Labeled Data Rows

The ORDER BY clause of a SELECT statement can be used to order rows by the numeric label tag.

### About the Dominance Functions

You can use dominance functions to specify ranges in queries.

The following functions enable you to indicate dominance relationships between specified labels.

Table B-2 Functions to Determine Dominance

| Function                  | Description  |
|---------------------------|--|
| OLS_DOMINATES             | The value of label1 dominates, or is equal to, that of label2.   |
| OLS_LABEL_DOMINATES       | The value of the session label for the corresponding policy_name dominates, or is equal to, that of label. |
| OLS_STRICTLY_DOMINATES    | The value of label1 dominates that of label2, and is not equal to it.                                      |
| OLS_DOMINATED_BY          | The value of label1 is dominated by that of label2.  |
| OLS_STRICTLY_DOMINATED_BY | The value of label1 is dominated by that of label2, and is not equal to it.                                |

Note that there are two types of dominance function. While the SA\_UTL dominance functions return BOOLEAN values, the standalone dominance functions return integers.

### **OLS DOMINATES Standalone Function**

The  $OLS\_DOMINATES$  ( $OLS\_DOM$ ) function returns 1 (TRUE) if label1 dominates label2, or 0 (FALSE) if it does not.

```
OLS_DOMINATES (
label1 IN NUMBER,
label2 IN NUMBER)
RETURN INTEGER;
```



Table B-3 OLS\_DOMINATES Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing label tags 1111 and 1112.

#### Note:

The old OLS functions, DOMINATES and DOM, have been deprecated in Oracle Database 12c release 1 (12.1).

You can still use the old functions in this release, but Oracle recommends that you use the  ${\tt OLS\_LABEL\_DOMINATES}$  and  ${\tt OLS\_DOM}$  functions instead. Using the new function names avoids potential name conflicts with other database components.

### OLS\_LABEL\_DOMINATES Standalone Function

The standalone  ${\tt OLS\_LABEL\_DOMINATES}$  function checks the dominance of session labels.

It returns 1 (TRUE) if the session label of the specified policy\_name value dominates or is equal to the label that is specified by the label parameter. Otherwise, this function returns 0 (FALSE). This function is publicly available.

#### Note:

This feature is available starting with Oracle Database 12c release 1 (12.1.0.2).

In addition to Oracle Label Security policies, you can use this function with both Oracle Data Redaction and Oracle Database Vault policies.



#### **Syntax**

#### **Parameters**

#### Table B-4 OLS\_LABEL\_DOMINATES Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | The name of the Oracle Label Security policy whose session label must be checked for dominance. To find existing label values for policies, query the POLICY_NAME and LABEL columns of the ALL_SA_LABELS view. |
| label       | The base label against whom the dominance has to be checked  |

#### **Examples**

The following example checks if the session label for the  $hr_ols_pol$  policy dominates or is equal to the hs label.

This example shows how you can use the <code>OLS\_LABEL\_DOMINATES</code> function in an Oracle Data Redaction policy:

```
BEGIN

DBMS_REDACT.ADD_POLICY(
  object_schema => 'oe',
  object_name => 'customers',
  column_name => 'customer_id',
  policy_name => 'redact_cust_user_ids',
  function_type => DBMS_REDACT.FULL,
  expression => 'OLS_LABEL_DOMINATES(''hr_ols_pol'', ''hs'') = 0');
END;
//
```

The following example shows how you can use the <code>OLS\_LABEL\_DOMINATES</code> function in an Oracle Database Vault rule definition:

```
EXEC DBMS_MACADM.CREATE_RULE('Check OLS Factor',
'OLS_LABEL_DOMINATES(''hr_ols_pol'', ''hs'') = 1');
```



#### See Also:

- Oracle Database Advanced Security Guide for more information about Data Redaction
- Oracle Database Vault Administrator's Guide for more information about Database Vault realms

### OLS\_STRICTLY\_DOMINATES Standalone Function

The OLS\_STRICTLY\_DOMINATES (OLS\_S\_DOM) function returns 1 (TRUE) if label1 dominates label2 and is not equal to it.

#### **Syntax**

```
OLS_STRICTLY_DOMINATES (
label1 IN NUMBER,
label2 IN NUMBER)
RETURN INTEGER;
```

#### **Parameters**

#### Table B-5 OLS\_STRICTLY\_DOMINATES Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Examples**

The following example compares existing label tags 1111 and 1112.

#### Note:

The old OLS functions, STRICTLY\_DOMINATES and S\_DOM have been deprecated in Oracle Database 12c release 1 (12.1).

You can still use the old functions in this release, but Oracle recommends that you use the <code>OLS\_STRICTLY\_DOMINATES</code> and <code>OLS\_S\_DOM</code> functions instead. Using the new function names avoids potential name conflicts with other database components.



### OLS DOMINATED BY Standalone Function

The OLS\_DOMINATED\_BY (OLS\_DOM\_BY) function returns 1 (TRUE) if label1 is dominated by label2.

#### **Syntax**

```
OLS_DOMINATED_BY (
label1 IN NUMBER,
label2 IN NUMBER)
RETURN INTEGER;
```

#### **Parameters**

#### Table B-6 OLS STRICTLY DOMINATES Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing label tags 1111 and 1112.

### Note:

The old OLS functions, <code>DOMINATED\_BY</code> and <code>DOM\_BY</code> have been deprecated in Oracle Database 12c release 1 (12.1).

You can still use the old functions in this release, but Oracle recommends that you use the <code>OLS\_DOMINATED\_BY</code> and <code>OLS\_DOM\_BY</code> functions instead. Using the new function names avoids potential name conflicts with other database components.

### OLS\_STRICTLY\_DOMINATED\_BY Standalone Function

The  $OLS\_STRICTLY\_DOMINATED\_BY$  ( $OLS\_S\_DOM\_BY$ ) function returns 1 (TRUE) if label1 is dominated by label2 and is not equal to it.



Table B-7 OLS\_DOMINATES Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing label tags 1111 and 1112.

#### Note:

The old OLS functions, STRICTLY\_DOMINATED\_BY and S\_DOM\_BY have been deprecated in Oracle Database 12c release 1 (12.1).

You can still use the old functions in this release, but Oracle recommends that you use the <code>OLS\_STRICTLY\_DOMINATED\_BY</code> and <code>OLS\_S\_DOM\_BY</code> functions instead. Using the new function names avoids potential name conflicts with other database components.

### SA\_UTL.DOMINATES

The SA\_UTL.DOMINATES function returns TRUE if label1 dominates label2 or if the session label for the given OLS policy dominates label.

```
SA_UTL.DOMINATES (
label1 IN NUMBER,
label2 IN NUMBER)
RETURN BOOLEAN;

Syntax
```

```
SA_UTL.DOMINATES (
ols_policy_name IN VARCHAR2,
label IN VARCHAR2)
RETURN BOOLEAN;
```



Table B-8 SA\_UTL.DOMINATES Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing label tags 1111 and 1112.

```
SET SERVEROUTPUT ON
BEGIN

IF SA_UTL.DOMINATES(1111, 1112)

THEN DBMS_OUTPUT.PUT_LINE('Label 1111 dominates label 1112.');
ELSE

DBMS_OUTPUT.PUT_LINE('Label 1112 dominates label 1111.');
END IF;
END;
/
Label 1112 dominates label 1111.
```

#### Note:

The second SA\_UTL.DOMINATES function, which takes the Oracle Label Security policy name and label as inputs, has been deprecated in Oracle Database 12c release 1 (12.1).

You can still use this function, but not with Oracle Data Redaction and Oracle Database Vault conditions. Oracle recommends that you use the <code>OLS\_LABEL\_DOMINATES</code> function instead.

The first SA\_UTL.DOMINATES function, which uses the NUMBER datatype, is not deprecated.

### SA\_UTL.STRICTLY\_DOMINATES

The SA\_UTL.STRICTLY\_DOMINATES function returns TRUE if label1 dominates label2 and is not equal to it.

```
SA_UTL.STRICTLY_DOMINATES (
label1 IN NUMBER,
label2 IN NUMBER)
RETURN BOOLEAN;
```



Table B-9 SA\_UTL.STRICTLY\_DOMINATES Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing label tags 1111 and 1112.

```
SET SERVEROUTPUT ON

BEGIN

IF SA_UTL.STRICTLY_DOMINATES(1111, 1112)

THEN DBMS_OUTPUT.PUT_LINE('Label 1111 strictly dominates label 1112.');

ELSE

DBMS_OUTPUT.PUT_LINE('Label 1112 strictly dominates label 1111.');

END IF;

END;

/

Label 1112 strictly dominates label 1111.
```

### SA UTL.DOMINATED BY

The SA\_UTL.DOMINATED\_BY function returns TRUE if label1 is dominated by label2.

#### **Syntax**

```
SA_UTL.DOMINATED_BY (
label1 IN NUMBER,
label2 IN NUMBER)
RETURN BOOLEAN;
```

#### **Parameters**

Table B-10 SA\_UTL.DOMINATED\_BY Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing label tags 1111 and 1112.

```
SET SERVEROUTPUT ON
BEGIN
IF SA_UTL.DOMINATED_BY(1111, 1112)
THEN DBMS_OUTPUT.PUT_LINE('Label 1111 is dominated by label 1112.');
ELSE
```



```
DBMS_OUTPUT.PUT_LINE('Label 1112 is dominated by label 1111.');
END IF;
END;
/
Label 1111 is dominated by label 1112.
```

### SA\_UTL.STRICTLY\_DOMINATED\_BY

The SA\_UTL.STRICTLY\_DOMINATED\_BY function returns TRUE if label1 is dominated by label2 and is not equal to it.

#### **Syntax**

#### **Parameters**

Table B-11 SA\_UTL.STRICTLY\_DOMINATED\_BY Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing label tags 1111 and 1112.

```
SET SERVEROUTPUT ON

BEGIN

IF SA_UTL.STRICTLY_DOMINATED_BY(1111, 1112)

THEN DBMS_OUTPUT.PUT_LINE('Label 1111 is strictly dominated by label 1112.');

ELSE

DBMS_OUTPUT.PUT_LINE('Label 1112 is strictly dominated by label 1111.');

END IF;

END;

/

Label 1111 is strictly dominated by label 1112.
```

#### **Related Topics**

 Determination of the Upper and Lower Bounds of Labels
 Oracle Label Security provides functions that determine the least upper bound or the greatest lower bound of two or more labels.

# Queries for Audited Oracle Label Security Session Labels

You can use the unified audit trail to capture information from various audit sources, including Oracle Label Security.

- About Queries for Auditing Oracle Label Security Session Labels
   You must configure Oracle Label Security auditing by creating unified audit
   policies.
- ORA\_GET\_AUDITED\_LABEL Function
   The ORA\_GET\_AUDITED\_LABEL function returns the audited session label for the specified OLS policy and APPLICATION\_CONTEXTS column value.

### About Queries for Auditing Oracle Label Security Session Labels

You must configure Oracle Label Security auditing by creating unified audit policies.

OLS auditing enables you to audit additional events such as enabling and disabling of OLS policies.

The session labels that the audit trail captures are stored in the APPLICATION\_CONTEXTS column of the UNIFIED\_AUDIT\_TRAIL view. You can use the LBACSYS.ORA\_GET\_AUDITED\_LABEL function to retrieve session labels that are stored in the APPLICATION\_CONTEXTS column. This function accepts the UNIFIED\_AUDIT\_TRAIL.APPLICATION\_CONTEXTS column value, and the Oracle Label Security policy name as arguments, and then returns the session label that is stored in the column for the specified policy.



Oracle Database Security Guide for detailed information about configuring and using OLS auditing in a unified audit trail

### ORA\_GET\_AUDITED\_LABEL Function

The ORA\_GET\_AUDITED\_LABEL function returns the audited session label for the specified OLS policy and APPLICATION CONTEXTS column value.

The AUDIT\_VIEWER role has EXECUTE privilege on the ORA\_GET\_AUDITED\_LABEL function.

#### **Syntax**

```
ORA_GET_AUDITED_LABEL (
appctx_col_value IN VARCHAR2,
ols_policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

#### **Parameters**

#### Table B-12 ORA\_GET\_AUDITED\_LABEL Parameters

| Parameter        | Description  |
|------------------|--|
| appctx_col_value | Value in the UNIFIED_AUDIT_TRAIL.APPLICATION_CONTEXTS column |
| policy_name      | The label security policy name                               |



#### **Example**

The following example returns the audited session label for the hr\_ols\_pol policy.

# Oracle Call Interface for Setting Session Labels

You can use an Oracle Call Interface (OCI) to set session labels.

- About Using the Oracle Call Interface to Set Session Labels
   When you connect using Oracle Call Interface (OCI), you can use the
   SYS\_CONTEXT variables to initialize the session label and the row label.
- Using the Oracle Call Interface to Set Session Labels
   You can use the Oracle Call Interface to set the session labels.
- Example: Using Oracle Call Interface with the SYS\_CONTEXT Function
   You can create an OCI call that uses an externalized SYS\_CONTEXT function with
   Oracle Label Security.

### About Using the Oracle Call Interface to Set Session Labels

When you connect using Oracle Call Interface (OCI), you can use the SYS\_CONTEXT variables to initialize the session label and the row label.

You can set the variables using the <code>OCIAttrSet</code> function to initialize <code>externally</code> initialized <code>SYS\_CONTEXT</code> variables. These are available when Oracle Label Security is enabled.

Each policy has a SYS\_CONTEXT named SA\$policy\_name\_X. You can set these two variables, INITIAL\_LABEL and INITIAL\_ROW\_LABEL.

When the new values are set to valid labels within the user's authorizations, they will be used instead of the default values stored for the user. This is the same mechanism used for remote connections.

#### **Related Topics**

Using Oracle Label Security with a Distributed Database
 You should understand the special considerations for using Oracle Label Security
 in a distributed configuration.

### Using the Oracle Call Interface to Set Session Labels

You can use the Oracle Call Interface to set the session labels.

1. Call OCIAttrSet with OCI\_ATTR\_APPCTX\_SIZE to initialize the context array size with the desired number of context attributes:

```
OCIAttrSet(session, OCI_HTYPE_SESSION, (dvoid *)&size, (ub4)0, OCI_ATTR_APPCTX_SIZE, error_handle);
```



This defines additional attributes for OCIAttrSet.

Note that the size is ub4 type.

2. Call OCIAttrGet with OCI\_ATTR\_APPCTX\_LIST to get a handle on the application context list descriptor for the session:

Note that ctxl\_desc is (OCIParam \*) type.

3. Call OCIParamGet with the application context list descriptor to obtain an individual descriptor for the i-th application context:

```
OCIParamGet(ctxl_desc, OCI_DTYPE_PARAM, error_handle,(dvoid **)&ctx_desc, i);
```

Note that ctx\_desc is (OCIParam \*) type.

4. Call OCIAttrSet with each of the three new attributes, OCI\_ATTR\_APPCTX\_NAME, OCI\_ATTR\_APPCTX\_ATTR, and OCI\_ATTR\_APPCTX\_VALUE, to set the proper values in the application context:

Note that only character type is supported, because application context operations are based on the VARCHAR2 type.

# Example: Using Oracle Call Interface with the SYS\_CONTEXT Function

You can create an OCI call that uses an externalized <code>SYS\_CONTEXT</code> function with Oracle Label Security.

Example B-1 shows how to accomplish this.

#### Example B-1 Using OCI to Externalize SYS\_CONTEXT with OLS

```
#ifdef RCSID
static char *RCSid =
    "$Header: ext_mls.c 09-may-00.10:07:08 jdoe Exp $ ";
#endif /* RCSID */

/* Copyright (c) Oracle Corporation 1999, 2000. All Rights Reserved. */
/*
    NAME
ext_mls.c - externalized SYS_CONTEXT with Label Security
    DESCRIPTION
```



```
Run olsdemo.sql script before executing this example.
Usage: <executable obtained with .c file> <user_name> <password> <session-initial-
label
Example: avg_sal sa_demo sa_demo L3:M,E:D10
   PUBLIC FUNCTION(S)
<list of external functions declared/defined - with one-line descriptions>
   PRIVATE FUNCTION(S)
descriptions 
The average salary in the EMP table of the SA DEMO schema querying as the specified
user with the specified session label.
  NOTES
<other useful comments, qualifications, and so on>
  MODIFIED (MM/DD/YY)
jlev
     09/18/03 - cleanup
         05/09/00 - cleanup
          10/13/99 - standalone OCI program to test MLS SYS_CONTEXT
            10/13/99 - Creation
   jdoe
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <oci.h>
static OCIEnv *envhp;
static OCIError *errhp;
int main(/*_ int argc, char *argv[] _*/);
/* get and print error */
static void checkerr(/*_OCIError *errhp, sword status _*/);
/* print error */
static void printerr(char *call);
static sword status;
/* return the average of employees' salary */
static CONST text *const selectstmt = (text *)
     "select avg(sal) from sa_demo.emp";
int main(argc, argv)
int argc;
char *argv[];
 OCISession *authp = (OCISession *) 0;
 OCIServer *srvhp;
 OCISvcCtx *svchp;
 OCIDefine *defnp = (OCIDefine *) 0;
 dvoid *parmdp;
 ub4 ctxsize;
 OCIParam *ctxldesc;
 OCIParam *ctxedesc;
 OCIStmt *stmtp = (OCIStmt *) 0;
 ub4 avg_sal = 0;
  sword status;
```



```
if (OCIInitialize((ub4) OCI_DEFAULT, (dvoid *) 0,
                  (dvoid * (*)(dvoid *, size_t)) 0,
                  (dvoid * (*)(dvoid *, dvoid *, size_t)) 0,
                  (void (*)(dvoid *, dvoid *)) 0))
  printerr("OCIInitialize");
if (OCIEnvInit((OCIEnv **) &envhp, OCI_DEFAULT, (size_t) 0, (dvoid **) 0))
 printerr("OCIEnvInit");
if (OCIHandleAlloc((dvoid *) envhp, (dvoid **) &errhp, OCI_HTYPE_ERROR,
                   (size_t) 0, (dvoid **) 0))
  printerr("OCIHandleAlloc:OCI_HTYPE_ERROR");
if (OCIHandleAlloc((dvoid *) envhp, (dvoid **) &srvhp, OCI_HTYPE_SERVER,
                   (size_t) 0, (dvoid **) 0))
 printerr("OCIHandleAlloc:OCI_HTYPE_SERVER");
if (OCIHandleAlloc((dvoid *) envhp, (dvoid **) &svchp, OCI_HTYPE_SVCCTX,
                   (size_t) 0, (dvoid **) 0))
 printerr("OCIHandleAlloc:OCI_HTYPE_SVCCTX");
if (OCIServerAttach(srvhp, errhp, (text *) "", strlen(""), 0))
 printerr("OCIServerAttach");
/* set attribute server context in the service context */
if (OCIAttrSet((dvoid *) svchp, OCI_HTYPE_SVCCTX, (dvoid *) srvhp,
               (ub4) 0, OCI_ATTR_SERVER, (OCIError *) errhp))
 printerr("OCIAttrSet:OCI_HTYPE_SVCCTX");
if (OCIHandleAlloc((dvoid *) envhp, (dvoid **) &authp,
                   (ub4) OCI_HTYPE_SESSION, (size_t) 0, (dvoid **) 0))
  printerr("OCIHandleAlloc:OCI_HTYPE_SESSION");
/* set application context to 1 */
ctxsize = 1;
/* set up app ctx buffer */
if (OCIAttrSet((dvoid *) authp, (ub4) OCI_HTYPE_SESSION, (dvoid *) &ctxsize,
               (ub4) 0, (ub4) OCI_ATTR_APPCTX_SIZE, errhp))
 printerr("OCIAttrSet:OCI_ATTR_APPCTX_SIZE");
/* retrieve the list descriptor */
if (OCIAttrGet((dvoid *) authp, (ub4) OCI_HTYPE_SESSION,
               (dvoid *) &ctxldesc, 0, OCI_ATTR_APPCTX_LIST, errhp))
 printerr("OCIAttrGet:OCI_ATTR_APPCTX_LIST");
if (status = OCIParamGet(ctxldesc, OCI_DTYPE_PARAM, errhp,
                         (dvoid **) &ctxedesc, 1))
    if (status == OCI_NO_DATA)
       printf("No Data found!\n");
       exit(1);
  }
/* set context namespace to SA$<pol_name>_X */
if (OCIAttrSet((dvoid *) ctxedesc, (ub4) OCI_DTYPE_PARAM,
               (dvoid *) "SA$HUMAN_RESOURCES_X",
               (ub4) strlen((char *) "SA$HUMAN_RESOURCES_X"),
               (ub4) OCI_ATTR_APPCTX_NAME, errhp))
```

```
printerr("OCIAttrSet:OCI_ATTR_APPCTX_NAME:SA$HUMAN_RESOURCES_X");
/* set context attribute to INITIAL_LABEL */
if (OCIAttrSet((dvoid *) ctxedesc, (ub4) OCI_DTYPE_PARAM,
               (dvoid *) "INITIAL_LABEL",
               (ub4) strlen((char *) "INITIAL_LABEL"),
               (ub4) OCI_ATTR_APPCTX_ATTR, errhp))
  printerr("OCIAttrSet:OCI_DTYPE_PARAM:INITIAL_LABEL");
/* set context value to argv[3] - initial label */
if (OCIAttrSet((dvoid *) ctxedesc, (ub4) OCI_DTYPE_PARAM,
               (dvoid *) argv[3],
               (ub4) strlen((char *) argv[3]),
               (ub4) OCI_ATTR_APPCTX_VALUE, errhp))
  printerr("OCIAttrSet:argv[3]");
/* username first command line argument */
if (OCIAttrSet((dvoid *) authp, (ub4) OCI_HTYPE_SESSION, (dvoid *) argv[1],
               (ub4) strlen((char *) argv[1]), (ub4) OCI_ATTR_USERNAME,
               errhp))
  printerr("OCIAttrSet:username");
/* password second command line argument */
if (OCIAttrSet((dvoid *) authp, (ub4) OCI_HTYPE_SESSION, (dvoid *) argv[2],
               (ub4) strlen((char *) argv[2]), (ub4) OCI_ATTR_PASSWORD,
               errhp))
  printerr("OCIAttrSet:password");
if (OCISessionBegin(svchp, errhp, authp, OCI_CRED_RDBMS, (ub4) OCI_DEFAULT))
  printerr("OCISessionBegin");
if (OCIAttrSet((dvoid *) svchp, (ub4) OCI_HTYPE_SVCCTX, (dvoid *) authp,
               (ub4) 0, (ub4) OCI_ATTR_SESSION, errhp))
  printerr("OCIAttrSet:OCI_ATTR_SESSION");
if (OCIHandleAlloc((dvoid *) envhp, (dvoid **) &stmtp, OCI_HTYPE_STMT,
                   0,0))
  printerr("OCIHandleAlloc:OCI_HTYPE_STMT");
if (OCIStmtPrepare(stmtp, errhp, (CONST OraText *) selectstmt,
                   (ub4) strlen((const char *) selectstmt),
                   (ub4) OCI_NTV_SYNTAX, (ub4) OCI_DEFAULT))
  printerr("OCIStmtPrepare");
if (OCIDefineByPos(stmtp, &defnp, errhp, (ub4) 1, (dvoid *) &avg_sal,
                   (sb4) sizeof(avg_sal), SQLT_INT, 0, 0, 0, OCI_DEFAULT))
 printerr("OCIDefineByPos");
if (status = OCIStmtExecute(svchp, stmtp, errhp, 1, 0, NULL, NULL,
                            OCI_DEFAULT))
    if (status == OCI_NO_DATA)
        printf("No Data found!\n");
        exit(1);
if (OCISessionEnd(svchp, errhp, authp, OCI_DEFAULT))
  printerr("OCISessionEnd");
```

```
printf("average salary is: %d\n", avg_sal);
void checkerr(errhp, status)
    OCIError *errhp;
    sword status;
 text errbuf[512];
  sb4 errcode = 0;
  switch (status)
   case OCI_ERROR:
     (void) OCIErrorGet((dvoid *) errhp, 1, NULL, &errcode, errbuf,
                        (ub4) sizeof(errbuf), OCI_HTYPE_ERROR);
     printf("Error - %.*s\n", 512, errbuf);
     break;
   default:
     break;
}
void printerr(call)
    char *call;
 printf("Error: %s\n", call);
/* end of file ext_mls.c */
```



C

# Command-line Tools for Label Security Using Oracle Internet Directory

Oracle Label Security provides command-line tools for using Oracle Internet Directory.

- About the Command-line Oracle Label Security Tools
   When you use Oracle Label Security with Oracle Internet Directory, you can create
   and alter label security attributes stored in the directory.
- Oracle Label Security Commands in Categories
   Oracle Label Security commands can be categorized according to policies, levels, groups, and so on.
- olsadmintool Command Reference
  The olsadmintool commands performs tasks such as adding enterprise users to administrative groups for an Oracle Label Security policy.
- Relating Parameters to Commands for olsadmintool
   You must follow a set of guidelines for using the olsadmintool parameters.
- Examples of Using the olsadmintool Utility
   You use the olsadmintool commands to set up Oracle Label Security in an Oracle Internet Directory environment.

# About the Command-line Oracle Label Security Tools

When you use Oracle Label Security with Oracle Internet Directory, you can create and alter label security attributes stored in the directory.

The commands perform updates, inserts and deletes of entries in the directory and are implemented through a script named olsadmintool, which you call from <code>\$ORACLE\_HOME/bin/olsadmintool</code>.



You can also use the graphical user interface provided by Oracle Enterprise Manager to manage Oracle Label Security. Detailed documentation can be found in Oracle Enterprise Manager help.

# Oracle Label Security Commands in Categories

Oracle Label Security commands can be categorized according to policies, levels, groups, and so on.

Table C-1 lists all the commands, in categories, with links to their explanations.

Some of these commands replace PL/SQL procedures that are used for the indicated purposes when Oracle Label Security is used without Oracle Internet Directory. Sites already using Oracle Label Security that add Oracle Internet Directory must replace the use of those PL/SQL procedures by switching to use these new commands instead.

Table C-1 Oracle Label Security Commands in Categories

| Command<br>Category       | Command                        | Replaces PL/SQL Statement                         |
|---------------------------|--------------------------------|---|
| Policies                  | olsadmintool createpolicy      | SA_SYSDBA.CREATE_POLICY                           |
| Policies                  | olsadmintool alterpolicy       | SA_SYSDBA.ALTER_POLICY                            |
| Policies                  | olsadmintool droppolicy        | SA_SYSDBA.DROP_POLICY                             |
| Policies                  | olsadmintool addpolcreator     | None; new   |
| Policies                  | olsadmintool droppolcreator    | None; new   |
| Levels in a<br>Policy     | olsadmintool createlevel       | SA_COMPONENTS.CREATE_LEVEL                        |
| Levels in a<br>Policy     | olsadmintool alterlevel        | SA_COMPONENTS.ALTER_LEVEL                         |
| Levels in a<br>Policy     | olsadmintool droplevel         | SA_COMPONENTS.DROP_LEVEL                          |
| Groups in a<br>Policy     | olsadmintool creategroup       | SA_COMPONENTS.CREATE_GROUP                        |
| Groups in a<br>Policy     | olsadmintool altergroup        | SA_COMPONENTS.ALTER_GROUP                         |
| Groups in a<br>Policy     | olsadmintool altercompartent   | SA_COMPONENTS.ALTER_GROUP_PARE NT                 |
| Groups in a<br>Policy     | olsadmintool dropgroup         | SA_COMPONENTS.DROP_GROUP                          |
| Compartmen ts in a Policy | olsadmintool createcompartment | SA_COMPONENTS.CREATE_COMPARTME NT                 |
| Compartmen ts in a Policy | olsadmintool altercompartent   | SA_COMPONENTS.ALTER_COMPARTMEN T                  |
| Compartmen ts in a Policy | olsadmintool dropcompartment   | SA_COMPONENTS.DROP_COMPARTMENT                    |
| Data Labels               | olsadmintool createlabel       | SA_LABEL_ADMIN.CREATE_LABEL                       |
| Data Labels               | olsadmintool alterlabel        | SA_LABEL_ADMIN.ALTER_LABEL                        |
| Data Labels               | olsadmintool droplabel         | SA_LABEL_ADMIN.DROP_LABEL                         |
| Users                     | olsadmintool adduser           | None; new   |
| Users                     | olsadmintool dropuser          | SA_USER_ADMIN.DROP_USER_ACCESS                    |
| Profiles                  | olsadmintool createprofile     | Replaces the use of several methods. <sup>1</sup> |
| Profiles                  | olsadmintool listprofile       | None; new   |
| Profiles                  | olsamindtool describeprofile   | None; new   |
| Profiles                  | olsadmintool dropprofile       | None; new   |



Table C-1 (Cont.) Oracle Label Security Commands in Categories

| Command<br>Category          | Command                | Replaces PL/SQL Statement |
|------------------------------|------------------------|---------------------------|
| Policy<br>Administrator<br>s | olsadmintool addadmin  | None; new                 |
| Policy<br>Administrator<br>s | olsadmintool dropadmin | None; new                 |
| Auditing                     | olsadmintool audit     | SA_AUDIT_ADMIN.AUDIT      |
| Auditing                     | olsadmintool noaudit   | SA_AUDIT_ADMIN.NOAUDIT    |
| Help                         | olsadmintoolhelp       | None; new                 |

Replaces several methods in SA\_USER\_ADMIN: SET\_LEVELS, SET\_USER\_PRIVILEGES, and SET\_DEFAULT\_LABEL

### olsadmintool Command Reference

The olsadmintool commands performs tasks such as adding enterprise users to administrative groups for an Oracle Label Security policy.

You must run olsadmintool from the command line.

#### About the olsadmintool Commands

You run the <code>olsadmintool</code> commands from a command prompt and can use special characters to perform specific operations.

#### olsadmintool addadmin

The olsadmintool addadmin command adds an enterprise user to the administrative group for a policy.

#### olsadmintool addpolcreator

The olsadmintool addpolcreator command enables the specified user to create policies.

#### olsadmintool adduser

The olsadmintool adduser command adds an enterprise user to a profile within a policy.

#### olsadmintool altercompartent

The olsadmintool altercompartment command changes the long name of a compartment.

#### olsadmintool altergroup

The olsadmintool altergroup command changes the long name for a group component or parent group.

#### olsadmintool altergroupparent

The olsadmintool altergroupparent command changes or removes the parent group of a group.

#### olsadmintool alterlabel

The olsadmintool alterlabel command changes the character string defining the label associated with a label tag.



#### olsadmintool alterlevel

The olsadmintool alterlevel command changes the long name of a level.

#### olsadmintool alterpolicy

The olsadmintool alterpolicy command alters the options of a policy.

#### olsadmintool audit

The olsadmintool olsadmintool audit command sets the audit options for a policy.

#### olsadmintool createcompartment

The olsadmintool createcompartment command creates a new compartment component.

#### olsadmintool creategroup

The olsadmintool creategroup command creates a new group component.

#### olsadmintool createlabel

The olsadmintool createlabel command creates a valid data label.

#### olsadmintool createlevel

The olsadmintool createlevel command creates a new level component.

#### olsadmintool createprofile

The olsadmintool createprofile command creates a new profile.

#### olsadmintool createpolicy

The olsadmintool createpolicy command creates a policy.

#### olsamindtool describeprofile

The olsadmintool describeprofile command enables you to see the contents of a policy profile.

#### olsadmintool dropadmin

The olsadmintool dropadmin command removes an enterprise user from the administrative group of a policy.

#### olsadmintool dropcompartment

The olsadmintool dropcompartment command removes a compartment component.

#### olsadmintool dropgroup

The olsadmintool dropgroup command removes a group component.

#### olsadmintool droplabel

The olsadmintool droplabel command drops a label from the policy.

#### olsadmintool droplevel

The olsadmintool droplevel command removes a level component from a specified policy.

#### olsadmintool droppolicy

The olsadmintool droppolicy command drops a policy.

#### olsadmintool dropprofile

The olsadmintool dropprofile command removes the specified profile.

#### olsadmintool droppolcreator

The olsadmintool droppolcreator command cancels the ability of the specified user to create policies.



#### olsadmintool dropuser

The olsadmintool dropuser command drops a user from the specified profile in the specified policy.

#### olsadmintool --help

The olsadmintool *command\_name* -- help command displays help information about the specified command.

#### olsadmintool noaudit

The olsadmintool noaudit command cancels the audit options for a policy.

#### olsadmintool listprofile

The olsadmintool listprofile command to see a list of all profiles in a given policy.

### About the olsadmintool Commands

You run the olsadmintool commands from a command prompt and can use special characters to perform specific operations.

In the <code>olsadmintool</code> commands, some parameters are optional, which is indicated by enclosing such a parameter within brackets. The two most common examples are [ -b  $admin\ context$  ] and [-p port], indicating that it is optional to specify either the administrative context for the command or the port through which to connect to Oracle Internet Directory. (Default port is 389.)

The use of two dashes (--, no space) is required for all parameters other than b, h, p, D, and w, which are preceded by a single dash. The double dash indicates the need to specify the full or long version of the name or parameter being used. If any such name or parameter contains spaces, it must be enclosed by double quotation marks, for example, "this is an extremely long name or parameter."

### olsadmintool addadmin

The olsadmintool addadmin command adds an enterprise user to the administrative group for a policy.

This enables the user to create, modify, or delete the specified policy's metadata. You must provide the policy name and the new administrator's DN. This group should contain only enterprise users.

#### **Syntax**

```
olsadmintool addadmin --polname policy_name --admindn admin_DN [ -b admin_context] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool addadmin --polname defense --admindn "cn=scott,c=us" -h sales_west -D cn=lbacsys -w bind_password
```

### olsadmintool addpolcreator

The olsadmintool addpolcreator command enables the specified user to create policies.

You must provide the DN for the user.



#### **Syntax**

```
olsadmintool addpolcreator --userdn user_DN [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Examples**

olsadmintool addpolcreator --userdn "cn=scott" -h sales\_west -D cn=lbacsys -w bind\_password

### olsadmintool adduser

The olsadmintool adduser command adds an enterprise user to a profile within a policy.

