Oracle® Database

Database Upgrade Guide

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Primary Author: Douglas Williams

Contributors: Drew Adams, Pablo Sainz Albanez, Frederick Alvarez, Yasin Baskan, Subhransu Basu, Rae Burns, Rhonda Day, Mike Dietrich, Joseph Errede, Yuan Hao, Jai Krisnani, Cindy Lim, Valarie Moore, Byron Motta, Satish Panchumarthy, Geetha Ravi, Carol Tagliaferri, Hector Vieyra, Eric Wittenberg

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Changes in This Release for Oracle Database Upgrade Guide

The new release of Oracle Database provides improvements to upgrade performance, automation, and reporting.

Changes in Oracle Database 18c

Review new and changed features in this section to understand new options after you upgrade.to Oracle Database 18c

New Features

New features in Oracle Database 18c are described in Chapter 8, "Behavior Changes, Deprecated and Desupported Features for Oracle Database 18c

Related Topics

- Feature Changes for Oracle Database 18c Upgrade Planning

Deprecated Features

Deprecated Features in Oracle Database 18c

Deprecated features are described in Chapter 8, "Behavior Changes, Deprecated and Desupported Features for Oracle Database 18c

Related Topics

- Behavior Changes, Deprecated and Desupported Features for Oracle Database 18c
  Review for information about Oracle Database 18c changes, deprecations, and desupports.

Desupported Features

Desupported features in Oracle Database 18c

Desupported features are described in Chapter 8, "Behavior Changes, Deprecated and Desupported Features for Oracle Database 18c."

Related Topics

- Deprecated Features in Oracle Database 18c
  Review the deprecated features listed in this section to prepare to use alternatives after you upgrade.

- Initialization Parameter Changes in Oracle Database 18c
  Review to see the list of new, deprecated, and desupported initialization parameters in this release.

Preface

These topics provide information about the scope of these contents for upgrading plans and procedures.

This book guides you through the process of planning and executing Oracle Database upgrades. In addition, this manual provides information about compatibility, upgrading applications, and important changes in the new Oracle Database release, such as initialization parameter changes and data dictionary changes.

Oracle Database Upgrade Guide contains information that describes the features and functions of Oracle Database (also known as the standard edition) and Oracle Database Enterprise Edition products. Oracle Database and Oracle Database Enterprise Edition have the same basic features. However, several advanced features are available only with Oracle Database Enterprise Edition, and some of these are optional. For example, to use application failover, you must have the Enterprise Edition with the Oracle Real Application Clusters option.

> **See Also:**
>
> *Oracle Database New Features Guide* for information about the differences between Oracle Database and Oracle Database Enterprise Edition and the features and options that are available to you

Audience

Oracle Database Upgrade Guide is intended for database administrators (DBAs), application developers, security administrators, system operators, and anyone who plans or performs Oracle Database upgrades.

To use this document, you must be familiar with the following information:

- Relational database concepts
- Your current Oracle Database release
- Your operating system environment

Documentation Accessibility

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

Access to Oracle Support

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

Related Documentation

Review this documentation list for additional information.

- *Oracle Database Concepts* for a comprehensive introduction to the concepts and terminology used in this manual
- *Oracle Database Administrator's Guide* for information about administering Oracle Database
- *Oracle Database SQL Language Reference* for information on Oracle Database SQL commands and functions
- *Oracle Database Utilities* for information about utilities bundled with Oracle Database
- *Oracle Database Net Services Administrator's Guide* for information about Oracle Net Services

Many of the examples in this guide use the sample schemas, installed by default when you select the Basic Installation option with an Oracle Database installation. For information on how these schemas are created and how you can use them, refer to the following guide:

Oracle Database Sample Schemas

Conventions

The following text conventions are used in this document:

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

1

Introduction to Upgrading Oracle Database

Oracle provides upgrade options and strategies that are designed for your database environment, and an array of tools that automate the Oracle Database upgrade process.

Topics:

Overview of Oracle Database Upgrade Tools and Processes

Review these topics to understand Oracle Database terms, tools and processes.

Definition of Terms Upgrading and Migrating

Upgrading and migrating are different types of database changes.

Upgrading transforms an existing Oracle Database environment (including installed components and associated applications) into a new release Oracle Database

environment. The data dictionary for the database is upgraded to the new release. Upgrading does not directly affect user data; no data is touched, changed, or moved during an upgrade.

Migrating data refers to moving data from one Oracle Database into another database previously created for migrating or moving the data. You migrate data when you need to move your database environment to a new hardware or operating system platform, or to a new character set. Migrating does not include upgrading to the latest release. The upgrade process is handled separately after you migrate the data.

The upgrade steps in *Oracle Database Upgrade Guide* apply to all operating systems, unless otherwise specified. Some operating systems can require additional upgrade steps.

Related Topics

- *Oracle Database Installation Guide*
- *Oracle Database Utilities*

Upgrade and Data Migration Methods and Processes

Oracle provides features and products to automate the upgrade process, and to assist you with completing upgrades efficiently.

