1

Getting Started with Database Administration

To get started with database administration, you must understand basic database concepts, such as the types of database users, database security, and privileges. You must also be able to complete basic tasks, such as submitting commands and SQL to the database and creating a password file.

- Changes on Oracle Database Release 23ai for Oracle Database Administrator's Guide
  The following are changes in *Oracle Database Administrator's Guide* for Oracle Database Release 23ai.
- Types of Oracle Database Users
  The types of users and their roles and responsibilities depend on the database site. A small site can have one database administrator who administers the database for application developers and users. A very large site can find it necessary to divide the duties of a database administrator among several people and among several areas of specialization.
- Tasks of a Database Administrator
  You must complete several specific tasks to design, implement, and maintain an Oracle Database.
- SQL Statements
  The primary means of communicating with Oracle Database is by submitting SQL statements.
- Identifying Your Oracle Database Software Release
  As many as five numbers may be required to fully identify a release.
- About Database Administrator Security and Privileges
  To perform the administrative tasks of an Oracle Database DBA, you need specific privileges within the database and possibly in the operating system of the server on which the database runs. Ensure that access to a database administrator's account is tightly controlled.
- Database Administrator Authentication
  As a DBA, you often perform special operations such as shutting down or starting up a database. Because only a DBA should perform these operations, the database administrator user names require a secure authentication scheme.
- Creating and Maintaining a Database Password File
  You can create a database password file using the password file creation utility, `ORAPWD`. For some operating systems, you can create this file as part of your standard installation.
- Data Utilities
  Oracle utilities are available to help you maintain the data in your Oracle Database.

1.1 Changes on Oracle Database Release 23ai for Oracle Database Administrator's Guide

The following are changes in *Oracle Database Administrator's Guide* for Oracle Database Release 23ai.

1.1.1 New Features in 23ai

The following features are new in this release.

The new feature list for Oracle Database 23ai is too long to list in this guide. See Oracle Database New Features Release 23ai for a complete list of features.

1.1.2 Deprecated Features

The following features are deprecated in this release.

- **Oracle Persistent Memory Database**

  Oracle Persistent Memory Database (PMEM) is deprecated as of Oracle Database 23ai due to Intel discontinuing Optane Persistent Memory hardware.
  Intel has announced they will discontinue the Optane Persistent Memory product. Therefore, Oracle Persistent Memory Database is being deprecated.

- **Enterprise User Security (EUS)**

  Enterprise User Security (EUS) is deprecated with Oracle Database 23ai.

1.1.3 Desupported Features

The following features are desupported in this release.

- **Data Recovery Advisor (DRA)**

  Starting in Oracle Database 23ai, the Data Recovery Advisor (DRA) feature is desupported.
  The desupport of DRA includes desupporting the following Oracle Recovery Manager (RMAN) commands: `LIST FAILURE`, `ADVISE FAILURE`, `REPAIR FAILURE`, and `CHANGE FAILURE`. Database administrators will no longer have access to these commands. There is no replacement feature for DRA.

- **EXP Export Utility**

  The original Oracle Database Export (`exp`) utility is desupported in Oracle Database 23ai. Oracle recommends that you use Oracle Data Pump Export (`expdp`).

- **Oracle Enterprise Manager Database Express**

  Oracle Enterprise Manager Database Express (EM Express) is desupported in Oracle Database Release 23ai.
  EM Express is a web-based database management tool that is built inside Oracle Database. It supports key performance management and basic database administration functions. EM Express was deprecated in Oracle Database 21c. Many of EM Express's capabilities are now available in Oracle Cloud Infrastructure (OCI) Database Management service, Oracle Enterprise Manager Cloud Control, or Oracle SQL Developer.

  Instead of EM Express, Oracle recommends that you choose a tool that fits the requirements and deployment type (cloud, on-premises, or hybrid) from OCI Database

Management service, Oracle Enterprise Manager Cloud Control or Oracle SQL Developer Web or Oracle SQL Developer desktop products.

- **Traditional Auditing**

  Traditional auditing is desupported in Oracle Database 23ai. Oracle recommends that you use unified auditing.
  Starting with Oracle Database 23ai, unified auditing is the way forward to perform Oracle Database auditing. Unified auditing offers more flexibility to perform selective and effective auditing, which helps you focus on activities that really matter to your enterprise. Unified auditing has one single and secure unified trail, conditional policy for audit selectivity, and default preconfigured policies for simplicity. To improve security and compliance, Oracle strongly recommends that you use unified auditing.

  See *Oracle Database Security Guide*

1.2 Types of Oracle Database Users

The types of users and their roles and responsibilities depend on the database site. A small site can have one database administrator who administers the database for application developers and users. A very large site can find it necessary to divide the duties of a database administrator among several people and among several areas of specialization.

- Database Administrators
  Each database requires at least one database administrator (DBA). An Oracle Database system can be large and can have many users. Therefore, database administration is sometimes not a one-person job, but a job for a group of DBAs who share responsibility.
- Security Officers
  In some cases, a site assigns one or more security officers to a database. A security officer enrolls users, controls and monitors user access to the database, and maintains system security.
- Network Administrators
  Some sites have one or more network administrators. A network administrator, for example, administers Oracle networking products, such as Oracle Net Services.
- Application Developers
  Application developers design and implement database applications.
- Application Administrators
  An Oracle Database site can assign one or more application administrators to administer a particular application. Each application can have its own administrator.
- Database Users
  Database users interact with the database through applications or utilities.

1.2.1 Database Administrators

Each database requires at least one database administrator (DBA). An Oracle Database system can be large and can have many users. Therefore, database administration is sometimes not a one-person job, but a job for a group of DBAs who share responsibility.

A database administrator's responsibilities can include the following tasks:

- Installing and upgrading the Oracle Database server and application tools
- Allocating system storage and planning future storage requirements for the database system

- Creating primary database storage structures (tablespaces) after application developers have designed an application
- Creating primary objects (tables, views, indexes) once application developers have designed an application
- Modifying the database structure, as necessary, from information given by application developers
- Enrolling users and maintaining system security
- Ensuring compliance with Oracle license agreements
- Controlling and monitoring user access to the database
- Monitoring and optimizing the performance of the database
- Planning for backup and recovery of database information
- Maintaining archived data on tape
- Backing up and restoring the database
- Contacting Oracle for technical support

1.2.2 Security Officers

In some cases, a site assigns one or more security officers to a database. A security officer enrolls users, controls and monitors user access to the database, and maintains system security.

As a DBA, you might not be responsible for these duties if your site has a separate security officer.

See *Oracle Database Security Guide* for information about the duties of security officers.

1.2.3 Network Administrators

Some sites have one or more network administrators. A network administrator, for example, administers Oracle networking products, such as Oracle Net Services.

See *Oracle Database Net Services Administrator's Guide* for information about the duties of network administrators.

> **See Also:**
>
> Distributed Database Management, for information on network administration in a distributed environment

1.2.4 Application Developers

Application developers design and implement database applications.

Their responsibilities include the following tasks:

- Designing and developing the database application
- Designing the database structure for an application

- Estimating storage requirements for an application
- Specifying modifications of the database structure for an application
- Relaying this information to a database administrator
- Tuning the application during development
- Establishing security measures for an application during development

Application developers can perform some of these tasks in collaboration with DBAs. See *Oracle Database Development Guide* for information about application development tasks.

1.2.5 Application Administrators

An Oracle Database site can assign one or more application administrators to administer a particular application. Each application can have its own administrator.

1.2.6 Database Users

Database users interact with the database through applications or utilities.

A typical user's responsibilities include the following tasks:

- Entering, modifying, and deleting data, where permitted
- Generating reports from the data

1.3 Tasks of a Database Administrator

You must complete several specific tasks to design, implement, and maintain an Oracle Database.

> **Note:**
>
> When upgrading to a new release, back up your existing production environment, both software and database, before installation. For information on preserving your existing production database, see *Oracle Database Upgrade Guide*.

- Task 1: Evaluate the Database Server Hardware
  Evaluate how Oracle Database and its applications can best use the available computer resources.
- Task 2: Install the Oracle Database Software
  As the database administrator, you install the Oracle Database server software and any front-end tools and database applications that access the database.
- Task 3: Plan the Database
  As the database administrator, you must plan the logical storage structure of the database, the overall database design, and a backup strategy for the database.
- Task 4: Create and Open the Database
  After you complete the database design, you can create the database and open it for normal use.

- Task 5: Back Up the Database
  After you create the database structure, perform the backup strategy you planned for the database.
- Task 6: Enroll System Users
  After you back up the database structure, you can enroll the users of the database in accordance with your Oracle license agreement, and grant appropriate privileges and roles to these users.
- Task 7: Implement the Database Design
  After you create and start the database, and enroll the system users, you can implement the planned logical structure database by creating all necessary tablespaces. When you have finished creating tablespaces, you can create the database objects.
- Task 8: Back Up the Fully Functional Database
  When the database is fully implemented, again back up the database. In addition to regularly scheduled backups, you should always back up your database immediately after implementing changes to the database structure.
- Task 9: Tune Database Performance
  Optimizing the performance of the database is one of your ongoing responsibilities as a DBA. Oracle Database provides a database resource management feature that helps you to control the allocation of resources among various user groups.
- Task 10: Download and Install Release Updates and Release Update Revisions
  After the database installation, download and install Release Updates (Updates) and Release Update Revisions (Revisions) for your Oracle software on a regular basis.
- Task 11: Roll Out to Additional Hosts
  After you have an Oracle Database installation properly configured, tuned, patched, and tested, you may want to roll that exact installation out to other hosts.

1.3.1 Task 1: Evaluate the Database Server Hardware

Evaluate how Oracle Database and its applications can best use the available computer resources.

This evaluation should reveal the following information:

- How many disk drives are available to the Oracle products
- How many, if any, dedicated tape drives are available to Oracle products
- How much memory is available to the instances of Oracle Database you will run (see your system configuration documentation)

1.3.2 Task 2: Install the Oracle Database Software

As the database administrator, you install the Oracle Database server software and any front-end tools and database applications that access the database.

In some distributed processing installations, the database is controlled by a central computer (database server) and the database tools and applications are executed on remote computers (clients). In this case, you must also install the Oracle Net components necessary to connect the remote systems to the computer that executes Oracle Database.

For more information on what software to install, see "Identifying Your Oracle Database Software Release".

> **See Also:**
>
> For specific requirements and instructions for installation, see the following documentation:
>
> - The Oracle documentation specific to your operating system
> - The installation guides for your front-end tools and Oracle Net drivers

1.3.3 Task 3: Plan the Database

As the database administrator, you must plan the logical storage structure of the database, the overall database design, and a backup strategy for the database.

It is important to plan how the logical storage structure of the database will affect system performance and various database management operations. For example, before creating any tablespaces for your database, you should know how many data files will comprise the tablespace, what type of information will be stored in each tablespace, and on which disk drives the data files will be physically stored. When planning the overall logical storage of the database structure, take into account the effects that this structure will have when the database is actually created and running. Consider how the logical storage structure of the database will affect:

- The performance of the computer running Oracle Database
- The performance of the database during data access operations
- The efficiency of backup and recovery procedures for the database

Plan the relational design of the database objects and the storage characteristics for each of these objects. By planning the relationship between each object and its physical storage before creating it, you can directly affect the performance of the database as a unit. Be sure to plan for the growth of the database.

In distributed database environments, this planning stage is extremely important. The physical location of frequently accessed data dramatically affects application performance.