You must provide the profile and policy names and the user DN.<sup>1</sup> Enterprise users are normal Oracle Internet Directory users with the additional capability of connecting to the database. Users added to a profile must be enterprise users.

#### **Syntax**

```
olsadmintool adduser --polname policy_name --profname profile_name --userdn enterprise_user_DN[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind password
```

#### **Example**

```
olsadmintool adduser --polname tradesecret --profname topsales --userdn "cn=perot" -b "cn=EDS" -h ford -p 1890 -D cn=lbacsys -w bind password
```

# olsadmintool altercompartent

The olsadmintool altercompartment command changes the long name of a compartment.

You must provide the name of the policy, the short name of the compartment, and the new long name of the compartment.

#### **Syntax**

```
olsadmintool altercompartment --polname policy_name --shortname short_compartment_name --longname new_long_compartment_name [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

olsadmintool altercompartment --polname defense --shortname A --longname "Allied Forces" -h sales\_west -D cn=defense\_admin -w bind\_password

Command FootnoteEvery command must include the directory host name, the bind DN, and the bind password. Any command may, as needed, also supply the subscriber administrative context (optional), the directory port number (also optional), or both. See also Table C-2 for additional details on these parameters.



### olsadmintool altergroup

The olsadmintool altergroup command changes the long name for a group component or parent group.

You must provide the name of the policy, the short name of the group, and the long name of the group.

#### **Syntax**

```
olsadmintool altergroup --polname policy_name --shortname short_group_name --longname "new_long_group_name"
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool altergroup --polname defense --shortname US --longname "United States of America" -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool altergroupparent

The olsadmintool altergroupparent command changes or removes the parent group of a group.

You must provide the name of the policy, the short name of the group, and either the short name of the parent group or the clearparent flag, but not both.

#### **Syntax**

```
olsadmintool altergroupparent --polname policy_name --shortname short_group_name [--parentname new_parent_group_name] [--clearparent] --longname "new_long_group_name" [--parentname new_short_group_name] [-b admin_context] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Examples**

```
olsadmintool altergroupparent --polname defense --shortname US --parentname "Earth" -h sales_west -p 5678 -D cn=defense_admin -w bind_password olsadmintool altergroupparent --polname defense --shortname US --clearparent -h sales_west -p 5678 -D cn=defense_admin -w bind_password
```

### olsadmintool alterlabel

The olsadmintool alterlabel command changes the character string defining the label associated with a label tag.

You must provide the policy name, the numeric tag of the label, and the new character string representing the label.

```
olsadmintool alterlabel --polname policy_name --tag tag_number --value new_label_value [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```



#### **Example**

olsadmintool alterlabel --polname defense --tag 100 --value "TS:A:US" -h sales\_west -D cn=defense\_admin -w bind\_password

### olsadmintool alterlevel

The olsadmintool alterlevel command changes the long name of a level.

You must provide the name of the policy, the short name of the level, and the new long name of the level.

#### **Syntax**

```
olsadmintool alterlevel --polname policy_name --shortname short_level_name --longname "new_long_level_name"
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool alterlevel --polname defense --shortname TS --longname "VERY TOP SECRET" -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool alterpolicy

The olsadmintool alterpolicy command alters the options of a policy.

You must provide the name of the policy and the new options.

#### **Syntax**

```
olsadmintool alterpolicy --name policy_name --options new_options [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### In this specification:

• new\_options can be any combination of the following entries: INVERSE\_GROUP, HIDE, LABEL\_DEFAULT, LABEL\_UPDATE, CHECK\_CONTROL, READ\_CONTROL, WRITE\_CONTROL, INSERT\_CONTROL, DELETE\_CONTROL, UPDATE\_CONTROL, ALL\_CONTROL, NO\_CONTROL

#### Example

```
olsadmintool alterpolicy --name defense --options "READ_CONTROL,INSERT_CONTROL" -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool audit

The olsadmintool olsadmintool audit command sets the audit options for a policy.

You must provide the policy name, the options to be audited, the type of audit, and the type of success to be audited.



#### **Syntax**

```
olsadmintool audit --polname policy_name --options audit_option_name --type audit_option_type --success audit_success_type [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### In this specification:

- audit\_option can be any combination of the following entries: APPLY, REMOVE, SET, PRIVILEGE
- type can be session or access
- success can be successful, not successful, or both

#### **Example**

```
olsadmintool audit --polname defense --options "APPLY,PRIVILEGE" --type session --success success -h sales_west -D cn=defense_admin -w bind_password
```

# olsadmintool createcompartment

The olsadmintool createcompartment command creates a new compartment component.

You must provide the name of the policy, the tag numeric value of the compartment, the short name of the compartment, and the long name of the compartment.

#### **Syntax**

```
olsadmintool createcompartment --polname policy_name --tag tag_number --shortname short_compartment_name --longname <"long_compartment_name">
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool createcompartment --polname defense --tag 100 --shortname A --longname Alpha -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool creategroup

The olsadmintool creategroup command creates a new group component.

You must provide the name of the policy, the tag numeric value of the group, the short name of the group, the long name of the group, and the parent group name (optional).

#### **Syntax**

```
olsadmintool creategroup --polname policy_name --tag tag_number --shortname short_group_name --longname <"long_group_name">
[--parentname parent_group_name]
[-b admin_context] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool creategroup --polname defense --tag 55 --shortname US --longname "United States" -h sales_west -D cn=defense_admin -w bind_password
```



### olsadmintool createlabel

The olsadmintool createlabel command creates a valid data label.

You must provide the policy name, the numeric tag of the label to be created, and the character string representation of the label.

#### **Syntax**

```
olsadmintool createlabel --polname policy_name --tag tag_number --value label_value [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool createlabel --polname defense --tag 100 --value "TS:A,B:US,CA" -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool createlevel

The olsadmintool createlevel command creates a new level component.

You must provide the name of the policy, the tag numeric value, the short name of the level, and the long name of the level.

#### **Syntax**

```
olsadmintool createlevel --polname policy_name --tag tag_number
--shortname short_level_name --longname <"long_level_name">
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool createlevel --polname defense --tag 100 --shortname TS --longname "TOP SECRET" -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool createprofile

The olsadmintool createprofile command creates a new profile.

You must provide the policy name, the profile name, and either privileges, labels, or both privileges and labels. (A user profile can have either null label information or null privilege information, but not both null at the same time.) For labels, specify the maximum label users in this profile can use to read data, the maximum label users in this profile can use to write data, the minimum label users in this profile can use to write data, the default label for reading, the default row label for writing. For privileges, enclose in quotation markets list of privileges, separated by commas, for members of this profile.

```
olsadmintool createprofile --polname policy_name --profname profile_name --maxreadlabel max_read_label --maxwritelabel max_write_label --minwritelabel min_read_label --defreadlabel default_read_label --defrowlabel default_row_label --privileges privileges_separated_by_comma [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```



#### **Example**

```
olsadmintool createprofile --polname topsecret --profname topsales --maxreadlabel "TS:A,B:US,CA" --maxwritelabel "TS:A,B:US,CA" --minwritelabel "C" --defreadlabel "TS:A,B:US,CA" --defrowlabel "C:A,B:US,CA" --privileges "READ,COMPACCESS,WRITEACROSS" -b EDS -h ford -p 1890 -D cn=lbacsys -w lbacsyspwrd
```

### olsadmintool createpolicy

The olsadmintool createpolicy command creates a policy.

You must provide the name of the policy, the name of its label column, and the options.

#### **Syntax**

```
olsadmintool createpolicy --name policy_name --colname column_name --options options_separated_by_commas
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### In this specification:

new\_options can be any combination of the following entries: INVERSE\_GROUP,
HIDE, LABEL\_DEFAULT, LABEL\_UPDATE, CHECK\_CONTROL, READ\_CONTROL,
WRITE\_CONTROL, INSERT\_CONTROL, DELETE\_CONTROL, UPDATE\_CONTROL, ALL\_CONTROL,
NO CONTROL

#### **Example**

```
olsadmintool createpolicy --name defense --colname defense_col --options "READ_CONTROL,UPDATE_CONTROL" -h sales_west -p 389 -D cn=defense_admin -w bind_password
```

# olsamindtool describeprofile

The olsadmintool describeprofile command enables you to see the contents of a policy profile.

You must provide the policy name and the name of the profile.

#### **Syntax**

```
olsadmintool describeprofile --polname policy_name --profname profile_name [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool describeprofile --polname defense --profname contractors -h sales_west -D cn=defense_admin -w bind_password
```



### olsadmintool dropadmin

The olsadmintool dropadmin command removes an enterprise user from the administrative group of a policy.

This means that the user is no longer able to create, modify, or delete the specified policy's metadata. You must provide the policy name and the DN of the administrator to be removed from the administrative group.

#### **Syntax**

```
olsadmintool dropadmin --polname policy_name --admindn admin_DN [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool dropadmin --polname defense --admindn "cn=scott,c=us" -h sales_west -D cn=lbacsys -w bind_password
```

# olsadmintool dropcompartment

The olsadmintool dropcompartment command removes a compartment component.

You must provide the name of the policy and the short name of the compartment.

#### **Syntax**

```
olsadmintool dropcompartment --polname policy_name
--shortname short_compartment_name
[ -b admin context ] -h OID host [-p port] -D bind DN -w bind password
```

#### **Example**

```
olsadmintool dropcompartment --polname defense --shortname A -h sales west -D cn=defense admin -w bind password
```

### olsadmintool dropgroup

The olsadmintool dropgroup command removes a group component.

You must provide the policy name and the short group name.

#### **Syntax**

```
olsadmintool dropgroup --polname policy_name --shortname short_group_name [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool dropgroup --polname defense --shortname US -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool droplabel

The olsadmintool droplabel command drops a label from the policy.

You must provide the policy name and the string representation of the label.

#### **Syntax**

```
olsadmintool droplabel --polname policy_name --value label_value -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool droplabel --polname defense --value "TS:A:US" h sales west -D cn=defense admin -w bind password
```

### olsadmintool droplevel

The olsadmintool droplevel command removes a level component from a specified policy.

You must provide the name of the policy and the short name of the level.

#### **Syntax**

```
olsadmintool droplevel --polname policy_name --shortname short_level_name [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool droplevel --polname defense --shortname TS -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool droppolicy

The olsadmintool droppolicy command drops a policy.

You must provide the name of the policy to be dropped. For directory-enabled installations of Oracle Label Security, refer to Subscription of Policies in Directory-Enabled Label Security.

#### **Syntax**

```
olsadmintool droppolicy --name policy_name
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

olsadmintool droppolicy --name defense -h sales\_west -D cn=defense\_admin -w bind password

### olsadmintool dropprofile

The olsadmintool dropprofile command removes the specified profile.

You must provide the policy name and the name of the profile to be dropped.





Dropping a profile removes the authorization on that policy for all the users in the dropped profile. The users will be unable to see data protected by that policy.

#### **Syntax**

```
olsadmintool dropprofile --polname policy_name --profname profile_name [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool dropprofile --name defense --profname employees -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool droppolcreator

The olsadmintool droppolcreator command cancels the ability of the specified user to create policies.

You must provide the user's DN.

#### **Syntax**

```
olsadmintool droppolcreator --userdn user_DN
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool droppolcreator --userdn "cn-scott,c=us" -b UA -h sales_west -p 1890 -D bind_DN -w bind_password
```

### olsadmintool dropuser

The olsadmintool dropuser command drops a user from the specified profile in the specified policy.

You must provide the policy name, the name of the profile, and the DN of the user.

#### **Syntax**

```
olsadmintool dropuser --polname policy_name --profname profile_name --userdn enterprise_user_DN [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### **Example**

```
olsadmintool dropuser --polname defense --profname contractors --userdn "cn=hanssen,c=us" -h sales_west -D cn=defense_admin -w bind_password
```



### olsadmintool --help

The olsadmintool *command\_name* -- help command displays help information about the specified command.

#### **Syntax**

olsadmintool command\_name --help

### olsadmintool noaudit

The olsadmintool noaudit command cancels the audit options for a policy.

You must provide the policy name and the options that are no longer to be audited.

#### **Syntax**

```
olsadmintool noaudit --polname policy_name --options audit_option_name [ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### In this specification:

 audit\_option\_name can be any combination of the following entries: APPLY, REMOVE, SET, PRIVILEGE

#### **Example**

```
olsadmintool noaudit --polname defense --options "APPLY,PRIVILEGES" -h sales_west -D cn=defense_admin -w bind_password
```

### olsadmintool listprofile

The olsadmintool listprofile command to see a list of all profiles in a given policy.

You must provide the policy name.

#### **Syntax**

```
olsadmintool listprofile --polname policy_name
[ -b admin_context ] -h OID_host [-p port] -D bind_DN -w bind_password
```

#### Example

```
olsadmintool listprofile --polname defense -b CIA -h sales_west -D cn=defense_admin -w bind_password
```

### Relating Parameters to Commands for olsadmintool

You must follow a set of guidelines for using the olsadmintool parameters.

- About Relating Parameters to Commands for olsadmintool
   All olsadmintool commands must specify connection parameters.
- Summaries of olsadmintool Parameters
   The olsadmintool has parameters that to accommodate different categories of need, such as policies, administration, and auditing.



### About Relating Parameters to Commands for olsadmintool

All olsadmintool commands must specify connection parameters.

These parameters include the OID host, the bind DN, the bind password, and optionally, the port through which the connection to Oracle Internet Directory is to be made. The default port is 389.

All olsadmintool commands may specify, as needed, the subscriber/administrative-context using the -b flag.

The fact that specifying a parameter is optional, such as a port or an administrative context, is shown by enclosing the parameter within brackets. The two most common examples are [ -b admin context] and [-p port].

Because every command must specify a host, bind DN, and password, and may, if needed, also specify an administrative context, Table C-2 uses the abbreviation **CON** to represent all of these connection parameters as a group:

```
[ -b admin_context ] h OID_host [-p port] -D bind_DN -w bind_password
```

### Summaries of olsadmintool Parameters

The olsadmintool has parameters that to accommodate different categories of need, such as policies, administration, and auditing.

Table C-2 summarizes the commands in several categories.

- Policies: creating, altering, or dropping policies or their components, that is, levels, groups, and compartments
- Data labels: creating, altering, or dropping them
- Administrators and policy creators: adding or dropping them
- Users: adding or dropping users from a profile
- Auditing options: setting the options for what to audit for a policy
- Profiles: creating, listing, describing, or dropping them
- Default read or row labels: setting them

In Table C-2 and Table C-3, the column headings show only the parameters, not the keywords that must precede them. For example, Table C-2 shows policyname and column-name as parameters for the createpolicy command, without showing the keywords that must precede them (--name and --colname).

Table C-2 explains the individual parameters that are used as column headings in the summaries of Table C-2 and Table C-3.

In all these tables:

- OptionsP means policy enforcement options, that is, any combination of the following entries, separated by a comma:
  - INVERSE\_GROUP
  - HIDE
  - LABEL\_DEFAULT



- LABEL\_UPDATE
- CHECK\_CONTROL
- READ\_CONTROL
- WRITE\_CONTROL
- INSERT\_CONTROL
- DELETE\_CONTROL
- UPDATE\_CONTROL
- ALL\_CONTROL
- NO\_CONTROL
- OptionsA means audit options, that is, any comma-separated combination of the following entries: SET, APPLY, REMOVE, or PRIVILEGE.

Table C-2 Summary: olsadmintool Command Parameters

| Command<br>Category         | Commands & Parameters             | -              | -               | -             | -            | -            | -                |
|-----------------------------|-----------------------------------|----------------|-----------------|---------------|--------------|--------------|------------------|
| Policies                    | Command                           | policy<br>name | column-<br>name | optionsP      | CON          | -            | -                |
| a policy                    | olsadmintool<br>createpolicy      | Requir<br>ed   | Required        | Required      | Require<br>d | -            | -                |
| a policy                    | olsadmintool<br>alterpolicy       | Requir<br>ed   | Omitted         | Required      | Require<br>d | -            | -                |
| a policy                    | olsadmintool droppolicy           | Requir<br>ed   | Omitted         | Omitted       | Require<br>d | -            | -                |
| Within a Policy,<br>Create: | Command                           | policy<br>name | tag             | short<br>name | long<br>name | CON          | parent<br>name   |
| a level                     | olsadmintool createlevel          | Requir<br>ed   | Required        | Required      | Require<br>d | Require<br>d | Omitted          |
| a group                     | olsadmintool creategroup          | Requir<br>ed   | Required        | Required      | Require<br>d | Require<br>d | [ Requir<br>ed ] |
| a compartment               | olsadmintool<br>createcompartment | Requir<br>ed   | Required        | Required      | Require<br>d | Require<br>d | Omitted          |
| Within a Policy,<br>Alter:  | Command                           | -              | -               | -             | -            | -            | -                |
| a level                     | olsadmintool alterlevel           | Requir<br>ed   | Omitted         | Unused        | Unused       | Unused       | Omitted          |
| a group or group parent     | olsadmintool altergroup           | Requir<br>ed   | Omitted         | Required      | Require<br>d | Require<br>d | Omitted          |
| a group or group<br>parent  | olsadmintool<br>altergroupparent  | Requir<br>ed   | Omitted         | Required      | Omitted      | Require<br>d | [Requir<br>ed]   |
| a group or group parent     | Command                           | policy<br>name | tag             | short<br>name | long<br>name | CON          | parent<br>name   |
| a compartment               | olsadmintool<br>altercompartment  | Requir<br>ed   | Omitted         | Required      | Require<br>d | Require<br>d | Omitted          |



Table C-2 (Cont.) Summary: olsadmintool Command Parameters

| Command<br>Category       | Commands & Parameters           | -              | -               | -        |              | -            | -       |
|---------------------------|---------------------------------|----------------|-----------------|----------|--------------|--------------|---------|
| Within a Policy,<br>Drop: | Command                         |                | -               | -        | -            | -            | -       |
| level                     | olsadmintool droplevel          | Requir<br>ed   | Omitted         | Required | Omitted      | Require<br>d | Omitted |
| group                     | olsadmintool dropgroup          | Requir<br>ed   | Omitted         | Required | Omitted      | Require<br>d | Omitted |
| compartment               | olsadmintool<br>dropcompartment | Requir<br>ed   | Omitted         | Required | Omitted      | Require<br>d | Omitted |
| Data Labels               | Command                         | policy<br>name | tag             | value    | CON          | -            | -       |
| Create label              | olsadmintool<br>createlabel     | Requir<br>ed   | Required        | Required | Require<br>d | -            | -       |
| Alter data label          | olsadmintool alterlabel         | Requir<br>ed   | Required        | Required | Require<br>d | -            | -       |
| Drop data label           | olsadmintool droplabel          | Requir<br>ed   | Omitted         | Required | Require<br>d | -            | -       |
| Policy<br>Administrators  | Command                         | policy<br>name | userDN          | CON      | -            | -            | -       |
| Add an Admin              | olsadmintool addadmin           | Requir<br>ed   | Required        | Required | -            | -            | -       |
| Drop an Admin             | olsadmintool dropadmin          | Requir<br>ed   | Required        | Required | -            | -            | -       |
| Policy Creation           | olsadmintool<br>addpolcreator   | Omitte<br>d    | Required        | Required | -            | -            | -       |
| Policy Creation           | olsadmintool<br>droppolcreator  | Omitte<br>d    | Required        | Required | -            | -            | -       |
| Users                     | Command                         | policy<br>name | profile<br>name | userDN   | CON          | -            | -       |
| add a user                | olsadmintool adduser            | Requir<br>ed   | Required        | Required | Require<br>d | -            | -       |
| drop a user               | olsadmintool dropuser           | Requir<br>ed   | Required        | Required | Require<br>d | -            | -       |
| Auditing                  | olsadmintool audit              | Requir<br>ed   | optionsA        | type     | success      | CON          | -       |
| auditing                  | olsadmintool noaudit            | Requir<br>ed   | Required        | Required | Require<br>d | Require<br>d | -       |
| Help on<br>olsadmintool   | olsadmintool  command_name help | Omitte<br>d    | Omitted         | Omitted  | Omitted      | Omitted      | -       |



| Profile Action                | Profile<br>Command                  | Policy<br>Name | Profil<br>e<br>Name | Max<br>Read<br>Labe<br>I | Max<br>Write<br>Labe<br>I | Min<br>Write<br>Labe<br>I | Def<br>Read<br>Labe<br>I | Def<br>Row<br>Labe<br>I | Priv'<br>s   | CON          |
|-------------------------------|-------------------------------------|----------------|---------------------|--------------------------|---------------------------|---------------------------|--------------------------|-------------------------|--------------|--------------|
| Create a Profile <sup>1</sup> | olsadmintool<br>createprofile       | Required       | Requir<br>ed        | Requi<br>red             | Requi<br>red              | Requi<br>red              | Requi<br>red             | Requi<br>red            | Requi<br>red | Requi<br>red |
| List Profiles                 | olsadmintool<br>list profile        | Required       | Omitte<br>d         | Omitt<br>ed              | Omitt<br>ed               | Omitt<br>ed               | Omitt<br>ed              | Omitt<br>ed             | Omitt<br>ed  | Requi<br>red |
| Describe a Profile            | olsadmintool<br>describe<br>profile | Required       | Requir<br>ed        | Omitt<br>ed              | Omitt<br>ed               | Omitt<br>ed               | Omitt<br>ed              | Omitt<br>ed             | Omitt<br>ed  | Requi<br>red |
| Drop a Profile                | olsadmintool<br>drop profile        | Required       | Requir<br>ed        | Omitt<br>ed              | Omitt<br>ed               | Omitt<br>ed               | Omitt<br>ed              | Omitt<br>ed             | Omitt<br>ed  | Requi<br>red |

<sup>&</sup>lt;sup>1</sup> In createprofile, specifying both privileges and labels is not required: a profile can specify labels, privileges, or both.

### Examples of Using the olsadmintool Utility

You use the <code>olsadmintool</code> commands to set up Oracle Label Security in an Oracle Internet Directory environment.

Each command appears in this listing on multiple lines for readability, but in reality, would be given out as a single long string on the command line. The summarized results of carrying out all these commands appear in Results of These Examples, which follows the last example.

#### Example: Making Other Users Policy Creators

The olsadmintool addpolcreator command can enable other users to be policy creators.

#### Example: Creating Policies with Valid Options

The olsadmintool createpolicy command can create policies.

#### Example: Creating Policy Administrators

The olsadmintool addadmin command can create policy administrators.

#### Example: Creating Levels

The olsadmintool createlevel command can create individual levels.

#### Example: Creating Compartments

The olsadmintool createcompartment command can create a compartment.

#### Example: Creating Groups

The olsadmintool creategroup can create a group.

#### Example: Creating Labels

The olsadmintool createlabel can create a label.

#### • Example: Creating a Profile

The olsadmintool createprofile command can create a profile.

#### Example: Adding a User to a Profile

The olsadmintool adduser command can add a user to a profile.



Example: Adding Another User to a Profile

You can use the <code>olsadmintool</code> adduser command to add another user to a profile.

Example: Setting Audit Options

The olsadmintool audit command can set audit options in a non-unified auditing environment.

Results of These Examples

As a result of running the sets of olsadmintool commands, the sample Oracle Label Security site has a specific structure.

### Example: Making Other Users Policy Creators

The olsadmintool addpolcreator command can enable other users to be policy creators.

```
ORACLE_HOME/bin/olsadmintool addpolcreator --userdn "cn=psmith,c=us" -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=lbacsys,c=us" -w bind_password
```

### **Example: Creating Policies with Valid Options**

The olsadmintool createpolicy command can create policies.

```
ORACLE_HOME/bin/olsadmintool createpolicy --name Policy1 --colname pol1 --options READ_CONTROL,WRITE_CONTROL -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=psmith,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool createpolicy --name Policy2 --colname pol2 --options READ_CONTROL -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=lbacsys,c=us" -w bind_password
```

### **Example: Creating Policy Administrators**

The olsadmintool addadmin command can create policy administrators.

```
ORACLE_HOME/bin/olsadmintool addadmin --polname Policy1
--admindn "cn=shwong,c=us" -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389
-D "cn=psmith,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool addadmin --polname Policy2
--admindn "cn=shwong,c=us" -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389
-D "cn=lbacsys,c=us" -w bind_password
```

### **Example: Creating Levels**

The olsadmintool createlevel command can create individual levels.

```
ORACLE_HOME/bin/olsadmintool createlevel --polname Policy1 --tag 100
--shortname TS --longname "TOP SECRET" -b "ou=Americas,o=Oracle, c=US"
-h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool createlevel --polname Policy1 --tag 99
--shortname S --longname SECRET -b "ou=Americas,o=Oracle,c=US"
-h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool createlevel --polname Policy1 --tag 98
```

```
--shortname U --longname UNCLASSIFIED -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```

### **Example: Creating Compartments**

The olsadmintool createcompartment command can create a compartment.

```
ORACLE_HOME/bin/olsadmintool createcompartment --polname Policy1 --tag 100
--shortname A --longname ALPHA -b "ou=Americas,o=Oracle,c=US"
-h sales_west -p 389 D "cn=shwong,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool createcompartment --polname Policy1 --tag 99
--shortname B --longname BETA -b "ou=Americas,o=Oracle,c=US"
-h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```

### **Example: Creating Groups**

The olsadmintool creategroup can create a group.

```
ORACLE_HOME/bin/olsadmintool creategroup --polname Policy1 --tag 100
--shortname G1 --longname GROUP1
-b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool creategroup --polname Policy1 --tag 99
--shortname G2 --longname GROUP2
-b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool creategroup --polname Policy1 --tag 98
--shortname G3 --longname GROUP3
-b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```

### **Example: Creating Labels**

The olsadmintool createlabel can create a label.

```
ORACLE_HOME/bin/olsadmintool createlabel --polname Policy1
--tag 100 --value TS:A:G1
-b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password

ORACLE_HOME/bin/olsadmintool createlabel --polname Policy1 --tag 101
--value TS:A,B:G2
-b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```

### Example: Creating a Profile

The olsadmintool createprofile command can create a profile.