Oracle Database supports the following methods for upgrading or migrating a database to the new release:

- Database Upgrade Assistant (DBUA)

  Provides a graphical user interface that guides you through the upgrade of a database. DBUA can be launched during installation with the Oracle Universal Installer, or you can launch DBUA as a standalone tool at any time in the future.

- Manual upgrade using the Parallel Upgrade Utility, and other command-line utilities

  Enables upgrades to be performed using shell scripts.

- Migrating data using Oracle Data Pump

  Provides export and import utilities. Oracle Data Pump can perform a full or partial export from your database, followed by a full, or partial import into the new release of Oracle Database. Export/Import in Oracle Data Pump can copy a subset of the data, leaving the database unchanged.

- `CREATE TABLE AS` SQL statement

  Migrates data from a database into a new Oracle Database release. By using this method, you can copy a subset of the data, leaving the database unchanged.

- Upgrading CDBs and PDBs using a priority list to group and upgrade PDBs according to their priority.

  Run the Parallel Upgrade Utility (`dbupgrade`, or `catctl.pl`) using the `-L` option to run the upgrade using a priority list, and to call that list as the upgrade runs.

- Synchronizing a standby database, upgrading, and using Oracle GoldenGate to synchronize the upgraded database (a zero downtime option)

- Using Rapid Home Provisioning (RHP) to upgrade databases.

In a Rapid Home Provisioning upgrade, you carry out a new Oracle Database installation. After testing the database, and modifying it in accordance with the standard operating environment (SOE) that you want to use for your databases, you create an RHP gold image. A DBA deploys instances of that gold image to servers that have earlier release databases that you want to upgrade. After deployment of these gold images, a DBA can run a single `rhpctl` command to move files, perform configuration changes, and perform other steps required to use the new binaries. Refer to *Oracle Clusterware Administration and Deployment Guide* for more information about Rapid Home Provisioning.

Related Topics

- *Oracle Clusterware Administration and Deployment Guide*

Oracle Database Releases That Support Direct Upgrade

Review the supported options for direct upgrades to the latest Oracle Database release.

You can perform a direct upgrade to the new release from the following releases:

- 11.2.0.3 and 11.2.0.4
- 12.1.0.1 and 12.1.0.2
- 12.2.0.1

The path that you must take to upgrade to the latest Oracle Database release depends on the release number of your current database.

If your current Oracle Database is a release earlier than 11.2.0.3, then you cannot directly upgrade your Oracle Database to the latest release. In this case, you are required to upgrade to an intermediate release before upgrading to Oracle Database 18c.

If you cannot carry out a direct upgrade, then carry out an upgrade to the most recent release where direct upgrades are supported.

> **Note:**
>
> For any multi-step upgrade, if you must carry out two upgrades to upgrade to the current release, then you must run the preupgrade script twice: First, for the intermediate upgrade release, and second, for the target upgrade target release.
>
> For example, if the database from which you are upgrading is running Oracle Database 10*g*, then follow these steps:
>
> 1. Upgrade release 10.2.0.5 to release 12.1.0.2 using the instructions in *Oracle Database Upgrade Guide 12c Release 1 (12.1)*, including running the pre-upgrade script for 12.1.0.2.
> 2. Upgrade Oracle Database 12*c* release 1 (12.1.0.2) directly to Oracle Database 18c. Use the instructions in this book, *Oracle Database Upgrade Guide*, including running the preupgrade script for 18.1.

The following table shows the required upgrade path for each release of Oracle Database. Use the upgrade path and the specified documentation to perform an intermediate upgrade of your database before fully upgrading to Oracle Database 18c.

Table 1-1 Examples of Upgrade Paths for Oracle Database 18c

Current Release	Upgrade Options
12.2.0.1, 12.1.0.1, 12.1.0.2 11.2.0.3, 11.2.0.4	**Direct upgrade is supported.** Perform the upgrade using the current Oracle Database Upgrade Guide, which is this guide.
11.2.0.1, 11.2.0.2 11.1.0.6, 11.1.0.7 10.2.0.2, 10.2.0.3, 10.2.0.4 and 10.2.0.5 10.1.0.5 9.2.0.8 or earlier	**Direct upgrade to Oracle Database 18c is not supported.** **Solution:** Upgrade to an intermediate Oracle Database release that can be directly upgraded to the current release. Upgrade Oracle Database releases that are not supported for direct upgrade in this release to an intermediate Oracle Database release that is supported for direct upgrade. When upgrading to an intermediate Oracle Database release, follow the instructions in the intermediate release documentation, including running the preupgrade scripts for that intermediate release. After you complete an upgrade to the intermediate release Oracle Database, you can upgrade the intermediate release database to the current Oracle Database release. This restriction does not apply if you use Oracle Data Pump export/import to migrate data to the new release. For example: • If you are upgrading from release 11.2.0.2 or 11.1.0.7, then you must first upgrade to Oracle Database 11*g* release 2 (11.2.0.3). • If you are upgrading from release 10.2.0.2, 10.2.0.3, 10.2.0.4,10.2.0.5 or 10.1.0.5, then you must first upgrade to release 11.2. or 12.1 • If you are upgrading from release 9.2.0.8, then you must first upgrade to a sequence of intermediate Oracle Database releases: Upgrade from release 9.2.0.8 to release 11.2.0.3 or 11.2.0.4. Then upgrade from release 11.2 to 18c **Note:** Always update to the most recent intermediate release to which you can upgrade directly. Your case can be different from that of the examples provided here.