During the planning stage, develop a backup strategy for the database. You can alter the logical storage structure or design of the database to improve backup efficiency.

It is beyond the scope of this book to discuss relational and distributed database design. If you are not familiar with such design issues, see accepted industry-standard documentation.

Oracle Database Structure and Storage, and Schema Objects, provide specific information on creating logical storage structures, objects, and integrity constraints for your database.

1.3.4 Task 4: Create and Open the Database

After you complete the database design, you can create the database and open it for normal use.

You can create a database at installation time, using the Database Configuration Assistant, or you can supply your own scripts for creating a database.

> **See Also:**
>
> - *Oracle Multitenant Administrator's Guide* for information on creating a database
> - *Oracle Database SQL Language Reference* for guidance in starting up the database

1.3.5 Task 5: Back Up the Database

After you create the database structure, perform the backup strategy you planned for the database.

Create any additional redo log files, take the first full database backup (online or offline), and schedule future database backups at regular intervals.

> **See Also:**
>
> *Oracle Database Backup and Recovery User's Guide*

1.3.6 Task 6: Enroll System Users

After you back up the database structure, you can enroll the users of the database in accordance with your Oracle license agreement, and grant appropriate privileges and roles to these users.

See Managing Users and Securing the Database for guidance in this task.

1.3.7 Task 7: Implement the Database Design

After you create and start the database, and enroll the system users, you can implement the planned logical structure database by creating all necessary tablespaces. When you have finished creating tablespaces, you can create the database objects.

Oracle Database Structure and Storage and Schema Objects provide information on creating logical storage structures and objects for your database.

1.3.8 Task 8: Back Up the Fully Functional Database

When the database is fully implemented, again back up the database. In addition to regularly scheduled backups, you should always back up your database immediately after implementing changes to the database structure.

1.3.9 Task 9: Tune Database Performance

Optimizing the performance of the database is one of your ongoing responsibilities as a DBA. Oracle Database provides a database resource management feature that helps you to control the allocation of resources among various user groups.

The database resource manager is described in Managing Resources with Oracle Database Resource Manager.

> **See Also:**
>
> *Oracle Database Performance Tuning Guide* for information about tuning your database and applications

1.3.10 Task 10: Download and Install Release Updates and Release Update Revisions

After the database installation, download and install Release Updates (Updates) and Release Update Revisions (Revisions) for your Oracle software on a regular basis.

Starting with Oracle Database 18c, Oracle provides quarterly updates in the form of Release Updates (Updates) and Release Update Revisions (Revisions). Oracle no longer releases patch sets. Check the My Oracle Support website for required updates for your installation.

> **See Also:**
>
> - *Oracle Database Installation Guide* for your platform for instructions on downloading and installing Release Updates (Updates) and Release Update Revisions (Revisions)
> - My Oracle Support Note 2285040.1

1.3.11 Task 11: Roll Out to Additional Hosts

After you have an Oracle Database installation properly configured, tuned, patched, and tested, you may want to roll that exact installation out to other hosts.

Reasons to do this include the following:

- You have multiple production database systems.
- You want to create development and test systems that are identical to your production system.

Instead of installing, tuning, and patching on each additional host, you can clone your tested Oracle Database installation to other hosts, saving time and avoiding inconsistencies. There are two types of cloning available to you:

- Cloning an Oracle home—Just the configured and patched binaries from the Oracle home directory and subdirectories are copied to the destination host and *fixed* to match the new environment. You can then start an instance with this cloned home and create a database.

  You can use Oracle Enterprise Manager Cloud Control to clone an Oracle home to one or more destination hosts. You can manually clone an Oracle home using a set of provided scripts and Oracle Universal Installer.
- Cloning a database—The tuned database, including database files, initialization parameters, and so on, are cloned to an existing Oracle home (possibly a cloned home).

You can use Cloud Control to clone an Oracle database instance to an existing Oracle home.

See Also:

- *Oracle Enterprise Manager Cloud Administration Guide*
- *Oracle Enterprise Manager Lifecycle Management Administrator's Guide*
- Cloud Control online help
- *Oracle Multitenant Administrator's Guide*

1.4 SQL Statements

The primary means of communicating with Oracle Database is by submitting SQL statements.

- Submitting Commands and SQL to the Database
  There are several ways to submit SQL statements and commands to Oracle Database.
- About SQL*Plus
  SQL*Plus is the primary command-line interface to your Oracle database. You use SQL*Plus to start up and shut down the database, set database initialization parameters, create and manage users, create and alter database objects (such as tables and indexes), insert and update data, run SQL queries, and more.
- Connecting to the Database with SQL*Plus
  Connect to the Oracle Database instance using SQL*Plus.

1.4.1 Submitting Commands and SQL to the Database

There are several ways to submit SQL statements and commands to Oracle Database.

- Directly, using the command-line interface of SQL*Plus
- Indirectly, using a graphical user interface, such as Oracle Enterprise Manager Database Express (EM Express) or Oracle Enterprise Manager Cloud Control (Cloud Control)

  With these tools, you use an intuitive graphical interface to administer the database, and the tool submits SQL statements and commands behind the scenes.

  See the online help for the tool for more information.
- Directly, using SQL Developer

  Developers use SQL Developer to create and test database schemas and applications, although you can also use it for database administration tasks.

  See *Oracle SQL Developer User's Guide* for more information.

Oracle Database also supports a superset of SQL, which includes commands for starting up and shutting down the database, modifying database configuration, and so on.

> **Note:**
>
> Oracle Enterprise Manager Database Express (EM Express) is deprecated, and will be removed in a future Oracle Database release.

1.4.2 About SQL*Plus

SQL*Plus is the primary command-line interface to your Oracle database. You use SQL*Plus to start up and shut down the database, set database initialization parameters, create and manage users, create and alter database objects (such as tables and indexes), insert and update data, run SQL queries, and more.

Before you can submit SQL statements and commands, you must connect to the database. With SQL*Plus, you can connect locally or remotely. **Connecting locally** means connecting to an Oracle database running on the same computer on which you are running SQL*Plus. **Connecting remotely** means connecting over a network to an Oracle database that is running on a remote computer. Such a database is referred to as a **remote database**. The SQL*Plus executable on the local computer is provided by a full Oracle Database installation, an Oracle Client installation, or an Instant Client installation.

> **See Also:**
>
> *SQL*Plus User's Guide and Reference*

1.4.3 Connecting to the Database with SQL*Plus

Connect to the Oracle Database instance using SQL*Plus.

- About Connecting to the Database with SQL*Plus
  Oracle Database includes the following components: the Oracle Database instance, which is a collection of processes and memory, and a set of disk files that contain user data and system data.
- Step 1: Open a Command Window
  Take the necessary action on your platform to open a window into which you can enter operating system commands.
- Step 2: Set Operating System Environment Variables
  Depending on your platform, you may have to set environment variables before starting SQL*Plus, or at least verify that they are set properly.
- Step 3: Start SQL*Plus
  To connect to Oracle Database, use one of these options to start SQL*Plus.
- Step 4: Submit the SQL*Plus CONNECT Command
  Submit the SQL*Plus `CONNECT` command to initially connect to the Oracle database instance or at any time to reconnect as a different user.

1.4.3.1 About Connecting to the Database with SQL*Plus

Oracle Database includes the following components: the Oracle Database instance, which is a collection of processes and memory, and a set of disk files that contain user data and system data.

Each instance has an instance ID, also known as a system ID (SID). Because there can be multiple Oracle instances on a host computer, each with its own set of data files, you must identify the instance to which you want to connect. For a local connection, you identify the instance by setting operating system environment variables. For a remote connection, you identify the instance by specifying a network address and a database service name. For both local and remote connections, you must set environment variables to help the operating system find the SQL*Plus executable and to provide the executable with a path to its support files and scripts.

To manage objects that are shared by the multitenant container database and its pluggable databases (PDBs), such as control files, redo log files, or archived redo log files, connect to the CDB root. Objects such as tablespaces, data files, or temp files can be created in the CDB root or a PDB. To manage such objects, connect to the container that owns the object.

In the remainder of this book, connecting to the database means connecting to the CDB root.

> **See Also:**
>
> *Oracle Database Concepts* for background information about the Oracle instance

1.4.3.2 Step 1: Open a Command Window

Take the necessary action on your platform to open a window into which you can enter operating system commands.

- Open a command window.

1.4.3.3 Step 2: Set Operating System Environment Variables

Depending on your platform, you may have to set environment variables before starting SQL*Plus, or at least verify that they are set properly.

For example, on most platforms, you must set the environment variables `ORACLE_SID` and `ORACLE_HOME`. In addition, you must configure the `PATH` environment variable to include the `ORACLE_HOME/bin` directory. Some platforms may require additional environment variables:

- On Unix and Linux, set environment variables by entering operating system commands as needed.
- On Microsoft Windows, the installer automatically assigns values to `ORACLE_HOME` and `ORACLE_SID` in the Windows registry. Modify the `PATH` environment variable as needed.

If you did not create a database upon installation, then the installer does not set `ORACLE_SID` in the registry; after you create your database at a later time, you must set the `ORACLE_SID` environment variable from a command window.

Unix and Linux installations come with two scripts, `oraenv` and `coraenv`, that you can use to easily set environment variables.

For all platforms, when switching between instances with different Oracle homes, you must change the `ORACLE_HOME` environment variable. If multiple instances share the same Oracle home, then you must change only `ORACLE_SID` when switching instances.

Example 1-1 Setting Environment Variables in Unix (C Shell)

```
setenv ORACLE_SID orcl
setenv ORACLE_HOME /u01/app/oracle/product/database_release_number/dbhome_1
setenv LD_LIBRARY_PATH $ORACLE_HOME/lib:/usr/lib:/usr/dt/lib:/usr/openwin/lib:/usr/ccs/lib
```

Example 1-2 Setting Environment Variables in Linux (Bash Shell)

```
export ORACLE_SID=orcl
export ORACLE_HOME=/u01/app/oracle/product/database_release_number/dbhome_1
export LD_LIBRARY_PATH=$ORACLE_HOME/lib:/usr/lib:/usr/dt/lib:/usr/openwin/lib:/usr/ccs/lib
```

1.4.3.4 Step 3: Start SQL*Plus

To connect to Oracle Database, use one of these options to start SQL*Plus.

1. Do one of the following:
   - Ensure that the `PATH` environment variable contains *`$ORACLE_HOME`*`/bin`.
   - Change directory to *`$ORACLE_HOME`*`/bin`. Ensure that the `PATH` environment variable contains a dot (“.”).
2. Enter the following command (case-sensitive on Unix and Linux):

   ```
   sqlplus /nolog
   ```

   You can also run the `sqlplus` command by specifying its complete path:

   ```
   $ORACLE_HOME/bin/sqlplus /nolog
   ```

1.4.3.5 Step 4: Submit the SQL*Plus CONNECT Command

Submit the SQL*Plus `CONNECT` command to initially connect to the Oracle database instance or at any time to reconnect as a different user.

- In SQL*Plus, submit the `CONNECT` command.

  This command is used to connect to the CDB root or a particular PDB.

Example 1-3 Connecting to a Local Database User

This simple example connects to a local database as user `SYSTEM`. SQL*Plus prompts for the `SYSTEM` user password.

```
connect system
```

Example 1-4 Connecting to a Local Database User with SYSDBA Privilege

This example connects to a local database as user `SYS` with the `SYSDBA` privilege. SQL*Plus prompts for the `SYS` user password.

```
connect sys as sysdba
```

When connecting as user SYS, you must connect AS SYSDBA.