```
ORACLE_HOME/bin/olsadmintool createprofile --polname Policyl --profname Profilel --maxreadlabel TS:A:Gl --maxwritelabel TS:A:Gl --minwritelabel U:: --defreadlabel U:A:Gl --defrowlabel U:A:Gl --privileges WRITEUP,READ -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```



### Example: Adding a User to a Profile

The olsadmintool adduser command can add a user to a profile.

```
ORACLE_HOME/bin/olsadmintool adduser --polname Policy1 --profname Profile1 --userdn cn=nina,ou=Asia,o=microsoft,l=seattle,st=WA,c=US -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```

### Example: Adding Another User to a Profile

You can use the olsadmintool adduser command to add another user to a profile.

```
ORACLE_HOME/bin/olsadmintool adduser --polname Policy1 --profiname Profile1 --userdn cn=daniel,ou=France,o=oracle,l=madison,st=WI,c=US -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```

### **Example: Setting Audit Options**

The olsadmintool audit command can set audit options in a non-unified auditing environment.

```
ORACLE_HOME/bin/olsadmintool audit --polname Policy1 --option "SET,APPLY" --type SESSION --success BOTH -b "ou=Americas,o=Oracle,c=US" -h sales_west -p 389 -D "cn=shwong,c=us" -w bind_password
```

### Results of These Examples

As a result of running the sets of olsadmintool commands, the sample Oracle Label Security site has a specific structure.

Policy creators: User psmithPolicies: Policy1 and Policy2

Policy Administrators: User shwong

Levels, Compartments, and Groups: Refer to Table C-4.

Table C-4 Label Component Definitions from Using olsadmintool Commands

| Label<br>Component | Tag | Short Name | Long Name    |
|--------------------|-----|------------|--------------|
| Level              | 100 | TS         | TOP SECRET   |
| Level              | 99  | S          | SECRET       |
| Level              | 98  | U          | UNCLASSIFIED |
| Compartment        | 100 | Α          | ALPHA        |
| Compartment        | 99  | В          | BETA         |
| Group              | 100 | G1         | GROUP1       |
| Group              | 99  | G2         | GROUP2       |
| Group              | 98  | G3         | GROUP3       |



- Data labels: Tag 100 for TS:A:G1 and tag 101 for TS:A,B:G2
- Users: Nina, from the Asia group of Microsoft, based in Seattle, Washington, managed under the Americas organization of the US Oracle organization, and Daniel, from the France group of Oracle in Madison, Wisconsin, managed under the same organization.
- Profiles: Refer to Table C-5.

Table C-5 Contents of Profile1 from Using olsadmintool Commands

| Profile Element | Contents       | Long-name Expansion or Meaning                                     |
|-----------------|----------------|--|
| MaxReadLabel    | TS:A:G1        | TOP SECRET:ALPHA:GROUP1  |
| MaxWriteLabel   | TS:A:G1        | TOP SECRET:ALPHA:GROUP1  |
| MinWriteLabel   | U::            | UNCLASSIFIED (not restricted to any compartments or groups)        |
| DefReadLabel    | U:A:G1         | UNCLASSIFIED:ALPHA:GROUP1  |
| DefRowLabel     | U:A:G1         | UNCLASSIFIED:ALPHA:GROUP1  |
| Privileges      | WRITE_UP, READ | User can read any row and raise the level of rows the user writes. |

Auditing options: SET, APPLY, SESSION, and BOTH



D

### Oracle Label Security in an Oracle RAC Environment

You can use Oracle Label Security in an Oracle Real Application Clusters (Oracle RAC) environment.

- Oracle Label Security Policy Functions in an Oracle RAC Environment
   Policy changes made on one instance are available to other instances in the
   Oracle Real Application Clusters (Oracle RAC) environment immediately.
- Transparent Application Failover in Oracle Label Security
   Session information is preserved on Transparent Application Failover.

## Oracle Label Security Policy Functions in an Oracle RAC Environment

Policy changes made on one instance are available to other instances in the Oracle Real Application Clusters (Oracle RAC) environment immediately.

It is not necessary to restart the other instances to pick up the changes.

Important changes made on one database instance are automatically propagated to the other instances. One example would be creating a new policy. Another would be altering the policy options.

Propagating such changes ensures two valuable protections:

- That all users of the table are subject to the same policy
- That if any instance fails, continuation of its work by other instances will use the same policies and parameters that were in force immediately prior to that failure.
   So, if a policy had been enabled or disabled, it would be seen as such in all instances.

If an administrator changes policy information in one instance by using the policy functions listed in Table D-1, Oracle Label Security stores the relevant information about whatever that function call changed. The new information is immediately available to the other active instances in the Oracle RAC, enabling uniformity among users of the affected policies.

Table D-1 Policy Functions Preserving Status in an Oracle RAC Environment

| Policy Functions        | Description                |
|-------------------------|----------------------------|
| SA_SYSDBA.CREATE_POLICY | Creates a new policy       |
| SA_SYSDBA.DROP_POLICY   | Drops an existing policy   |
| SA_SYSDBA.ENABLE_POLICY | Enables an existing policy |



Table D-1 (Cont.) Policy Functions Preserving Status in an Oracle RAC Environment

| Policy Functions         | Description                 |
|--------------------------|-----------------------------|
| SA_SYSDBA.DISABLE_POLICY | Disables an existing policy |
| SA_SYSDBA.ALTER_POLICY   | Alters an existing policy   |

### Transparent Application Failover in Oracle Label Security

Session information is preserved on Transparent Application Failover.

Any changes to the session's information by way of session functions listed in Table D-2 are preserved on Transparent Application Failover.

For example, suppose a user Scott is logged on with default label Top Secret. If he calls sa\_session.set\_label() to change his session label to Secret, and a failover to another instance occurs, he will see no change but his session label remains Secret.

Preserving current user session information means that the access permissions and restrictions on what data that user can see or affect remain as they were. Despite the failover, the user can see and affect only the tables and rows accessible before the failover. If preservation were not the case, failing over to another instance could cause or enable the user to see a different set of data.

Whenever one of the session functions listed in Table D-2 is used, Oracle Label Security stores the relevant information about whatever was changed by that function call.

Table D-2 Session Functions Preserving Status in an Oracle RAC Environment

| Session Functions                 | Description   |
|-----------------------------------|---|
| SA_SESSION.SET_LABEL              | Lets the user set a new level and new compartments and groups to which he or she has read access                    |
| SA_SESSION.SET_ROW_LABEL          | Lets the user set the default row label that will be applied to new rows  |
| SA_SESSION.SAVE_DEFAULT_LABELS    | Lets the user store the current session label and row label as the default for future sessions                      |
| SA_SESSION.RESTORE_DEFAULT_LABELS | Lets the user reset the current session label and row label to the stored default settings                          |
| SA_SESSION.SET_ACCESS_PROFILE     | Sets the Oracle Label Security authorizations and privileges of the database session to those of the specified user |



Е

## Oracle Label Security PL/SQL Packages

Oracle Label Security provides a set of PL/SQL packages.

- SA\_AUDIT\_ADMIN Oracle Label Security Auditing PL/SQL Package
   For a non-unified auditing environment, the SA\_AUDIT\_ADMIN PL/SQL package
   configures auditing that is specific to Oracle Label Security.
- SA\_COMPONENTS Label Components PL/SQL Package
   The SA\_COMPONENTS PL/SQL package manages the component definitions of an Oracle Label Security label.
- SA\_LABEL\_ADMIN Label Management PL/SQL Package
   The SA\_LABEL\_ADMIN PL/SQL package provides an administrative interface to manage the labels used by a policy.
- SA\_POLICY\_ADMIN Policy Administration PL/SQL Package
   The SA\_POLICY\_ADMIN PL/SQL package manages Oracle Label Security policies as a whole.
- SA\_SESSION Session Management PL/SQL Package
   The SA\_SESSION PL/SQL package manages session behavior for user
   authorizations.
- SA\_SYSDBA Policy Management PL/SQL Package
   The SA\_SYSDBA PL/SQL package manages Oracle Label Security policies.
- SA\_USER\_ADMIN PL/SQL Package
   The SA\_USER\_ADMIN PL/SQL package manages user labels by label component.
- SA\_UTL PL/SQL Utility Functions and Procedures
   The SA\_UTL PL/SQL package contains utility functions and procedures that are used in PL/SQL programs.



Using Dominance Functions for additional standalone Oracle Label Security functions

# SA\_AUDIT\_ADMIN Oracle Label Security Auditing PL/SQL Package

For a non-unified auditing environment, the SA\_AUDIT\_ADMIN PL/SQL package configures auditing that is specific to Oracle Label Security.

About the SA\_AUDIT\_ADMIN PL/SQL Package
 The SA\_AUDIT\_ADMIN PL/SQL package configures auditing for labels and policies, as well as creating an auditing-related view.

#### SA AUDIT ADMIN.AUDIT

The SA AUDIT ADMIN. AUDIT procedure enables policy-specific auditing.

#### SA AUDIT ADMIN.AUDIT LABEL

The SA\_AUDIT\_ADMIN.AUDIT\_LABEL procedure records policy labels during auditing.

#### SA AUDIT ADMIN.AUDIT LABEL ENABLED

The SA\_AUDIT\_ADMIN.AUDIT\_LABEL\_ENABLED function shows whether labels are being recorded in audit records for the policy.

#### SA AUDIT ADMIN.CREATE VIEW

The SA\_AUDIT\_ADMIN.CREATE\_VIEW procedure creates an audit trail view named DBA policyname AUDIT TRAIL.

#### SA AUDIT ADMIN.DROP VIEW

The SA\_AUDIT\_ADMIN.DROP\_VIEW procedure drops the audit trail view for the specified policy.

#### SA AUDIT ADMIN.NOAUDIT

The SA\_AUDIT\_ADMIN.NOAUDIT procedure disables Oracle Label Security policy-specific auditing.

#### SA AUDIT ADMIN.NOAUDIT LABEL

The SA\_AUDIT\_ADMIN.NOAUDIT\_LABEL procedure disables the auditing of policy labels.

### About the SA AUDIT ADMIN PL/SQL Package

The SA\_AUDIT\_ADMIN PL/SQL package configures auditing for labels and policies, as well as creating an auditing-related view.

If you are using unified auditing, then see *Oracle Database Security Guide* for information about creating unified audit policies for Oracle Label Security. In a unified auditing environment, no new audit records will be generated as a result of setting the procedures that are described in this section.

After you have enabled systemwide auditing, you can use SA\_AUDIT\_ADMIN PL/SQL package procedures to enable or disable Oracle Label Security auditing. To use this package, you must be granted the  $policy_DBA$  role (for example, HR\_OLS\_POL\_DBA for a role for the hr\_ols\_pol policy) and the EXECUTE privilege for the SA\_AUDIT\_ADMIN package.

#### See Also:

Duties of Oracle Label Security Administrators for information about the policy\_DBA role

### SA\_AUDIT\_ADMIN.AUDIT

The SA\_AUDIT\_ADMIN.AUDIT procedure enables policy-specific auditing.

Auditing of each policy is independent of the others. The audit records capture Oracle Label Security administrative actions and the use of Oracle Label Security privileges



that were used during logons, DML executions, and trusted stored procedure invocations.

#### **Syntax**

#### **Parameters**

Table E-1 SA\_AUDIT\_ADMIN.AUDIT Parameters

| Parameter    | Description  |
|--------------|--|
| policy_name  | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| users        | <ul> <li>Optional. A comma-delimited list of user names to audit, as follows:</li> <li>If you are auditing OLS administrative actions, then ensure that the users you enter have the policy_DBA role and the EXECUTE privilege for the Oracle Label Security packages.</li> <li>If you are auditing the use of OLS privileges, then these users do not need to be OLS administrators.</li> <li>If you do not specify any users, then all users are audited.</li> <li>To find users who have privileges to modify Oracle Label Security policies, query the USER_NAME column of the DBA_SA_USERS view.</li> </ul>   |
| audit_option | <ul> <li>Optional. A comma-delimited list of options to be audited. Options are as follows:</li> <li>APPLY: Audits application of specified Oracle Label Security policies to tables and schemas</li> <li>REMOVE: Audits removal of specified Oracle Label Security policies from tables and schemas</li> <li>SET: Audits the setting of user authorizations, and user and program privileges</li> <li>PRIVILEGES: Audits use of all policy-specific privileges</li> <li>If not specified, then all default options (that is, options not including privileges) are audited. Audit options for privileged operations should be set explicitly by specifying the PRIVILEGES option, which sets audit options for all privileges.</li> </ul> |
| audit_type   | Optional. BY ACCESS or BY SESSION. If not specified, then audit records are written BY SESSION.  |
| success      | Optional. SUCCESSFUL if the action was successful, or NOT SUCCESSFUL. If not specified, then audit is written for both.  |

#### **Examples**

The following example audits any failed  ${\tt APPLY}$  and  ${\tt REMOVE}$  attempts by the users  ${\tt psmith}$  and  ${\tt rlayton}.$ 

```
BEGIN
SA_AUDIT_ADMIN.AUDIT(
  policy_name => 'hr_ols_pol',
```



```
users => 'jjones, rlayton',
audit_option => 'apply, remove',
audit_type => 'by access',
success => 'not successful');
END;
//
```

If the you do not specify any audit options, then all options except the privilege-related ones are audited. You must specify the auditing of privileges explicitly. For example, if you enter the following statement, then the default options are set for the hr\_ols\_pol policy:

```
EXEC SA_AUDIT_ADMIN.AUDIT ('hr_ols_pol');
```

When you enable auditing, it will be performed on all users by session, whether their actions are successful or not.

When you set auditing parameters and options, the new values apply only to subsequent sessions, not to the current session.

Consider also a case in which one SA\_AUDIT\_ADMIN.AUDIT call (with no users specified) enables auditing for APPLY operations for all users, and then a second call enables auditing of REMOVE operations for a specific user. For example:

```
EXEC SA_AUDIT_ADMIN.AUDIT ('hr_ols_pol', null, 'apply');
EXEC SA_AUDIT_ADMIN.AUDIT ('hr_ols_pol', 'scott', 'remove');
```

In this case, SCOTT is audited for both APPLY and REMOVE operations.

### SA\_AUDIT\_ADMIN.AUDIT\_LABEL

The SA\_AUDIT\_ADMIN.AUDIT\_LABEL procedure records policy labels during auditing.

This procedure stores the user's session label in the audit table.

#### **Syntax**

```
SA_AUDIT_ADMIN.AUDIT_LABEL (
    policy_name IN VARCHAR2);
```

#### **Parameter**

Table E-2 SA\_AUDIT\_ADMIN.AUDIT\_LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

#### **Example**

The following example writes output indicating whether the Oracle Label Security labels are being audited for the hr\_ols\_pol policy.

```
BEGIN
SA_AUDIT_ADMIN.AUDIT_LABEL(
  policy_name => 'hr_ols_pol');
```



```
END;
```

### SA\_AUDIT\_ADMIN.AUDIT\_LABEL\_ENABLED

The SA\_AUDIT\_ADMIN.AUDIT\_LABEL\_ENABLED function shows whether labels are being recorded in audit records for the policy.

#### **Syntax**

```
SA_AUDIT_ADMIN.AUDIT_LABEL_ENABLED (
  policy_name IN VARCHAR2)
RETURN BOOLEAN;
```

#### **Parameters**

Table E-3 SA\_AUDIT\_ADMIN.AUDIT\_LABEL\_ENABLED Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

#### **Example**

The following example writes output indicating whether the Oracle Label Security labels are being audited for the hr\_ols\_pol policy.

```
SET SERVEROUTPUT ON

BEGIN

IF SA_AUDIT_ADMIN.AUDIT_LABEL_ENABLED('hr_ols_pol')

THEN DBMS_OUTPUT.PUT_LINE('OLS hr_ols_pol labels are being audited.');

ELSE

DBMS_OUTPUT.PUT_LINE('OLS hr_ols_pol labels not being audited.');

END IF;

END;
```

### SA\_AUDIT\_ADMIN.CREATE\_VIEW

The SA\_AUDIT\_ADMIN.CREATE\_VIEW procedure creates an audit trail view named DBA\_policyname\_AUDIT\_TRAIL.

This view contains the specified policy's label column as well as all the entries in the audit trail written on behalf of this policy. If the view name exceeds the database limit of 30 characters, then the user can optionally specify a shorter view name.



Oracle Label Security User-Created Auditing View to find the columns that are contained in the DBA\_policyname\_AUDIT\_TRAIL view



#### **Syntax**

#### **Parameters**

#### Table E-4 SA\_AUDIT\_ADMIN.CREATE\_VIEW Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.     |
| view_name   | Optional. Specifies the name of the view name. If you omit this setting, then the name defaults to DBA_policyname_AUDIT_TRAIL. |

#### **Examples**

The following example creates a view called  $hr_ols_pol_view$  for the  $hr_ols_pol_view$  for  $hr_ols_pol_view$  for the  $hr_ols_pol_view$  for  $hr_ols_pol_view$  for

### SA\_AUDIT\_ADMIN.DROP\_VIEW

The SA\_AUDIT\_ADMIN.DROP\_VIEW procedure drops the audit trail view for the specified policy.

#### **Syntax**

#### **Parameters**

#### Table E-5 SA\_AUDIT\_ADMIN.DROP\_VIEW Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary |
|             | view.  |



Table E-5 (Cont.) SA\_AUDIT\_ADMIN.DROP\_VIEW Parameters

| Parameter | Description   |
|-----------|---|
| view_name | Specifies an existing view's name. You can find this view by first querying the ALL_SA_POLICIES data dictionary view to find the name of the policy on which the view was based, and then querying ALL_VIEWS data dictionary view to find any views that have the name of the policy. |

#### **Example**

The following example drops the view called  $hr_ols_pol_view$  from the  $hr_ols_pol_view$  from the hr

### SA\_AUDIT\_ADMIN.NOAUDIT

The  ${\tt SA\_AUDIT\_ADMIN.NOAUDIT}$  procedure disables Oracle Label Security policy-specific auditing.

#### **Syntax**

#### **Parameters**

Table E-6 SA\_AUDIT\_ADMIN.NO\_AUDIT Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.               |
| users       | Optional. A comma-delimited list of users who were audited. If not specified, then auditing is disabled for all users.                   |
|             | To find users who have privileges to modify Oracle Label Security policies, query the USER_NAME column of the ALL_SA_AUDIT_OPTIONS view. |



Table E-6 (Cont.) SA\_AUDIT\_ADMIN.NO\_AUDIT Parameters

| Parameter    | Description   |
|--------------|---|
| audit_option | Optional. A comma-delimited list of options to be disabled. Options are as follows:   |
|              | <ul> <li>APPLY: Audits application of specified Oracle Label Security policies to tables and schemas</li> <li>REMOVE: Audits removal of specified Oracle Label Security policies from tables and schemas</li> <li>SET: Audits the setting of user authorizations, and user and</li> </ul> |
|              | program privileges • PRIVILEGES: Audits use of all policy-specific privileges If not specified, then all default options are disabled. Privileges must be disabled explicitly.  |

#### **Examples**

The following example disables auditing for failed APPLY and REMOVE attempts by the users psmith and rlayton.

You can disable auditing for all enabled options, or only for a subset of enabled options. All auditing for the specified options is disabled for all specified users (or all users, if the *users* parameter is NULL). For example, the following statement disables auditing of the APPLY and REMOVE operations for users John, Mary, and Scott:

```
EXEC SA_AUDIT_ADMIN.NOAUDIT ('HR', 'JOHN, MARY, SCOTT', 'APPLY, REMOVE');
```

Consider also a case in which one AUDIT call enables auditing for a specific user, and a second call (with no user specified) enables auditing for all users. For example:

```
EXEC SA_AUDIT_ADMIN.AUDIT ('HR', 'SCOTT');
EXEC SA_AUDIT_ADMIN.AUDIT ('HR');
```

In this case, a subsequent call to <code>NOAUDIT</code> with no users specified (such as the following statement) does not reverse the auditing that was set for <code>SCOTT</code> explicitly in the first call. So, auditing continues to be performed on <code>SCOTT</code>.

```
EXEC SA_AUDIT_ADMIN.NOAUDIT ('HR');
```

In this way, even if SA\_AUDIT\_ADMIN.NOAUDIT is set for all users, Oracle Label Security still audits any users for whom auditing was explicitly set.

Auditing of privileged operations must be specified explicitly. If you run  ${\tt SA\_AUDIT\_ADMIN.NOAUDIT}$  with no options, the Oracle Label Security will nonetheless continue to audit privileged operations. For example, if auditing is enabled and you enter

```
EXEC SA_AUDIT_ADMIN.NOAUDIT ('HR');
```



then auditing will continue to be performed on the privileged operations (such as WRITEDOWN).

SA\_AUDIT\_ADMIN.NOAUDIT parameters and options that you set apply only to subsequent sessions, not to current sessions.

If you try to enable an audit option that has already been set, or if you try to disable an audit option that has not been set, then Oracle Label Security processes the statement without indicating an error. An attempt to specify an invalid option results in an error message. You can find the status of audit options by querying the ALL\_SA\_AUDIT\_OPTIONS data dictionary view.

### SA\_AUDIT\_ADMIN.NOAUDIT\_LABEL

The SA\_AUDIT\_ADMIN.NOAUDIT\_LABEL procedure disables the auditing of policy labels.

#### **Syntax**

#### **Parameters**

Table E-7 SA AUDIT ADMIN.NO AUDIT LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

#### Example

The following example disables auditing for the hr\_ols\_pol policy.

```
BEGIN
SA_AUDIT_ADMIN.NOAUDIT_LABEL(
  policy_name => 'hr_ols_pol');
END;
//
```

### SA\_COMPONENTS Label Components PL/SQL Package

The SA\_COMPONENTS PL/SQL package manages the component definitions of an Oracle Label Security label.

- About the SA\_COMPONENTS PL/SQL Package

  The GR GOMPONENTS PL/SQL package configures as
  - The  $SA\_COMPONENTS$  PL/SQL package configures compartments, groups, parent groups, and levels.
- SA COMPONENTS.ALTER COMPARTMENT
  - The SA\_COMPONENTS.ALTER\_COMPARTMENT procedure changes the short name and long name associated with a compartment.
- SA COMPONENTS.ALTER GROUP
  - The SA\_COMPONENTS.ALTER\_GROUP procedure changes the short name and long name associated with a group.



#### SA\_COMPONENTS.ALTER\_GROUP\_PARENT

The SA\_COMPONENTS.ALTER\_GROUP\_PARENT procedure changes the parent group associated with a particular group.

#### SA\_COMPONENTS.ALTER\_LEVEL

The SA\_COMPONENTS.ALTER\_LEVEL procedure changes the short name and long name associated with a level.

#### SA\_COMPONENTS.CREATE\_COMPARTMENT

The SA\_COMPONENTS.CREATE\_COMPARTMENT procedure creates a compartment and specify its short name and long name.

#### SA COMPONENTS.CREATE GROUP

The SA\_COMPONENTS.CREATE\_GROUP procedure creates a group and specify its short name and long name, and optionally a parent group.

#### SA\_COMPONENTS.CREATE\_LEVEL

The SA\_COMPONENTS.CREATE\_LEVEL procedure creates a level and specify its short name and long name.

#### SA COMPONENTS.DROP COMPARTMENT

The SA\_COMPONENTS.DROP\_COMPARTMENT procedure removes a compartment.

#### SA\_COMPONENTS.DROP\_GROUP

The SA COMPONENTS. DROP GROUP procedure removes a group.

#### SA COMPONENTS.DROP LEVEL

The SA\_COMPONENTS.DROP\_LEVEL procedure removes a level.

### About the SA\_COMPONENTS PL/SQL Package

The SA\_COMPONENTS PL/SQL package configures compartments, groups, parent groups, and levels.

To use this package, you must be granted the  $policy_DBA$  role (for example,  $HR_OLS_POL_DBA$  for a role for the  $hr_ols_pol$  policy) and the EXECUTE privilege on the  $SA_COMPONENTS$  package.

#### **Related Topics**

Understanding Data Labels and User Labels
 You should understand fundamental concepts of data labels and user labels.

### SA\_COMPONENTS.ALTER\_COMPARTMENT

The  ${\tt SA\_COMPONENTS.ALTER\_COMPARTMENT}$  procedure changes the short name and long name associated with a compartment.

Once set, the <code>comp\_num</code> parameter cannot be changed. If the <code>comp\_num</code> parameter is used in any existing label, then its short name *cannot* be changed but its long name <code>can</code> be changed.



Table E-8 SA\_COMPONENTS.ALTER\_COMPARTMENT Parameters

| Parameter      | Description  |
|----------------|--|
| policy_name    | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| comp_num       | Specifies the number of the compartment to be altered. To find a list of existing compartment numbers, query the COMP_NUM column of the ALL_SA_COMPARTMENTS view.              |
| short_name     | Specifies the short name of the compartment to be altered (up to 30 characters). To find the current compartment, query the SHORT_NAME column of the ALL_SA_COMPARTMENTS view. |
| new_short_name | Specifies the new short name of the compartment (up to 30 characters)  |
| new_long_name  | Specifies the new long name of the compartment (up to 80 characters).  |

#### **Example**

The following example modifies the hr\_ols\_pol policy.

### SA\_COMPONENTS.ALTER\_GROUP

The  $\mathtt{SA\_COMPONENTS}.\mathtt{ALTER\_GROUP}$  procedure changes the short name and long name associated with a group.

Once set, the <code>group\_num</code> parameter cannot be changed. If the group is used in any existing label, then its short name *cannot* be changed, but its long name *can* be changed.



```
short_name IN VARCHAR2,
new_long_name IN VARCHAR2);
```

Table E-9 SA\_COMPONENTS.ALTER\_GROUP Parameters

| Parameter      | Description   |
|----------------|---|
| policy_name    | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                  |
| group_num      | Specifies the existing group number to be altered. To find existing group numbers, query the GROUP_NUM column of the ALL_SA_GROUPS view.    |
| short_name     | Specifies the existing group short name to be altered. To find existing short names, query the SHORT_NAME column of the ALL_SA_GROUPS view. |
| new_short_name | Specifies the new short name for the group (up to 30 characters)  |
| new_long_name  | Specifies the new long name for the group (up to 80 characters)   |

#### **Example**

The following example modifies the long\_name setting for the hr\_ols\_pol policy.

### SA\_COMPONENTS.ALTER\_GROUP\_PARENT

The SA\_COMPONENTS.ALTER\_GROUP\_PARENT procedure changes the parent group associated with a particular group.



Table E-10 SA\_COMPONENTS.ALTER\_GROUP\_PARENT Parameters

| Parameter       | Description   |
|-----------------|---|
| policy_name     | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                            |
| group_num       | Specifies the existing group number to be altered. To find existing group numbers, query the GROUP_NUM column of the ALL_SA_GROUPS view.              |
| short_name      | Specifies the existing group short name to be altered. To find existing short names, query the SHORT_NAME column of the ALL_SA_GROUPS view.           |
| new_parent_num  | Specifies the number of an existing group as the parent group. To find existing parent groups, query the PARENT_NUM column of the ALL_SA_GROUPS view. |
| new_parent_name | Specifies the short name of an existing group as the parent group. To find existing groups, query the SHORT_NAME column of the ALL_SA_GROUPS view.    |

#### **Example**

The following example modifies the parent name for the hr\_ols\_pol policy.

### SA\_COMPONENTS.ALTER\_LEVEL

The SA\_COMPONENTS.ALTER\_LEVEL procedure changes the short name and long name associated with a level.

Once they are defined, level numbers cannot be changed. If a level is used in any existing label, then its short name *cannot* be changed, but its long name *can* be changed.



Table E-11 SA\_COMPONENTS.ALTER\_LEVEL Parameters

| Parameter      | Description  |
|----------------|--|
| policy_name    | Specifies the policy, which much exist. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| level_num      | Specifies the number of the level to be altered. To find existing levels, query the LEVEL_NUM column of the ALL_SA_LEVELS view.              |
| short_name     | Specifies the existing short name of the level. To find existing level short names, query the SHORT_NAME column of the ALL_SA_LEVELS view.   |
| new_short_name | Specifies the new short name for the level (up to 30 characters)   |
| new_long_name  | Specifies the new long name for the level (up to 80 characters)  |

#### **Example**

The following example modifies the short and long names for the hr\_ols\_pol policy level

```
BEGIN
SA_COMPONENTS.ALTER_LEVEL (
  policy_name => 'hr_ols_pol',
  level_num => 40,
  new_short_name => 'TS',
  new_long_name => 'TOP_SECRET');
END;
/
```

### SA\_COMPONENTS.CREATE\_COMPARTMENT

The SA\_COMPONENTS.CREATE\_COMPARTMENT procedure creates a compartment and specify its short name and long name.

The <code>comp\_num</code> parameter determines the order in which compartments are listed in the character string representation of labels.

```
SA_COMPONENTS.CREATE_COMPARTMENT (
   policy_name IN VARCHAR2,
   comp_num IN NUMBER(38),
   short_name IN VARCHAR2,
   long_name IN VARCHAR2);
```



Table E-12 SA\_COMPONENTS.CREATE\_COMPARTMENT Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| comp_num    | Specifies the compartment number (0-9999)  |
| short_name  | Specifies the short name for the compartment (up to 30 characters)   |
| long_name   | Specifies the long name for the compartment (up to 80 characters)  |

#### **Example**

The following example creates a compartment for the hr\_ols\_pol policy.

```
BEGIN

SA_COMPONENTS.CREATE_COMPARTMENT (

policy_name => 'hr_ols_pol',

comp_num => '48',

short_name => 'FIN',

long_name => 'FINANCE');

END;
```

### SA\_COMPONENTS.CREATE\_GROUP

The SA\_COMPONENTS.CREATE\_GROUP procedure creates a group and specify its short name and long name, and optionally a parent group.