Where to Find the Latest Information About Upgrading Oracle Database

In addition to this document, Oracle provides information about upgrades on its support site, and through its Pre-Upgrade Information Tool.

Through its support website, Oracle provides late-breaking updates, discussions, and best practices about pre-upgrade requirements, upgrade processes, post-upgrade, compatibility, and interoperability.

Oracle also strongly recommends that you download and run the Pre-Upgrade Information Tool, which is available on My Oracle Support.

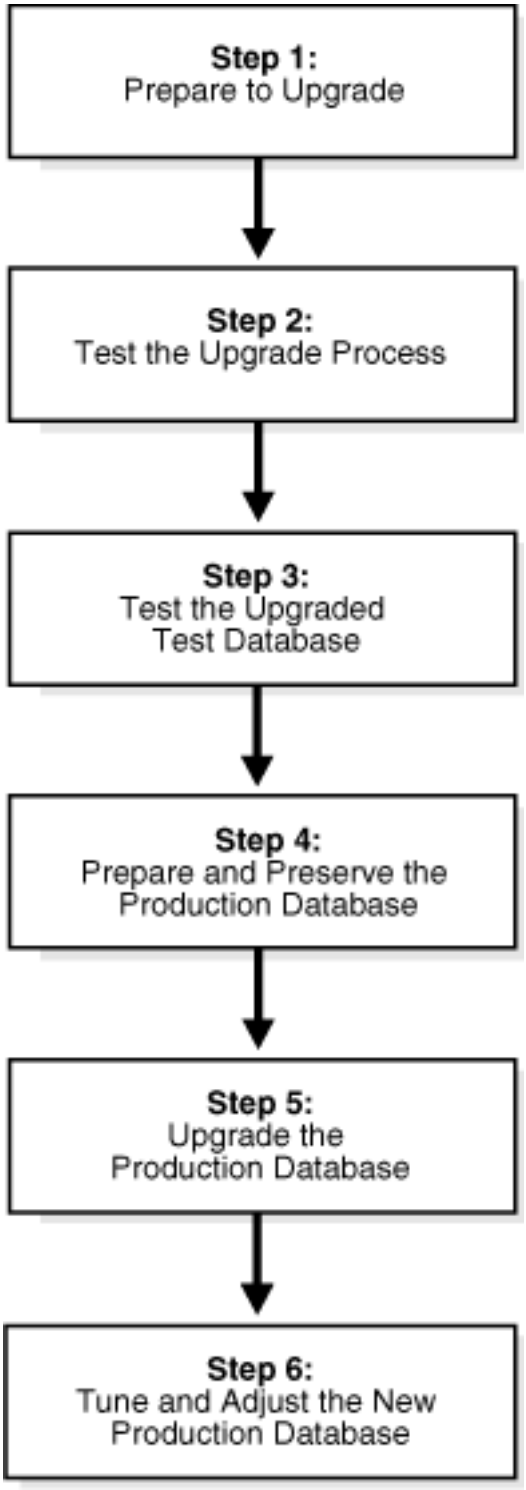
Major Steps in the Upgrade Process for Oracle Database

Oracle Database upgrades consist of six major steps.

Upgrade Steps Workflow

The following figure summarizes the major procedures performed during the upgrade process:

Figure 1-1 Upgrade Steps Workflow for Oracle Database



Step 1: Prepare to Upgrade Oracle Database

- Become familiar with the features of the new release of Oracle Database.
- Determine the upgrade path to the new release.

- Select an upgrade method.
- Select an Oracle home directory for the new release.
- Develop a testing plan.
- Prepare a backup strategy.
- Follow preupgrade recommendations.
- Run preupgrade fixup scripts, or carry out manual preupgrade system updates.

> **Note:**
>
> During the upgrade, consider running multiple releases of the database software, so that you can use the existing release as your production environment while you test the new release.
>
> Consider completing a software-only installation to the new Oracle Database release. In a software-only installation, you install the Oracle Database software but do not create a database as part of the installation process.

Step 2: Test the Upgrade Process for Oracle Database

- Perform a test upgrade using a test database. Conduct the test upgrade in an environment created for testing that does not interfere with the production database. Your test environment should be on a server that is as much as possible a replica of the production environment. For example: the server should not only use the same operating system. The operating system should be running the same patch level, with the same packages, and match other details of system configuration.