Example 1-5 Connecting to a Local Database User with SYSBACKUP Privilege

This example connects to a local database as user SYSBACKUP with the SYSBACKUP privilege. SQL*Plus prompts for the SYSBACKUP user password.

```
connect sysbackup as sysbackup
```

When connecting as user SYSBACKUP, you must connect AS SYSBACKUP.

Example 1-6 Connecting Locally with SYSDBA Privilege with Operating System Authentication

This example connects locally with the SYSDBA privilege with operating system authentication.

```
connect / as sysdba
```

Example 1-7 Connecting to a Pluggable Database with SYSDBA Privilege

This example connects locally to a pluggable database (PDB) named sales_pdb as user SYS with the SYSDBA privilege. SQL*Plus prompts for the SYS user password.

```
connect sys@sales_pdb as sysdba
```

When connecting as user SYS, you must connect AS SYSDBA.

Example 1-8 Connecting with Easy Connect Syntax

This example uses Easy Connect syntax to connect as user salesadmin to a remote database running on the host dbhost.example.com. The Oracle Net listener (the listener) is listening on the default port (1521). The database service is sales.example.com. SQL*Plus prompts for the salesadmin user password.

```
connect salesadmin@"dbhost.example.com/sales.example.com"
```

Example 1-9 Connecting with Easy Connect Syntax with the Service Handler Type Indicated

This example is identical to the preceding example of connecting with Easy Connect, except that the service handler type is indicated.

```
connect salesadmin@"dbhost.example.com/sales.example.com:dedicated"
```

Example 1-10 Connecting with Easy Connect Syntax with a Nondefault Listener Port

This example is identical to the preceding example of connecting with Easy Connect, except that the listener is listening on the nondefault port number 1522.

```
connect salesadmin@"dbhost.example.com:1522/sales.example.com"
```

Example 1-11 Connecting with Easy Connect Syntax with the Host IP Address

This example is identical to the preceding example of connecting with Easy Connect, except that the host IP address is substituted for the host name.

```
connect salesadmin@"192.0.2.5/sales.example.com"
```

Example 1-12 Connecting with an IPv6 Address

This example connects to the database using an Internet Protocol version 6 (IPv6) address. Note the enclosing square brackets.

```
connect salesadmin@"[2001:0DB8:0:0::200C:417A]/sales.example.com"
```

Example 1-13 Connecting by Specifying an Instance

This example specifies the instance to which to connect, and omits the database service name. Note that when you specify only the instance, you cannot specify the service handler type.

```
connect salesadmin@"dbhost.example.com/orcl"
```

Example 1-14 Connecting with a Net Service Name

This example connects remotely as user `salesadmin` to the database service designated by the net service name `sales1`. SQL*Plus prompts for the `salesadmin` user password.

```
connect salesadmin@sales1
```

Example 1-15 Connecting with External Authentication

This example connects remotely with external authentication to the database service designated by the net service name `sales1`.

```
connect /@sales1
```

Example 1-16 Connecting with SYSDBA Privilege and External Authentication

This example connects remotely with the `SYSDBA` privilege and with external authentication to the database service designated by the net service name `sales1`.

```
connect /@sales1 as sysdba
```

Example 1-17 Connecting as a User with a Service Name

This example connects remotely as user `salesadmin` to the database service designated by the net service name `sales1`. The database session starts in the `rev21` edition. SQL*Plus prompts for the `salesadmin` user password.

```
connect salesadmin@sales1 edition=rev21
```

> **Note:**
>
> If you come across any issues while connecting to the database as a user with the `SYSDBA` privileges, then refer to My Oracle Support Notes 69642.1, 233223.1, 18089.1, and 747456.1.

- Syntax of the SQL*Plus CONNECT Command
  Use the SQL*Plus `CONNECT` command to initially connect to the Oracle instance or to reconnect to the Oracle instance.

1.4.3.5.1 Syntax of the SQL*Plus CONNECT Command

Use the SQL*Plus `CONNECT` command to initially connect to the Oracle instance or to reconnect to the Oracle instance.

Syntax

```
CONN[ECT] [logon] [AS {SYSOPER | SYSDBA | SYSBACKUP | SYSDG | SYSKM | SYSRAC}]
```

The syntax of *logon* is as follows:

```
{username | /}[@connect_identifier] [edition={edition_name | DATABASE_DEFAULT}]
```

When you provide the *username*, SQL*Plus prompts for a password. The password is not echoed as you type it.

The following table describes the syntax components of the CONNECT command.

Syntax Component	Description
/	Calls for external authentication of the connection request. A database password is not used in this type of authentication. The most common form of external authentication is operating system authentication, where the database user is authenticated by having logged in to the host operating system with a certain host user account. External authentication can also be performed with an Oracle wallet or by a network service. See *Oracle Database Security Guide* for more information. See also "Using Operating System Authentication".
AS {SYSOPER | SYSDBA | SYSBACKUP | SYSDG | SYSKM | SYSRAC}	Indicates that the database user is connecting with an administrative privilege. Only certain predefined administrative users or users who have been added to the password file may connect with these privileges. See "Administrative Privileges" for more information.
username	A valid database user name. The database authenticates the connection request by matching *username* against the data dictionary and prompting for a user password.
connect_identifier (1)	An Oracle Net connect identifier, for a remote connection. The exact syntax depends on the Oracle Net configuration. If omitted, SQL*Plus attempts connection to a local instance. A common connect identifier is a *net service name*. This is an alias for an Oracle Net connect descriptor (network address and database service name). The alias is typically resolved in the tnsnames.ora file on the local computer, but can be resolved in other ways. See *Oracle Database Net Services Administrator's Guide* for more information on connect identifiers.

Syntax Component	Description
connect_identifier (2)	As an alternative, a connect identifier can use *easy connect* syntax. Easy connect provides out-of-the-box TCP/IP connectivity for remote databases without having to configure Oracle Net Services on the client (local) computer. Easy connect syntax for the connect identifier is as follows (the enclosing double-quotes must be included): "*host*[:*port*][/*service_name*][:*server*][/*instance_name*]" where: • *host* is the host name or IP address of the computer hosting the remote database. Both IP version 4 (IPv4) and IP version 6 (IPv6) addresses are supported. IPv6 addresses must be enclosed in square brackets. See *Oracle Database Net Services Administrator's Guide* for information about IPv6 addressing. • *port* is the TCP port on which the Oracle Net listener on *host* listens for database connections. If omitted, 1521 is assumed. • *service_name* is the database service name to which to connect. It can be omitted if the Net Services listener configuration on the remote host designates a default service. If no default service is configured, then *service_name* must be supplied. Each database typically offers a standard service with a name equal to the global database name, which is made up of the DB_NAME and DB_DOMAIN initialization parameters as follows: DB_NAME.DB_DOMAIN If DB_DOMAIN is null, then the standard service name is just the DB_NAME. For example, if DB_NAME is orcl and DB_DOMAIN is us.example.com, then the standard service name is orcl.us.example.com. See "*Oracle Database SQL Language Reference*" for more information. • *server* is the type of service handler. Acceptable values are dedicated, shared, and pooled. If omitted, then the default type of server is chosen by the listener: shared server if configured, otherwise dedicated server. • *instance_name* is the instance to which to connect. You can specify both service name and instance name, which you would typically do only for Oracle Real Application Clusters (Oracle RAC) environments. For Oracle RAC or single instance environments, if you specify only instance name, then you connect to the default database service. If there is no default service configured in the listener.ora file, then an error is generated. You can obtain the instance name from the INSTANCE_NAME initialization parameter. See *Oracle Database Net Services Administrator's Guide* for more information on easy connect.
edition={*edition_name* | DATABASE_DEFAULT}	Specifies the edition in which the new database session starts. If you specify an edition, then it must exist, and you must have the USE privilege on it. If this clause is not specified, then the database default edition is used for the session. See *Oracle Database Development Guide* for information on editions and edition-based redefinition.

See Also:

- "Using Operating System Authentication"
- *SQL*Plus User's Guide and Reference* for more information on the `CONNECT` command
- *Oracle Database Net Services Administrator's Guide* for more information on net service names
- *Oracle Database Net Services Reference* for information on how to define the default service in `listener.ora`

1.5 Identifying Your Oracle Database Software Release

As many as five numbers may be required to fully identify a release.

Because Oracle Database continues to evolve and can require maintenance, Oracle periodically produces new releases. Not all customers initially subscribe to a new release or require specific maintenance for their existing release. As a result, multiple releases of the product exist simultaneously.

- About Oracle Database Release Numbers
  Oracle Database releases are categorized by five numeric segments that indicate release information.
- Checking Your Current Release Number
  To identify the release of Oracle Database that is currently installed and to see the release levels of other database components you are using, query the data dictionary view `PRODUCT_COMPONENT_VERSION`.

1.5.1 About Oracle Database Release Numbers

Oracle Database releases are categorized by five numeric segments that indicate release information.

Note:

Starting with October 2022, Oracle provides quarterly updates in the form of Release Updates (Updates, or RU) and Monthly Recommended Patches (MRPs). Oracle no longer releases patch sets or bundle patch sets. MRPs replace Release Update Revisions (RURs). For more information, see My Oracle Support note 555.1.

Release Numbers and their Meaning

Oracle Database releases are released in `version` and `version_full` releases.

The `version` release is designated in the form *`major release version`*`.0.0.0.0`. The major release version is based on the last two digits of the year in which an Oracle Database version is released for the first time. For example, the Oracle Database version released for the first time in the year 2023 has the major release version of 23, and thus its `version` release is `23.0.0.0.0`. This base release number is not updated over the course of the release. You can

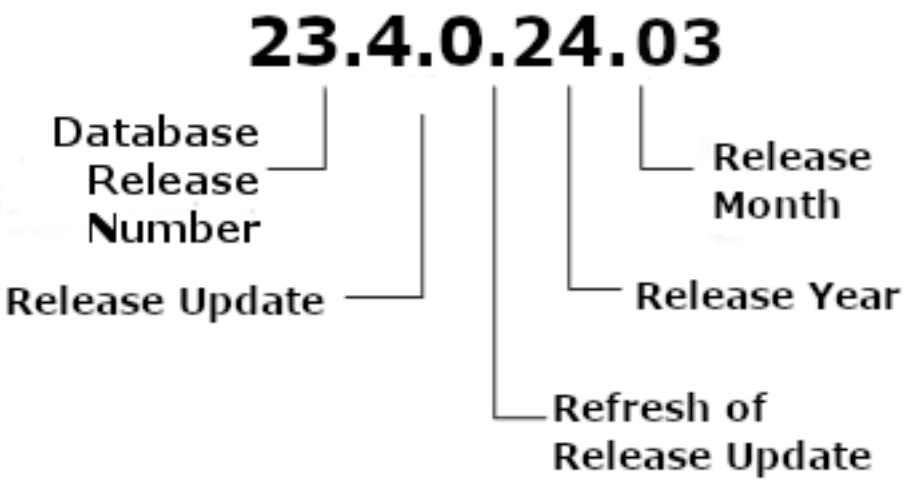
identify the base release by logging in to SQL*Plus and entering `SELECT BANNER FROM V$VERSION` to see the release displayed. For example:

```
SELECT BANNER FROM V$VERSION;

BANNER
--------------------------------------------------------------------------------
--
Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0
```

The `version_full` releases are categorized by five numeric segments separated by periods as shown in the following example:

Figure 1-1 Example of an Oracle Database Version Full Release Number



- First numeral: This numeral indicates the major release version. It also denotes the last two digits of the year in which the Oracle Database version was released for the first time.
- Second numeral: This numeral indicates the release update level. In this example, the release update is Release Update (RU) 4 (04).
- Third numeral: This numeral indicates a refresh of an RU or a Monthly Recommended Patch (MRP) version. In this example, the numeral is 0, indicating that this is the initial release of Release Update 4.
- Fourth numeral: The fourth numeral indicates the year of release for the software, RU, or MRP, by last two digits. In this example, the year is 2024 (24).
- Fifth numeral: This numeral indicates the month (01 through 12) in which a release, RU, or MRP was released. In this example, the month is March (03).