#### **Syntax**

```
SA_COMPONENTS.CREATE_GROUP (
   policy_name IN VARCHAR2,
   group_num IN NUMBER(38),
   short_name IN VARCHAR2,
   long_name IN VARCHAR2,
   parent_name IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

Table E-13 SA\_COMPONENTS.CREATE\_GROUP Parameters

| Description  |
|--|
| Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| Specifies the group number (0-9999)  |
| Specifies the short name for the group (up to 30 characters)   |
|  |



Table E-13 (Cont.) SA\_COMPONENTS.CREATE\_GROUP Parameters

| Parameter   | Description  |
|-------------|--|
| long_name   | Specifies the long name for the group (up to 80 characters)  |
| parent_name | Specifies the short name of an existing group as the parent group. If NULL, then the group is a top-level group. |

Note that the group number affects the order in which groups will be displayed when labels are selected.

#### **Examples**

In the following examples, the first creates a parent group,  $\mathbb{E}\mathbb{R}$ , and the second creates a second group that is part of the parent group.

### SA\_COMPONENTS.CREATE\_LEVEL

The SA\_COMPONENTS.CREATE\_LEVEL procedure creates a level and specify its short name and long name.

The numeric values assigned to the level\_num parameter determine the sensitivity ranking (that is, a lower number indicates less sensitive data).



Table E-14 SA\_COMPONENTS.CREATE\_LEVEL Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy, which must exist. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| level_num   | Specifies the level number (0-9999)  |
| short_name  | Specifies the short name for the level (up to 30 characters)   |
| long_name   | Specifies the long name for the level (up to 80 characters)  |

#### **Example**

The following example creates a level for the hr\_ols\_pol policy.

```
BEGIN
SA_COMPONENTS.CREATE_LEVEL (
  policy_name => 'hr_ols_pol',
  level_num => 40,
  short_name => 'HS',
  long_name => 'HIGHLY_SENSITIVE');
END;
//
```

### SA\_COMPONENTS.DROP\_COMPARTMENT

The SA\_COMPONENTS.DROP\_COMPARTMENT procedure removes a compartment.

If the compartment is used in any existing label, then it *cannot* be dropped. You can find all existing labels by querying the LABEL column of the ALL\_SA\_DATA\_LABELS data dictionary view.

#### **Syntax**

```
SA_COMPONENTS.DROP_COMPARTMENT (
   policy_name IN VARCHAR2,
   comp_num IN INTEGER);

SA_COMPONENTS.DROP_COMPARTMENT (
   policy_name IN VARCHAR2,
   short_name IN VARCHAR2);
```

#### **Parameters**

Table E-15 SA\_COMPONENTS.DROP\_COMPARTMENT Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |



Table E-15 (Cont.) SA\_COMPONENTS.DROP\_COMPARTMENT Parameters

| Parameter  | Description  |
|------------|--|
| comp_num   | Specifies the number of an existing compartment for the policy. To find existing compartment numbers, query the COMP_NUM column of the DBA_SA_COMPARTMENTS view.           |
| short_name | Specifies the short name of an existing compartment for the policy. To find existing compartment short names, query the SHORT_NAME column of the DBA_SA_COMPARTMENTS view. |

#### **Example**

The following example removes the FIN compartment from the hr\_ols\_pol policy.

### SA\_COMPONENTS.DROP\_GROUP

The SA\_COMPONENTS.DROP\_GROUP procedure removes a group.

If the group is used in an existing label, then it cannot be dropped.

#### **Syntax**

```
SA_COMPONENTS.DROP_GROUP (
   policy_name IN VARCHAR2,
   group_num IN NUMBER(38));

SA_COMPONENTS.DROP_GROUP (
   policy_name IN VARCHAR2,
   short_name IN VARCHAR2);
```

#### **Parameters**

Table E-16 SA\_COMPONENTS.DROP\_GROUP Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                      |
| group_num   | Specifies the number of an existing group for the policy. To find existing group numbers, query the GROUP_NUM column of the ALL_SA_GROUPS view. |
| short_name  | Specifies the short name of an existing group. To find existing group short names, query the SHORT_NAME column of the ALL_SA_GROUPS view.       |



#### **Example**

The following example removes a group based on the group number for the  $hr\_ols\_pol$  policy.

```
BEGIN
    SA_COMPONENTS.DROP_GROUP (
    policy_name => 'hr_ols_pol',
    group_num => 2000);
END;
//
```

### SA\_COMPONENTS.DROP\_LEVEL

The SA\_COMPONENTS.DROP\_LEVEL procedure removes a level.

If the level is used in any existing label, then it cannot be dropped.

#### **Syntax**

```
SA_COMPONENTS.DROP_LEVEL (
   policy_name IN VARCHAR2,
   level_num IN NUMBER(38));

SA_COMPONENTS.DROP_LEVEL (
   policy_name IN VARCHAR2,
   short name IN VARCHAR2);
```

#### **Parameters**

Table E-17 SA\_COMPONENTS.DROP\_LEVEL Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy, which much exist. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.             |
| level_num   | Specifies the number of an existing level for the policy. To find existing level numbers, query the LEVEL_NUM column of the ALL_SA_LEVELS view.          |
| short_name  | Specifies the short name for the level (up to 30 characters). To find existing level short names, query the SHORT_NAME column of the ALL_SA_LEVELS view. |

#### **Example**

The following example drops the level 40 from the hr\_ols\_pol policy.

```
BEGIN
SA_COMPONENTS.DROP_LEVEL (
  policy_name => 'hr_ols_pol',
  level_num => 40);
END;
//
```



### SA\_LABEL\_ADMIN Label Management PL/SQL Package

The SA\_LABEL\_ADMIN PL/SQL package provides an administrative interface to manage the labels used by a policy.

- About the SA\_LABEL\_ADMIN PL/SQL Package
   The SA\_LABEL\_ADMIN PL/SQL package creates, alters, and deletes labels.
- SA\_LABEL\_ADMIN.ALTER\_LABEL
   The SA\_LABEL\_ADMIN.ALTER\_LABEL procedure changes the character string label definition associated with a label tag.
- SA\_LABEL\_ADMIN.CREATE\_LABEL
   The SA\_LABEL\_ADMIN.CREATE\_LABEL procedure creates data labels.
- SA\_LABEL\_ADMIN.DROP\_LABEL
  The SA\_LABEL\_ADMIN.DROP\_LABEL procedure deletes a specified policy label.

### About the SA\_LABEL\_ADMIN PL/SQL Package

The SA\_LABEL\_ADMIN PL/SQL package creates, alters, and deletes labels.

### SA LABEL ADMIN.ALTER LABEL

The SA\_LABEL\_ADMIN.ALTER\_LABEL procedure changes the character string label definition associated with a label tag.

The label tag itself cannot be changed.

If you change the character string associated with a label tag, then the sensitivity of the data in the rows changes accordingly. For example, if the label character string TS:A with an associated label tag value of 4001 is changed to the label TS:B, then access to the data changes accordingly. This is true even when the label tag value (4001) has not changed. In this way, you can change the data's sensitivity without the need to update all the rows.

Ensure that when you specify a label to alter, you can refer to it either by its label tag or by its character string value.



Table E-18 SA\_LABEL\_ADMIN.ALTER\_LABEL Parameters

| Parameter       | Description  |
|-----------------|--|
| policy_name     | Specifies the name of an existing policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                           |
| label_tag       | Identifies the integer tag assigned to the label to be altered. To find existing label tags, query the LABEL_TAG column of the ALL_SA_LABELS view.                       |
| label_value     | Identifies the existing character string representation of the label to be altered. To find the existing label values, query the LABEL column of the ALL_SA_LABELS view. |
| new_label_value | Specifies the new character string representation of the label value. If NULL, the existing value is not changed.  |
| new_data_label  | TRUE if the label can be used to label row data. If NULL, the existing value is not changed.   |

#### **Example**

The following example modifies the label\_tag and label\_value settings of  $hr_ols_pol$  policy.

### SA\_LABEL\_ADMIN.CREATE\_LABEL

The SA\_LABEL\_ADMIN.CREATE\_LABEL procedure creates data labels.

```
SA_LABEL_ADMIN.CREATE_LABEL (
   policy_name IN VARCHAR2,
   label_tag IN BINARY_INTEGER,
   label_value IN VARCHAR2,
   data_label IN BOOLEAN DEFAULT TRUE);
```



Table E-19 SA\_LABEL\_ADMIN.CREATE\_LABEL Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the name of an existing policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| label_tag   | Specifies a unique integer value representing the sort order of the label, relative to other policy labels (0-99999999). This value must be 1 to 8 digits long.  |
| label_value | Specifies the character string representation of the label to be created. Use the short name of the level, compartment, and group. You can find these values by querying the SHORT_NAME column of the ALL_SA_LEVELS, ALL_SA_COMPARTMENTS, and ALL_SA_GROUPS views. |
| data_label  | ${\tt TRUE}$ if the label can be used to label row data. Use this to define the label as valid for data.   |

When you identify valid labels, you specify which of all the possible combinations of levels, compartments, and groups can potentially be used to label data in tables.

#### **Example**

The following example creates a label for the hr\_ols\_pol policy.

```
BEGIN
    SA_LABEL_ADMIN.CREATE_LABEL (
    policy_name => 'hr_ols_pol',
    label_tag => 1111,
    label_value => 'HS:FIN',
    data_label => TRUE);
END;
/
```

#### Note:

If you create a new label by using the TO\_DATA\_LABEL procedure, then a system-generated label tag of 10 digits is generated automatically.

However, when Oracle Label Security is installed to work with Oracle Internet Directory, dynamic label generation is not permitted, because labels are managed centrally in Oracle Internet Directory, using olsadmintool commands.

So, when Oracle Label Security is directory-enabled, the TO\_DATA\_LABEL function is not available and will generate an error message if used.



### SA LABEL ADMIN.DROP LABEL

The SA LABEL ADMIN. DROP LABEL procedure deletes a specified policy label.

Any subsequent reference to the label (in data rows, or in user or program unit labels) will raise an invalid label error.

Use this procedure only while setting up labels, prior to data population. If you should inadvertently drop a label that is being used, you can recover it by disabling the policy, fixing the problem, and then re-enabling the policy.

#### **Syntax**

```
SA_LABEL_ADMIN.DROP_LABEL (
 policy_name IN VARCHAR2,
  label_tag
             IN BINARY_INTEGER);
SA_LABEL_ADMIN.DROP_LABEL (
```

#### **Parameters**

Table E-20 SA\_LABEL\_ADMIN.DROP\_LABEL Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the name of an existing policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.    |
| label_tag   | Specifies the integer tag assigned to the label to be dropped. To find existing label tags, query the LABEL_TAG column of the ALL_SA_LABELS view. |
| label_value | Specifies the string value of the label to be dropped. To find existing label values, query the LABEL column of the ALL_SA_LABELS view.           |

#### WARNING:

Do not drop a label that is in use anywhere in the database. You can find labels by querying the ALL\_SA\_LABELS data dictionary view.

#### Example

The following example drops the hr\_ols\_pol policy label based on its label\_tag setting.

```
BEGIN
 SA_LABEL_ADMIN.DROP_LABEL (
  policy_name => 'hr_ols_pol',
  label_tag => 1111);
END;
```



# SA\_POLICY\_ADMIN Policy Administration PL/SQL Package

The SA\_POLICY\_ADMIN PL/SQL package manages Oracle Label Security policies as a whole.

# About the SA POLICY ADMIN PL/SQL Package

The SA\_POLICY\_ADMIN PL/SQL package configures schema and table policies, and performs subscribe and unsubscribe actions.

# SA POLICY ADMIN.ALTER SCHEMA POLICY

The SA\_POLICY\_ADMIN.ALTER\_SCHEMA\_POLICY procedure changes the default enforcement options for the policy.

# SA POLICY ADMIN.APPLY SCHEMA POLICY

The SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY procedure applies a policy to all of the tables in a schema and enables the policy for these tables.

# SA POLICY\_ADMIN.APPLY\_TABLE\_POLICY

The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure adds the specified policy to a table.

# SA\_POLICY\_ADMIN.DISABLE\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.DISABLE\_SCHEMA\_POLICY procedure disables the enforcement of the policy for all tables in a schema.

### SA POLICY ADMIN.DISABLE TABLE POLICY

The SA\_POLICY\_ADMIN.DISABLE\_TABLE\_POLICY procedure disables the enforcement of the policy for a table without changing the enforcement options, labeling function, or predicate values.

# SA POLICY ADMIN.ENABLE SCHEMA POLICY

The SA\_POLICY\_ADMIN.ENABLE\_SCHEMA\_POLICY procedure reenables the current enforcement options, labeling function, and predicate for the tables in the specified schema.

# SA\_POLICY\_ADMIN.ENABLE\_TABLE\_POLICY

The SA\_POLICY\_ADMIN.ENABLE\_TABLE\_POLICY procedure reenables the current enforcement options, labeling function, and predicate for the specified table.

# SA POLICY ADMIN.POLICY SUBSCRIBE

In an Oracle Internet Directory-enabled Oracle Label Security configuration, the SA\_POLICY\_ADMIN.POLICY\_SUBSCRIBE procedure subscribes to the policy for usage in SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY and SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY.

#### SA POLICY ADMIN.POLICY UNSUBSCRIBE

In an Oracle Internet Directory enabled Oracle Label Security configuration, the SA\_POLICY\_ADMIN.POLICY\_UNSUBSCRIBE procedure unsubscribes to the policy.

#### SA POLICY ADMIN.REMOVE SCHEMA POLICY

The SA\_POLICY\_ADMIN.REMOVE\_SCHEMA\_POLICY procedure removes the specified policy from a schema.

# SA\_POLICY\_ADMIN.REMOVE\_TABLE\_POLICY

The SA\_POLICY\_ADMIN.REMOVE\_TABLE\_POLICY procedure removes the specified policy from a table.



# About the SA\_POLICY\_ADMIN PL/SQL Package

The SA\_POLICY\_ADMIN PL/SQL package configures schema and table policies, and performs subscribe and unsubscribe actions.

To use this package, you must be granted the  $policy_DBA$  role (for example,  $HR_OLS_POL_DBA$  for a role for the  $hr_ols_pol$  policy) and the EXECUTE privilege for the  $SA_POLICY_ADMIN$  package.

# SA\_POLICY\_ADMIN.ALTER\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.ALTER\_SCHEMA\_POLICY procedure changes the default enforcement options for the policy.

Any new tables created in the schema will automatically have the new enforcement options applied. The existing tables in the schema are not affected.

To change enforcement options on a table (rather than a schema), you must first drop the policy from the table, make the change, and then reapply the policy.

If you alter the enforcement options on a schema, then this will take effect the next time a table is created in the schema. As a result, different tables within a schema may have different policy enforcement options in force.

# **Syntax**

#### **Parameters**

Table E-21 SA\_POLICY\_ADMIN.ALTER\_SCHEMA Parameters

| Parameter       | Description  |
|-----------------|--|
| policy_name     | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| schema_name     | The schema that contains the table. To find existing schemas associated with this policy, query the POLICY_NAME and SCHEMA_NAME columns of the ALL_SA_TABLE_POLICIES view. |
| default_options | The default options to be used for new tables in the schema.<br>Separate each option with a comma.<br>See Table 8-2 for a listing of the default enforcement options.      |

#### Example

The following example adds the UPDATE\_CONTROL default option to the HR schema.

```
BEGIN
SA_POLICY_ADMIN.ALTER_SCHEMA_POLICY(
  policy_name => 'hr_ols_pol',
  schema_name => 'HR',
```



```
default_options => 'read_control, write_control, update_control');
END;
//
```

# SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY procedure applies a policy to all of the tables in a schema and enables the policy for these tables.

That is, it applies to those tables that do not already have the policy applied. Then, whenever a new table is created in the schema, the policy is automatically applied to that table, using the schema's default options. No changes are made to existing tables in the schema that already have the policy applied.

# **Syntax**

```
SA_POLICY_ADMIN.APPLY_SCHEMA_POLICY (
policy_name IN VARCHAR2,
schema_name IN VARCHAR2,
default_options IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

#### Table E-22 SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY Parameters

| Parameter       | Description   |
|-----------------|---|
| policy_name     | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| schema_name     | The schema that contains the table to protect   |
| default_options | The default options to be used for tables in the schema.  Separate each option with a comma. If the default_options parameter is NULL, then the policy's default options will be used to apply the policy to the tables in the schema.  See Table 8-2 for a listing of the default enforcement options. |

### **Example**

The following example applies the READ\_CONTROL and WRITE\_CONTROL options to the HR schema.



# SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY

The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure adds the specified policy to a table.

A policy label column is added to the table if it does not exist, and is set to NULL. When a policy is applied, it is automatically enabled. To change the table options, labeling function, or predicate, you must first remove the policy, and then reapply it.

# **Syntax**

#### **Parameters**

Table E-23 SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY Parameters

| Parameter      | Description   |
|----------------|---|
| policy_name    | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| schema_name    | The schema that contains the table that the policy protects   |
| table_name     | The table to be protected by the policy   |
| table_options  | A comma-delimited list of policy enforcement options to be used for the table. If NULL, then the policy's default options are used. See Table 8-2 for a listing of the default enforcement options.           |
| label_function | A string calling a function to return a label value to use as the default. For example, my_label(:new.dept,:new.status) computes the label based on the new values of the DEPT and STATUS columns in the row. |
| predicate      | An additional predicate to combine (using AND or OR) with the label-based predicate for READ_CONTROL  |

# **Example**

The following statement applies the  $hr_ols_pol$  policy to the EMPLOYEES table in the HR schema.



```
END;
```

# SA\_POLICY\_ADMIN.DISABLE\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.DISABLE\_SCHEMA\_POLICY procedure disables the enforcement of the policy for all tables in a schema.

However, it does not change the enforcement options, labeling function, or predicate values.

This procedure removes the row level security predicate and DML triggers from all the tables in the schema.

### **Syntax**

#### **Parameters**

# Table E-24 SA\_POLICY\_ADMIN.DISABLE\_SCHEMA\_POLICY Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                                |
| schema_name | The schema that contains the table for this policy. To find this schema, query the POLICY_NAME and SCHEMA_NAME columns of the ALL_SA_TABLE_POLICIES view. |

### **Example**

The following example disables the hr\_ols\_pol policy for the HR schema.

# SA\_POLICY\_ADMIN.DISABLE\_TABLE\_POLICY

The SA\_POLICY\_ADMIN.DISABLE\_TABLE\_POLICY procedure disables the enforcement of the policy for a table without changing the enforcement options, labeling function, or predicate values.

This procedure removes the row level security predicate and DML triggers from the table.



#### **Parameters**

Table E-25 SA\_POLICY\_ADMIN.DISABLE\_TABLE\_POLICY Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| schema_name | The schema that contains the table. To find this schema, query the POLICY_NAME and SCHEMA_NAME columns of the ALL_SA_TABLE_POLICIES view.                           |
| table_name  | The table in the schema specified by schema_name. To find this table, query the POLICY_NAME, SCHEMA_NAME, and TABLE_NAME columns of the ALL_SA_TABLE_POLICIES view. |

#### **Example**

The following statement disables the  $hr_ols_pos$  policy on the EMPLOYEES table in the HR schema:

```
BEGIN
SA_POLICY_ADMIN.DISABLE_TABLE_POLICY(
  policy_name => 'hr_ols_pol',
    schema_name => 'HR',
    table_name => 'EMPLOYEES');
END;
//
```

# SA POLICY\_ADMIN.ENABLE\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.ENABLE\_SCHEMA\_POLICY procedure reenables the current enforcement options, labeling function, and predicate for the tables in the specified schema.

It accomplishes this by re-applying the row level security predicate and DML triggers. The result is similar to enabling a policy for a table, but it covers all the tables in the schema.



# **Parameters**

Table E-26 SA\_POLICY\_ADMIN.ENABLE\_SCHEMA\_POLICY Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies and their status, query the POLICY_NAME and STATUS columns of the ALL_SA_POLICIES data dictionary view. |
| schema_name | The schema that contains the table. To find this schema, query the POLICY_NAME and SCHEMA_NAME columns of the ALL_SA_TABLE_POLICIES view.               |

# **Example**

The following example enables the hr\_ols\_pol policy for the HR schema.

# SA\_POLICY\_ADMIN.ENABLE\_TABLE\_POLICY

The SA\_POLICY\_ADMIN.ENABLE\_TABLE\_POLICY procedure reenables the current enforcement options, labeling function, and predicate for the specified table.

It accomplishes this by reapplying the row level security predicate and DML triggers.

# **Syntax**

#### **Parameters**

Table E-27 SA POLICY ADMIN.ENABLE TABLE POLICY Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. POLICY_NAME and STATUS columns of the ALL_SA_POLICIES data dictionary view.   |
| schema_name | The schema that contains the table. To find this schema, query the POLICY_NAME and SCHEMA_NAME columns of the ALL_SA_TABLE_POLICIES view.                           |
| table_name  | The table in the schema specified by schema_name. To find this table, query the POLICY_NAME, SCHEMA_NAME, and TABLE_NAME columns of the ALL_SA_TABLE_POLICIES view. |



### **Example**

The following statement reenables the  $hr_ols_pol$  policy on the EMPLOYEES table in the HR schema:

```
BEGIN
SA_POLICY_ADMIN.ENABLE_TABLE_POLICY(
  policy_name => 'hr_ols_pol',
    schema_name => 'HR',
    table_name => 'EMPLOYEES');
END;
//
```

# SA\_POLICY\_ADMIN.POLICY\_SUBSCRIBE

In an Oracle Internet Directory-enabled Oracle Label Security configuration, the SA\_POLICY\_ADMIN.POLICY\_SUBSCRIBE procedure subscribes to the policy for usage in SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY.

You must call this procedure for a policy before that policy can be applied to a table or schema. Subscribing is needed only once, not for each use of the policy in a table or schema.

You cannot drop any subscribed policy unless it has been removed from any table or schema to which it was applied, and then unsubscribed.

### **Syntax**

#### **Parameter**

Table E-28 SA\_POLICY\_ADMIN.POLICY\_SUBSCRIBE Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |



This procedure must be used before policy usage only in the case of Oracle Internet Directory-enabled Oracle Label Security configuration. In the standalone Oracle Label Security case, the policy can be used in APPLY\_TABLE\_POLICY and APPLY\_SCHEMA\_POLICY directly without the need to subscribe.

#### **Example**

The following statement subscribes the database to the  $hr_ols_pol_policy$  so that it can used by applying on tables and schema.



```
BEGIN
SA_POLICY_ADMIN.POLICY_SUBSCRIBE(
  policy_name => 'hr_ols_pol');
END;
//
```

# SA\_POLICY\_ADMIN.POLICY\_UNSUBSCRIBE

In an Oracle Internet Directory enabled Oracle Label Security configuration, the SA\_POLICY\_ADMIN.POLICY\_UNSUBSCRIBE procedure unsubscribes to the policy.

You can use this procedure only if the policy is not in use; that is, it has not been applied to any table or schema. (If it has been applied to tables or schemas, then it must be removed from all of them before it can be unsubscribed.) A policy can be dropped in Oracle Internet Directory only if is not subscribed in any of the databases that have registered with that Oracle Internet Directory. To unsubscribe a policy, use the olsadmintool dropprofile command.

You cannot drop any subscribed policy unless it has been removed from any table or schema to which it was applied, and then unsubscribed.

### **Syntax**

```
SA_POLICY_ADMIN.POLICY_UNSUBSCRIBE(
   policy_name IN VARCHAR2);
```

#### **Parameter**

#### Table E-29 SA POLICY ADMIN.POLICY UNSUBSCRIBE Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

### **Example**

The following statement unsubscribes the database to the hr\_ols\_pol policy.

```
BEGIN
SA_POLICY_ADMIN.POLICY_UNSUBSCRIBE(
  policy_name => 'hr_ols_pol');
END;
//
```

# SA\_POLICY\_ADMIN.REMOVE\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.REMOVE\_SCHEMA\_POLICY procedure removes the specified policy from a schema.

The policy will be removed from all the tables in the schema and, optionally, the label column for the policy will be dropped from all the tables.



```
schema_name IN VARCHAR2,
drop_column IN BOOLEAN DEFAULT FALSE);
```

#### **Parameters**

Table E-30 SA\_POLICY\_ADMIN.REMOVE\_SCHEMA\_POLICY Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                     |
| schema_name | The schema that contains the table associated with this policy. To find this schema, query the SCHEMA_NAME of the ALL_SA_SCHEMA_POLICIES view. |
| drop_column | If $\mathtt{TRUE},$ then the policy's column will be dropped from the tables, otherwise, the column will remain.                               |

### **Example**

The following example drops the human\_resource policy's column from the HR schema.

# SA POLICY ADMIN.REMOVE TABLE POLICY

The SA\_POLICY\_ADMIN.REMOVE\_TABLE\_POLICY procedure removes the specified policy from a table.

The policy predicate and any DML triggers will be removed from the table, and the policy label column can optionally be dropped. Policies can be removed from tables belonging to a schema that is protected by the policy.

#### **Syntax**

```
SA_POLICY_ADMIN.REMOVE_TABLE_POLICY (
policy_name IN VARCHAR2,
schema_name IN VARCHAR2,
table_name IN VARCHAR2,
drop_column IN BOOLEAN DEFAULT FALSE);
```

### **Parameters**

Table E-31 SA\_POLICY\_ADMIN.REMOVE\_TABLE\_POLICY Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |



Table E-31 (Cont.) SA\_POLICY\_ADMIN.REMOVE\_TABLE\_POLICY Parameters

| Parameter   | Description  |
|-------------|--|
| schema_name | The schema that contains the table associated with this policy.  To find this schema, query the SCHEMA_NAME of the  ALL_SA_SCHEMA_POLICIES view.                   |
| table_name  | The table in the schema specified by schema_name. To find this table query the POLICY_NAME, SCHEMA_NAME, and TABLE_NAME columns of the ALL_SA_TABLE_POLICIES view. |
| drop_column | Whether the column is to be dropped: if TRUE, then the policy's column will be dropped from the table, otherwise, it will remain                                   |

#### **Example**

The following statement removes the  $hr_ols_pol$  policy from the EMPLOYEES table in the HR schema:

# SA SESSION Session Management PL/SQL Package

The SA\_SESSION PL/SQL package manages session behavior for user authorizations.

About the SA SESSION PL/SQL Package

The SA\_SESSION PL/SQL package manages user name, levels, labels, and read and write permissions for a user session.

SA SESSION.COMP READ

The SA\_SESSION.COMP\_READ function returns a comma-delimited list of compartments that the user is authorized to read.

SA SESSION.COMP WRITE

The SA\_SESSION.COMP\_WRITE function returns a comma-delimited list of compartments to which the user is authorized to write.

SA\_SESSION.GROUP\_READ

The SA\_SESSION.GROUP\_READ function returns a comma-delimited list of groups that the user is authorized to read.

SA SESSION.GROUP WRITE

The SA\_SESSION.GROUP\_WRITE function returns a comma-delimited list of groups that the user is authorized to write.

SA SESSION.LABEL

The SA\_SESSION. LABEL function returns the label that is associated with the specified policy for the current session.

#### SA SESSION.MAX LEVEL

The SA\_SESSION.MAX\_LEVEL function returns the maximum Oracle Label Security level authorized for the session.

#### SA SESSION.MAX READ LABEL

The SA\_SESSION.MAX\_READ\_LABEL function returns the label string that was used to initialize the user's maximum authorized read label.

### SA SESSION.MAX WRITE LABEL

The SA\_SESSION.MAX\_WRITE\_LABEL function returns the label string that was used to initialize the user's maximum authorized write label.

# SA SESSION.MIN LEVEL

The SA\_SESSION.MIN\_LEVEL function returns the minimum Oracle Label Security level authorized for the session.

# • SA\_SESSION.MIN\_WRITE\_LABEL

The SA\_SESSION.MIN\_WRITE\_LABEL function retrieves the label string that was used to initialize the user's minimum authorized write label.

#### SA SESSION.PRIVS

The SA\_SESSION.PRIVS function returns the set of current session privileges, in a comma-delimited list.

### SA SESSION.RESTORE DEFAULT LABELS

The SA\_SESSION.RESTORE\_DEFAULT\_LABELS procedure restores the session label and row label to those stored in the data dictionary.

# SA\_SESSION.ROW\_LABEL

The SA\_SESSION.ROW\_LABEL function returns the name of the row label that is associated with the policy for the current session.

# SA\_SESSION.SET\_LABEL

The  ${\tt SA\_SESSION.SET\_LABEL}$  procedure sets the label of the current database session.

# SA SESSION.SA USER NAME

The SA\_SESSION.SA\_USER\_NAME function returns the name of the current Oracle Label Security user, as set by the SA\_SESSION.SET\_ACCESS\_PROFILE procedure (or as established at login).

#### SA SESSION.SAVE DEFAULT LABELS

The SA\_SESSION.SAVE\_DEFAULT\_LABELS procedure stores the current session label and row label as your initial session label and default row label.

# SA\_SESSION.SET\_ACCESS\_PROFILE

The SA\_SESSION.SET\_ACCESS\_PROFILE procedure sets the Oracle Label Security authorizations and privileges of the database session to those of the specified user.

### SA SESSION.SET ROW LABEL

The SA\_SESSION.SET\_ROW\_LABEL procedure sets the default row label value for the current database session.

# About the SA SESSION PL/SQL Package

The SA\_SESSION PL/SQL package manages user name, levels, labels, and read and write permissions for a user session.



Users can change labels during a session within the authorizations set by the administrator.

You do not need special privileges to use this package.



SA\_UTL PL/SQL Utility Functions and Procedures for additional functions that return numeric label tags and BOOLEAN values

# SA\_SESSION.COMP\_READ

The SA\_SESSION.COMP\_READ function returns a comma-delimited list of compartments that the user is authorized to read.