Step 3: Test the Upgraded Test Oracle Database

- Perform the tests that you planned in Step 1 on the test database that you upgraded to the new release of Oracle Database.
- Review the results, noting anomalies in the tests.
- Investigate ways to correct any anomalies that you find and then implement the corrections.
- Repeat Step 1, Step 2, and the first parts of Step 3, as necessary, until the test upgrade is successful and works with any required applications.
- To test for anomalies and determine potential support questions, carry out SQL plan management. SQL plan management includes the following steps:

  1. Before the upgrade, capture baselines and plans on the earlier release Oracle Database, and store those plans.

     Oracle recommends that you store the plans on staging tables, and then run the Data Pump Export utility `expdp` for those tables.

  2. After the upgrade, in the event of a regression or a performance issue, apply (load/accept/evolve) an old plan that you know is good, based on the plans you captured from the previous release Oracle Database.

See Also:

- *Oracle Database SQL Tuning Guide* for more information about SQL plan management
- Document 1948958.1 Patches to Consider for 11.2.0.3 to Avoid Problems with SQL Plan Management (SPM)
- Document 2034706.1 Patches to Consider for 11.2.0.4 to Avoid Problems with SQL Plan Management (SPM)
- Document 2035897.1 Patches to Consider When Upgrading From 12.1.0.1 to Avoid Problems with SQL Plan Management (SPM)

Step 4: Prepare and Preserve the Production Oracle Database

Complete these tasks before you upgrade your existing production database:

- Prepare the current production database as appropriate to ensure that the upgrade to the new release of Oracle Database is successful.
- Schedule the downtime required for backing up and upgrading the production database.
- Back up the current production database.

  Before you carry out a major change to a system, Oracle recommends that you make sure that you have a fallback strategy implemented. Your fallback strategy should include the following:

  – Test your backup strategy, and ensure that it works.
  – If you need a backup strategy, then plan for the time required to apply it.
  – To perform plan stability checks in preparation for upgrade, carry out SQL plan management. Raise a service request if you need assistance.

Note:

A database upgrade that installs a new optimizer version usually results in plan changes for a small percentage of SQL statements.

Most plan changes result in either improvement or no performance change. However, some plan changes may cause performance regressions. SQL plan baselines significantly minimize potential regressions resulting from an upgrade.

When you upgrade, the database only uses plans from the plan baseline. The database puts new plans that are not in the current baseline into a holding area, and later evaluates them to determine whether they use fewer resources than the current plan in the baseline. If the plans perform better, then the database promotes them into the baseline; otherwise, the database does not promote them.

> **See Also:**
>
> *Oracle Database SQL Tuning Guide*

Step 5: Upgrade the Production Oracle Database

- Upgrade the production database to the new release of Oracle Database.
- After the upgrade, perform a full backup of the production database and perform other post-upgrade tasks.

Step 6: Tune and Adjust the New Production Oracle Database

- Tune the new production database for Oracle Database 12*c*. The new production database should perform to the same standards, or better, than the database before the upgrade.
- Determine which features of Oracle Database 12*c* to use, and update your applications accordingly.
- Develop new database administration procedures as needed.
- Do not upgrade production users to the new release until all applications have been tested and operate properly.

Related Topics

- https://support.oracle.com/epmos/faces/DocumentDisplay?cmd=show&type=NOT&id=1948958.1
- https://support.oracle.com/epmos/faces/DocumentDisplay?cmd=show&type=NOT&id=2034706.1
- https://support.oracle.com/epmos/faces/DocumentDisplay?cmd=show&type=NOT&id=2035897.1

Compatibility and Interoperability between Oracle Database Releases

Review to understand compatibility differences.

Compatibility and interoperability issues may arise because of differences between Oracle Database releases. These differences can affect both general database administration and existing applications.

- About Oracle Database Release Numbers
  Oracle Database releases are categorized by five numeric segments that indicate release information.
- Convention for Referring to Release Numbers in Oracle Database Upgrade Guide
  Review to understand how statements apply to releases.
- What Is Oracle Database Compatibility?
  If new features are incompatible with your earlier release, then Database compatibility can cause issues.

- What Is Interoperability for Oracle Database Upgrades?
  In the context of upgrading Oracle Database, *interoperability* is the ability of different releases of Oracle Database to communicate and work in a distributed environment.
- About Invalid Schema Objects and Database Upgrades
  Run `utlrp.sql` to validate invalid objects as part of your upgrade test plan.
- About Upgrading Oracle OLAP Data Security Policies
  Security policies are stored differently starting with Oracle Database 12*c*. If your existing Oracle Database is 11*g* Release 11.2, then delete security roles.

About Oracle Database Release Numbers

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

Oracle Database releases are released in `version` and `version_full` releases. The version is designated in the form *major release numeral*.0.0.0.0. The release version is the annual release designation of the database software. For example: 2018 is the release year, and the release version is `18.0.0.0.0`. The `version_full` release is updated using numeric segments that change, based on the annual release designation of the software, the quarterly release update version (RU), and the quarterly release updates revision (RUR).