> **Note:**
>
> The first three numerals mainly identify an Oracle Database release.

You can see both the major release version and the compatibility and any RU or MRP updates by entering `SELECT BANNER_FULL FROM V$VERSION`. For example:

```
SQL> SELECT BANNER_FULL FROM V$VERSION;

BANNER_FULL
--------------------------------------------------------------------------------
--
Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0
Version 23.4.0.24.5
```

Monthly Recommended Patches and Release Updates

For each new release update (RU) after October 2022, Oracle provides to customers six MRPs for each RU, with the following characteristics:

- Each MRP for an RU contains all MRPs previously released for the RU, as well as the most current set of recommended one-off patches for the RU. These patches are documented My Oracle Support Note 555.1
- MRPs replace RURs.
- MRPs are available only for the Linux operating system.

Related Topics

- Primary Note for Database Proactive Patch Program (Doc ID 888.1)
- My Oracle Support note 2118136.2

1.5.2 Checking Your Current Release Number

To identify the release of Oracle Database that is currently installed and to see the release levels of other database components you are using, query the data dictionary view `PRODUCT_COMPONENT_VERSION`.

A sample query follows. Other product release levels may increment independent of the database server.

```
COL PRODUCT FORMAT A38
COL VERSION FORMAT A10
COL VERSION_FULL FORMAT A12
COL STATUS FORMAT A12
SELECT * FROM PRODUCT_COMPONENT_VERSION;

PRODUCT                                  VERSION    VERSION_FULL STATUS
---------------------------------------- ---------- ------------ ------------
NLSRTL                                   19.0.0.0.0 19.2.0.0.0   Production
Oracle Database 19c Enterprise Edition 19.0.0.0.0 19.2.0.0.0   Production
PL/SQL                                   19.0.0.0.0 19.2.0.0.0   Production
...
```

It is important to convey to Oracle the results of this query when you report problems with the software.

> **Note:**
>
> You can also query the `V$VERSION` view to see component-level information about all the Oracle Database components that are currently installed.

1.6 About Database Administrator Security and Privileges

To perform the administrative tasks of an Oracle Database DBA, you need specific privileges within the database and possibly in the operating system of the server on which the database runs. Ensure that access to a database administrator's account is tightly controlled.

- The Database Administrator's Operating System Account
  To perform many of the administrative duties for a database, you must be able to execute operating system commands.
- Administrative User Accounts
  Oracle Database provides several administrative user accounts that are associated with administrative privileges.

1.6.1 The Database Administrator's Operating System Account

To perform many of the administrative duties for a database, you must be able to execute operating system commands.

Depending on the operating system on which Oracle Database is running, you might need an operating system account or ID to gain access to the operating system. If so, your operating system account might require operating system privileges or access rights that other database users do not require (for example, to perform Oracle Database software installation). Although you do not need the Oracle Database files to be stored in your account, you should have access to them.

> **See Also:**
>
> Your operating system-specific Oracle documentation. The method of creating the account of the database administrator is specific to the operating system.

1.6.2 Administrative User Accounts

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

- About Administrative User Accounts
  Administrative user accounts have special privileges required to administer areas of the database, such as the `CREATE ANY TABLE` or `ALTER SESSION` privilege, or `EXECUTE` privilege on packages owned by the `SYS` schema.
- SYS
  When you create an Oracle database, the user `SYS` is automatically created with all the privileges.

- SYSTEM
  When you create an Oracle database, the user `SYSTEM` is also automatically created and granted the `DBA` role.
- SYSBACKUP, SYSDG, SYSKM, and SYSRAC
  When you create an Oracle database, the following users are automatically created to facilitate separation of duties for database administrators: `SYSBACKUP`, `SYSDG`, `SYSKM`, and `SYSRAC`.
- The DBA Role
  A predefined `DBA` role is automatically created with every Oracle Database installation. This role contains most database system privileges. Therefore, the DBA role should be granted only to actual database administrators.

1.6.2.1 About Administrative User Accounts

Administrative user accounts have special privileges required to administer areas of the database, such as the `CREATE ANY TABLE` or `ALTER SESSION` privilege, or `EXECUTE` privilege on packages owned by the `SYS` schema.

The following administrative user accounts are automatically created when Oracle Database is installed:

- `SYS`
- `SYSTEM`
- `SYSBACKUP`
- `SYSDG`
- `SYSKM`
- `SYSRAC`

Oracle recommends that you create at least one additional administrative user and grant it appropriate privileges for performing daily administrative tasks. Do not use `SYS` and `SYSTEM` for these purposes.

> **Note:**
>
> Both Oracle Universal Installer (OUI) and Database Configuration Assistant (DBCA) prompt for `SYS` and `SYSTEM` passwords and do not accept default passwords.

> **See Also:**
>
> - *Oracle Multitenant Administrator's Guide* for information about passwords for the `SYS` and `SYSTEM` users
> - *Oracle Database Security Guide* for the security checklist for configuring a database

1.6.2.2 SYS

When you create an Oracle database, the user `SYS` is automatically created with all the privileges.

All of the base tables and views for the database data dictionary are stored in the schema `SYS`. These base tables and views are critical for the operation of Oracle Database. To maintain the integrity of the data dictionary, tables in the `SYS` schema are manipulated only by the database. They should never be modified by any user or database administrator, and no one should create any tables in the schema of user `SYS`. (However, you can change the storage parameters of the data dictionary settings if necessary.)

Ensure that most database users are never able to connect to Oracle Database using the `SYS` account.

1.6.2.3 SYSTEM

When you create an Oracle database, the user `SYSTEM` is also automatically created and granted the `DBA` role.

The `SYSTEM` user name is used to create additional tables and views that display administrative information, and internal tables and views used by various Oracle Database options and tools. Never use the `SYSTEM` schema to store tables of interest to non-administrative users.

1.6.2.4 SYSBACKUP, SYSDG, SYSKM, and SYSRAC

When you create an Oracle database, the following users are automatically created to facilitate separation of duties for database administrators: `SYSBACKUP`, `SYSDG`, `SYSKM`, and `SYSRAC`.

These users separate duties in the following ways:

- `SYSBACKUP` facilitates Oracle Recovery Manager (RMAN) backup and recovery operations either from RMAN or SQL*Plus.
- `SYSDG` facilitates Data Guard operations. The user can perform operations either with Data Guard Broker or with the `DGMGRL` command-line interface.
- `SYSKM` facilitates Transparent Data Encryption keystore operations.
- `SYSRAC` facilitates Oracle Real Application Clusters (Oracle RAC) operations by connecting to the database by the Clusterware agent on behalf of Oracle RAC utilities such as SRVCTL.

  The `SYSRAC` administrative privilege cannot be granted to database users and is not supported in a password file. The `SYSRAC` administrative privilege is used only by the Oracle agent of Oracle Clusterware to connect to the database using operating system authentication.

Each of these accounts provides a designated user for the new administrative privilege with the same name. Specifically, the `SYSBACKUP` account provides a designated user for the `SYSBACKUP` administrative privilege. The `SYSDG` account provides a designated user for the `SYSDG` administrative privilege. The `SYSKM` account provides a designated user for the `SYSKM` administrative privilege.

Create a user and grant to that user an appropriate administrative privilege to use when performing daily administrative tasks. Doing so enables you to manage each user account

separately, and each user account can have a distinct password. Do not use the SYSBACKUP, SYSDG, or SYSKM user account for these purposes.

To use one of these administrative privileges, a user must exercise the privilege when connecting to a database by specifying the privilege, for example AS SYSBACKUP, AS SYSDG, or AS SYSKM. If the authentication succeeds, then the user is connected to a database with a session in which the administrative privilege is enabled. In this case, the session user is the corresponding administrative user account. For example, if user bradmin connects with the AS SYSBACKUP administrative privilege, then the session user is SYSBACKUP.

Note:

- These user accounts cannot be dropped.
- These user accounts are *schema only* accounts, that is, they are created without passwords. You can assign passwords to these user accounts whenever you want them to be authenticated.

See Also:

- "Administrative Privileges"
- *Oracle Database Security Guide*

1.6.2.5 The DBA Role

A predefined DBA role is automatically created with every Oracle Database installation. This role contains most database system privileges. Therefore, the DBA role should be granted only to actual database administrators.

Note:

The DBA role does not include the SYSDBA, SYSOPER, SYSBACKUP, SYSDG, or SYSKM system privileges. These are special administrative privileges that allow an administrator to perform basic database administration tasks, such as creating the database and instance startup and shutdown. These administrative privileges are discussed in "Administrative Privileges".

See Also:

- *Oracle Database Security Guide* for more information about administrative user accounts
- "Using Password File Authentication"

1.7 Database Administrator Authentication

As a DBA, you often perform special operations such as shutting down or starting up a database. Because only a DBA should perform these operations, the database administrator user names require a secure authentication scheme.

- Administrative Privileges
  Administrative privileges that are required for an administrator to perform basic database operations are granted through special system privileges.
- Operations Authorized by Administrative Privileges
  Each administrative privilege authorizes a specific set of operations.
- Authentication Methods for Database Administrators
  Database administrators can be authenticated with account passwords, operating system (OS) authentication, password files, or strong authentication with a directory-based authentication service, such as Oracle Internet Directory.
- Using Operating System Authentication
  Membership in special operating system groups enables a DBA to authenticate to the database through the operating system rather than with a database user name and password. This is known as operating system authentication.
- Using Password File Authentication
  You can use password file authentication for an Oracle database instance and for an Oracle Automatic Storage Management (Oracle ASM) instance. The password file for an Oracle database is called a database password file, and the password file for Oracle ASM is called an Oracle ASM password file.

1.7.1 Administrative Privileges

Administrative privileges that are required for an administrator to perform basic database operations are granted through special system privileges.

These privileges are:

- `SYSDBA`
- `SYSOPER`
- `SYSBACKUP`
- `SYSDG`
- `SYSKM`
- `SYSRAC`

Excluding the `SYSRAC` privilege, grant these privileges to users depending upon the level of authorization they require. The `SYSRAC` privilege cannot be granted to users because it is used

only by the Oracle agent of Oracle Clusterware to connect to the database using operating system authentication.

Starting with Oracle Database 12*c* Release 1 (12.1), the `SYSBACKUP`, `SYSDG`, and `SYSKM` administrative privileges are available. Starting with Oracle Database 12*c* Release 2 (12.2), the `SYSRAC` administrative privilege is available. Each new administrative privilege grants the minimum required privileges to complete tasks in each area of administration. The new administrative privileges enable you to avoid granting `SYSDBA` administrative privilege for many common tasks.