### **Syntax**

```
SA_SESSION.COMP_READ (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

#### **Parameter**

# Table E-32 SA\_SESSION.COMP\_READ Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

#### **Example**

The following example returns the compartments that the user can read for the  $hr\_ols\_pol$  policy.

```
SELECT SA_SESSION.COMP_READ ('hr_ols_pol') FROM DUAL;
```

# SA SESSION.COMP WRITE

The SA\_SESSION.COMP\_WRITE function returns a comma-delimited list of compartments to which the user is authorized to write.

This function is a subset of SA\_SESSION.COMP\_READ.

```
SA_SESSION.COMP_WRITE (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```



#### **Parameter**

Table E-33 SA\_SESSION.COMP\_WRITE Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

### **Example**

The following example returns the compartments that the user can modify for the  $hr\_ols\_pol$  policy.

SELECT SA\_SESSION.COMP\_WRITE ('hr\_ols\_pol') FROM DUAL;

# SA\_SESSION.GROUP\_READ

The SA\_SESSION.GROUP\_READ function returns a comma-delimited list of groups that the user is authorized to read.

### **Syntax**

SA\_SESSION.GROUP\_READ (
 policy\_name IN VARCHAR2)
RETURN VARCHAR2;

#### **Parameter**

Table E-34 SA\_SESSION.GROUP\_READ Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

# **Example**

The following example returns the list of groups that a user can read for the  $hr_ols_pol_policy$ .

SELECT SA\_SESSION.GROUP\_READ ('hr\_ols\_pol') FROM DUAL;

# SA\_SESSION.GROUP\_WRITE

The SA\_SESSION.GROUP\_WRITE function returns a comma-delimited list of groups that the user is authorized to write.

This function is a subset of SA\_SESSION.GROUP\_READ.



# **Syntax**

SA\_SESSION.GROUP\_WRITE (
 policy\_name IN VARCHAR2)
RETURN VARCHAR2;

### **Parameter**

Table E-35 SA\_SESSION.GROUP\_WRITE Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

# Example

The following example returns the groups the user is authorized to modify for the  $hr\_ols\_pol$  policy.

SELECT SA\_SESSION.GROUP\_WRITE ('hr\_ols\_pol') FROM DUAL;

# SA\_SESSION.LABEL

The  ${\tt SA\_SESSION.LABEL}$  function returns the label that is associated with the specified policy for the current session.

# **Syntax**

SA\_SESSION.LABEL (
 policy\_name IN VARCHAR2)
RETURN VARCHAR2;

# **Parameter**

Table E-36 SA\_SESSION.LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

# **Example**

The following example returns the label that is associated with the hr\_ols\_pol policy.

SELECT SA\_SESSION.LABEL ('hr\_ols\_pol') FROM DUAL;



# SA\_SESSION.MAX\_LEVEL

The SA\_SESSION.MAX\_LEVEL function returns the maximum Oracle Label Security level authorized for the session.

# **Syntax**

```
SA_SESSION.MAX_LEVEL (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

#### **Parameter**

#### Table E-37 SA\_SESSION.MAX\_LEVEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

### **Example**

The following example returns the maximum Oracle Label Security level that is authorized for the  $hr_ols_pol$  policy.

SELECT SA\_SESSION.MAX\_LEVEL ('hr\_ols\_pol') FROM DUAL;

# SA\_SESSION.MAX\_READ\_LABEL

The SA\_SESSION.MAX\_READ\_LABEL function returns the label string that was used to initialize the user's maximum authorized read label.

The return string is composed of the user's maximum level, compartments authorized for read access, and groups authorized for read access.

#### **Syntax**

```
SA_SESSION.MAX_READ_LABEL (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

### **Parameter**

# Table E-38 SA\_SESSION.MAX\_READ\_LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |



### **Example**

The following example returns the maximum read label privileges for the hr\_ols\_pol policy.

```
SELECT SA_SESSION.MAX_READ_LABEL ('hr_ols_pol') FROM DUAL;
```

# SA SESSION.MAX WRITE LABEL

The SA\_SESSION.MAX\_WRITE\_LABEL function returns the label string that was used to initialize the user's maximum authorized write label.

This return string is composed of the user's maximum level, compartments authorized for write access, and groups authorized for write access.

#### **Syntax**

```
SA_SESSION.MAX_WRITE_LABEL (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

#### **Parameter**

# Table E-39 SA\_SESSION.MAX\_WRITE\_LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

# **Example**

The following example returns the maximum write label privileges for the hr\_ols\_pol policy.

```
SELECT SA_SESSION.MAX_WRITE_LABEL ('hr_ols_pol') FROM DUAL;
```

# SA\_SESSION.MIN\_LEVEL

The  ${\tt SA\_SESSION.MIN\_LEVEL}$  function returns the minimum Oracle Label Security level authorized for the session.

```
SA_SESSION.MIN_LEVEL (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```



# **Parameter**

Table E-40 SA\_SESSION.MIN\_LEVEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

### **Example**

The following example returns the current minimum level for the hr\_ols\_pol policy.

SELECT SA\_SESSION.MIN\_LEVEL ('hr\_ols\_pol') FROM DUAL;

# SA\_SESSION.MIN\_WRITE\_LABEL

The SA\_SESSION.MIN\_WRITE\_LABEL function retrieves the label string that was used to initialize the user's minimum authorized write label.

The return string contains only the level, with no compartments or groups.

# **Syntax**

```
SA_SESSION.MIN_WRITE_LABEL (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

#### **Parameter**

Table E-41 SA\_SESSION.MIN\_WRITE\_LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

# **Example**

The following example returns the maximum write label privileges for the hr\_ols\_pol policy.

SELECT SA\_SESSION.MIN\_WRITE\_LABEL ('hr\_ols\_pol') FROM DUAL;

# SA\_SESSION.PRIVS

The SA\_SESSION.PRIVS function returns the set of current session privileges, in a comma-delimited list.

```
SA_SESSION.PRIVS (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```



# **Parameter**

Table E-42 SA\_SESSION.Privs Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

#### **Example**

The following example returns the current session privileges for the hr\_ols\_pol policy.

```
SELECT SA_SESSION.PRIVS ('hr_ols_pol') FROM DUAL;
```

# SA\_SESSION.RESTORE\_DEFAULT\_LABELS

The SA\_SESSION.RESTORE\_DEFAULT\_LABELS procedure restores the session label and row label to those stored in the data dictionary.

This command is useful to reset values after a SA\_SESSION.SET\_LABEL command has been processed.

# **Syntax**

```
SA_SESSION.RESTORE_DEFAULT_LABELS (
  policy_name in VARCHAR2);
```

#### **Parameter**

Table E-43 SA\_SESSION.RESTORE\_DEFAULT\_LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

#### **Example**

The following example restores the default labels for the hr\_ols\_pol policy.

```
BEGIN
SA_SESSION.RESTORE_DEFAULT_LABELS (
  policy_name => 'hr_ols_pol');
END;
//
```



# SA\_SESSION.ROW\_LABEL

The SA\_SESSION.ROW\_LABEL function returns the name of the row label that is associated with the policy for the current session.

#### **Syntax**

```
SA_SESSION.ROW_LABEL (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

#### **Parameter**

#### Table E-44 SA SESSION.ROW LABEL Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

### **Example**

The following example returns the row label that is associated with the hr\_ols\_pol policy.

```
SELECT SA_SESSION.ROW_LABEL ('hr_ols_pol') FROM DUAL;
```

# SA\_SESSION.SET\_LABEL

The SA\_SESSION.SET\_LABEL procedure sets the label of the current database session.

You can set the session label to:

- Any level equal to or less than the maximum, and equal to or greater than the minimum level
- Include any compartments in the authorized compartment list
- Include any groups in the authorized group list. (Subgroups of authorized groups are implicitly included in the authorized list.)

Note that if you change the session label, this change may affect the value of the session's row label. The session's row label contains the subset of compartments and groups for which the user has write access. This may or may not be equivalent to the session label. For example, if you use the  $SA_SESSION.SET_LABEL$  procedure to set your current session label to C:A,B:US and you have write access only on the A compartment, then your row label would be set to C:A.

```
SA_SESSION.SET_LABEL (
  policy_name IN VARCHAR2,
  label IN VARCHAR2);
```



# **Parameters**

Table E-45 SA\_SESSION.SET\_LABEL Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| label       | The value to set as the label  |

# **Example**

The following example sets the label for the hr\_ols\_pol policy.

# **Related Topics**

SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL

The SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL procedure sets the user's initial session label to the one specified.

# SA\_SESSION.SA\_USER\_NAME

The SA\_SESSION.SA\_USER\_NAME function returns the name of the current Oracle Label Security user, as set by the SA\_SESSION.SET\_ACCESS\_PROFILE procedure (or as established at login).

This is how you can determine the identity of the current user in relation to Oracle Label Security, rather than in relation to your Oracle login name.

# **Syntax**

```
SA_SESSION.SA_USER_NAME (
   policy_name IN VARCHAR2)
RETURN VARCHAR2;
```

#### **Parameter**

Table E-46 SA\_SESSION.SA\_USER\_NAME Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |



### **Example**

The following example finds the name of the Oracle Label Security user for the hr\_ols\_pol policy.

```
SELECT SA_SESSION.SA_USER_NAME ('hr_ols_pol') FROM DUAL;
```

# SA SESSION.SAVE DEFAULT LABELS

The SA\_SESSION. SAVE\_DEFAULT\_LABELS procedure stores the current session label and row label as your initial session label and default row label.

This procedure permits you to change your defaults to reflect your current session label and row label. The saved labels will be used as the initial default settings for future sessions.

When you log in to a database, your default session label and row label are used to initialize the session label and row label. When the administrator originally authorized your Oracle Label Security labels, he or she also defined your default level, default compartments, and default groups. If you change your session label and row label, and want to save these values as the default labels, you can use the SA\_SESSION.SAVE\_DEFAULT\_LABELS procedure.

This procedure is useful if you have multiple sessions and want to be sure that all additional sessions have the same labels. You can save the current labels as the default, and all future sessions will have these as the initial labels.

Consider a situation in which you connect to the database through Oracle Forms and want to run a report. By saving the current session labels as the default before you call Oracle Reports, you ensure that Oracle Reports will initialize at the same labels as are being used by Oracle Forms.

#### **Syntax**

```
SA_SESSION.SAVE_DEFAULT_LABELS (
   policy_name IN VARCHAR2);
```

#### **Parameter**

# Table E-47 SA\_SESSION.SAVE\_DEFAULT\_LABELS Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

# **Example**

The following example saves the label defaults for the hr\_ols\_pol policy.

```
BEGIN
SA_SESSION.SAVE_DEFAULT_LABELS (
  policy_name => 'hr_ols_pol');
END;
//
```





The SA\_SESSION.SAVE\_DEFAULT\_LABELS procedure overrides the settings established by the administrator.

# SA\_SESSION.SET\_ACCESS\_PROFILE

The SA\_SESSION.SET\_ACCESS\_PROFILE procedure sets the Oracle Label Security authorizations and privileges of the database session to those of the specified user.

Note that the originating user retains the PROFILE\_ACCESS privilege.

The user who executes the SA\_SESSION.SET\_ACCESS\_PROFILE procedure must have the PROFILE\_ACCESS privilege. The logged-in database user (the Oracle user ID) does not change. That user assumes only the authorizations and privileges of the specified user. By contrast, the Oracle Label Security user name *is* changed.

This administrative procedure is useful for various tasks:

- With SA\_SESSION.SET\_ACCESS\_PROFILE, you can see the result of the authorization and privilege settings for a particular user.
- Applications need to have proxy accounts connect as (and assume the identity of)
  application users, for purposes of accessing labeled data. With the
  SA\_SESSION.SET\_ACCESS\_PROFILE privilege, the proxy account can act on behalf of
  the application users.

### **Syntax**

```
SA_SESSION.SET_ACCESS_PROFILE (
  policy_name IN VARCHAR2
  user_name IN VARCHAR2);
```

#### **Parameters**

Table E-48 SA\_SESSION.SET\_ACCESS\_PROFILE Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name   | Name of the user whose authorizations and privileges should be assumed (typically, the user associated with this policy). To find this user, query the USER_NAME and POLICY_NAME columns of the DBA_SA_USERS view. |

#### **Example**

The following example enables user psmith to have Oracle Label Security authorizations and privileges for the database session.

```
BEGIN
SA_SESSION.SET_ACCESS_PROFILE (
```



# SA\_SESSION.SET\_ROW\_LABEL

The SA\_SESSION.SET\_ROW\_LABEL procedure sets the default row label value for the current database session.

The compartments and groups in the label must be a subset of the compartments and groups in the session label to which the user has write access. When the LABEL\_DEFAULT option is set, this row label value is used on insert if the user does not explicitly specify the label.

If the SA\_SESSION.SET\_ROW\_LABEL procedure is not used to set the default row label value, then this value is automatically derived from the session label. It contains the level of the session label and the subset of the compartments and groups in the session label for which the user has write authorization.

The row label is automatically reset if the session label changes. For example, if you change your session level from <code>HIGHLY\_SENSITIVE</code> to <code>SENSITIVE</code>, then the level component of the row label automatically changes to <code>SENSITIVE</code>.

The user can set the row label independently, but only to include:

- A level that is less than or equal to the level of the session label, and greater than or equal to the user's minimum level
- A subset of the compartments and groups from the session label, for which the user is authorized to have write access

If the user tries to set the row label to an invalid value, then the operation is not permitted and the row label value is unchanged.

#### **Syntax**

```
SA_SESSION.SET_ROW_LABEL (
policy_name IN VARCHAR2,
row_label IN VARCHAR2);
```

#### **Parameters**

# Table E-49 SA\_SESSION.SET\_ROW\_LABEL Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| label       | The value to set as the default row label  |

#### **Example**

The following example sets the row label for the hr\_ols\_pol policy.

```
BEGIN
SA_SESSION.SET_ROW_LABEL (
```



# **Related Topics**

SA\_USER\_ADMIN.SET\_ROW\_LABEL

The SA\_USER\_ADMIN.SET\_ROW\_LABEL procedure sets a user's initial row label to the one specified.

# SA\_SYSDBA Policy Management PL/SQL Package

The SA\_SYSDBA PL/SQL package manages Oracle Label Security policies.

About the SA\_SYSDBA PL/SQL Package

The SA\_SYSDBA PL/SQL package creates, modifies, enables or disables, and drops Oracle Label Security policies.

SA SYSDBA.ALTER POLICY

The SA\_SYSDBA.ALTER\_POLICY procedure sets and modifies column names that are associated with the policy.

SA SYSDBA.CREATE POLICY

The SA\_SYSDBA.CREATE\_POLICY procedure creates a new Oracle Label Security policy, defines a policy-specific column name, and specifies default policy options.

SA SYSDBA, DISABLE POLICY

The SA\_SYSDBA.DISABLE\_POLICY procedure turns off enforcement of a policy, without removing it from the database.

SA SYSDBA.DROP POLICY

The SA\_SYSDBA.DROP\_POLICY procedure deletes the policy and its associated user labels and data labels from the database.

SA\_SYSDBA.ENABLE\_POLICY

The  $SA\_SYSDBA.ENABLE\_POLICY$  procedure enforces access control on the tables and schemas protected by the policy.

# About the SA\_SYSDBA PL/SQL Package

The SA\_SYSDBA PL/SQL package creates, modifies, enables or disables, and drops Oracle Label Security policies.

To use this package, you must be granted the LBAC\_DBA role and the EXECUTE privilege on the SA\_SYSDBA package. The SA\_SYSDBA package is an invoker's rights package, so you must provide the following INHERIT PRIVILEGES grant to the user SYS before you can use this package:

```
GRANT INHERIT PRIVILEGES ON USER SYS TO LBACSYS;
```

You only need to grant this privilege on user  ${\tt SYS}$ . You do not need to grant it on other users.



# SA\_SYSDBA.ALTER\_POLICY

The SA\_SYSDBA.ALTER\_POLICY procedure sets and modifies column names that are associated with the policy.

SA\_SYSDBA.ALTER\_POLICY can only be used to change column name for policies that are not applied on any user tables or schemas. Otherwise, this error appears:

```
12474, 00000, "cannot change column name for a policy in use"
```

#### **Syntax**

```
SA_SYSDBA.ALTER_POLICY (

policy_name IN VARCHAR2,

default_options IN VARCHAR2 DEFAULT NULL,

column_name IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

Table E-50 SA\_SYSDBA.ALTER\_POLICY Parameters

| Parameter       | Description  |
|-----------------|--|
| policy_name     | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| default_options | Specifies the default enforcement options to be used when the policy is applied and no table- or schema-specific options are specified. Includes enforcement options and the option to hide the label column. Separate each option with a comma. |
|                 | See Categories of Policy Enforcement Options for a listing of the default enforcement options.   |
| column_name     | Specifies the column name associated with the policy. To find this column name, query the COLUMN_NAME column of the ALL_SA_POLICIES view.  |

### **Example**

The following example updates the  $hr_ols_pol$  policy to use a different set of default options. Because the name of the column does not need to change, the  $column_name$  parameter is omitted.

# SA\_SYSDBA.CREATE\_POLICY

The SA\_SYSDBA.CREATE\_POLICY procedure creates a new Oracle Label Security policy, defines a policy-specific column name, and specifies default policy options.

After you create the policy, a role for it is created and granted to you. The format of the role name is  $policy_DBA$  (for example,  $my_ols_pol_DBA$ ).



### **Syntax**

#### **Parameters**

Table E-51 SA\_SYSDBA.CREATE\_POLICY Parameters

| Parameter       | Description  |
|-----------------|--|
| policy_name     | Specifies the policy name, which must be unique within the database. It can have a maximum of 30 characters, but only the first 26 characters in the policy_name are significant. Two policies may not have the same first 26 characters in the policy_name. |
|                 | To find a list of existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| column_name     | Specifies the name of the column to be added to tables protected by the policy. If NULL, then the name <code>policy_name_COL</code> is used. Two Oracle Label Security policies cannot share the same column name.   |
| default_options | Specifies the default options to be used when the policy is applied and no table- or schema-specific options are specified. Includes enforcement options and the option to hide the label column. Separate each option with a comma.                         |
|                 | See Categories of Policy Enforcement Options for a listing of the default enforcement options.   |

#### **Example**

The following example creates a policy container whose default options are READ\_CONTROL and WRITE\_CONTROL. The WRITE\_CONTROL option encompasses the INSERT\_CONTROL, UPDATE\_CONTROL, and DELETE\_CONTROL options.

# SA\_SYSDBA.DISABLE\_POLICY

The SA\_SYSDBA.DISABLE\_POLICY procedure turns off enforcement of a policy, without removing it from the database.

The policy is not enforced for all subsequent access to the database.

To disable a policy means that no access control is enforced on the tables and schemas protected by the policy. The administrator can continue to perform administrative operations while the policy is disabled.





This feature is extremely powerful, and should be used with caution. When a policy is disabled, anyone who connects to the database can access all the data normally protected by the policy. So, your site should establish guidelines for use of this feature.

Normally, a policy should not be disabled in order to manage data. At times, however, an administrator may need to disable a policy to perform application debugging tasks. In this case, the database should be run in single-user mode. In a development environment, for example, you may need to observe data processing operations without the policy turned on. When you reenable the policy, all of the selected enforcement options become effective again.

#### **Syntax**

```
SA_SYSDBA.DISABLE_POLICY (
  policy_name IN VARCHAR2);
```

#### **Parameters**

Table E-52 SA\_SYSDBA.DISABLE\_POLICY Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies and their status, query the POLICY_NAME and STATUS columns of the ALL_SA_POLICIES data dictionary view. |

#### **Example**

The following example disables the hr\_ols\_pol policy:

```
EXEC SA_SYSDBA.DISABLE_POLICY ('hr_ols_pol');
```

# SA\_SYSDBA.DROP\_POLICY

The SA\_SYSDBA.DROP\_POLICY procedure deletes the policy and its associated user labels and data labels from the database.

This procedure purges the policy and these associations from the system entirely. You can optionally drop the label column from all tables controlled by the policy. The policy does not need to be disabled before you drop it.

```
SA_SYSDBA.DROP_POLICY (
   policy_name IN VARCHAR2,
   drop_column BOOLEAN DEFAULT FALSE);
```



#### **Parameters**

Table E-53 SA\_SYSDBA.DROP\_POLICY Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy to be dropped. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| drop_column | Indicates that the policy column should be dropped from protected tables (TRUE)  |

### **Example**

The following example deletes the hr\_ols\_pol policy.

EXEC SA\_SYSDBA.DROP\_POLICY ('hr\_ols\_pol');

# SA\_SYSDBA.ENABLE\_POLICY

The  $SA\_SYSDBA.ENABLE\_POLICY$  procedure enforces access control on the tables and schemas protected by the policy.

A policy is automatically enabled when it is created. After creation or enablement, the policy is enforced for all subsequent access to tables protected by the policy.

### **Syntax**

SA\_SYSDBA.ENABLE\_POLICY (policy\_name IN VARCHAR2);

### **Parameters**

Table E-54 SA SYSDBA.ENABLE POLICY Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies and their status, query the POLICY_NAME and STATUS columns of the ALL_SA_POLICIES data dictionary view. |

### **Example**

The following example enables the hr\_ols\_pol policy.

EXEC SA\_SYSDBA.ENABLE\_POLICY('hr\_ols\_pol');

# SA\_USER\_ADMIN PL/SQL Package

The SA\_USER\_ADMIN PL/SQL package manages user labels by label component.

About the SA\_USER\_ADMIN PL/SQL Package
 The SA\_USER\_ADMIN PL/SQL package configures compartments, groups. user access, labels, levels, and privileges.



#### SA USER ADMIN.ADD COMPARTMENTS

The SA\_USER\_ADMIN.ADD\_COMPARTMENTS procedure adds (assigns) compartments to a user's authorizations, indicating if the compartments are authorized for write and read privileges.

# SA USER ADMIN.ADD GROUPS

The SA\_USER\_ADMIN.ADD\_GROUPS procedure adds (assigns) groups to a user, indicating if the groups are authorized for write and read privileges.

#### SA USER ADMIN.ALTER COMPARTMENTS

The SA\_USER\_ADMIN.ALTER\_COMPARTMENTS procedure changes the write access, default label indicator, and row label indicator for the specified compartments.

### SA USER ADMIN.ALTER GROUPS

The SA\_USER\_ADMIN.ALTER\_GROUPS procedure changes the write access, default label indicator, and row label indicator for the specified groups.

# SA\_USER\_ADMIN.DROP\_ALL\_COMPARTMENTS

The SA\_USER\_ADMIN.DROP\_ALL\_COMPARTMENTS procedure drops all compartments from a user's authorizations.

# SA USER ADMIN.DROP ALL GROUPS

The SA\_USER\_ADMIN.DROP\_ALL\_GROUPS procedure drops all groups from a user's authorizations.

# SA\_USER\_ADMIN.DROP\_COMPARTMENTS

The SA\_USER\_ADMIN.DROP\_COMPARTMENTS procedure drops the specified compartments from a user's authorizations.

# SA USER ADMIN.DROP GROUPS

The  ${\tt SA\_USER\_ADMIN.DROP\_GROUPS}$  procedure drops the specified groups from a user's authorizations.

# SA\_USER\_ADMIN.DROP\_USER\_ACCESS

The SA\_USER\_ADMIN.DROP\_USER\_ACCESS procedure removes all Oracle Label Security authorizations and privileges from the specified user.

# SA USER ADMIN.SET COMPARTMENTS

The SA\_USER\_ADMIN.SET\_COMPARTMENTS procedure assigns compartments to a user and identifies default values for the user's session label and row label.

#### SA USER ADMIN.SET DEFAULT LABEL

The SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL procedure sets the user's initial session label to the one specified.

# SA\_USER\_ADMIN.SET\_GROUPS

The SA\_USER\_ADMIN.SET\_GROUPS procedure assigns groups to a user and identifies default values for the user's session label and row label.

#### SA USER ADMIN.SET LEVELS

The SA\_USER\_ADMIN.SET\_LEVELS procedure assigns a user minimum and maximum levels and identifies default values for the user's session label and row label.

#### SA USER ADMIN.SET PROG PRIVS

The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure sets policy-specific privileges for program units.

# SA\_USER\_ADMIN.SET\_ROW\_LABEL

The  ${\tt SA\_USER\_ADMIN.SET\_ROW\_LABEL}$  procedure sets a user's initial row label to the one specified.



# SA\_USER\_ADMIN.SET\_USER\_LABELS

The SA\_USER\_ADMIN.SET\_USER\_LABELS procedure sets the user's levels, compartments, and groups using a set of labels, instead of the individual components.

SA\_USER\_ADMIN.SET\_USER\_PRIVS

The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure sets policy-specific privileges for users.

# About the SA\_USER\_ADMIN PL/SQL Package

The SA\_USER\_ADMIN PL/SQL package configures compartments, groups. user access, labels, levels, and privileges.

To use this package, you must be granted the <code>policy\_dba</code> role (for example, <code>hr\_ols\_pol\_dba</code> for a role for the <code>hr\_ols\_pol</code> policy) and the <code>EXECUTE</code> privilege on the <code>SA\_USER\_ADMIN</code> package.

# SA\_USER\_ADMIN.ADD\_COMPARTMENTS

The SA\_USER\_ADMIN.ADD\_COMPARTMENTS procedure adds (assigns) compartments to a user's authorizations, indicating if the compartments are authorized for write and read privileges.

This procedure is useful if you have already used the SA\_USER\_ADMIN.SET\_COMPARTMENTS procedure for the user but then decide that you want to grant this user authorization for additional compartments, or to update the current set of compartments. You also can use it in place of SA\_USER\_ADMIN.SET\_COMPARTMENTS.

### **Syntax**

#### **Parameters**

### Table E-55 SA\_USER\_ADMIN.ADD\_COMPARTMENTS Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name   | Specifies the user name. This user can be either a new user or a user who has already been authorized for this policy's compartments. To find an existing user, query the USER_NAME column of the DBA_SA_USER_COMPARTMENTS view. |



Table E-55 (Cont.) SA\_USER\_ADMIN.ADD\_COMPARTMENTS Parameters

| Parameter   | Description  |
|-------------|--|
| comps       | A comma-delimited list of compartments to add, by short name only. To find existing compartments, query the SHORT_NAME column of the ALL_SA_COMPARTMENTS view.       |
| access_mode | One of two public variables that contain string values that can<br>specify the type of access authorized. The variable names,<br>values, and meaning are as follows: |
|             | SA_UTL.READ_ONLY indicates no write access   |
|             | • SA_UTL.READ_WRITE indicates that write is authorized   |
|             | • If access_mode is NULL, then it is set to SA_UTL.READ_ONLY.  |
| in_def      | Specifies whether these compartments should be in the default compartments ( $Y/N$ )   |
|             | If in_def is NULL, then it is set to Y.  |
| in_row      | Specifies whether these compartments should be in the row label $(Y/N)$  |
|             | If in_row is NULL, then it is set to N.  |

### **Example**

The following example adds compartments to the hr\_ols\_pol policy.

```
BEGIN

SA_USER_ADMIN.ADD_COMPARTMENTS (

policy_name => 'hr_ols_pol',

user_name => 'jjones',

comps => 'FIN',

access_mode => SA_UTL.READ_ONLY,

in_def => 'y',

in_row => 'y');

END;
```

# SA\_USER\_ADMIN.ADD\_GROUPS

The SA\_USER\_ADMIN.ADD\_GROUPS procedure adds (assigns) groups to a user, indicating if the groups are authorized for write and read privileges.

This procedure is useful if you have already used the <code>SA\_USER\_ADMIN.SET\_GROUPS</code> procedure for the user but then decide that you want to grant this user authorization for additional groups or to update the current set of groups. You also can use it in place of <code>SA\_USER\_ADMIN.SET\_GROUPS</code>.

```
SA_USER_ADMIN.ADD_GROUPS (

policy_name IN VARCHAR2,

user_name IN VARCHAR2,

groups IN VARCHAR2,

access_mode IN VARCHAR2 DEFAULT NULL,

in_def IN VARCHAR2 DEFAULT NULL,

in_row IN VARCHAR2 DEFAULT NULL);
```



# **Parameters**

Table E-56 SA\_USER\_ADMIN.ADD\_GROUPS Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| user_name   | Specifies the user. This user can be either a new user or a user who has already been authorized for this policy's groups. To find an existing user, query the USER_NAME column of the DBA_SA_USER_GROUPS view. |
| groups      | A comma-delimited list of groups to add, by short name only. To find a list of existing groups, query the SHORT_NAME column of the ALL_SA_GROUPS view.  |
| access_mode | One of two public variables that contain string values that can specify the type of access authorized. The variable names, values, and meaning are as follows:  |
|             | SA_UTL.READ_ONLY indicates no write access  |
|             | <ul> <li>SA_UTL.READ_WRITE indicates that write is authorized</li> </ul>  |
|             | <ul> <li>If access_mode is NULL, then access_mode is set to<br/>SA_UTL.READ_ONLY.</li> </ul>  |
| in_def      | Specifies whether these groups should be in the default groups ( $Y/N$ )  |
|             | If in_def is NULL, then it is set to Y.   |
| in_row      | Specifies whether these groups should be in the row label ( $Y/N$ )   |
|             | If in_row is NULL, then it is set to N.   |

# **Example**

The following example adds several groups to the hr\_ols\_pol policy.

# SA\_USER\_ADMIN.ALTER\_COMPARTMENTS

The SA\_USER\_ADMIN.ALTER\_COMPARTMENTS procedure changes the write access, default label indicator, and row label indicator for the specified compartments.