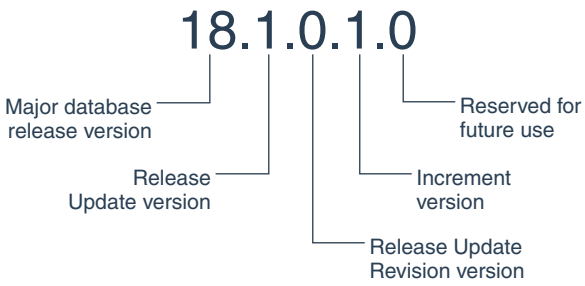
Oracle Database `version_full` releases are categorized by three numeric segments, which are divided by periods. The first, second, and third numerals provide information about the Oracle Database releases, starting with Oracle Database release 18c:

- First numeral: Oracle Database major release number. For example: Oracle Database 18c; Oracle Database 12*c*. Starting with Oracle Database 18*c,* the first numeral indicates the initial year in which an Oracle Database version is released. For example: 2018 is the initial release year for Oracle Database 18c (18.0.0.0.0)
- Second numeral: Oracle Database release update in Oracle Database 18c and later releases. For example: 18.1 is release update 1. In releases before Oracle Database 18c, the second numeral designates a maintenance release number. For example: Oracle Database 12*c* release 1 (12.1); Oracle 12*c* release 2 (12.2).
- Third numeral: Oracle Database release updates revision (RUR) version. For example: 18.1.1.; 18.2.1.
- Fourth numeral: Oracle Database increment version. This nomenclature can apply to updates in future releases, and it applies to all releases earlier than 18c. For example: 12.1.0.1, 12.2.0.1,
- Fifth numeral: This numeral is reserved for future use.

> **Caution:**
>
> Oracle strongly recommends that you apply the most recent release update (RU) or bundle patch or patch set update to your source and target databases before starting an upgrade, and before starting a downgrade.

The following illustration shows each part of a release number, and what each numeral represents:

Figure 1-2 Example of an Oracle Database Release Number



Related Topics

- https://support.oracle.com/rs?type=docid=2285040.1
- https://support.oracle.com/rs?type=doc&id=854428.1

Convention for Referring to Release Numbers in *Oracle Database Upgrade Guide*

Review to understand how statements apply to releases.

When a statement is made in *Oracle Database Upgrade Guide* about a major database release number, the statement applies to all releases within that major database release.

Similarly, when a statement is made in *Oracle Database Upgrade Guide* about a maintenance release, the statement applies to all component-specific and platform-specific releases within that maintenance release. A statement about Oracle Database 12*c* applies to all component-specific and platform-specific releases within this release. A statement about Oracle Database 11*g* Release 2 (11.2) applies to release 11.2.0.2, release 11.2.0.3, and all other platform-specific releases within Oracle Database 11*g* Release 2 (11.2).

What Is Oracle Database Compatibility?

If new features are incompatible with your earlier release, then Database compatibility can cause issues.

Databases from different releases of Oracle Database software are compatible if they support the same features, and if those features perform the same way. When you upgrade to a new release of Oracle Database, certain new features can make your database incompatible with your earlier release.

Your upgraded database becomes incompatible with your earlier release under the following conditions:

- A new feature stores any data on disk (including data dictionary changes) that cannot be processed with your earlier release.

- An existing feature behaves differently in the new environment as compared to the old environment.

Topics:

The COMPATIBLE Initialization Parameter in Oracle Database

Review to understand how to set the COMPATIBLE initialization parameter for non-CDB and multitenant architecture containers.

Oracle Database enables you to control the compatibility of your database with the `COMPATIBLE` initialization parameter.

Understanding the COMPATIBLE Initialization Parameter

In Oracle Database 18c, when the `COMPATIBLE` initialization parameter is not set in your parameter file, the COMPATIBLE parameter value defaults to `18.0.0` If you do not set the `COMPATIBLE` initialization parameter to `18.0.0`, then you cannot use the new Oracle Database 18c features, because your upgraded database is not running in the required `COMPATIBILITY` setting for Oracle Database 18c features.

When the Oracle Database `COMPATIBLE` parameter is increased to `18.0.0`, the first Java call to the database initiates a "name translation" operation. This operation can require a few minutes to complete. You should expect this delay the first time a Java call is made to the database after you increase the compatibility parameter. This initial delay to carry out the name translation occurs only during the initial Java call.

Note:

- Before upgrading to Oracle Database 18c, you must set the `COMPATIBLE` initialization parameter to at least `11.2.0`, which is the minimum setting for Oracle Database 18c.
- The compatible parameter must be at least 3 decimal numbers, separated by periods. For example:

  ```
  SQL> ALTER SYSTEM SET COMPATIBLE = '12.1.0.2' SCOPE=SPFILE;
  ```

- Oracle recommends that you only raise the `COMPATIBLE` parameter after you have thoroughly tested the upgraded database.
- After you increase the `COMPATIBLE` parameter, you cannot downgrade the database.