> **Note:**
>
> These administrative privileges allow access to a database instance even when the database is not open. Control of these privileges is totally outside of the database itself. Methods for authenticating database administrators with these privileges include operating system (OS) authentication, password files, and strong authentication with a directory-based authentication service.
>
> These privileges can also be thought of as types of connections that enable you to perform certain database operations for which privileges cannot be granted in any other fashion. For example, if you have the `SYSDBA` privilege, then you can connect to the database by specifying the `AS SYSDBA` clause in the `CONNECT` command and perform `STARTUP` and `SHUTDOWN` operations. See "Authentication Methods for Database Administrators".

1.7.2 Operations Authorized by Administrative Privileges

Each administrative privilege authorizes a specific set of operations.

The following table lists the operations that are authorized by each administrative privilege:

Administrative Privilege	Operations Authorized
`SYSDBA`	• Perform `STARTUP` and `SHUTDOWN` operations • `ALTER DATABASE`: open, mount, back up, or change character set • `CREATE DATABASE` • `DROP DATABASE` • `CREATE SPFILE` • `ALTER DATABASE ARCHIVELOG` • `ALTER DATABASE RECOVER` • Includes the `RESTRICTED SESSION` privilege This administrative privilege allows most operations, including the ability to view user data. It is the most powerful administrative privilege.

Administrative Privilege	Operations Authorized
SYSOPER	• Perform STARTUP and SHUTDOWN operations • CREATE SPFILE • ALTER DATABASE: open, mount, or back up • ALTER DATABASE ARCHIVELOG • ALTER DATABASE RECOVER (Complete recovery only. Any form of incomplete recovery, such as UNTIL TIME|CHANGE|CANCEL|CONTROLFILE requires connecting as SYSDBA.) • Includes the RESTRICTED SESSION privilege This privilege allows a user to perform basic operational tasks, but without the ability to view user data.
SYSBACKUP	This privilege allows a user to perform backup and recovery operations either from Oracle Recovery Manager (RMAN) or SQL*Plus. See *Oracle Database Security Guide* for the full list of operations allowed by this administrative privilege.
SYSDG	This privilege allows a user to perform Data Guard operations. You can use this privilege with either Data Guard Broker or the DGMGRL command-line interface. See *Oracle Database Security Guide* for the full list of operations allowed by this administrative privilege.
SYSKM	This privilege allows a user to perform Transparent Data Encryption keystore operations. See *Oracle Database Security Guide* for the full list of operations allowed by this administrative privilege.
SYSRAC	This privilege allows the Oracle agent of Oracle Clusterware to perform Oracle Real Application Clusters (Oracle RAC) operations. See *Oracle Database Security Guide* for the full list of operations allowed by this administrative privilege.

The manner in which you are authorized to use these privileges depends upon the method of authentication that you use.

When you connect with an administrative privilege, you connect with a current schema that is not generally associated with your username. For SYSDBA, the current schema is SYS. For SYSOPER, the current schema is PUBLIC. For SYSBACKUP, SYSDG, and SYSRAC, the current schema is SYS for name resolution purposes. However, the current schema for SYSKM is SYSKM.

Also, when you connect with an administrative privilege, you connect with a specific session user. When you connect as SYSDBA, the session user is SYS. For SYSOPER, the session user is PUBLIC. For SYSBACKUP, SYSDG, SYSKM, and SYSRAC, the session user is SYSBACKUP, SYSDG, SYSKM, and SYSRAC, respectively.

> **See Also:**
>
> - "Administrative User Accounts"
> - "Using Operating System Authentication"
> - "Using Password File Authentication"
> - *Oracle Database SQL Language Reference* for more information about the current schema and the session user
> - *Oracle Database Security Guide*

Example 1-18 Current Schema When Connecting AS SYSDBA

This example illustrates that a user is assigned another schema (`SYS`) when connecting with the `SYSDBA` administrative privilege. Assume that the sample user `mydba` has been granted the `SYSDBA` administrative privilege and has issued the following command and statement:

```
CONNECT mydba
CREATE TABLE admin_test(name VARCHAR2(20));
```

Later, user `mydba` issues this command and statement:

```
CONNECT mydba AS SYSDBA
SELECT * FROM admin_test;
```

User `mydba` now receives the following error:

```
ORA-00942: table or view does not exist
```

Having connected as `SYSDBA`, user `mydba` now references the `SYS` schema, but the table was created in the `mydba` schema.

Example 1-19 Current Schema and Session User When Connecting AS SYSBACKUP

This example illustrates that a user is assigned another schema (`SYS`) and another session user (`SYSBACKUP`) when connecting with the `SYSBACKUP` administrative privilege. Assume that the sample user `mydba` has been granted the `SYSBACKUP` administrative privilege and has issued the following command and statements:

```
CONNECT mydba AS SYSBACKUP

SELECT SYS_CONTEXT('USERENV', 'CURRENT_SCHEMA') FROM DUAL;

SYS_CONTEXT('USERENV','CURRENT_SCHEMA')
--------------------------------------------------------------------------------
SYS

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

SYS_CONTEXT('USERENV','SESSION_USER')
--------------------------------------------------------------------------------
SYSBACKUP
```

1.7.3 Authentication Methods for Database Administrators

Database administrators can be authenticated with account passwords, operating system (OS) authentication, password files, or strong authentication with a directory-based authentication service, such as Oracle Internet Directory.

- About Authentication Methods for Database Administrators
  There are several ways to authenticate database administrators.
- Nonsecure Remote Connections
  To connect to Oracle Database as a privileged user over a nonsecure connection, you must be authenticated by a password file.
- Local Connections and Secure Remote Connections
  You can connect to Oracle Database as a privileged user over a local connection or a secure remote connection.

1.7.3.1 About Authentication Methods for Database Administrators

There are several ways to authenticate database administrators.

Oracle database can authenticate database administrators through the data dictionary, (using an account password) like other users. Keep in mind that database passwords are case-sensitive. See *Oracle Database Security Guide* for more information about case-sensitive database passwords.

In addition to normal data dictionary authentication, the following methods are available for authenticating database administrators with the `SYSDBA`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, or `SYSKM` privilege:

- Operating system (OS) authentication
- Password file including Kerberos and SSL authentication services
- Strong authentication with a directory-based authentication service, such as Oracle Internet Directory

> **Note:**
>
> The `SYSRAC` privilege only allows OS authentication by the Oracle agent of Oracle Clusterware. Password files and strong authentication cannot be used with the `SYSRAC` privilege.

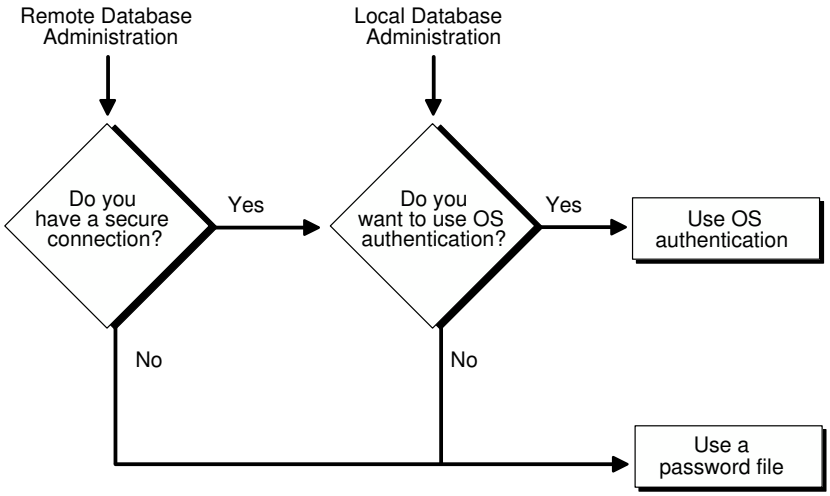
These methods are required to authenticate a database administrator when the database is not started or otherwise unavailable. (They can also be used when the database is available.)

The remainder of this section focuses on operating system authentication and password file authentication. See *Oracle Database Security Guide* for information about authenticating database administrators with directory-based authentication services.

> **Note:**
>
> Operating system authentication takes precedence over password file authentication. If you meet the requirements for operating system authentication, then even if you use a password file, you will be authenticated by operating system authentication.

Your choice is influenced by whether you intend to administer your database locally on the same system where the database resides, or whether you intend to administer many different databases from a single remote client. The following figure illustrates the choices you have for database administrator authentication schemes.

Figure 1-2 Database Administrator Authentication Methods



If you are performing remote database administration, then consult your Oracle Net documentation to determine whether you are using a secure connection. Most popular connection protocols, such as TCP/IP and DECnet, are not secure.

> **See Also:**
>
> - *Oracle Database Security Guide* for information about authenticating database administrators with directory-based authentication services.
> - *Oracle Database Net Services Administrator's Guide*

1.7.3.2 Nonsecure Remote Connections

To connect to Oracle Database as a privileged user over a nonsecure connection, you must be authenticated by a password file.

When using password file authentication, the database uses a password file to keep track of database user names that have been granted the `SYSDBA`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, or `SYSKM`

administrative privilege. This form of authentication is discussed in "Using Password File Authentication".

1.7.3.3 Local Connections and Secure Remote Connections

You can connect to Oracle Database as a privileged user over a local connection or a secure remote connection.

You can connect in two ways:

- If the database has a password file and you have been granted a system privilege, then you can connect and be authenticated by a password file.
- If the server is not using a password file, or if you have not been granted a system privilege and are therefore not in the password file, then you can use operating system authentication. On most operating systems, authentication for database administrators involves placing the operating system username of the database administrator in a special group.

  For example, users in the OSDBA group are granted the `SYSDBA` administrative privilege. Similarly, the OSOPER group is used to grant `SYSOPER` administrative privilege to users, the OSBACKUPDBA group is used to grant `SYSBACKUP` administrative privilege to users, the OSDGDBA group is used to grant `SYSDG` administrative privilege to users, the OSKMDBA group is used to grant `SYSKM` administrative privilege to users, and the OSRACDBA group is used to grant `SYSRAC` administrative privilege to users.

1.7.4 Using Operating System Authentication

Membership in special operating system groups enables a DBA to authenticate to the database through the operating system rather than with a database user name and password. This is known as operating system authentication.

- Operating System Groups
  Operating system groups are created and assigned specific names as part of the database installation process.
- Preparing to Use Operating System Authentication
  DBAs can authenticate to the database through the operating system rather than with a database user name and password.
- Connecting Using Operating System Authentication
  A user can connect to the database using operating system authentication.

1.7.4.1 Operating System Groups

Operating system groups are created and assigned specific names as part of the database installation process.

The default names of the operating system groups vary depending upon your operating system, and are listed in the following table:

Operating System Group	UNIX or Linux User Group	Windows User Group
OSDBA	`dba`	`ORA_DBA` (for all Oracle homes) `ORA_`*`HOMENAME`*`_DBA` (for each specific Oracle home)

Operating System Group	UNIX or Linux User Group	Windows User Group
OSOPER	`oper`	`ORA_OPER` (for all Oracle homes) `ORA_`*`HOMENAME`*`_OPER` (for each specific Oracle home)
OSBACKUPDBA	`backupdba`	`ORA_`*`HOMENAME`*`_SYSBACKUP`
OSDGDBA	`dgdba`	`ORA_`*`HOMENAME`*`_SYSDG`
OSKMDBA	`kmdba`	`ORA_`*`HOMENAME`*`_SYSKM`
OSRACDBA	`racdba`	`ORA_`*`HOMENAME`*`_SYSRAC`

For the Windows user group names, replace *HOMENAME* with the Oracle home name.