#### **Parameters**

Table E-57 SA\_USER\_ADMIN.ALTER\_COMPARTMENTS Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name   | Specifies the user who has been authorized for the compartment. To find authorized users, query the USER_NAME column of the DBA_SA_USER_COMPARTMENTS view.               |
| comps       | A comma-delimited list of compartments to modify, using the short name only. To find existing compartments, query the SHORT_NAME column of the ALL_SA_COMPARTMENTS view. |
| access_mode | One of two public variables that contain string values that can specify the type of access authorized. The variable names, values, and meaning are as follows:           |
|             | SA_UTL.READ_ONLY indicates no write access   |
|             | SA_UTL.READ_WRITE indicates that write is authorized   |
|             | If access_mode is NULL, then access_mode for the compartment is unaltered.   |
| in_def      | Specifies whether these compartments should be in the default compartments ( $Y/N$ )   |
|             | If $in\_def$ is NULL, then $in\_def$ for the compartment is unaltered.   |
| in_row      | Specifies whether these compartments should be in the row label $(Y/N)$  |
|             | If in_row is NULL, then in_row for the compartment is unaltered.   |
|             | If $in\_def$ is N, then $in\_row$ cannot be Y. This is because the row label compartments must be a subset of the session label compartments.                            |

# **Example**

The following example modifies compartments for the hr\_ols\_pol policy.

```
BEGIN

SA_USER_ADMIN.ALTER_COMPARTMENTS (

policy_name => 'hr_ols_pol',

user_name => 'jjones',

comps => 'FIN',

access_mode => SA_UTL.READ_ONLY,

in_def => 'y',

in_row => 'y');

END;
```



# SA\_USER\_ADMIN.ALTER\_GROUPS

The SA\_USER\_ADMIN.ALTER\_GROUPS procedure changes the write access, default label indicator, and row label indicator for the specified groups.

# **Syntax**

```
SA_USER_ADMIN.ALTER_GROUPS (
policy_name IN VARCHAR2,
user_name IN VARCHAR2,
groups IN VARCHAR2,
access_mode IN VARCHAR2 DEFAULT NULL,
in_def IN VARCHAR2 DEFAULT NULL,
in_row IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

Table E-58 SA\_USER\_ADMIN.ALTER\_GROUPS Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                            |
| user_name   | Specifies the user who has been authorized for the group. To find existing users, query the USER_NAME and GRP columns of the DBA_SA_USER_GROUPS view. |
| groups      | A comma-delimited list of groups to alter, by short name only. To find existing groups, query the SHORT_NAME column of the ALL_SA_GROUPS view.        |
| access_mode | Two public variables contain string values that can specify the type of access authorized. The variable names, values, and meaning are as follows:    |
|             | SA_UTL.READ_ONLY indicates no write access  |
|             | SA_UTL.READ_WRITE indicates that write is authorized  |
|             | If access_mode is NULL, then access_mode for the group is unaltered.  |
| in_def      | Specifies whether these groups should be in the default groups $(Y/N)$  |
|             | If $in\_def$ is NULL, then $in\_def$ for the group is unaltered.  |
| in_row      | Specifies whether these groups should be in the row label ( $(Y/N)$   |
|             | If in_row is NULL, then in_row for the group is unaltered.  |
|             | If $in\_def$ is N, then $in\_row$ cannot be Y. This is because the row label groups must be a subset of the session label groups.                     |

#### **Example**

The following example sets the access mode for the existing groups to be read only.

```
BEGIN
SA_USER_ADMIN.ALTER_GROUPS (
  policy_name => 'hr_ols_pol',
  user_name => 'jjones',
```



```
groups => 'ER',
access_mode => SA_UTL.READ_ONLY);
END;
/
```

# SA\_USER\_ADMIN.DROP\_ALL\_COMPARTMENTS

The SA\_USER\_ADMIN.DROP\_ALL\_COMPARTMENTS procedure drops all compartments from a user's authorizations.

#### **Syntax**

```
SA_USER_ADMIN.DROP_ALL_COMPARTMENTS (
policy_name IN VARCHAR2,
    user_name IN VARCHAR2);
```

#### **Parameters**

# Table E-59 SA\_USER\_ADMIN.DROP\_ALL\_COMPARTMENTS Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name   | Specifies the user who has been authorized for the compartment. To find existing users, query the <code>USER_NAME</code> column of the <code>DBA_SA_USER_COMPARTMENTS</code> view. |

# **Example**

The following example drops all compartments for the hr\_ols\_pol policy for user jjones.

```
BEGIN
SA_USER_ADMIN.DROP_ALL_COMPARTMENTS (
  policy_name => 'hr_ols_pol',
   user_name => 'jjones');
END;
//
```

# SA\_USER\_ADMIN.DROP\_ALL\_GROUPS

The SA\_USER\_ADMIN.DROP\_ALL\_GROUPS procedure drops all groups from a user's authorizations.

```
SA_USER_ADMIN.DROP_ALL_GROUPS (
  policy_name IN VARCHAR2,
  user_name IN VARCHAR2);
```



## **Parameters**

Table E-60 SA\_USER\_ADMIN.DROP\_ALL\_GROUPS Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name   | Specifies the user who has been authorized for the group. To find existing users, query the <code>USER_NAME</code> and <code>GRP</code> columns of the <code>DBA_SA_USER_GROUPS</code> view. |

## **Example**

The following example drops all groups from the hr\_ols\_pol policy for user jjones.

```
BEGIN
SA_USER_ADMIN.DROP_ALL_GROUPS (
  policy_name => 'hr_ols_pol',
   user_name => 'jjones');
END;
//
```

# SA\_USER\_ADMIN.DROP\_COMPARTMENTS

The SA\_USER\_ADMIN.DROP\_COMPARTMENTS procedure drops the specified compartments from a user's authorizations.

## **Syntax**

#### **Parameters**

Table E-61 SA USER ADMIN.DROP COMPARTMENTS Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                                      |
| user_name   | Specifies the user who has been authorized for the compartment. To find existing users, query the USER_NAME column of the DBA_SA_USER_COMPARTMENTS view.        |
| comps       | A comma-delimited list of compartments to drop. To find all comps for this policy, query the POLICY_NAME and COMP columns of the DBA_SA_USER_COMPARTMENTS view. |

## **Example**

The following example drops the FINANCIAL compartment from the hr\_ols\_pol policy.



```
BEGIN
SA_USER_ADMIN.DROP_COMPARTMENTS (
  policy_name => 'hr_ols_pol',
  user_name => 'jjones',
  comps => 'HR');
END;
//
```

# SA\_USER\_ADMIN.DROP\_GROUPS

The  ${\tt SA\_USER\_ADMIN.DROP\_GROUPS}$  procedure drops the specified groups from a user's authorizations.

### **Syntax**

```
SA_USER_ADMIN.DROP_GROUPS (
   policy_name IN VARCHAR2,
   user_name IN VARCHAR2,
   groups IN VARCHAR2);
```

#### **Parameters**

Table E-62 SA\_USER\_ADMIN.DROP\_GROUPS Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                            |
| user_name   | Specifies the user who has been authorized for the group. To find existing users, query the USER_NAME and GRP columns of the DBA_SA_USER_GROUPS view. |
| groups      | A comma-delimited list of groups to drop, by short name only. To find a list of groups, query the SHORT_NAME column of the ALL_SA_GROUPS view.        |

#### **Example**

The following example drops the NR\_FIN group from the hr\_ols\_pol policy.



## SA\_USER\_ADMIN.DROP\_USER\_ACCESS

The SA\_USER\_ADMIN.DROP\_USER\_ACCESS procedure removes all Oracle Label Security authorizations and privileges from the specified user.

### **Syntax**

```
SA_USER_ADMIN.DROP_USER_ACCESS (
policy_name IN VARCHAR2,
user_name IN VARCHAR2);
```

#### **Parameters**

## Table E-63 SA\_USER\_ADMIN.DROP\_USER\_ACCESS Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                         |
| user_name   | Specifies the user name. To find all users associated with this policy, query the USER_NAME and POLICY_NAME columns of the DBA_SA_USER_PRIVS view. |

### **Examples**

The following example removes user jjones's authorization for the hr\_ols\_pol policy.

# SA\_USER\_ADMIN.SET\_COMPARTMENTS

The SA\_USER\_ADMIN.SET\_COMPARTMENTS procedure assigns compartments to a user and identifies default values for the user's session label and row label.

After you have set the compartment, you can configure additional compartments by using the SA\_USER\_ADMIN.ADD\_COMPARTMENTS procedure. (See SA\_USER\_ADMIN.ADD\_COMPARTMENTS.)

All users must have their levels set before their authorized compartments can be established.

The write compartments, if specified, must be a subset of the read compartments. (The write compartments are those to which the user should have write access.)

#### **Syntax**

```
SA_USER_ADMIN.SET_COMPARTMENTS (
policy_name IN VARCHAR2,
user_name IN VARCHAR2,
read_comps IN VARCHAR2,
```



```
write_comps IN VARCHAR2 DEFAULT NULL,
def_comps IN VARCHAR2 DEFAULT NULL,
row_comps IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

Table E-64 SA\_USER\_ADMIN.SET\_COMPARTMENTS Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| user_name   | Specifies the user name to assign compartments  |
| read_comps  | A comma-delimited list of compartments authorized for read access, by short name only   |
|             | To find all compartments, query the SHORT_NAME column of the ALL_SA_COMPARTMENTS view.  |
| write_comps | A comma-delimited list of compartments authorized for write access (subset of read_comps), by short name only. If write_comps are NULL, then they are set to the read_comps.  |
| def_comps   | Specifies the default compartments, by short name only. This must be a subset of read_comps. If the def_comps are NULL, then they are set to the read_comps.  |
| row_comps   | Specifies the row compartments, by short name only. This must be a subset of write_comps and def_comps. If the row_comps are NULL, then they are set to the components in def_comps that are authorized for write access. |

## **Example**

The following example sets compartments for the hr\_ols\_pol policy.

```
BEGIN
SA_USER_ADMIN.SET_COMPARTMENTS (
  policy_name => 'hr_ols_pol',
  user_name => 'jjones',
  read_comps => 'FIN',
  write_comps => 'FIN',
  def_comps => 'FIN',
  row_comps => 'FIN');
END;
//
```

# SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL

The  ${\tt SA\_USER\_ADMIN.SET\_DEFAULT\_LABEL}$  procedure sets the user's initial session label to the one specified.

As long as the row label will still be dominated by the new write label, you can set the session label to:

 Any level equal to or less than his maximum, and equal to or greater than his minimum label

- Include any compartments in the authorized compartment list
- Include any groups in the authorized group list. (Subgroups of authorized groups are implicitly included in the authorized list.)

The row label must be dominated by the new write label that will result from resetting the session label. If this condition is not true, then the SET\_DEFAULT\_LABEL procedure will fail.

For example, suppose the current row label is S:A,B, and that you have write access to both compartments. If you attempt to set the new default label to C:A,B, then the  $SET\_LABEL$  procedure will fail. This is because the new write label would be C:A,B, which does not dominate the current row label.

To successfully reset the session label in this case, you must first lower the row label to a value that will be dominated by the resulting session label.

#### **Syntax**

```
SA_USER_ADMIN.SET_DEFAULT_LABELS (
policy_name IN VARCHAR2,
user_name IN VARCHAR2,
def_label IN VARCHAR2);
```

#### **Parameters**

Table E-65 SA USER ADMIN.SET DEFAULT LABEL Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| user_name   | Specifies the user who has been authorized with label components. To find this user, query the USER_NAME column of the ALL_SA_USER_LABELS view.   |
| def_label   | Specifies the label string to be used to initialize the user's default labels. This label may contain any compartments and groups that are authorized for read access. To find existing labels, query the LABEL column of the ALL_SA_LABELS view. |

### **Example**

The following example sets the default label for hr\_ols\_pol for user jjones.

## **Related Topics**

SA\_SESSION Session Management PL/SQL Package
 The SA\_SESSION PL/SQL package manages session behavior for user authorizations.

# SA\_USER\_ADMIN.SET\_GROUPS

The SA\_USER\_ADMIN.SET\_GROUPS procedure assigns groups to a user and identifies default values for the user's session label and row label.

All users must have their levels set before their authorized groups can be established. You can find information about a user's level authorization by querying the DBA\_SA\_USER\_LEVELS data dictionary view.

## **Syntax**

```
SA_USER_ADMIN.SET_GROUPS (policy_name IN VARCHAR2, user_name IN VARCHAR2, read_groups IN VARCHAR2, write_groups IN VARCHAR2 DEFAULT NULL, def_group IN VARCHAR2 DEFAULT NULL, row_groups IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

Table E-66 SA\_USER\_ADMIN.SET\_GROUPS Parameters

| Parameter    | Description  |
|--------------|--|
| policy_name  | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name    | Specifies the user name. This user is a first-time user for group authorization, but the user must already be authorized for levels. To find users who have been authorized for levels, query the USER_NAME column of the DBA_SA_USER_LEVELS view. |
| read_groups  | A comma-delimited list of groups authorized for read, by short name only.  |
|              | To find existing groups, query the SHORT_NAME column of the ALL_SA_GROUPS view.  |
| write_groups | A comma-delimited list of groups authorized for write, by short name only. This must be a subset of read_groups. If set to NULL, then this setting defaults to read_groups.  |
| def_groups   | Specifies the default groups, by short name only. This must be a subset of read_groups. If set to NULL, then this setting defaults to read_groups.   |
| row_groups   | Specifies the row groups, by short name only. This must be a subset of write_groups and def_groups. If set to NULL, then this setting defaults to the groups in def_groups that are authorized for write access.                                   |

### **Example**

The following example defines groups for the hr\_ols\_pol policy.

```
BEGIN
SA_USER_ADMIN.SET_GROUPS (
  policy_name => 'hr_ols_pol',
  user_name => 'jjones',
```



```
read_groups => 'ER_FIN',
write_groups => 'ER_FIN',
def_groups => 'ER_FIN',
row_groups => 'ER_FIN');
END;
```

# SA\_USER\_ADMIN.SET\_LEVELS

The SA\_USER\_ADMIN.SET\_LEVELS procedure assigns a user minimum and maximum levels and identifies default values for the user's session label and row label.

#### **Syntax**

```
SA_USER_ADMIN.SET_LEVELS (policy_name IN VARCHAR2, user_name IN VARCHAR2, max_level IN VARCHAR2, min_level IN VARCHAR2 DEFAULT NULL, def_level IN VARCHAR2 DEFAULT NULL, row_level IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

## Table E-67 SA\_USER\_ADMIN.SET\_LEVELS Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name   | Specifies the user name. This user does not need to have any Oracle Label Security authorizations before you run this procedure.   |
| max_level   | The highest level for read and write access, by short name only.   |
|             | To find existing levels, query the SHORT_NAME column of the ALL_SA_LEVELS view.  |
| min_level   | The lowest level for write access, by short name only. If set to NULL, then the default is the lowest level for the policy.  |
| def_level   | Specifies the default level (equal to or greater than the minimum level, and equal to or less than the maximum level). Use the short name only. If set to NULL, then the default is the max_level.                       |
| row_level   | Specifies the row level (equal to or greater than the minimum level, and equal to or less than the default level). Use the short name only. If set to <code>NULL</code> , then it is set to the <code>def_level</code> . |

## **Example**

The following example sets levels for the hr\_ols\_pol policy.

```
BEGIN

SA_USER_ADMIN.SET_LEVELS (

policy_name => 'hr_ols_pol',

user_name => 'jjones',

max_level => 'PUB',

min_level => 'HS');
```



```
END;
```

# SA\_USER\_ADMIN.SET\_PROG\_PRIVS

The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure sets policy-specific privileges for program units.

If the privileges parameter is NULL, then the program unit's privileges for the policy are removed.

To grant privileges to a stored program unit, you must have the  $policy\_DBA$  role, and the <code>EXECUTE</code> permission on the <code>SA\_USER\_ADMIN.SA\_USER\_ADMIN</code> package. You can use either the <code>SA\_USER\_ADMIN</code> package or Oracle Enterprise Manager to manage Oracle Label Security privileges.

### **Syntax**

```
SA_USER_ADMIN.SET_PROG_PRIVS (
policy_name IN VARCHAR2,
schema_name IN VARCHAR2,
program_unit_name IN VARCHAR2,
privileges IN VARCHAR2);
```

#### **Parameters**

Table E-68 SA\_SESSION.SET\_LABEL Parameters

| Parameter         | Description   |
|-------------------|---|
| policy_name       | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.                                      |
| schema_name       | The name of the schema that contains the program unit   |
| program_unit_name | Specifies the program unit to be granted privileges   |
| privileges        | A comma-delimited character string of policy-specific privileges. If you set privileges to NULL, then the program unit's privileges for the policy are removed. |
|                   | See About Granting Privileges to Users and Trusted Program Units for the Policy for list of available privileges to grant.                                      |

### **Example**

The following example gives the READ privilege to the SUM\_PURCHASES function (described in Example: Trusted Stored Program Unit):



When the <code>check\_emp\_hours</code> procedure is then called, it runs with the <code>READ</code> privilege as well as the current user's Oracle Label Security privileges. Using this technique, the user can be allowed to find the value of the total employee hours that were logged, without learning what hours any individual employee logged.

## SA\_USER\_ADMIN.SET\_ROW\_LABEL

The SA\_USER\_ADMIN.SET\_ROW\_LABEL procedure sets a user's initial row label to the one specified.

The user can set the row label independently, but only to:

- A level that is less than or equal to the level of the session label, and greater than or equal to the user's minimum level
- Include a subset of the compartments and groups from the session label, for which the user is authorized to have write access

If you try to set the row label to an invalid value, then the operation is disallowed, and the row label value is unchanged.

## **Syntax**

```
SA_USER_ADMIN.SET_ROW_LABEL (
policy_name IN VARCHAR2,
user_name IN VARCHAR2,
row_label IN VARCHAR2);
```

#### **Parameters**

Table E-69 SA\_USER\_ADMIN.SET\_ROW\_LABEL Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| user_name   | Specifies the user name. This user must have the sufficient compartment, group, and level authorizations. To find this user, query the USER_NAME column of the DBA_SA_USER_COMPARTMENTS, DBA_SA_USER_GROUPS, and DBA_SA_USER_LEVELS views.  |
| row_label   | Specifies the label string to be used to initialize the user's row label. The label must contain only those compartments and groups from the default label that are authorized for write access. To find existing compartments and groups, query the ALL_SA_COMPARTMENTS and ALL_SA_GROUPS views. |

#### **Example**

The following example sets the row label for the hr\_ols\_pol policy for user jjones.

#### BEGIN



```
END;
```

SA\_SESSION.SET\_ROW\_LABEL

The SA\_SESSION.SET\_ROW\_LABEL procedure sets the default row label value for the current database session.

# SA\_USER\_ADMIN.SET\_USER\_LABELS

The SA\_USER\_ADMIN.SET\_USER\_LABELS procedure sets the user's levels, compartments, and groups using a set of labels, instead of the individual components.

## **Syntax**

```
SA_USER_ADMIN.SET_USER_LABELS (
policy_name IN VARCHAR2,
user_name IN VARCHAR2,
max_read_label IN VARCHAR2,
max_write_label IN VARCHAR2 DEFAULT NULL,
min_write_label IN VARCHAR2 DEFAULT NULL,
def_label IN VARCHAR2 DEFAULT NULL,
row_label IN VARCHAR2 DEFAULT NULL);
```

#### **Parameters**

Table E-70 SA\_USER\_ADMIN.SET\_USER\_LABELS Parameters

| Devementer      | Description   |
|-----------------|---|
| Parameter       | Description   |
| policy_name     | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| user_name       | Specifies the user name. The user can be an existing database user, a Real Application Security user, or any named user that resides in Oracle Internet Directory. This user does not need any Oracle Label Security authorizations before you run this procedure.                            |
| max_read_label  | Specifies the label string to be used to initialize the user's maximum authorized read label. Composed of the user's maximum level, compartments authorized for read access, and groups authorized for read access.   |
|                 | To find information for these settings, query the DBA_SA_USERS data dictionary view.  |
| max_write_label | Specifies the label string to be used to initialize the user's maximum authorized write label. Composed of the user's maximum level, compartments authorized for write access, and groups authorized for write access. If max_write_label is not specified, then it is set to max_read_label. |
| min_write_label | Specifies the label string to be used to initialize the user's minimum authorized write label. Contains only the level, with no compartments or groups. If min_write_label is not specified, then it is set to the lowest defined level for the policy, with no compartments or groups.       |



Table E-70 (Cont.) SA\_USER\_ADMIN.SET\_USER\_LABELS Parameters

| Parameter | Description   |
|-----------|---|
| def_label | Specifies the label string to be used to initialize the user's session label, including level, compartments, and groups (a subset of max_read_label). If default_label is not specified, then it is set to max_read_label.  |
| row_label | Specifies the label string to be used to initialize the program's row label. Includes level, components, and groups: subsets of max_write_label and def_label. If row_label is not specified, then it is set to def_label, with only the compartments and groups authorized for write access. |

### **Examples**

The following example sets user labels for the hr\_ols\_pol policy for user jjones.

```
BEGIN

SA_USER_ADMIN.SET_USER_LABELS (

policy_name => 'hr_ols_pol',

user_name => 'jjones',

max_read_label => 'HS:FIN',

max_write_label => 'HS',

def_label => 'HS',

row_label => 'HS');

END;

/
```

The following example sets user labels for the XSOLSPOL1 policy for the Oracle Database Real Application Security user XSUSER1. To execute the following example, you must either be an administrative user named LBACSYS, be granted the LBAC\_DBA database role and granted the EXECUTE privilege, or be granted the XSOLSPOL1\_DBA role and granted the EXECUTE privilege on the SA\_USER\_ADMIN package.

```
EXEC SA_USER_ADMIN.SET_USER_LABELS('XSOLSPOL1', 'XSUSER1', 'MID');
```

## In this specification:

- XSOLSPOL1 is the name of an existing OLS policy.
- XSUSER1 is the name of an existing Oracle Database Real Application Security user.
- MID is the value of the max\_read\_label.
- MID is the value of the max\_write\_label.

#### **Related Topics**

SA\_USER\_ADMIN.SET\_PROG\_PRIVS

The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure sets policy-specific privileges for program units.



# SA\_USER\_ADMIN.SET\_USER\_PRIVS

The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure sets policy-specific privileges for users.

These privileges do not become effective until the next time the user logs into the database. The new set of privileges replaces any existing privileges. A NULL value for the privileges parameter removes the user's privileges for the policy.

To assign policy privileges to users, you must have the EXECUTE privilege for the SA\_USER\_ADMIN package, and must have been granted the policy\_DBA role.

## **Syntax**

```
SA_USER_ADMIN.SET_USER_PRIVS (
policy_name IN VARCHAR2,
user_name IN VARCHAR2,
privileges IN VARCHAR2);
```

#### **Parameters**

Table E-71 SA\_USER\_ADMIN.SET\_USER\_PRIVS Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.   |
| user_name   | The name of the user to be granted privileges. The user can be an existing database user, a Real Application Security user, or any named user that resides in Oracle Internet Directory. This user should already have been authorized for policy levels, compartments, and groups. To find this user, query the USER_NAME column of the DBA_SA_USER_COMPARTMENTS, DBA_SA_USER_GROUPS, and DBA_SA_USER_LABELS views. |
| privileges  | A character string of policy-specific privileges separated by commas. See About Granting Privileges to Users and Trusted Program Units for the Policy for list of available privileges to grant.   |

#### **Examples**

The following example grants user <code>jgodfrey</code> full privileges for the <code>hr\_ols\_pol</code> policy settings.

The following example grants Oracle Database Real Application Security user XSUSER1 the READ privilege for the Oracle Label Security policy XSOLSPOL1. To execute the following example, you must either be an administrative user named LBACSYS, be

granted the LBAC\_DBA database role and granted the EXECUTE privilege, or be granted the XSOLSPOL1\_DBA role and granted the EXECUTE privilege on the SA\_USER\_ADMIN package.

EXEC SA\_USER\_ADMIN.SET\_USER\_PRIVS('XSOLSPOL1', 'XSUSER1','READ');

#### In this specification:

- XSOLSPOL1 is the name of an existing OLS policy.
- XSUSER1 is the name of an existing Oracle Database Real Application Security user.
- READ is the privilege to be granted to XSUSER1 in OLS policy XSOLSPOL1.

## **Related Topics**

About Granting Privileges to Users and Trusted Program Units for the Policy
After you have authorized users for policy levels, compartments, and groups, you
are ready to grant the user privileges.

# SA\_UTL PL/SQL Utility Functions and Procedures

The  $SA\_UTL$  PL/SQL package contains utility functions and procedures that are used in PL/SQL programs.

About the SA UTL PL/SQL Package

The SA\_UTL PL/SQL package utility functions include returning the values such as user privileges or label information.

SA UTL.CHECK LABEL CHANGE

The SA\_UTL.CHECK\_LABEL\_CHANGE function checks if the user can change the data label for a policy protected table row.

SA UTL.CHECK READ

The SA\_UTL.CHECK\_READ function checks if a user can read a policy-protected table row.

SA UTL.CHECK WRITE

The  ${\tt SA\_UTL.CHECK\_WRITE}$  function to checks if the user can insert, update, or delete data in a policy protected table row.

SA UTL.DATA LABEL

The SA\_UTL.DATA\_LABEL function returns TRUE if the label is a data label.

SA UTL.GREATEST LBOUND

The SA\_UTL.GREATEST\_LBOUND function returns a label that is the greatest lower bound of the two label arguments.

SA UTL.LEAST UBOUND

The  ${\tt SA\_UTL.LEAST\_UBOUND}$  function returns a label that is the least upper bound of the label arguments.

SA UTL.NUMERIC LABEL

The SA\_UTL.NUMERIC\_LABEL function returns the current session label.

SA\_UTL.NUMERIC\_ROW\_LABEL

The SA UTL.NUMERIC ROW LABEL function returns the current row label. .

SA\_UTL.SET\_LABEL

The <code>SA\_UTL.SET\_LABEL</code> procedure sets the label of the current database session.



## SA\_UTL.SET\_ROW\_LABEL

The SA\_UTL.SET\_ROW\_LABEL procedure sets the row label of the current database session.

# About the SA\_UTL PL/SQL Package

The SA\_UTL PL/SQL package utility functions include returning the values such as user privileges or label information.

These programs return information about the current values of the session security attributes, as numeric label values. They are primarily for use in trusted stored program units. You do not need special privileges to use this package.

## **Related Topics**

How Setting and Returning Label Information Works
 The SA\_UTL package has functions to return information about current values of session security attributes using numeric label values.

## SA\_UTL.CHECK\_LABEL\_CHANGE

The SA\_UTL.CHECK\_LABEL\_CHANGE function checks if the user can change the data label for a policy protected table row.

This function returns 1 if the user can change the data label. It returns 0 if the user cannot change the data label. The input values are the policy name, the current data label, and the new data label.

#### **Syntax**

```
SA_UTL.CHECK_LABEL_CHANGE (
policy_name IN VARCHAR2,
current_label IN NUMBER,
new_label IN NUMBER)
RETURN NUMBER;
```



You must have update privileges on the table to write any data into the table.

#### **Parameters**

Table E-72 SA\_UTL.CHECK\_LABEL\_CHANGE Parameters

| Parameter     | Description  |
|---------------|--|
| policy_name   | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| current_label | The current value of the label. To find existing label values, query the LABEL column of the ALL_SA_LABELS view.           |
| new_label     | The new value for the label  |



#### **Example**

The following example indicates if users can change data labels in policy-protected rows.

```
SET SERVEROUTPUT ON
BEGIN
   IF SA_UTL.CHECK_LABEL_CHANGE('hr_ols_pol',2000, 2200) = 1
    THEN DBMS_OUTPUT.PUT_LINE('Users can chagne data labels in policy-protected rows.');
   ELSE
    DBMS_OUTPUT.PUT_LINE('Users cannot change data labels in policy-protected rows.');
   END IF;
END;
//
```

# SA\_UTL.CHECK\_READ

The  ${\tt SA\_UTL.CHECK\_READ}$  function checks if a user can read a policy-protected table row.

This function returns 1 if the user can read the table row. It returns 0 if the user cannot read the table row.



The user must have the SELECT privilege on the table to read any data from the table.

#### **Syntax**

#### **Parameters**

#### Table E-73 SA\_UTL.CHECK\_READ Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| label       | The label to be checked. To find existing label values, query the LABEL column of the ALL_SA_LABELS view.                  |

## **Example**

The following example indicates if users can read a policy-protected row.

```
SET SERVEROUTPUT ON BEGIN
```



```
IF SA_UTL.CHECK_READ('hr_ols_pol',2000) = 1
   THEN DBMS_OUTPUT.PUT_LINE('Users can read policy-protected rows.');
ELSE
   DBMS_OUTPUT.PUT_LINE('Users cannot read policy-protected rows.');
END IF;
END;
//
```

# SA\_UTL.CHECK\_WRITE

The SA\_UTL.CHECK\_WRITE function to checks if the user can insert, update, or delete data in a policy protected table row.

The user should already have the UPDATE privilege on the table to write any data into the table. This function returns 1 if the user can write to the table row. It returns 0 if the user cannot write to the table row. The input values are the policy name and the row data label.

### **Syntax**

#### **Parameters**

Table E-74 SA\_UTL.CHECK\_WRITE Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |
| label       | The label to be checked. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view.         |

## **Example**

The following example indicates if users can write to policy-protected rows.

```
SET SERVEROUTPUT ON
BEGIN
   IF SA_UTL.CHECK_WRITE('hr_ols_pol',2000) = 1
    THEN DBMS_OUTPUT.PUT_LINE('Users can write to policy-protected rows.');
ELSE
   DBMS_OUTPUT.PUT_LINE('Users cannot write to policy-protected rows.');
END IF;
END;
//
```



# SA\_UTL.DATA\_LABEL

The SA\_UTL.DATA\_LABEL function returns TRUE if the label is a data label.

## **Syntax**

```
SA_UTL.DATA_LABEL(
  label IN NUMBER)
RETURN BOOLEAN;
```

#### **Parameters**

## Table E-75 SA\_UTL.DATA\_LABEL Parameter

| Parameter | Description  |
|-----------|--|
| label     | The label to be checked. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |

## **Example**

The following example indicates if the label 2000 is a data label.

```
SET SERVEROUTPUT ON
BEGIN

IF SA_UTL.DATA_LABEL(2000)

THEN DBMS_OUTPUT.PUT_LINE('Label 2000 is a data label.');
ELSE

DBMS_OUTPUT.PUT_LINE('Label 2000 is not a data label.');
END IF;
END;
//
```

# SA\_UTL.GREATEST\_LBOUND

The  ${\tt SA\_UTL.GREATEST\_LBOUND}$  function returns a label that is the greatest lower bound of the two label arguments.