Caution:

If you are upgrading from Oracle Database release 11.2, then you must set the compatible value to at least 11.2.0. You must do this at the time of the upgrade. Do not make this change until you are ready to upgrade, because a downgrade back to an earlier compatibility level is not possible after you raise the COMPATIBLE initialization parameter value.

See Also:

Oracle Database Administrator's Guide for information about managing initialization parameters

Rules for COMPATIBILE Parameter Settings in Multitenant Architecture

The `COMPATIBLE` parameter of the container database (CDB) affects the `COMPATIBLE` parameter settings of pluggable databases (PDBs) plugged into that container database. Review the following scenarios that occur when you plug in a PDB to a CDB:

- PDB `COMPATIBLE` equal to `CDB$ROOT` `COMPATIBLE` parameter setting.

  Result: No change to the PDB COMPATIBLE parameter setting.

- PDB `COMPATIBLE` is lower than `CDB$ROOT` `COMPATIBLE` parameter setting.

  Result: The PDB COMPATIBILE parameter is increased automatically to the same `COMPATIBLE` parameter setting as `CDB$ROOT`. After you plug in the PDB, you cannot downgrade the PDB to an earlier release.

- PDB `COMPATIBLE` is higher than `CDB$ROOT` `COMPATIBLE` parameter setting.

  Result: The PDB cannot be plugged in. Only PDBs with a `COMPATIBLE` parameter setting equal to or higher than `CDB$ROOT` can be plugged in to the CDB.

Values for the COMPATIBLE Initialization Parameter in Oracle Database

Review to find the default, minimum, and maximum values for `COMPATIBLE`.

The following table lists the default, minimum, and maximum values of the `COMPATIBLE` initialization parameter in Oracle Database 18c and in each release supported for upgrading to Oracle Database 18c:

Table 1-2 The COMPATIBLE Initialization Parameter

Oracle Database Release	Default Value	Minimum Value	Maximum Value
Oracle Database 18c	`18.0.0`	`11.2.0`	`18.`*`RU`*`.`*`RUR`* With each release update (RU) or release update revision (RUR), the maximum value increment increases to the most recent update or revision. For example, for 18.1.0, the maximum value is 18.1.0. For 18c release update 2, release update revision 2, the maximum value is 18.2.2.
Oracle Database 12*c* Release 2 (12.2)	`12.2.0`	`11.2.0`	`12.2.0`
Oracle Database 12*c* Release 1 (12.1)	`12.0.0`	`11.0.0`	`12.1.0`
Oracle Database 11*g* Release 2 (11.2)	`11.2.0`	`10.0.0`	`11.2.0`

About Downgrading and Compatibility for Upgrading Oracle Database

Before upgrading to Oracle Database 18c , you must set the `COMPATIBLE` initialization parameter to at least `11.2.0`.

After upgrading to Oracle Database 18c, you can set the `COMPATIBLE` initialization parameter to match the release number of the new release. Doing so enables you to use all features of the new release, but prevents you from downgrading to your earlier release. Only a subset of Oracle Database 18c features are available while the `COMPATIBLE` initialization parameter is set to a lower value.

> **Note:**
>
> After you increase the `COMPATIBLE` parameter, the database cannot be downgraded.

Related Topics

- Downgrading Oracle Database to an Earlier Release

How the COMPATIBLE Initialization Parameter Operates in Oracle Database

The `COMPATIBLE` initialization parameter enables or disables Oracle Database features based on release compatibility

The `COMPATIBLE` initialization parameter operates in the following way:

- The `COMPATIBLE` initialization parameter enables or disables the use of features, to help protect your existing application use of data.

  If you run an Oracle Database 12*c* database with the `COMPATIBLE` initialization parameter set to `11.2.0`, then the database software generates database structures on disk that are compatible with Oracle Database Release 11*g* release 2 (11.2). If you try to use features that are part of a later release of Oracle Database, and make the database incompatible with the `COMPATIBLE` initialization parameter, then an error occurs. However, new features are enabled that do not create changes on disk that are incompatible with Oracle Database Release 11*g* release 2.
- If you make changes to the database that make the database incompatible with the `COMPATIBLE` initialization parameter setting you want to use, then the database does not start, and initialization terminates in an error. If this happens, then you must set the `COMPATIBLE` initialization parameter to an appropriate value for the database.

Checking the Compatibility Level of Oracle Database

Use this SQL query to check that the compatibility level of your database corresponds to the value of the `COMPATIBLE` initialization parameter:

```
SQL> SELECT name, value FROM v$parameter
         WHERE name = 'compatible';
```

When to Set the COMPATIBLE Initialization Parameter in Oracle Database

Oracle recommends increasing the `COMPATIBLE` parameter only after you have completed testing the upgraded database.

After the upgrade is complete, you can increase the setting of the `COMPATIBLE` initialization parameter to the maximum level for the new Oracle Database release. However, after you increase the `COMPATIBLE` parameter, you cannot subsequently downgrade the database.