Oracle Universal Installer uses these default names, but, on UNIX or Linux, you can override them. On UNIX or Linux, one reason to override them is if you have multiple instances running on the same host computer in different Oracle homes. If each instance has a different person as the principal DBA, then you can improve the security of each instance by creating different groups for each instance.

For example, for two instances on the same UNIX or Linux host in different Oracle homes, the OSDBA group for the first instance might be named `dba1`, and OSDBA for the second instance might be named `dba2`. The first DBA would be a member of `dba1` only, and the second DBA would be a member of `dba2` only. Thus, when using operating system authentication, each DBA would be able to connect only to their assigned instance.

On Windows, default user group names cannot be changed. The *HOMENAME* placeholder enables you to have different user group names when you have multiple instances running on the same host Windows computer.

Membership in a group affects your connection to the database in the following ways:

- If you are a member of the OSDBA group, and you specify `AS SYSDBA` when you connect to the database, then you connect to the database with the `SYSDBA` administrative privilege.
- If you are a member of the OSOPER group, and you specify `AS SYSOPER` when you connect to the database, then you connect to the database with the `SYSOPER` administrative privilege.
- If you are a member of the OSBACKUPDBA group, and you specify `AS SYSBACKUP` when you connect to the database, then you connect to the database with the `SYSBACKUP` administrative privilege.
- If you are a member of the OSDGDBA group, and you specify `AS SYSDG` when you connect to the database, then you connect to the database with the `SYSDG` administrative privilege.
- If you are a member of the OSKMDBA group, and you specify `AS SYSKM` when you connect to the database, then you connect to the database with the `SYSKM` administrative privilege.
- If you are a member of the OSRACDBA group, and you specify `AS SYSRAC` when you connect to the database, then you connect to the database with the `SYSRAC` administrative privilege.
- If you are not a member of one of these operating system groups, and you attempt to connect as `SYSDBA`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, `SYSKM`, or `SYSRAC`, then the `CONNECT` command fails.

> **See Also:**
>
> Your operating system specific Oracle documentation for information about creating the OSDBA and OSOPER groups

1.7.4.2 Preparing to Use Operating System Authentication

DBAs can authenticate to the database through the operating system rather than with a database user name and password.

To enable operating system authentication of an administrative user:

1. Create an operating system account for the user.
2. Add the account to the appropriate operating-system defined groups.

1.7.4.3 Connecting Using Operating System Authentication

A user can connect to the database using operating system authentication.

You can use operating system authentication by performing one of the following actions.

- A user can be authenticated, enabled as an administrative user, and connected to a local database by typing one of the following SQL*Plus commands:

```
CONNECT / AS SYSDBA
CONNECT / AS SYSOPER
CONNECT / AS SYSBACKUP
CONNECT / AS SYSDG
CONNECT / AS SYSKM
```

- For the Windows platform only, remote operating system authentication over a secure connection is supported. You must specify the net service name for the remote database:

```
CONNECT /@net_service_name AS SYSDBA
CONNECT /@net_service_name AS SYSOPER
CONNECT /@net_service_name AS SYSBACKUP
CONNECT /@net_service_name AS SYSDG
CONNECT /@net_service_name AS SYSKM
```

  Both the client computer and database host computer must be on a Windows domain.

> **Note:**
>
> The `SYSRAC` administrative privilege is used only by the Oracle agent of Oracle Clusterware to connect to the database using operating system authentication.

> **See Also:**
>
> - "Connecting to the Database with SQL*Plus"
> - *SQL*Plus User's Guide and Reference* for the syntax of the `CONNECT` command

1.7.5 Using Password File Authentication

You can use password file authentication for an Oracle database instance and for an Oracle Automatic Storage Management (Oracle ASM) instance. The password file for an Oracle database is called a database password file, and the password file for Oracle ASM is called an Oracle ASM password file.

- Preparing to Use Password File Authentication
  To prepare for password file authentication, you must create the password file, set the `REMOTE_LOGIN_PASSWORDFILE` initialization parameter, and grant privileges.
- Connecting Using Password File Authentication
  Using password file authentication, administrative users can be connected and authenticated to a local or remote database by using the SQL*Plus `CONNECT` command. By default, passwords are case-sensitive.

> **See Also:**
>
> *Oracle Automatic Storage Management Administrator's Guide* for information about creating an Oracle ASM password file.

1.7.5.1 Preparing to Use Password File Authentication

To prepare for password file authentication, you must create the password file, set the `REMOTE_LOGIN_PASSWORDFILE` initialization parameter, and grant privileges.

To enable authentication of an administrative user using password file authentication, you must do the following:

1. If it is not already created, then create the password file using the `ORAPWD` utility:

   ```
   orapwd FILE=filename FORMAT=12.2
   ```

   See "Creating and Maintaining a Database Password File" for details.

> **Note:**
>
> - When you invoke the Database Configuration Assistant (DBCA) as part of the Oracle Database installation process, DBCA creates a password file.
> - The administrative privileges `SYSBACKUP`, `SYSDG`, and `SYSKM` are not supported in the password file when the file is created with the `FORMAT=LEGACY` argument.
> - `12.2` is the default for the `FORMAT` command-line argument.
> - The administrative privilege `SYSRAC` is not supported in the password file.
> - The administrative privileges can be granted to external users only when the file is created with the `FORMAT=12.2` argument. `FORMAT=12.2` also enables SSL and Kerberos authentication for administrative users.
> - When you create a database password file that is stored in an Oracle ASM disk group, it can be shared among the multiple Oracle RAC database instances. The password file is not duplicated on each Oracle RAC database instance.

2. Set the `REMOTE_LOGIN_PASSWORDFILE` initialization parameter to `exclusive`. (This is the default).

> **Note:**
>
> `REMOTE_LOGIN_PASSWORDFILE` is a static initialization parameter and therefore cannot be changed without restarting the database.

3. Connect to the database as user `SYS` (or as another user with the administrative privileges).
4. If the user does not already exist in the database, then create the user and assign a password.

   Keep in mind that database passwords are case-sensitive. See *Oracle Database Security Guide* for more information about case-sensitive database passwords.
5. Grant the `SYSDBA`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, or `SYSKM` administrative privilege to the user. For example:

   ```
   GRANT SYSDBA to mydba;
   ```

   This statement adds the user to the password file, thereby enabling connection `AS SYSDBA`, `AS SYSOPER`, `AS SYSBACKUP`, `AS SYSDG`, or `AS SYSKM`.

> **See Also:**
>
> "Creating and Maintaining a Database Password File" for instructions for creating and maintaining a password file

1.7.5.2 Connecting Using Password File Authentication

Using password file authentication, administrative users can be connected and authenticated to a local or remote database by using the SQL*Plus `CONNECT` command. By default, passwords are case-sensitive.

To connect using password file authentication:

- In SQL*Plus, execute the `CONNECT` command with a valid username and password and the `AS SYSDBA`, `AS SYSOPER`, `AS SYSBACKUP`, `AS SYSDG`, or `AS SYSKM` clause.

For example, if user `mydba` has been granted the `SYSDBA` privilege, then `mydba` can connect as follows:

```
CONNECT mydba AS SYSDBA
```

However, if user `mydba` has not been granted the `SYSOPER` privilege, then the following command fails:

```
CONNECT mydba AS SYSOPER
```

> **Note:**
>
> Operating system authentication takes precedence over password file authentication. Specifically, if you are a member of the appropriate operating system group, such as OSDBA or OSOPER, and you connect with the appropriate clause (for example, `AS SYSDBA`), then you will be connected with associated administrative privileges regardless of the *username/password* that you specify.
>
> If you are not in the one of the operating system groups, and you are not in the password file, then attempting to connect with the clause fails.

> **See Also:**
>
> - "About Connecting to the Database with SQL*Plus"
> - "Creating a Database Password File with ORAPWD"
> - *SQL*Plus User's Guide and Reference* for syntax of the `CONNECT` command
> - *Oracle Database Security Guide*

1.8 Creating and Maintaining a Database Password File

You can create a database password file using the password file creation utility, `ORAPWD`. For some operating systems, you can create this file as part of your standard installation.

- ORAPWD Syntax and Command Line Argument Descriptions
  The `ORAPWD` command creates and maintains a password file.

- Creating a Database Password File with ORAPWD
  You can create a database password file with `ORAPWD`.
- Sharing and Disabling the Database Password File
  You use the initialization parameter `REMOTE_LOGIN_PASSWORDFILE` to control whether a database password file is shared among multiple Oracle Database instances. You can also use this parameter to disable password file authentication.
- Keeping Administrator Passwords Synchronized with the Data Dictionary
  If you change the `REMOTE_LOGIN_PASSWORDFILE` initialization parameter from `none` to `exclusive` or `shared`, then you must ensure that the passwords stored in the data dictionary and the passwords stored in the password file for the non-SYS administrative users, such as `SYSDBA`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, and `SYSKM` users are the same.
- Adding Users to a Database Password File
  When you grant `SYSDBA`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, or `SYSKM` administrative privilege to a user, that user's name and privilege information are added to the database password file.
- Granting and Revoking Administrative Privileges
  Use the `GRANT` statement to grant administrative privileges. Use the `REVOKE` statement to revoke administrative privileges.
- Viewing Database Password File Members
  The `V$PWFILE_USERS` view contains information about users that have been granted administrative privileges.
- Removing a Database Password File
  You can remove a database password file if it is no longer needed.

See Also:

- "Using Password File Authentication"
- "Authentication Methods for Database Administrators"
- *Oracle Automatic Storage Management Administrator's Guide* for information about creating and maintaining an Oracle ASM password file

1.8.1 ORAPWD Syntax and Command Line Argument Descriptions

The `ORAPWD` command creates and maintains a password file.

The syntax of the `ORAPWD` command is as follows:

```
orapwd FILE=filename
[FORCE={y|n}]
[ASM={y|n}]
[DBUNIQUENAME=dbname]
[FORMAT={12.2|12}]
[SYS={y|n|password|external('sys-external-name')|global('sys-directory-DN')}]
[SYSBACKUP={y|n|password|external('sysbackup-external-name')|global('sysbackup-directory-DN')}]
[SYSDG={y|n|password|external('sysdg-external-name')|global('sysdg-directory-DN')}]
[SYSKM={y|n|password|external('syskm-external-name')|global('syskm-directory-DN')}]
[DELETE={y|n}]
[INPUT_FILE=input-fname]

orapwd DESCRIBE FILE=filename
```

Command arguments are summarized in the following table.