## **Syntax**

```
SA_UTL.GREATEST_LBOUND (
  label1 IN NUMBER,
  label2 IN NUMBER)
RETURN NUMBER;
```

#### **Parameters**

#### Table E-76 SA\_UTL.GREATEST\_LBOUND Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |



## **Examples**

The following example compares existing label tags 3110 and 3111.

# SA\_UTL.LEAST\_UBOUND

The SA\_UTL.LEAST\_UBOUND function returns a label that is the least upper bound of the label arguments.

#### **Syntax**

```
SA_UTL.LEAST_UBOUND (
label1 IN NUMBER,
label2 IN NUMBER)
RETURN NUMBER;
```

#### **Parameters**

## Table E-77 SA\_UTL.LEAST\_UBOUND Parameters

| Parameter | Description   |
|-----------|---|
| label1    | The first label to check. To find existing label values, query the LABEL and TAG columns of the ALL_SA_LABELS view. |
| label2    | The second label to check   |

#### **Example**

The following example compares existing labels 3110 and 3111.



Determination of the Upper and Lower Bounds of Labels. The functions described here are the same as those described in that topic, except that these return a number instead of a character string.



# SA\_UTL.NUMERIC\_LABEL

The SA\_UTL.NUMERIC\_LABEL function returns the current session label.

This function takes a policy name as the input parameter and returns a NUMBER value.

## **Syntax**

```
SA_UTL.NUMERIC_LABEL (
   policy_name)
RETURN NUMBER;
```

#### **Parameters**

#### Table E-78 SA\_UTL.NUMERIC\_LABEL Parameter

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

#### **Example**

The following example returns a the session numeric label for the user who is currently connected to the database instance.

```
SET SERVEROUTPUT ON
DECLARE
num_label number;
BEGIN
num_label := SA_UTL.NUMERIC_LABEL('hr_ols_pol');
DBMS_OUTPUT.PUT_LINE('Numeric label: '||num_label);
END;
//
```

# SA\_UTL.NUMERIC\_ROW\_LABEL

The SA\_UTL.NUMERIC\_ROW\_LABEL function returns the current row label. .

This function takes a policy name as the input parameter and returns a NUMBER value

### **Syntax**

```
SA_UTL.NUMERIC_ROW_LABEL (
   policy_name)
RETURN NUMBER;
```



## **Parameters**

Table E-79 SA\_UTL.NUMERIC\_ROW\_LABEL Parameters

| Parameter   | Description  |
|-------------|--|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view. |

### **Examples**

The following example returns the session numeric row label for the user who is currently connected to the database instance.

```
SET SERVEROUTPUT ON
DECLARE
num_row number;
BEGIN
num_row := SA_UTL.NUMERIC_ROW_LABEL('hr_ols_pol');
DBMS_OUTPUT.PUT_LINE('Numeric row label: '||num_row);
END;
//
```

# SA\_UTL.SET\_LABEL

The SA\_UTL.SET\_LABEL procedure sets the label of the current database session.

The session's write label and row label are set to the subset of the label's compartments and groups that are authorized for write access.

## **Syntax**

```
SA_UTL.SET_LABEL (
policy_name IN VARCHAR2,
label IN LBAC_LABEL);
```

#### **Parameters**

Table E-80 SA\_UTL.SET\_LABEL Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.  |
| label       | The label to set as the session label. To find existing label values, query the LABEL column of the ALL_SA_LABELS view.   |
|             | You must pass this parameter through as an output of the TO_LBAC_DATA_LABEL function, which converts a label in character form to an LBAC_LABEL type. (The example in the next section shows how to do this.) |

## **Example**

The following example sets the label for the hr\_ols\_pol policy.



```
BEGIN
    SA_UTL.SET_LABEL (
        policy_name => 'hr_ols_pol',
        label => to_lbac_data_label('hr_ols_pol','hs:pii'));
END;
//
```

How Labeling Functions in Oracle Label Security Policies Works
 Labeling functions enable you to consider, in your rules for assigning labels, information drawn from the application context.

## SA\_UTL.SET\_ROW\_LABEL

The SA\_UTL.SET\_ROW\_LABEL procedure sets the row label of the current database session.

The compartments and groups in the label must be a subset of compartments and groups in the session label that are authorized for write access.

### **Syntax**

```
SA_UTL.SET_ROW_LABEL (
policy_name IN VARCHAR2,
label IN BINARY_INTEGER);
```

#### **Parameters**

Table E-81 SA\_UTL.SET\_ROW\_LABEL Parameters

| Parameter   | Description   |
|-------------|---|
| policy_name | Specifies the policy. To find existing policies, query the POLICY_NAME column of the ALL_SA_POLICIES data dictionary view.          |
| label       | The label to set as the session default row label. To find existing label values, query the LABEL column of the ALL_SA_LABELS view. |

#### **Example**

The following example sets the row label for the hr\_ols\_pol policy to 3000.

## **Related Topics**

SA\_SESSION Session Management PL/SQL Package
 The SA\_SESSION PL/SQL package manages session behavior for user authorizations.



F

# Oracle Label Security Reference

Oracle Label Security provides data dictionary tables and views. You should also be aware of Oracle Label Security restrictions.

- Oracle Label Security Data Dictionary Tables and Views
   Oracle Label Security provides data dictionary tables, data dictionary views, and an user-created auditing view.
- Restrictions in Oracle Label Security
   Several restrictions exist in this Oracle Label Security release.

# Oracle Label Security Data Dictionary Tables and Views

Oracle Label Security provides data dictionary tables, data dictionary views, and an user-created auditing view.

- Oracle Database Data Dictionary Tables
   Oracle Label Security does not label the Oracle data dictionary tables; accss is controlled by standard Oracle Database system and object privileges.
- Oracle Label Security Data Dictionary Views
   Oracle Label Security maintains an independent set of data dictionary views,
   which are exempt from any policy enforcement.
- Oracle Label Security User-Created Auditing View
   The SA\_AUDIT\_ADMIN.CREATE\_VIEW procedure can be used to create an audit trail view for a specific policy.

# Oracle Database Data Dictionary Tables

Oracle Label Security does not label the Oracle data dictionary tables; accss is controlled by standard Oracle Database system and object privileges.



Oracle Database Reference for detailed information about all data dictionary tables and views

# Oracle Label Security Data Dictionary Views

Oracle Label Security maintains an independent set of data dictionary views, which are exempt from any policy enforcement.

Access to the data dictionary views is granted by default to the SELECT\_CATALOG\_ROLE, a standard Oracle Database role that lets you examine the Oracle Database data dictionary.

#### ALL SA AUDIT OPTIONS View

The ALL\_SA\_AUDIT\_OPTIONS data dictionary view shows for the current user Oracle Label Security auditing options, based on the SA\_AUDIT\_ADMIN.AUDIT procedure settings.

#### ALL SA COMPARTMENTS

The ALL\_SA\_COMPARTMENTS data dictionary view shows information for the current user about Oracle Label Security policy compartments, based on the SA\_COMPONENTS.CREATE\_COMPARTMENT procedure settings.

## • ALL SA DATA LABELS

The ALL\_SA\_DATA\_LABELS data dictionary view shows for the current user Oracle Label Security policy labels and tags, based on the SA\_LABEL\_ADMIN.CREATE\_LABEL procedure settings.

## • ALL SA GROUPS

The ALL\_SA\_GROUPS data dictionary shows information about the current user's Oracle Label Security policy groups, based on the SA\_COMPONENTS.CREATE\_GROUP and SA\_COMPONENTS.ALTER GROUP PARENT procedures.

#### ALL SA LABELS

The ALL\_SA\_LABELS data dictionary view shows for the current user information about the tags and types of labels, based on SA\_LABEL\_ADMIN.CREATE\_LABEL and SA\_LABEL\_ADMIN.ALTER\_LABEL.

#### ALL SA LEVELS

The ALL\_SA\_LEVELS data dictionary view shows for the current user information about levels, based on the SA\_COMPONENTS.CREATE\_LEVEL procedure.

#### ALL SA POLICIES

The ALL\_SA\_POLICIES data dictionary view shows for the current user information about Oracle Label Security policies, based on the SA\_SYSDBA.CREATE\_POLICY procedure.

## ALL\_SA PROG PRIVS

The ALL\_SA\_PROG\_PRIVS data dictionary view shows for the current user information about the policy-specific privileges for program units, based on SA USER ADMIN.SET PROG PRIVS.

#### ALL SA SCHEMA POLICIES

The ALL\_SA\_SCHEMA\_POLICIES data dictionary view shows for the current user information about policies applied to all tables in the schema, based on SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY.

## • ALL SA TABLE POLICIES

The ALL\_SA\_TABLE\_POLICIES data dictionary view shows for the current user information about a policy added to a database table, based SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY settings.

## ALL\_SA\_USERS

The ALL\_SA\_USERS data dictionary view shows for the current user information about Oracle Label Security user privileges, based on SA\_USER\_ADMIN.SET\_USER\_LABELS and SA\_USER\_ADMIN.SET\_USER\_PRIVS.

#### ALL SA USER LABELS

The ALL\_SA\_USER\_LABELS data dictionary view shows for the current user label-specific information about users, based on the SA\_USER\_ADMIN.SET\_USER\_LABELS procedure settings.



## ALL\_SA\_USER\_LEVELS

The ALL\_SA\_USER\_LEVELS data dictionary view shows for the current user the minimum and maximum levels assigned to users, based on the SA\_USER\_ADMIN.SET\_LEVELS procdure.

#### ALL SA USER PRIVS

The ALL\_SA\_USER\_PRIVS data dictionary view shows for the current user policy-specific privileges granted to users, based on the SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure.

## CDB\_OLS\_STATUS

The CDB\_OLS\_STATUS data dictionary view shows the configuration status of Oracle Label Security in the database in a multitenant environment.

#### DBA SA AUDIT OPTIONS

The DBA\_SA\_AUDIT\_OPTIONS data dictionary view data dictionary view shows for the entire database the Oracle Label Security audit options.

#### DBA SA COMPARTMENTS

The ALL\_SA\_COMPARTMENTS data dictionary view shows for the entire database information about Oracle Label Security policy compartments.

## DBA SA DATA LABELS

The ALL\_SA\_DATA\_LABELS data dictionary view shows for the entire database the labels and label tags for the specified Oracle Label Security policy.

#### DBA SA GROUPS

The  ${\tt ALL\_SA\_GROUPS}$  data dictionary view shows for the entire database information about Oracle Label Security policy groups.

#### DBA SA GROUP HIERARCHY

The DBA\_SA\_GROUP\_HIERARCHY data dictionary view shows the hierarchy of groups (that is, parent-child relationships) in a policy.

## DBA\_SA\_LABELS

The DBA\_SA\_LABELS data dictionary view shows for the entire database information about the tags and types of labels for a policy.

#### DBA SA LEVELS

The DBA\_SA\_LEVELS data dictionary view shows for the entire database information about levels associated with a policy.

#### DBA SA POLICIES

The DBA\_SA\_POLICIES data dictionary view shows for the entire database information about Oracle Label Security policies, based on the SA\_SYSDBA.CREATE\_POLICY procedure.

## DBA SA PROG PRIVS

The DBA\_SA\_PROG\_PRIVS data dictionary view shows for the entire database information about the policy-specific privileges for program units.

#### DBA SA SCHEMA POLICIES

The DBA\_SA\_SCHEMA\_POLICIES data dictionary view shows for the entire database information about policies that have been applied to all tables in the schema.

## • DBA SA TABLE POLICIES

The DBA\_SA\_TABLE\_POLICIES data dictionary view shows for the entire database information about a policy that has been added to a database table.



#### DBA SA USERS

The DBA\_SA\_USERS data dictionary view shows for the entire database information about the privileges that Oracle Label Security users have.

#### DBA SA USER COMPARTMENTS

The DBA\_SA\_USER\_COMPARTMENTS data dictionary view shows for the entire database the user authorizations, based on the SA USER ADMIN.ADD COMPARTMENTS procedure.

#### DBA SA USER GROUPS

The DBA\_SA\_USER\_GROUPS data dictionary view shows for the entire database the groups associated with users, based on the SA\_USER\_ADMIN.ADD\_GROUPS procedure.

#### DBA SA USER LABELS

The DBA\_SA\_USER\_LABELS data dictionary view shows for the entire database label-specific information about users.

#### DBA SA USER LEVELS

The DBA\_SA\_USER\_LEVELS data dictionary view shows for the entire database the minimum and maximum levels that have been assigned to users.

## DBA SA USER PRIVS

The DBA\_SA\_USER\_PRIVS data dictionary view shows for the current user the policy-specific privileges that have been granted to users.

#### DBA OLS STATUS

The DBA\_OLS\_STATUS data dictionary view shows the configuration status of Oracle Label Security in the database.

#### USER SA SESSION

The USER\_SA\_SESSION data dictionary view shows the security attribute values for the current database session.

## ALL\_SA\_AUDIT\_OPTIONS View

The ALL\_SA\_AUDIT\_OPTIONS data dictionary view shows for the current user Oracle Label Security auditing options, based on the SA\_AUDIT\_ADMIN.AUDIT procedure settings.

## See SA AUDIT ADMIN.AUDIT.

This view displays whether auditing is configured to generate audit records per session (BY SESSION) or per access (BY ACCESS) and for successful or unsuccessful operations. Possible values are as follows:

- A dash (-) indicates that the audit option is not set.
- The S character indicates that the audit option is set BY SESSION.
- The A character indicates that the audit option is set BY ACCESS.
- Each audit option has two possible settings, WHENEVER SUCCESSFUL and WHENEVER NOT SUCCESSFUL, separated by a slash (/).

For example, in the following output, user jjones is audited with the BY ACCESS audit type for successful actions involving policy-specific privileges. User rlayton is audited with the BY SESSION audit type: audit records are written for failed attempts to remove policies and for successful attempts at setting user authorizations.



#### SELECT \* FROM DBA\_SA\_AUDIT\_OPTIONS;

| POLICY_NAME | USER_NAME | APY | REM | SET_ | PRV |
|-------------|-----------|-----|-----|------|-----|
|             |           |     |     |      |     |
| HR_OLS_POL  | JJONES    | -/- | -/- | -/-  | A/- |
| HR_OLS_POL  | RLAYTON   | -/- | -/S | S/-  | -/- |

| Column      | Datatype      | Null     | Description   |
|-------------|---------------|----------|---|
| POLICY_NAME | VARCHAR2(30)  | NOT NULL | Name of the Oracle Label<br>Security policy   |
| USER_NAME   | VARCHAR2(128) | NOT NULL | Name of the user associated with the policy   |
| APY         | VARCHAR2(3)   | NULL     | Audit option; refers to the application of specified Oracle Label Security policies to tables and schemas |
| REM         | VARCHAR2(3)   | NULL     | Audit option; refers to the removal of specified Oracle Label Security policies from tables and schemas   |
| SET_        | VARCHAR2(3)   | NULL     | Audit option; refers to the setting of user authorizations, and user and program privileges               |
| PRV         | VARCHAR2(3)   | NULL     | Audit option; refers to the use of all policy-specific privileges   |

## ALL\_SA\_COMPARTMENTS

The ALL\_SA\_COMPARTMENTS data dictionary view shows information for the current user about Oracle Label Security policy compartments, based on the SA\_COMPONENTS.CREATE\_COMPARTMENT procedure settings.

| Column      | Datatype     | Null     | Description                                 |
|-------------|--------------|----------|---|
| POLICY_NAME | VARCHAR2(30) | NOT NULL | Name of the Oracle Label Security policy    |
| COMP_NUM    | NUMBER (4)   | NOT NULL | Compartment number in the range of (0-9999) |
| SHORT_NAME  | VARCHAR2(30) | NOT NULL | Short name for the compartment              |
| LONG_NAME   | VARCHAR2(80) | NOT NULL | Long name for the compartment               |

## **Related Topics**

SA\_COMPONENTS.CREATE\_COMPARTMENT

The  ${\tt SA\_COMPONENTS.CREATE\_COMPARTMENT}$  procedure creates a compartment and specify its short name and long name.

# ALL\_SA\_DATA\_LABELS

The ALL\_SA\_DATA\_LABELS data dictionary view shows for the current user Oracle Label Security policy labels and tags, based on the SA\_LABEL\_ADMIN.CREATE\_LABEL procedure settings.



| Column      | Datatype       | Null     | Description   |
|-------------|----------------|----------|---|
| POLICY_NAME | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label<br>Security policy   |
| LABEL       | VARCHAR2(4000) | NULL     | Short name of the level, compartment, or group that was specified as the label value                    |
| LABEL_TAG   | NUMBER         | NULL     | Integer that represents the sort<br>order of the label, relative to<br>other policy labels (0-99999999) |

SA\_LABEL\_ADMIN.CREATE\_LABEL
The SA\_LABEL\_ADMIN.CREATE\_LABEL procedure creates data labels.

## ALL SA GROUPS

The ALL\_SA\_GROUPS data dictionary shows information about the current user's Oracle Label Security policy groups, based on the SA\_COMPONENTS.CREATE\_GROUP and SA\_COMPONENTS.ALTER\_GROUP\_PARENT procedures.

| Column      | Datatype     | Null     | Description  |
|-------------|--------------|----------|--|
| POLICY_NAME | VARCHAR2(30) | NOT NULL | Name of the Oracle Label<br>Security policy            |
| GROUP_NUM   | NUMBER(4)    | NOT NULL | Group number (0-9999)                                  |
| SHORT_NAME  | VARCHAR2(30) | NOT NULL | Short name of the group                                |
| LONG_NAME   | VARCHAR2(80) | NOT NULL | Long name of the group                                 |
| PARENT_NUM  | NUMBER(4)    | NULL     | Numerical ID for the associated parent group           |
| PARENT_NAME | VARCHAR2(30) | NULL     | Name of the group assigned as the parent for the group |

## **Related Topics**

SA COMPONENTS.CREATE GROUP

The SA\_COMPONENTS.CREATE\_GROUP procedure creates a group and specify its short name and long name, and optionally a parent group.

• SA\_COMPONENTS.ALTER\_GROUP\_PARENT
The SA\_COMPONENTS.ALTER\_GROUP\_PARENT procedure changes the parent group associated with a particular group.

## ALL\_SA\_LABELS

The ALL\_SA\_LABELS data dictionary view shows for the current user information about the tags and types of labels, based on SA\_LABEL\_ADMIN.CREATE\_LABEL and SA\_LABEL\_ADMIN.ALTER\_LABEL.

Access to  ${\tt ALL\_SA\_LABELS}$  is  ${\tt PUBLIC}$ . However, only the labels authorized for read access by the session are visible.



| Column      | Datatype       | Null     | Description  |
|-------------|----------------|----------|--|
| POLICY_NAME | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label<br>Security policy        |
| LABEL       | VARCHAR2(4000) | NOT NULL | Short name of the level associated with this label |
| LABEL_TAG   | NUMBER(30)     | NOT NULL | Integer tag assigned to the label                  |
| LABEL_TYPE  | VARCHAR2(15)   | NULL     | Type of label                                      |

- SA\_LABEL\_ADMIN.CREATE\_LABEL
  The SA\_LABEL\_ADMIN.CREATE\_LABEL procedure creates data labels.
- SA\_LABEL\_ADMIN.ALTER\_LABEL
   The SA\_LABEL\_ADMIN.ALTER\_LABEL procedure changes the character string label definition associated with a label tag.

## ALL SA LEVELS

The ALL\_SA\_LEVELS data dictionary view shows for the current user information about levels, based on the SA\_COMPONENTS.CREATE\_LEVEL procedure.

| Column      | Datatype     | Null     | Description                              |
|-------------|--------------|----------|--|
| POLICY_NAME | VARCHAR2(30) | NOT NULL | Name of the Oracle Label Security policy |
| LEVEL_NUM   | NUMBER (4)   | NOT NULL | Level number (0-9999)                    |
| SHORT_NAME  | VARCHAR2(30) | NOT NULL | Short name for the level                 |
| LONG_NAME   | VARCHAR2(80) | NOT NULL | Long name for the level                  |

## **Related Topics**

• SA\_COMPONENTS.CREATE\_LEVEL
The SA\_COMPONENTS.CREATE\_LEVEL procedure creates a level and specify its short name and long name.

## ALL\_SA\_POLICIES

The ALL\_SA\_POLICIES data dictionary view shows for the current user information about Oracle Label Security policies, based on the SA\_SYSDBA.CREATE\_POLICY procedure.

| Column      | Datatype      | Null     | Description   |
|-------------|---------------|----------|---|
| POLICY_NAME | VARCHAR2(30)  | NOT NULL | Name of the Oracle Label Security policy                            |
| COLUMN_NAME | VARCHAR2(128) | NOT NULL | Name of the column that was added to tables protected by the policy |
| STATUS      | VARCHAR2(8)   | NULL     | Whether the policy has been enabled or disabled                     |



| Column          | Datatype       | Null | Description  |
|-----------------|----------------|------|--|
| POLICY_OPTION S | VARCHAR2(4000) | NULL | Options that were set for this policy  |
|                 |                |      | See Categories of Policy<br>Enforcement Options for a listing<br>of the possible enforcement<br>options. |

SA\_SYSDBA.CREATE\_POLICY

The SA\_SYSDBA.CREATE\_POLICY procedure creates a new Oracle Label Security policy, defines a policy-specific column name, and specifies default policy options.

## ALL SA PROG PRIVS

The ALL\_SA\_PROG\_PRIVS data dictionary view shows for the current user information about the policy-specific privileges for program units, based on SA\_USER\_ADMIN.SET\_PROG\_PRIVS.

| Column                 | Datatype       | Null     | Description   |
|------------------------|----------------|----------|---|
| SCHEMA_NAME            | VARCHAR2(128)  | NOT NULL | Name of the schema that contains the program unit   |
| PROGRAM_NAME           | VARCHAR(128)   | NOT NULL | Program unit that was granted privileges  |
| POLICY_NAME            | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label<br>Security policy   |
| PROGRAM_PRIVILEG<br>ES | VARCHAR2(4000) | NULL     | Policy-specific privileges.  See About Granting Privileges to Users and Trusted Program Units for the Policy for list of possible privileges. |

## **Related Topics**

SA USER ADMIN.SET PROG PRIVS

The SA\_USER\_ADMIN.SET\_PROG\_PRIVS procedure sets policy-specific privileges for program units.

## ALL\_SA\_SCHEMA\_POLICIES

The ALL\_SA\_SCHEMA\_POLICIES data dictionary view shows for the current user information about policies applied to all tables in the schema, based on SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY.

| Column      | Datatype      | Null     | Description                                    |
|-------------|---------------|----------|--|
| POLICY_NAME | VARCHAR2(30)  | NOT NULL | Name of the Oracle Label Security policy       |
| SCHEMA_NAME | VARCHAR2(128) | NOT NULL | Name of the schema associated with this policy |



| Column         | Datatype       | Null | Description  |
|----------------|----------------|------|--|
| STATUS         | VARCHAR2(8)    | NULL | Whether the policy has been enabled or disabled for the schema (by the SA_POLICY_ADMIN.APPLY_SCHEMA _POLICY or SA_POLICY_ADMIN.DISABLE_SCHE MA_POLICY for procedure) |
| SCHEMA_OPTIONS | VARCHAR2(4000) | NULL | Options that have been applied.  |

## SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY

The SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY procedure applies a policy to all of the tables in a schema and enables the policy for these tables.

Categories of Policy Enforcement Options
 Oracle Label Security enforces policies using three categories: label management options, access control options, and overriding options.

# ALL\_SA\_TABLE\_POLICIES

The ALL\_SA\_TABLE\_POLICIES data dictionary view shows for the current user information about a policy added to a database table, based SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY settings.

| Column        | Datatype       | Null     | Description   |
|---------------|----------------|----------|---|
| POLICY_NAME   | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label Security policy  |
| SCHEMA_NAME   | VARCHAR2(128)  | NOT NULL | Schema that contains the table that the policy protects   |
| TABLE_NAME    | VARCHAR2(128)  | NOT NULL | Table to be protected by the policy   |
| STATUS        | VARCHAR2(8)    | NULL     | Whether the policy has been enabled or disabled for the table (by the SA_POLICY_ADMIN.APPLY_TABLE _POLICY or SA_POLICY_ADMIN.DISABLE_TAB LE_POLICY for procedure) |
| TABLE_OPTIONS | VARCHAR2(4000) | NULL     | Policy enforcement options to be used for the table   |
| FUNCTION      | VARCHAR2(1024) | NULL     | Name of the function to return a label value to use as the default  |
| PREDICATE     | VARCHAR2(256)  | NULL     | Predicate to combine (using AND or OR) with the label-based predicate for READ_CONTROL  |



SA POLICY ADMIN.APPLY TABLE POLICY

The SA\_POLICY\_ADMIN.APPLY\_TABLE\_POLICY procedure adds the specified policy to a table.

Categories of Policy Enforcement Options
 Oracle Label Security enforces policies using three categories: label management

options, access control options, and overriding options.

## ALL SA USERS

The ALL\_SA\_USERS data dictionary view shows for the current user information about Oracle Label Security user privileges, based on SA\_USER\_ADMIN.SET\_USER\_LABELS and SA\_USER\_ADMIN.SET\_USER\_PRIVS.

| Column                  | Туре           | Null     | Description  |
|-------------------------|----------------|----------|--|
| USER_NAME               | VARCHAR2(1024) | NOT NULL | Name of the user   |
| POLICY_NAME             | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label Security policy   |
| USER_PRIVILEGES         | VARCHAR2(4000) | NULL     | Policy-specific privileges granted to the user.  |
| MAX_READ_LABEL          | VARCHAR2(4000) | NULL     | Label string to initialize the user's maximum authorized read label  |
| MAX_WRITE_LABEL         | VARCHAR2(4000) | NULL     | Label string to initialize the user's maximum authorized write label   |
| MIN_WRITE_LABEL         | VARCHAR2(4000) | NULL     | Label string to initialize the user's minimum authorized write label   |
| DEFAULT_READ_LAB<br>EL  | VARCHAR2(4000) | NULL     | Label string to initialize the user's session label, including level, compartments, and groups, for read access  |
| DEFAULT_WRITE_LA<br>BEL | VARCHAR2(4000) | NULL     | Label string to initialize the user's session label, including level, compartments, and groups, for write access |
| DEFAULT_ROW_LABE<br>L   | VARCHAR2(4000) | NULL     | Label string to initialize the program's row label; includes level, components, and groups                       |
| USER_LABELS             | VARCHAR2(4000) | NULL     | Retained solely for backward compatibility and will be removed in the next release                               |

## **Related Topics**

SA USER ADMIN.SET USER LABELS

The SA\_USER\_ADMIN.SET\_USER\_LABELS procedure sets the user's levels, compartments, and groups using a set of labels, instead of the individual components.

SA USER ADMIN.SET USER PRIVS

The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure sets policy-specific privileges for users.



About Granting Privileges to Users and Trusted Program Units for the Policy
After you have authorized users for policy levels, compartments, and groups, you
are ready to grant the user privileges.

## ALL\_SA\_USER\_LABELS

The ALL\_SA\_USER\_LABELS data dictionary view shows for the current user label-specific information about users, based on the SA\_USER\_ADMIN.SET\_USER\_LABELS procedure settings.

| Column                  | Datatype       | Null     | Description  |
|-------------------------|----------------|----------|--|
| USER_NAME               | VARCHAR2(1024) | NOT NULL | Name of the user   |
| POLICY_NAME             | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label<br>Security policy  |
| LABELS                  | VARCHAR2(4000) | NULL     | Retained solely for backward compatibility and will be removed in the next release                               |
| MAX_READ_LABEL          | VARCHAR2(4000) | NOT NULL | Label string to initialize the user's maximum authorized read label  |
| MAX_WRITE_LABEL         | VARCHAR2(4000) | NULL     | Label string to initialize the user's maximum authorized write label   |
| MIN_WRITE_LABEL         | VARCHAR2(4000) | NULL     | Label string to initialize the user's minimum authorized write label   |
| DEFAULT_READ_LAB<br>EL  | VARCHAR2(4000) | NULL     | Label string to initialize the user's session label, including level, compartments, and groups, for read access  |
| DEFAULT_WRITE_LA<br>BEL | VARCHAR2(4000) | NULL     | Label string to initialize the user's session label, including level, compartments, and groups, for write access |
| DEFAULT_ROW_LABE        | VARCHAR2(4000) | NULL     | Label string to initialize the program's row label; includes level, components, and groups                       |

## **Related Topics**

SA\_USER\_ADMIN.SET\_USER\_LABELS

The  ${\tt SA\_USER\_ADMIN.SET\_USER\_LABELS}$  procedure sets the user's levels, compartments, and groups using a set of labels, instead of the individual components.

## ALL SA USER LEVELS

The ALL\_SA\_USER\_LEVELS data dictionary view shows for the current user the minimum and maximum levels assigned to users, based on the SA\_USER\_ADMIN.SET\_LEVELS procdure.

It also lists the user's session label and row label default values.



| Column      | Datatype       | Null     | Description   |
|-------------|----------------|----------|---|
| POLICY_NAME | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label Security policy                  |
| USER_NAME   | VARCHAR2(1024) | NOT NULL | Name of the user  |
| MAX_LEVEL   | VARCHAR2(30)   | NOT NULL | Short name of the highest level for read and write access |
| MIN_LEVEL   | VARCHAR2(30)   | NOT NULL | Short name of the lowest level for read and write access  |
| DEF_LEVEL   | VARCHAR2(30)   | NOT NULL | Short name of the default level                           |
| ROW_LEVEL   | VARCHAR2(30)   | NOT NULL | Short name of the row level                               |

SA USER ADMIN.SET LEVELS

The SA\_USER\_ADMIN.SET\_LEVELS procedure assigns a user minimum and maximum levels and identifies default values for the user's session label and row label.