What Is Interoperability for Oracle Database Upgrades?

In the context of upgrading Oracle Database, *interoperability* is the ability of different releases of Oracle Database to communicate and work in a distributed environment.

A distributed database system can comprise different releases of Oracle Database, and all supported releases of Oracle Database can participate in the distributed database system. However, the applications that work with a distributed database must also be able to interoperate with the features and functions that are available at each node in the system.

Interoperability across disparate operating systems and operating system versions can cause problems (especially during rolling upgrades) because the minimum requirements for the new Oracle Database release may require you to upgrade the operating systems on some or all of your hosts. For this reason, before you start an Oracle Database upgrade, you must check to ensure that drivers, network, and storage are compatible for all the interim upgrade states of the system during the rolling upgrade.

> **Note:**
>
> Because *Oracle Database Upgrade Guide* discusses upgrading and downgrading between different releases of Oracle Database, the definition of *interoperability* is for Oracle Database releases. Other Oracle documentation may use a broader definition of the term *interoperability*. For example, interoperability in some cases can describe communication between different hardware platforms and operating systems.
>
> My Oracle Support note 207303.1 "Client / Server / Interoperability Support Between Different Oracle Versions" provides additional information.

Related Topics

- https://support.oracle.com/rs?type=doc&id=207303.1

About Invalid Schema Objects and Database Upgrades

Run `utlrp.sql` to validate invalid objects as part of your upgrade test plan.

After database upgrades, release changes can result in invalid schema objects in the upgraded database. Typically, invalid objects fix themselves as they are accessed or run. However, Oracle recommends that you recompile invalid objects in the database as part of your patching and upgrade procedure, so that you resolve issues with invalid objects, and any required dependencies, before users encounter these invalid objects.

Object validation is an operation that checks the Oracle Database Data Definition Language (DDL) statements. These statements are used to define the database structure or schema. Validating DDL statements can take time to complete. The following is a list of some common factors that can affect object validation time:

- Number of invalid objects
- CPU types
- Processor speeds
- System loads
- Available physical memory

The `utlrp.sql` command recompiles all objects in an invalid state, including packages, procedures, and types. It is located in the `$ORACLE_HOME/rdbms/admin` directory. The `utlrp.sql` script automatically runs in serial or in parallel recompilation, based on the number of CPUs available (identified by the parameter `cpu_count`), multiplied by the number of threads for each CPU (identified by the parameter `parallel_threads_per_cpu`). On Oracle Real Application Clusters

systems (Oracle RAC), the number of parallel threads is added across all Oracle RAC nodes.

Run the command either as the SYS user, or as another user account that is granted the SYSDBA system privileges.

Oracle recommends that you run the `utlrp.sql` command in the earlier release Oracle Database to recompile any existing invalid objects in your database. Particularly ensure that SYS and SYSTEM user schema invalid objects are updated. During upgrade tests, run `utlrp.sql` in the upgraded Oracle Database as part of your upgrade test plan, so that you can include planning for recompilation time as part of your upgrade. Recompilation time is proportional to the number of invalid objects in the database. If the upgrade results in a large number of invalid objects, then `utlrp.sql` can take a significant amount of time to run.

About Upgrading Oracle OLAP Data Security Policies

Security policies are stored differently starting with Oracle Database 12*c*. If your existing Oracle Database is 11*g* Release 11.2, then delete security roles.

In Oracle Database 12*c*, Oracle OLAP uses Oracle Real Application Security (ORAS) to store OLAP data security policies instead of Extensible Data Security (XDS), which it used in Oracle Database 11*g* releases.

When you upgrade Oracle Database from release 11*g* to new Oracle Database releases, any XDS data security policies are automatically converted to ORAS.

> **Note:**
>
> Data security roles defined in a release 11*g* Oracle Database instance are not automatically converted to ORAS. Before you upgrade Oracle Database Release 11*g* to a current Oracle Database release, you must delete any data security roles that are defined in the 11*g* database. After the upgrade, you can use the new release Oracle Database Analytic Workspace Manager to define the data security roles again.
>
> If you upgrade an 11*g* database without deleting the 11*g* data security roles, then any data security policies that include a data security role are invalid in the later Oracle Database releases.

Related Topics

- *Oracle OLAP User's Guide*

About Running Multiple Oracle Releases

Run multiple releases using Optimal Flexible Architecture (OFA).

Optimal Flexible Architecture (OFA) is a set of configuration guidelines for efficient and reliable Oracle Database and Oracle Grid Infrastructure deployments. Oracle recommends that you deploy all Oracle software installations in accordance with the OFA architecture standard for Oracle Database installations. Following the OFA standard helps to ensure that your installations are easier for you to maintain, and easier for you to obtain rapid assistance from Oracle Support.