Argument	Description
FILE	If the DESCRIBE argument is not included, then specify the name to assign to the new password file. You must supply a complete path. If you supply only a file name, the file is written to the current directory. If the DESCRIBE argument is included, then specify the name of an existing password file.
FORCE	(Optional) If y, permits overwriting an existing password file. It also clears CRS resources, if they already have the password file registered.
ASM	(Optional) If y, create an Oracle ASM password file in an Oracle ASM disk group. If n, the default, create a password file in the operating system file system. When the DBUNIQUENAME argument is specified, the password file is a database password file. When the DBUNIQUENAME argument is not specified, the password file can be a database password file or an Oracle ASM password file.
DBUNIQUENAME	Unique database name used to identify database password files residing in an ASM disk group only. This argument is required when the database password file is stored on an Oracle ASM disk group. This argument is ignored when an Oracle ASM password file is created by setting the ASM argument to y.
FORMAT	(Optional) Specify one of the following values: • 12.2, the default, creates the password file in 12.2. format. This format supports granting administrative privileges to external users and enables SSL and Kerberos authentication for administrative users. • 12 creates the password file in Oracle Database 12*c* format. This format supports the SYSBACKUP, SYSDG, and SYSKM administrative privileges.
SYS	(Optional) This argument specifies if SYS user is password, externally, or globally authenticated. This argument can be set to y, n, *password*, external('*sys-external-name*'), or global(*sys-directory-DN*). If SYS=y and INPUT_FILE is specified to migrate password file entries, then you will be prompted to enter the new password for the SYS administrative user. If *password*, then you will be prompted to enter the password for the SYS administrative user. If external('*sys-external-name*'), then replace *sys-external-name* with the external name for SSL or Kerberos authentication for the SYS administrative user. If global(*sys-directory-DN*), then specify the directory service name for the global SYS user.
SYSBACKUP	(Optional) Creates SYSBACKUP entry. This argument specifies if SYSBACKUP user is password, externally, or globally authenticated. This argument can be set to y, n, *password*, external('*sysbackup-external-name*'), or global(*sysbackup-directory-DN*). If *password*, then you will be prompted to enter the password for the SYSBACKUP administrative user. If external('*sysbackup-external-name*'), then replace *sysbackup-external-name* with the external name for SSL or Kerberos authentication for the SYSBACKUP administrative user. If global(*sysbackup-directory-DN*), then specify the directory service name for the global SYSBACKUP user.

Argument	Description
SYSDG	(Optional) Creates SYSDG entry. This argument specifies if SYSDG user is password, externally, or globally authenticated. This argument can be set to y, n, *password*, external('*sysdg-external-name*'), or global(*sysdg-directory-DN*). If *password*, then you will be prompted to enter the password for the SYSDG administrative user. If external('*sysdg-external-name*'), then replace *sysdg-external-name* with the external name for SSL or Kerberos authentication for the SYSDG administrative user. If global(*sysdg-directory-DN*), then specify the directory service name for the global SYSDG user.
SYSKM	(Optional) Creates SYSKM entry. This argument specifies if SYSKM user is password, externally, or globally authenticated. (Optional) This argument can be set to y, n, *password*, external('*syskm-external-name*'), or global(*syskm-directory-DN*). If *password*, then you will be prompted to enter the password for the SYSKM administrative user. If external('*syskm-external-name*'), then replace *syskm-external-name* with the external name for SSL or Kerberos authentication for the SYSKM administrative user. If y, creates a SYSKM entry in the password file. You are prompted for the password. The password is stored in the created password file. If n, no SYSKM entry is created in the password file. **Note:** The y and n values in the SYSKM argument are deprecated in Oracle Database 12*c* Release 2 (12.2) and may be desupported in a future release. If global(*syskm-directory-DN*), then specify the directory service name for the global SYSKM user.
DELETE	(Optional) If y, delete the specified password file. If n, the default, create the specified password file.
INPUT_FILE	(Optional) Name of the input password file. ORAPWD migrates the entries in the input file to a new password file. This argument can be used to convert a password file from one format to another, for example from 12 format to 12.2 format. This argument also can be used to reset the password for the SYS administrative user. ORAPWD cannot migrate an input password that is stored in an Oracle ASM disk group.
DESCRIBE	Describes the properties of the specified password file, including the FORMAT value (12.2 or 12).

There are no spaces permitted around the equal-to (=) character.

> **Note:**
>
> Each external name must be unique.

The following sections provide more information about some of the ORAPWD command line arguments.

FILE
This argument sets the name of the password file being created. This argument is mandatory. If you specify a location on an Oracle ASM disk group, then the database password file is shared automatically among the nodes in the cluster. When you use an Oracle ASM disk group to store the password file, and you are not using Oracle Managed Files, you must specify the name of the password file, including its full path. The full path is not required if you are using Oracle Managed Files.
If you do not specify a location on an Oracle ASM disk group, then the file name required for the password file is operating system specific. Some operating systems require the password file to adhere to a specific format and be located in a specific directory. Other operating systems allow the use of environment variables to specify the name and location of the password file.
The following table lists the required name and location for the password file on the UNIX, Linux, and Windows platforms. For other platforms, consult your platform-specific documentation.

Platform	Required Name	Required Location
UNIX and Linux	orapw*ORACLE_SID*	ORACLE_BASE/dbs
Windows	PWD*ORACLE_SID*.ora	ORACLE_BASE\database

For example, for a database instance with the SID orcldw, the password file must be named orapworcldw on Linux and PWDorcldw.ora on Windows.
In an Oracle Real Application Clusters (Oracle RAC) environment on a platform that requires an environment variable to be set to the path of the password file, the environment variable for each instance must point to the same password file.
For a policy-managed Oracle RAC database or an Oracle RAC One Node database with ORACLE_SID of the form *db_unique_name_n*, where *n* is a number, the password file is searched for first using ORACLE_BASE/dbs/orapw*sid_prefix* or ORACLE_BASE\database\PWD*sid_prefix*.ora. The *sid_prefix* (the first 8 characters of the database name) is used to locate the password file.

Note:

- It is critically important to the security of your system that you protect your password file and the environment variables that identify the location of the password file. Any user with access to these could potentially compromise the security of the connection.
- For Oracle Database 18c and later, if the password file is not found in its default directory, then the database checks for the password file in the directory that was the default directory in the earlier database releases. In the Oracle Database releases earlier to 18c, the default directory of the password file on UNIX and Linux platforms was ORACLE_HOME/dbs and on Windows was ORACLE_HOME\database.

> **See Also:**
>
> Using Oracle Managed Files

FORCE
This argument, if set to `y`, enables you to overwrite an existing password file. An error is returned if a password file of the same name already exists and this argument is omitted or set to `n`.

ASM
If this argument is set to `y`, then `ORAPWD` creates an Oracle ASM password file. The `FILE` argument must specify a location in the Oracle ASM disk group.
If this argument is set to `n`, the default, then `ORAPWD` creates a password file. The `FILE` argument can specify a location in the Oracle ASM disk group or in the operating system file system. When the `DBUNIQUENAME` argument is specified, the password file is a database password file. When the `DBUNIQUENAME` argument is not specified, the password file can be a database password file or an Oracle ASM password file.

> **See Also:**
>
> *Oracle Automatic Storage Management Administrator's Guide* for information about creating and maintaining an Oracle ASM password file

DBUNIQUENAME
This argument sets the unique database name for a database password file being created on an Oracle ASM disk group. It identifies which database resource to update with the database password file location.
This argument is not required when a database password file is created on an operating system file system.
This argument is ignored when an Oracle ASM password file is created by setting the `ASM` argument to `y`.

FORMAT
If this argument is set to 12.2, the default, then `ORAPWD` creates a database password file in 12.2 format. 12.2 format is required for the password file to support granting administrative privileges to external users and SSL and Kerberos authentication for administrative users. Password profiles assigned to the users are also enforced on the administrative users.
If this argument is set to `12`, then `ORAPWD` creates a database password file in Oracle Database 12*c* format. Oracle Database 12*c* format is required for the password file to support `SYSBACKUP`, `SYSDG`, and `SYSKM` administrative privileges.
If this argument is set to `legacy`, then `ORAPWD` creates a database password file that is in the format before Oracle Database 12*c*. The password file supports `SYSDBA` and `SYSOPER` administrative privileges, but it does not support `SYSBACKUP`, `SYSDG`, and `SYSKM` administrative privileges.

SYS
If `SYS=Y` and `INPUT_FILE` is specified to migrate password file entries, then you will be prompted to enter the new password for the `SYS` administrative user.
If *`password`*, then you will be prompted to enter the password for the `SYS` administrative user.
If `external('`*`sys-external-name`*`')`, then replace *`sys-external-name`* with the external name for SSL or Kerberos authentication for the `SYS` administrative user.

If `global(sys-directory-DN)`, then specify the directory service name for the global `SYS` user.

SYSBACKUP
If *password*, then you will be prompted to enter the password for the `SYSBACKUP` administrative user.
If `external('sysbackup-external-name')`, then replace *sysbackup-external-name* with the external name for SSL or Kerberos authentication for the `SYSDG` administrative user.
If `global(sysbackup-directory-DN)`, then specify the directory service name for the global `SYSBACKUP` user.

SYSDG
If *password*, then you will be prompted to enter the password for the `SYSDG` administrative user.
If `external('sysdg-external-name')`, then replace *sysdg-external-name* with the external name for SSL or Kerberos authentication for the `SYSDG` administrative user.
If `global(sysdg-directory-DN)`, then specify the directory service name for the global `SYSDG` user.

SYSKM
If *password*, then you will be prompted to enter the password for the `SYSKM` administrative user.
If `external('syskm-external-name')`, then replace *syskm-external-name* with the external name for SSL or Kerberos authentication for the `SYSKM` administrative user.
If `global(syskm-directory-DN)`, then specify the directory service name for the global `SYSKM` user.

DELETE
If this argument is set to `y`, then `ORAPWD` deletes the specified password file. When `y` is specified, `FILE`, `ASM`, or `DBUNIQUENAME` must be specified. When `FILE` is specified, the file must be located on an ASM disk group.
If this argument is set to `n`, the default, then `ORAPWD` creates the password file.

INPUT_FILE
This argument specifies the name of the input password file. `ORAPWD` migrates the entries in the input file to a new password file. This argument can convert a password file from one format to another, for example from 12 format to 12.2 format.
This argument also can be used to reset the password for the `SYS` administrative user.
When the `INPUT_FILE` argument is specified, `ORAPWD` does not create any new entries. Therefore, `ORAPWD` ignores the following arguments:

- `PASSWORD`
- `SYSBACKUP`
- `SYSDG`
- `SYSKM`

When an input file is specified and the new password file replaces the input file, `FORCE` must be set to `y`.

> **Note:**
>
> When the `FORMAT` argument is not specified, by default the new password file is created in 12.2 format from the input file.

> **See Also:**
>
> "Administrative Privileges" and "Adding Users to a Database Password File"

1.8.2 Creating a Database Password File with ORAPWD

You can create a database password file with `ORAPWD`.

Passwords are case-sensitive. However, password files created using an earlier Oracle Database release retain their case-insensitive passwords, if the `ignorecase` option was omitted during password file creation. Oracle recommends that you force case sensitivity in these older password files by migrating the password file from one format to another.

The maximum number of bytes for a password is 1024. `ORAPWD` allows the passing of 1024 byte passwords for seeded administrative users such as `SYS`, `SYSBACKUP`, and others.

To create a database password file:

- Run the `ORAPWD` command.