# ALL\_SA\_USER\_PRIVS

The ALL\_SA\_USER\_PRIVS data dictionary view shows for the current user policy-specific privileges granted to users, based on the SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure.

| Column        | Datatype         | Null     | Description                                    |
|---------------|------------------|----------|--|
| USER_NAME     | VARCHAR2(1024)   | NOT NULL | Name of the user                               |
| POLICY_NAME   | VARCHAR2(30)     | NOT NULL | Name of the Oracle Label Security policy       |
| USER_PRIVILEG | G VARCHAR2(4000) | NULL     | Policy-specific privileges granted to the user |

## **Related Topics**

- SA\_USER\_ADMIN.SET\_USER\_PRIVS
  The Garage ADMIN.SET\_USER\_PRIVE preThe Garage ADMIN.SET\_USER\_PRIVE preThe Garage ADMIN.SET\_USER\_PRIVE preThe Garage ADMIN.SET\_USER\_PRIVE
  The GARAGE AD
  - The SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure sets policy-specific privileges for users.
- About Granting Privileges to Users and Trusted Program Units for the Policy
  After you have authorized users for policy levels, compartments, and groups, you
  are ready to grant the user privileges.

## CDB\_OLS\_STATUS

The CDB\_OLS\_STATUS data dictionary view shows the configuration status of Oracle Label Security in the database in a multitenant environment.



| Column     | Datatype     | Null     | Description  |
|------------|--------------|----------|--|
| NAME       | VARCHAR2(20) | NOT NULL | Name of the status. Values are:  |
|            |              |          | • OLS_CONFIGURE_STATUS   |
|            |              |          | • OLS_DIRECTORY_STATUS   |
|            |              |          | • OLS_ENABLE_STATUS  |
| STATUS     | VARCHAR2(5)  | NOT NULL | Indicates the status of the feature mentioned in the corresponding name column. For example, a TRUE value for the OLS_CONFIGURE_STATUS status says that Oracle Label Security has been configured. |
| DESCRIPTIO | VARCHAR2(400 | NOT NULL | Description of the status:   |
| N          | 0)           |          | <ul> <li>OLS_CONFIGURE_STATUS: Determines if<br/>Oracle Label Security is configured.</li> </ul>   |
|            |              |          | <ul> <li>OLS_DIRECTORY_STATUS: Determines if<br/>Oracle Internet Directory is enabled with<br/>Oracle Label Security.</li> </ul>   |
|            |              |          | • OLS_ENABLE_STATUS: Determines if Oracle Label Security is enabled.   |
| CON_ID     | NUMBER       | NOT NULL | The container database ID number   |

## DBA\_SA\_AUDIT\_OPTIONS

The DBA\_SA\_AUDIT\_OPTIONS data dictionary view data dictionary view shows for the entire database the Oracle Label Security audit options.

Its columns are the same as ALL\_SA\_AUDIT\_OPTIONS.

## **Related Topics**

ALL\_SA\_AUDIT\_OPTIONS View

The ALL\_SA\_AUDIT\_OPTIONS data dictionary view shows for the current user Oracle Label Security auditing options, based on the SA\_AUDIT\_ADMIN.AUDIT procedure settings.

## DBA SA COMPARTMENTS

The ALL\_SA\_COMPARTMENTS data dictionary view shows for the entire database information about Oracle Label Security policy compartments.

Its columns are the same as ALL SA COMPARTMENTS.

## **Related Topics**

ALL\_SA\_COMPARTMENTS

The ALL\_SA\_COMPARTMENTS data dictionary view shows information for the current user about Oracle Label Security policy compartments, based on the SA\_COMPONENTS.CREATE\_COMPARTMENT procedure settings.



## DBA SA DATA LABELS

The ALL\_SA\_DATA\_LABELS data dictionary view shows for the entire database the labels and label tags for the specified Oracle Label Security policy.

Its columns are the same as ALL\_SA\_DATA\_LABELS.

### **Related Topics**

ALL\_SA\_DATA\_LABELS

The ALL\_SA\_DATA\_LABELS data dictionary view shows for the current user Oracle Label Security policy labels and tags, based on the SA\_LABEL\_ADMIN.CREATE\_LABEL procedure settings.

## DBA SA GROUPS

The ALL\_SA\_GROUPS data dictionary view shows for the entire database information about Oracle Label Security policy groups.

Its columns are the same as ALL\_SA\_GROUPS.

## **Related Topics**

ALL\_SA\_GROUPS

The ALL\_SA\_GROUPS data dictionary shows information about the current user's Oracle Label Security policy groups, based on the SA\_COMPONENTS.CREATE\_GROUP and SA\_COMPONENTS.ALTER\_GROUP\_PARENT procedures.

## DBA\_SA\_GROUP\_HIERARCHY

The DBA\_SA\_GROUP\_HIERARCHY data dictionary view shows the hierarchy of groups (that is, parent-child relationships) in a policy.

| Column      | Туре         | Null     | Description                              |
|-------------|--------------|----------|--|
| POLICY_NAME | VARCHAR2(30) | NOT NULL | Name of the Oracle Label Security policy |



| Column              | Туре           | Null | Description  |
|---------------------|----------------|------|--|
| HIERARCHY_LE<br>VEL | NUMBER         | NULL | Indicates the level of a particular group in a group hierarchy. A group with no parent group will have HIERARCHY_LEVEL 1. Its child group will have HIERARCHY_LEVEL 2 and so on. |
|                     |                |      | For example, consider these groups in the following order:   |
|                     |                |      | <b>1.</b> G1, G4   |
|                     |                |      | <b>2.</b> G2, G5   |
|                     |                |      | <b>3.</b> G3   |
|                     |                |      | Here, G1 and G4 have<br>HIERARCHY_LEVEL 1; G2 and G5 have<br>HIERARCHY_LEVEL 2, and G3 has<br>HIERARCHY_LEVEL 3.   |
|                     |                |      | The parent-child relationships are:  |
|                     |                |      | • G3 is the child group of G2, and G2 is the child group of G1.  |
|                     |                |      | • G5 is the child group of G4.   |
| GROUP_NAME          | VARCHAR2(4000) | NULL | Short name of the group intended to indicate the hierarchy level   |

## DBA SA LABELS

The DBA\_SA\_LABELS data dictionary view shows for the entire database information about the tags and types of labels for a policy.

Its columns are the same as ALL\_SA\_LABELS.

## **Related Topics**

ALL SA LABELS

The ALL\_SA\_LABELS data dictionary view shows for the current user information about the tags and types of labels, based on SA\_LABEL\_ADMIN.CREATE\_LABEL and SA\_LABEL\_ADMIN.ALTER\_LABEL.

## DBA\_SA\_LEVELS

The DBA\_SA\_LEVELS data dictionary view shows for the entire database information about levels associated with a policy.

Its columns are the same as ALL\_SA\_LEVELS.

## **Related Topics**

ALL SA LABELS

The ALL\_SA\_LABELS data dictionary view shows for the current user information about the tags and types of labels, based on SA\_LABEL\_ADMIN.CREATE\_LABEL and SA\_LABEL\_ADMIN.ALTER\_LABEL.



### DBA SA POLICIES

The DBA\_SA\_POLICIES data dictionary view shows for the entire database information about Oracle Label Security policies, based on the SA\_SYSDBA.CREATE\_POLICY procedure.

This view also shows whether the policy has been enabled or disabled and its subscription status.

| Column                | Datatype       | Null     | Description   |
|-----------------------|----------------|----------|---|
| POLICY_NAME           | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label Security policy  |
| COLUMN_NAME           | VARCHAR2(128)  | NOT NULL | Name of the column that was added to tables protected by the policy   |
| STATUS                | VARCHAR2(8)    | NULL     | Whether the policy has been enabled or disabled   |
| POLICY_OPTIONS        | VARCHAR2(4000) | NULL     | Options that were set for this policy.  See Categories of Policy  Enforcement Options for a listing of the possible enforcement options.    |
| POLICY_SUBSCRI<br>BED | VARCHAR2(5)    | NULL     | Indicates the policy's subscription status, based on the SA_POLICY_ADMIN.POLICY_SUBSC RIBE or SA_POLICY_ADMIN.POLICY_UNSUB SCRIBE procedure |

### DBA\_SA\_PROG\_PRIVS

The DBA\_SA\_PROG\_PRIVS data dictionary view shows for the entire database information about the policy-specific privileges for program units.

Its columns are the same as ALL\_SA\_PROG\_PRIVS.

#### **Related Topics**

ALL SA PROG PRIVS

The ALL\_SA\_PROG\_PRIVS data dictionary view shows for the current user information about the policy-specific privileges for program units, based on SA\_USER\_ADMIN.SET\_PROG\_PRIVS.

### DBA\_SA\_SCHEMA\_POLICIES

The DBA\_SA\_SCHEMA\_POLICIES data dictionary view shows for the entire database information about policies that have been applied to all tables in the schema.

Its columns are the same as ALL\_SA\_SCHEMA\_POLICIES.

#### **Related Topics**

ALL SA SCHEMA POLICIES

The ALL\_SA\_SCHEMA\_POLICIES data dictionary view shows for the current user information about policies applied to all tables in the schema, based on SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY.



### DBA SA TABLE POLICIES

The DBA\_SA\_TABLE\_POLICIES data dictionary view shows for the entire database information about a policy that has been added to a database table.

Its columns are the same as ALL\_SA\_TABLE\_POLICIES.

#### **Related Topics**

#### ALL\_SA\_SCHEMA\_POLICIES

The ALL\_SA\_SCHEMA\_POLICIES data dictionary view shows for the current user information about policies applied to all tables in the schema, based on SA\_POLICY\_ADMIN.APPLY\_SCHEMA\_POLICY.

### DBA SA USERS

The DBA\_SA\_USERS data dictionary view shows for the entire database information about the privileges that Oracle Label Security users have.

Its columns are the same as ALL\_SA\_USERS.

#### **Related Topics**

#### ALL\_SA\_USERS

The ALL\_SA\_USERS data dictionary view shows for the current user information about Oracle Label Security user privileges, based on SA\_USER\_ADMIN.SET\_USER\_LABELS and SA\_USER\_ADMIN.SET\_USER\_PRIVS.

## DBA\_SA\_USER\_COMPARTMENTS

The DBA\_SA\_USER\_COMPARTMENTS data dictionary view shows for the entire database the user authorizations, based on the SA\_USER\_ADMIN.ADD\_COMPARTMENTS procedure.

This view also indicates whether the compartments are authorized for write and read privileges

| Column      | Datatype       | Null     | Description  |
|-------------|----------------|----------|--|
| POLICY_NAME | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label Security policy                                     |
| USER_NAME   | VARCHAR2(1024) | NOT NULL | Name of the user   |
| COMP        | VARCHAR2(30)   | NOT NULL | Short name of compartments that were added                                   |
| RW_ACCESS   | VARCHAR2(5)    | NULL     | Access mode. Possible values are:  |
|             |                |          | <ul> <li>SA_UTL.READ_ONLY indicates no write access</li> </ul>               |
|             |                |          | <ul> <li>SA_UTL.READ_WRITE indicates<br/>that write is authorized</li> </ul> |
| DEF_COMP    | VARCHAR2(1)    | NOT NULL | Whether the compartments are in the default compartments                     |
| ROW_COMP    | VARCHAR2(1)    | NOT NULL | whether the compartments are in the row label                                |



#### **Related Topics**

#### SA USER ADMIN.ADD COMPARTMENTS

The SA\_USER\_ADMIN.ADD\_COMPARTMENTS procedure adds (assigns) compartments to a user's authorizations, indicating if the compartments are authorized for write and read privileges.

### DBA\_SA\_USER\_GROUPS

The DBA\_SA\_USER\_GROUPS data dictionary view shows for the entire database the groups associated with users, based on the SA\_USER\_ADMIN.ADD\_GROUPS procedure.

| Column          | Datatype       | Null     | Description   |
|-----------------|----------------|----------|---|
| POLICY_NA<br>ME | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label Security policy                                  |
| USER_NAME       | VARCHAR2(1024) | NOT NULL | Name of the user  |
| GRP             | VARCHAR2(30)   | NOT NULL | Short name of groups that were added                                      |
| RW_ACCESS       | VARCHAR2(5)    | NULL     | Access mode. Possible values are:   |
|                 |                |          | <ul> <li>SA_UTL.READ_ONLY indicates read-<br/>only access</li> </ul>      |
|                 |                |          | <ul> <li>SA_UTL.READ_WRITE indicates read<br/>and write access</li> </ul> |
| DEF_GROUP       | VARCHAR2(1)    | NOT NULL | Whether the group is in a default group                                   |
| ROW_GROUP       | VARCHAR2(1)    | NOT NULL | Whether the group is in a label   |

#### **Related Topics**

#### SA USER ADMIN.ADD GROUPS

The SA\_USER\_ADMIN.ADD\_GROUPS procedure adds (assigns) groups to a user, indicating if the groups are authorized for write and read privileges.

### DBA SA USER LABELS

The DBA\_SA\_USER\_LABELS data dictionary view shows for the entire database label-specific information about users.

Its columns are the same as ALL\_SA\_USER\_LABELS.

#### **Related Topics**

#### ALL SA USER LABELS

The ALL\_SA\_USER\_LABELS data dictionary view shows for the current user label-specific information about users, based on the SA\_USER\_ADMIN.SET\_USER\_LABELS procedure settings.

### DBA\_SA\_USER\_LEVELS

The DBA\_SA\_USER\_LEVELS data dictionary view shows for the entire database the minimum and maximum levels that have been assigned to users.

This view also shows the default values for the user's session label and row label.

Its columns are the same as ALL SA USER LEVELS.



#### **Related Topics**

#### ALL SA USER LEVELS

The ALL\_SA\_USER\_LEVELS data dictionary view shows for the current user the minimum and maximum levels assigned to users, based on the SA\_USER\_ADMIN.SET\_LEVELS procdure.

### DBA SA USER PRIVS

The DBA\_SA\_USER\_PRIVS data dictionary view shows for the current user the policy-specific privileges that have been granted to users.

Its columns are the same as ALL\_SA\_USER\_PRIVS.

#### **Related Topics**

#### ALL\_SA\_USER\_PRIVS

The ALL\_SA\_USER\_PRIVS data dictionary view shows for the current user policy-specific privileges granted to users, based on the SA\_USER\_ADMIN.SET\_USER\_PRIVS procedure.

### DBA\_OLS\_STATUS

The DBA\_OLS\_STATUS data dictionary view shows the configuration status of Oracle Label Security in the database.

| Column     | Datatype     | Null | Description  |
|------------|--------------|------|--|
| NAME       | VARCHAR2(20) | NULL | Name of the status. Values are:  |
|            |              |      | • OLS_CONFIGURE_STATUS   |
|            |              |      | • OLS_DIRECTORY_STATUS   |
|            |              |      | • OLS_ENABLE_STATUS  |
| STATUS     | VARCHAR2(5)  | NULL | Indicates the status of the feature mentioned in the corresponding name column. For example, a TRUE value for the OLS_CONFIGURE_STATUS status says that Oracle Label Security has been configured. |
| DESCRIPTIO | VARCHAR2(400 | NULL | Description of the status:   |
| N          | 0)           |      | <ul> <li>OLS_CONFIGURE_STATUS: Determines if<br/>Oracle Label Security is configured.</li> </ul>   |
|            |              |      | <ul> <li>OLS_DIRECTORY_STATUS: Determines if<br/>Oracle Internet Directory is enabled with<br/>Oracle Label Security.</li> </ul>   |
|            |              |      | <ul> <li>OLS_ENABLE_STATUS: Determines if Oracle<br/>Label Security is enabled.</li> </ul>   |

## USER\_SA\_SESSION

The USER\_SA\_SESSION data dictionary view shows the security attribute values for the current database session.

Access to this view is PUBLIC.



| Column          | Datatype       | Null     | Description   |
|-----------------|----------------|----------|---|
| POLICY_NAME     | VARCHAR2(30)   | NOT NULL | Name of the Oracle Label<br>Security policy                             |
| SA_USER_NAME    | VARCHAR2(4000) | NULL     | Name of the current session user  |
| PRIVS           | VARCHAR2(4000) | NULL     | Current session privileges  |
| MAX_READ_LABEL  | VARCHAR2(4000) | NULL     | Label string that initialized the user's maximum authorized read label  |
| MAX_WRITE_LABEL | VARCHAR2(4000) | NULL     | Label string that initialized the user's maximum authorized write label |
| MIN_LEVEL       | VARCHAR2(4000) | NULL     | Minimum Oracle Label Security level authorized for the session          |
| LABEL           | VARCHAR2(4000) | NULL     | Label for the current database session                                  |
| COMP_WRITE      | VARCHAR2(4000) | NULL     | Compartments to which the user is authorized to write                   |
| GROUP_WRITE     | VARCHAR2(4000) | NULL     | Groups to which the user is authorized to write                         |
| ROW_LABEL       | VARCHAR2(4000) | NULL     | Row label that is associated with the policy for the current session    |

## Oracle Label Security User-Created Auditing View

The  ${\tt SA\_AUDIT\_ADMIN.CREATE\_VIEW}$  procedure can be used to create an audit trail view for a specific policy.

By default, this view is named DBA\_policyname\_AUDIT\_TRAIL.

| Column      | Datatype      | Null     | Description   |
|-------------|---------------|----------|---|
| USERNAME    | VARCHAR2(128) | NULL     | Name of the user whose actions were audited   |
| USERHOST    | VARCHAR2(128) | NULL     | Client host machine name  |
| TERMINAL    | VARCHAR2(255) | NULL     | Identifier of the user's terminal   |
| TIMESTAMP   | DATE          | NULL     | Date and time of the creation of the audit trail entry (date and time of user login for entries created by AUDIT SESSION) in the local database session time zone |
| OWNER       | VARCHAR2(128) | NULL     | Creator of the object affected by the action  |
| OBJ_NAME    | VARCHAR2(128) | NULL     | Name of the object affected by the action   |
| ACTION      | NUMBER        | NOT NULL | Numeric action type code. The corresponding name of the action type is in the ACTION_NAME column.   |
| ACTION_NAME | VARCHAR2(47)  | NULL     | Name of the action type corresponding to the numeric code in the ACTION column  |



| Column                 | Datatype                        | Null     | Description  |
|------------------------|---------------------------------|----------|--|
| COMMENT_TEXT           | VARCHAR2(4000)                  | NULL     | Text comment on the audit trail entry, providing more information about the statement audited  |
|                        |                                 |          | Also indicates how the user was authenticated. The method can be one of the following:   |
|                        |                                 |          | <ul> <li>DATABASE: Authentication was done<br/>by password</li> <li>NETWORK: Authentication was done by<br/>Oracle Net Services or by strong<br/>authentication</li> </ul> |
| SESSIONID              | NUMBER                          | NOT NULL | Numeric ID for each Oracle session   |
| ENTRYID                | NUMBER                          | NOT NULL | Numeric ID for each audit trail entry in the session   |
| STATEMENTID            | NUMBER                          | NOT NULL | Numeric ID for each statement run  |
| RETURNCODE             | NUMBER                          | NOT NULL | Oracle error code generated by the action. Some useful values:   |
|                        |                                 |          | <ul><li>0: Action succeeded</li><li>2004: Security violation</li></ul>   |
| EXTENDED_TIME<br>STAMP | TIMESTAMP (6)<br>WITH TIME ZONE | NULL     | Timestamp of the creation of the audit trail entry (timestamp of user login for entries created by AUDIT SESSION) in UTC (Coordinated Universal Time) time zone            |
| OLS_COL                | VARCHAR2(4000)                  | NULL     | Name of the column that was added to the tables that Oracle Label Security protects  |

#### **Related Topics**

#### SA\_AUDIT\_ADMIN.CREATE\_VIEW

The  $SA\_AUDIT\_ADMIN.CREATE\_VIEW$  procedure creates an audit trail view named  $DBA\_policyname\_AUDIT\_TRAIL.$ 

# Restrictions in Oracle Label Security

Several restrictions exist in this Oracle Label Security release.

These restrictions are as follows:

• CREATE TABLE AS SELECT restriction

If you attempt to perform CREATE TABLE AS SELECT in a schema that is protected by an Oracle Label Security policy, then the statement will fail.

Label tag restriction

Label tags must be unique across the policies in the database. When you use multiple policies in a database, you cannot use the same numeric label tag in different policies.

Export restriction

Before Oracle Database 12c release 1 (12.1), the LBACSYS schema could not be exported due to the use of opaque types in Oracle Label Security. An export of the

entire database (parameter FULL=Y) with Oracle Label Security installed can be done, except that the LBACSYS schema would not be exported.

From Oracle Database Release 12c on, this restriction has been removed. See Full Database Export for additional details on the database versions that the export can be supported from.

Oracle Label Security removal restriction

Do not perform a DROP USER CASCADE on the LBACSYS account.

Connect to the database as user SYS, using the AS SYSDBA syntax, and run the file \$ORACLE HOME/rdbms/admin/catnools.sql to remove Oracle Label Security.

See Also:

Your platform-specific Oracle installation documentation

Shared schema support restriction

User accounts defined in the Oracle Internet Directory cannot be given individual Oracle Label Security authorizations. However, authorizations can be given to the shared schema to which the directory users are mapped.

The Oracle Label Security function SET\_ACCESS\_PROFILE can be used programmatically to set the label authorization profile to use after a user has been authenticated and mapped to a shared schema. Oracle Label Security does not enforce a mapping between users who are given label authorizations in Oracle Label Security and actual database users.

Hidden columns restriction

PL/SQL does not recognize references to hidden columns in tables. A compiler error will be generated.



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# Frequently Asked Questions about Oracle Label Security

Customers have frequently asked questions about Oracle Label Security.

- Who Uses Oracle Label Security?
   Sensitivity labels can categorize data in virtually every industry.
- How Can Oracle Label Security Address My Security Needs?
   Oracle Label Security can label data and restrict access with a high degree of granularity.
- Should I Use Oracle Label Security to Protect All My Tables?
   No, you should not use Oracle Label Security to protect all of your tables.
- What Is the Difference Between Oracle Virtual Private Database and Oracle Label Security?
  - Oracle Virtual Private Database (VPD) is provided at no additional cost with the Enterprise Edition of Oracle Database.
- Can I Combine Oracle Virtual Private Database and Oracle Label Security?
   Yes. You can use a WHERE clause or a VPD policy.
- Can I Use Oracle Label Security with Oracle E-Business Suite?
   Oracle Applications use Oracle Virtual Private Database (VPD) to provide new functionality and security protections.
- Can I Use Oracle Label Security with Oracle Database Vault?
   You can protect Oracle Database Vault tables using Oracle Label Security just as you would do for an Oracle Database table.
- Does Oracle Label Security Provide Column-Level Access Control?
   No, Oracle Label Security is not column aware.
- Can I Base Secure Application Roles on Oracle Label Security?
   Yes, you can base secure application roles on Oracle Label Security.
- What Are Trusted Stored Program Units? Trusted stored program units are stored procedures, functions, and packages that execute with the system and object privileges (DAC) of the definer.
- Does VPD or OLS Add an Additional Column to the Protected Table?
   When you apply an Oracle Label Security (OLS) policy to a table, the policy adds an additional column to the table.
- Why Should the Additional OLS Row Label Column Be Hidden?
   Most applications are designed with access control mechanisms in mind, so Oracle Label Security must do this transparently.

## Who Uses Oracle Label Security?

Sensitivity labels can categorize data in virtually every industry.

These industries include health care, law enforcement, energy, retail, national security, and defense industries.

The following list gives some examples of sensitivity labels:

- Internal
- ConfidentialPhysician OnlyHighly SensitiveWidget CorporationConfidential: Chicago OperationSensitive: Finance: EuropeTop SecretUnclassified

# How Can Oracle Label Security Address My Security Needs?

Oracle Label Security can label data and restrict access with a high degree of granularity.

This is especially useful when multiple organizations or companies share a single application. Sensitivity labels can be used to restrict application users to an organization or to a subset of data within an organization.

Data privacy is important to consumers and regulatory measures continue to be announced. Oracle Label Security can be used to implement privacy policies on data, restricting access to only those who have a need-to-know.

# Should I Use Oracle Label Security to Protect All My Tables?

No, you should not use Oracle Label Security to protect all of your tables.

The traditional Oracle discretionary access control (DAC) object privileges such as SELECT, INSERT, UPDATE, and DELETE combined with database roles and stored procedures are sufficient in most cases. You can find a user's privileges by querying the DBA\_SYS\_PRIVS data dictionary view.

In addition, there are many other ways that you can protect access to your database tables, such using Oracle Virtual Private Database (VPD), Oracle Database Vault, Oracle Data Redaction, Transparent Data Encryption (TDE), or Transparent Sensitive Data Protection (TSDP).

# What Is the Difference Between Oracle Virtual Private Database and Oracle Label Security?

Oracle Virtual Private Database (VPD) is provided at no additional cost with the Enterprise Edition of Oracle Database.

Oracle Label Security is an add-on security option for the Oracle Database Enterprise Edition.

Oracle VPD is a term used for several powerful security features like, fine grained access control (FGAC), application context and global application context. VPD policies are written using PL/SQL, and can be assigned to an individual table or view.



An information request, that accesses a table or view protected by VPD, is modified according to the policy assigned to the table or view.

VPD policies can be as simple as enforcing access during business hours. VPD policies can restrict access by comparing the value of an attribute in an individual row with an application context value. Global application context allows an application context to be accessed across multiple database sessions, reducing or eliminating the need to create a separate application context for each user session.

Oracle Label Security is an out-of-the-box solution for row level security. No coding or software development is required, allowing the administrator to focus completely on the policy. Oracle Label Security provides an interface for creating policies, specifying enforcement options, defining data sensitivity labels, establishing user label authorizations, and protecting individual tables or schemes.

Data sensitivity labels provide a powerful and flexible method of restricting access to data. For example, data belonging to different organizations or companies can be separated using data sensitivity labels and selectively shared between companies by changing the data sensitivity label.

Depending on the complexity of the security policy, Oracle Virtual Private Database may be the preferred method for implementing your security policy. Oracle Label Security is best suited for situations where access control decisions need to be based on the sensitivity of the information.

# Can I Combine Oracle Virtual Private Database and Oracle Label Security?

Yes. You can use a WHERE clause or a VPD policy.

- A WHERE clause can be appended to an OLS policy, which provides one more level
  of granularity. An example would be that users, regardless of their label
  authorizations, are only allowed to connect from a specific IP address or subnet,
  and during business hours only.
- A VPD policy, whether column sensitive or not, can evaluate user labels and determine access to columns and rows without the need to apply data labels.

# Can I Use Oracle Label Security with Oracle E-Business Suite?

Oracle Applications use Oracle Virtual Private Database (VPD) to provide new functionality and security protections.

In addition, you can use other Oracle security products with Oracle E-Business Suite, such are Oracle Database Vault. Contact Oracle Support for more information.

# Can I Use Oracle Label Security with Oracle Database Vault?

You can protect Oracle Database Vault tables using Oracle Label Security just as you would do for an Oracle Database table.



In addition, Oracle Label Security can be used together with Database Vault features. You can assign Oracle Label Security labels to Database Vault Factors. These labels are then merged with the user clearance labels, following the algorithms documented in Merging Labels with the MERGE\_LABEL Function, before access control decisions are being made by comparing the merged user labels with the row labels.

The following example on the Oracle Technology Network Web site discusses using Oracle Label security along with Oracle Database Vault features:

http://www.oracle.com/technetwork/database/security/label-security-factors-093209.html

# Does Oracle Label Security Provide Column-Level Access Control?

No, Oracle Label Security is not column aware.

This behavior is available with Virtual Private Database (VPD). A VPD policy can be written so that it only becomes active when a certain column is part of a SQL statement against a protected table. If the *column sensitivity* switch is on, then VPD either returns only those rows for which the sensitive column values are accessible to the user, or it returns all rows with all cells in the sensitive column being empty, except those values that the user is allowed to see.

The following link on the Oracle Technology Network Web site contains an example:

http://www.oracle.com/technetwork/database/security/index-088277.html

A column-sensitive VPD policy can determine access to a specific column by evaluating OLS user labels, which this example demonstrates:

http://www.oracle.com/technetwork/database/security/ols-cs1-099558.html

# Can I Base Secure Application Roles on Oracle Label Security?

Yes, you can base secure application roles on Oracle Label Security.

The procedure that determines if the SET ROLE command is executed can evaluate OLS user labels. In this case, the OLS policy does not need to be applied to a table, since row labels are not part of this solution.

## What Are Trusted Stored Program Units?

Trusted stored program units are stored procedures, functions, and packages that execute with the system and object privileges (DAC) of the definer.

If the invoker is a user with Oracle Label Security user clearances (labels), the procedure executes with a combination of the definer's DAC privileges and the invoker's security clearances.

Trusted stored procedures are procedures that are either granted the Oracle Label Security privilege FULL or READ. When a trusted stored program unit is run, the policy



privileges in force are a combination of the invoking user's privileges and the program unit's privileges.

# Does VPD or OLS Add an Additional Column to the Protected Table?

When you apply an Oracle Label Security (OLS) policy to a table, the policy adds an additional column to the table.

The name of this column needs to be specified when the policy is initially created.

An existing column can be used to store the OLS row labels. This column must have the NUMBER(10) data type.

Oracle Virtual Private Database (VPD) does not add an additional column to the protected table.

# Why Should the Additional OLS Row Label Column Be Hidden?

Most applications are designed with access control mechanisms in mind, so Oracle Label Security must do this transparently.

When an application queries a table with a <code>SELECT FROM tablename</code> statement, it returns all columns, including the unhidden label column. Existing applications may not be designed to display an additional column, and malfunction. However, if the label column is hidden, then it is displayed only when its name is included in the SQL statement. A <code>SELECT FROM tablename</code> would return all columns as expected by the application, excluding the hidden OLS column.



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