Example 1-20 Creating a Database Password File Located in an Oracle ASM Disk Group

The following command creates a database password file in 12.2 format named `orapworcl` that is located in an Oracle ASM disk group. The `DBUNIQUENAME` argument is required because the database password file is located in an Oracle ASM disk group.

```
orapwd FILE='+DATA/orcl/orapworcl' DBUNIQUENAME='orcl' FORMAT=12.2
```

Example 1-21 Creating a Database Password File with a SYSBACKUP Entry

The following example is the similar to Example 1-20 except that it creates a `SYSBACKUP` entry in the database password file. The password file is in 12.2 format by default.

```
orapwd FILE='+DATA/orcl/orapworcl' DBUNIQUENAME='orcl' SYSBACKUP=password FORMAT=12.2
```

Example 1-22 Creating a Database Password File with External Authentication for SYS and SYSKM

The following example is the similar to Example 1-20 except that it specifies an external name for the `SYS` and `SYSKM` administrative users.

```
orapwd FILE='+DATA/orcl/orapworcl' DBUNIQUENAME='orcl' FORMAT=12.2
sys=external('KerberosUserSYS@example.com')
syskm=external('KerberosUserSYSKM@example.com')
```

Example 1-23 Creating a Database Password File Located in a File System

The following command creates a database password file in 12.2 format named `orapworcl` that is located in the default location in an operating system file system.

```
orapwd FILE='/u01/oracle/dbs/orapworcl' FORMAT=12.2
```

Example 1-24 Migrating a Database Password File to Oracle Database 12c Format

The following command migrates a database password file to the 12.2 format. The new password file is case-sensitive and will contain case-sensitive passwords. The password file is

named `orapworcl`, and it is located in an operating system file system. The new database password file replaces the existing database password file. Therefore, `FORCE` must be set to `y`.

```
orapwd FILE='/u01/oracle/dbs/orapworcl' FORMAT=12.2 INPUT_FILE='/u01/oracle/dbs/
orapworcl' FORCE=y
```

Example 1-25 Resetting the Password for the SYS Administrative User

The following command resets the password for the `SYS` administrative user. The new database password file replaces the existing database password file. Therefore, `FORCE` must be set to `y`.

```
orapwd FILE='/u01/oracle/dbs/orapworcl' SYS=Y INPUT_FILE='/u01/oracle/dbs/orapworcl'
FORCE=y
```

You are prompted to enter the new password for the `SYS` administrative user.

Example 1-26 Describing a Password File

The following command describes the `orapworcl` password file.

```
orapwd DESCRIBE FILE='orapworcl'
Password file Description : format=12.2
```

Note:

If the database password file name or location is changed, then run the following command for the changes to take effect:

```
SQL> ALTER SYSTEM FLUSH PASSWORDFILE_METADATA_CACHE;
```

This command flushes the metadata cache and the subsequent logins to the database use the new password file. In an Oracle RAC environment, this command clears cache in all the Oracle RAC databases, but there could be some databases that may still continue using the old password file till the change is propagated across all the Oracle RAC databases.

After running this command, you can verify the changes by querying the `V$PASSWORDFILE_INFO` view.

Note:

Whenever the password file is recreated, it is recommended that you restart the database instance to synchronize the user profile status from the data dictionary.

See Also:

Oracle Automatic Storage Management Administrator's Guide for information about managing a shared password file in an Oracle ASM disk group

1.8.3 Sharing and Disabling the Database Password File

You use the initialization parameter REMOTE_LOGIN_PASSWORDFILE to control whether a database password file is shared among multiple Oracle Database instances. You can also use this parameter to disable password file authentication.

To share a password file or disable password file authentication:

- Set the REMOTE_LOGIN_PASSWORDFILE initialization parameter.

You can set the REMOTE_LOGIN_PASSWORDFILE initialization parameter to one of the following values:

- none: Setting this parameter to none causes Oracle Database to behave as if the password file does not exist. That is, no privileged connections are allowed over nonsecure connections.
- exclusive: (The default) An exclusive password file can be used with only one database. Only an exclusive file can be modified. Using an exclusive password file enables you to add, modify, and delete users. It also enables you to change the password for SYS, SYSBACKUP, SYSDG, or SYSKM with the ALTER USER command.

  When an exclusive password file is stored on an Oracle ASM disk group, it can be used by a single-instance database or multiple instances of an Oracle Real Application Clusters (Oracle RAC) database.

  When an exclusive password file is stored on an operating system, it can be used with only one instance of one database.
- shared: A shared password file can be used by multiple databases running on the same server, or multiple instances of an Oracle RAC database, even when it is stored on an operating system. A shared password file is read-only and cannot be modified. Therefore, you cannot add users to a shared password file. Any attempt to do so or to change the password of SYS or other users with the administrative privileges generates an error. All users needing administrative privileges must be added to the password file when REMOTE_LOGIN_PASSWORDFILE is set to exclusive. After all users are added, you can change REMOTE_LOGIN_PASSWORDFILE to shared, and then share the file.

  This option is useful if you are administering multiple databases with a single password file.

  You cannot specify shared for an Oracle ASM password file.

If REMOTE_LOGIN_PASSWORDFILE is set to exclusive or shared and the password file is missing, this is equivalent to setting REMOTE_LOGIN_PASSWORDFILE to none.

1.8.4 Keeping Administrator Passwords Synchronized with the Data Dictionary

If you change the REMOTE_LOGIN_PASSWORDFILE initialization parameter from none to exclusive or shared, then you must ensure that the passwords stored in the data dictionary and the

passwords stored in the password file for the non-SYS administrative users, such as SYSDBA, SYSOPER, SYSBACKUP, SYSDG, and SYSKM users are the same.

> **Note:**
>
> Starting with Oracle Database 12*c* Release 2 (12.2), authentication for the SYS user happens using only the password file and not using the data dictionary.

To synchronize the passwords for non-SYS administrative users, such as SYSDBA, SYSOPER, SYSBACKUP, SYSDG, and SYSKM users, you must first revoke and then regrant the privileges to these users as follows:

1. Find all users who have been granted the SYSDBA privilege.

   ```
   SELECT USERNAME FROM V$PWFILE_USERS WHERE USERNAME != 'SYS' AND SYSDBA='TRUE';
   ```

2. Revoke and then re-grant the SYSDBA privilege to these users.

   ```
   REVOKE SYSDBA FROM non-SYS-user;
   GRANT SYSDBA TO non-SYS-user;
   ```

3. Find all users who have been granted the SYSOPER privilege.

   ```
   SELECT USERNAME FROM V$PWFILE_USERS WHERE USERNAME != 'SYS' AND SYSOPER='TRUE';
   ```

4. Revoke and regrant the SYSOPER privilege to these users.

   ```
   REVOKE SYSOPER FROM non-SYS-user;
   GRANT SYSOPER TO non-SYS-user;
   ```

5. Find all users who have been granted the SYSBACKUP privilege.

   ```
   SELECT USERNAME FROM V$PWFILE_USERS WHERE USERNAME != 'SYS' AND SYSBACKUP ='TRUE';
   ```

6. Revoke and regrant the SYSBACKUP privilege to these users.

   ```
   REVOKE SYSBACKUP FROM non-SYS-user;
   GRANT SYSBACKUP TO non-SYS-user;
   ```

7. Find all users who have been granted the SYSDG privilege.

   ```
   SELECT USERNAME FROM V$PWFILE_USERS WHERE USERNAME != 'SYS' AND SYSDG='TRUE';
   ```

8. Revoke and regrant the SYSDG privilege to these users.

   ```
   REVOKE SYSDG FROM non-SYS-user;
   GRANT SYSDG TO non-SYS-user;
   ```

9. Find all users who have been granted the SYSKM privilege.

   ```
   SELECT USERNAME FROM V$PWFILE_USERS WHERE USERNAME != 'SYS' AND SYSKM='TRUE';
   ```

10. Revoke and regrant the SYSKM privilege to these users.

    ```
    REVOKE SYSKM FROM non-SYS-user;
    GRANT SYSKM TO non-SYS-user;
    ```

1.8.5 Adding Users to a Database Password File

When you grant SYSDBA, SYSOPER, SYSBACKUP, SYSDG, or SYSKM administrative privilege to a user, that user's name and privilege information are added to the database password file.

A user's name remains in the password file only as long as that user has at least one of these privileges. If you revoke all of these privileges, then Oracle Database removes the user from the password file.

> **Note:**
>
> The password file must be created with the FORMAT=12.2 or FORMAT=12 argument to support SYSBACKUP, SYSDG, or SYSKM administrative privilege.

Creating a Password File and Adding New Users to It

Use the following procedure to create a password file and add new users to it:

1. Follow the instructions for creating a password file as explained in "Creating a Database Password File with ORAPWD".
2. Set the REMOTE_LOGIN_PASSWORDFILE initialization parameter to exclusive. (This is the default.)

   Oracle Database issues an error if you attempt to grant these privileges and the initialization parameter REMOTE_LOGIN_PASSWORDFILE is not set correctly.

   > **Note:**
   >
   > REMOTE_LOGIN_PASSWORDFILE is a static initialization parameter and therefore cannot be changed without restarting the database.

3. Connect with SYSDBA privileges as shown in the following example, and enter the SYS password when prompted:

   ```
   CONNECT SYS AS SYSDBA
   ```

4. Start up the instance and create the database if necessary, or mount and open an existing database.
5. Create users as necessary. Grant SYSDBA, SYSOPER, SYSBACKUP, SYSDG, or SYSKM administrative privilege to yourself and other users as appropriate. See "Granting and Revoking Administrative Privileges".

1.8.6 Granting and Revoking Administrative Privileges

Use the GRANT statement to grant administrative privileges. Use the REVOKE statement to revoke administrative privileges.

To grant the SYSDBA, SYSOPER, SYSBACKUP, SYSDG, or SYSKM administrative privilege to a user:

- Run the GRANT statement.

For example:

```
GRANT SYSDBA TO mydba;
```

To revoke the administrative privilege from a user:

- Run the `REVOKE` statement.

For example:

```
REVOKE SYSDBA FROM mydba;
```

The `WITH ADMIN OPTION` is ignored if it is specified in the `GRANT` statement that grants an administrative privilege, and the following rules apply:

- A user currently connected as `SYSDBA` can grant any administrative privilege to another user and revoke any administrative privilege from another user.
- A user currently connected as `SYSOPER` *cannot* grant any administrative privilege to another user and *cannot* revoke any administrative privilege from another user.
- A user currently connected as `SYSBACKUP` can grant or revoke another user's `SYSBACKUP` administrative privilege.
- A user currently connected as `SYSDG` can grant or revoke another user's `SYSDG` administrative privilege.
- A user currently connected as `SYSKM` can grant or revoke another user's `SYSKM` administrative privilege.

Administrative privileges cannot be granted to roles, because roles are available only after database startup. Do not confuse the database administrative privileges with operating system roles.

> **See Also:**
>
> *Oracle Database Security Guide* for more information on administrative privileges

1.8.7 Viewing Database Password File Members

The `V$PWFILE_USERS` view contains information about users that have been granted administrative privileges.

To determine which users have been granted administrative privileges:

- Query the `V$PWFILE_USERS` view.

> **See Also:**
>
> *Oracle Database Reference* for information about the `V$PWFILE_USERS` view

1.8.8 Removing a Database Password File

You can remove a database password file if it is no longer needed.

If you determine that you no longer require a database password file to authenticate users, then to remove it:

- Delete the database password file, and optionally reset the `REMOTE_LOGIN_PASSWORDFILE` initialization parameter to `none`.

After you remove this file, only those users who can be authenticated by the operating system can perform `SYSDBA`, `SYSOPER`, `SYSBACKUP`, `SYSDG`, or `SYSKM` database administration operations.

1.9 Data Utilities

Oracle utilities are available to help you maintain the data in your Oracle Database.

SQL*Loader

SQL*Loader is used both by database administrators and by other users of Oracle Database. It loads data from standard operating system files (such as, files in text or C data format) into database tables.

Export and Import Utilities

The Data Pump utility enables you to archive data and to move data between one Oracle Database and another. Also available are the original Import (IMP) and Export (EXP) utilities for importing and exporting data from and to earlier releases.

> **See Also:**
>
> - *Oracle Database Utilities* for detailed information about SQL*Loader
> - *Oracle Database Utilities* for detailed information about Data Pump