OFA provides the following benefits:

- Organizes large amounts of complicated software and data on disk, which can help to avoid device bottlenecks and poor performance
- Facilitates routine administrative tasks, such as software and data backup functions, which are often vulnerable to data corruption
- Simplifies the administration of multiple Oracle databases
- Helps eliminate fragmentation of free space in the data dictionary, isolates other fragmentation, and helps to minimize resource contention
- Assists database administrators to deploy an effective enterprise data management strategy

If you are not currently using the OFA standard, then switching to the OFA standard involves modifying your directory structure and relocating your database files.

For more information about OFA, refer to your operating system-specific Oracle documentation. For more information about managing data files and temp files, refer to *Oracle Database Administrator's Guide*.

- Databases in Multiple Oracle Homes on Separate Computers
  Review if you want to connect to multiple releases using Oracle Database clients.
- Databases in Multiple Oracle Homes on the Same Computer
  Installing earlier releases of Oracle Database on the same computer that is running Oracle Database 18c can cause issues with client connections.
- About the Optimal Flexible Architecture Standard
  Oracle Optimal Flexible Architecture (OFA) rules help you to organize database software and configure databases to allow multiple databases, of different versions, owned by different users to coexist.
- About Multiple Oracle Homes Support
  Oracle Database supports multiple Oracle homes. You can install this release or earlier releases of the software more than once on the same system, in different Oracle home directories.

Related Topics

- *Oracle Database Administrator's Guide*

Databases in Multiple Oracle Homes on Separate Computers

Review if you want to connect to multiple releases using Oracle Database clients.

You can install Oracle Database 12*c* and Oracle Database 11*g* databases in Oracle homes on separate computers and Oracle Database 12*c* with Oracle Database 11*g* clients connecting to any or all of the databases. However, you must install the latest release first and install earlier releases subsequently in descending chronological order. Installing in descending chronological order ensures that each installation can find the Oracle inventory and register its installation, so that you can avoid a corruption of the Oracle inventory.

Databases in Multiple Oracle Homes on the Same Computer

Installing earlier releases of Oracle Database on the same computer that is running Oracle Database 18c can cause issues with client connections.

You can find that you are not able to install earlier releases of Oracle Database on the same computer that is running Oracle Database 18c and have clients connect to the databases of the earlier releases. For example, you cannot have Oracle Database 11*g*, Oracle Database 12*c*, and Oracle Database 18c databases in multiple (or separate) Oracle homes on the same computer and have Oracle Database 11*c*, Oracle Database 12*c*, and Oracle Database 18c clients connecting to any or all of the databases on this computer. You may be able to have a combination of some releases on one system.

Oracle recommends that you obtain the latest information on compatibility and supported configurations from My Oracle Support Note 207303.1 "Client / Server / Interoperability Support Between Different Oracle Versions" on My Oracle Support.

About the Optimal Flexible Architecture Standard

Oracle Optimal Flexible Architecture (OFA) rules help you to organize database software and configure databases to allow multiple databases, of different versions, owned by different users to coexist.

In earlier Oracle Database releases, the OFA rules provided optimal system performance by isolating fragmentation and minimizing contention. In current releases, OFA rules provide consistency in database management and support, and simplifies expanding or adding databases, or adding additional hardware.

By default, Oracle Universal Installer places Oracle Database components in directory locations and with permissions in compliance with OFA rules. Oracle recommends that you configure all Oracle components on the installation media in accordance with OFA guidelines.

Oracle recommends that you accept the OFA default. Following OFA rules is especially of value if the database is large, or if you plan to have multiple databases.

> **Note:**
>
> OFA assists in identification of an ORACLE_BASE with its Automatic Diagnostic Repository (ADR) diagnostic data to properly collect incidents.

About Multiple Oracle Homes Support

Oracle Database supports multiple Oracle homes. You can install this release or earlier releases of the software more than once on the same system, in different Oracle home directories.

Careful selection of mount point names can make Oracle software easier to administer. Configuring multiple Oracle homes in compliance with Optimal Flexible Architecture (OFA) rules provides the following advantages:

- You can install this release, or earlier releases of the software, more than once on the same system, in different Oracle home directories. However, you cannot install products from one release of Oracle Database into an Oracle home directory of a different release. For example, you cannot install Oracle Database 18c software into an existing Oracle 11*g* Oracle home directory.

- Multiple databases, of different versions, owned by different users can coexist concurrently.
- You must install a new Oracle Database release in a new Oracle home that is separate from earlier releases of Oracle Database.

  You cannot install multiple releases in one Oracle home. Oracle recommends that you create a separate Oracle Database Oracle home for each release, in accordance with the Optimal Flexible Architecture (OFA) guidelines.
- In production, the Oracle Database server software release must be the same as the Oracle Database dictionary release through the first four digits (the major, maintenance, and patch release number).
- Later Oracle Database releases can access earlier Oracle Database releases. However, this access is only for upgrades. For example, Oracle Database 12*c* release 2 can access an Oracle Database 11*g* release 2 (11.2.0.4) database if the 11.2.0.4 database is started up in upgrade mode.
- Oracle Database Client can be installed in the same Oracle Database home if both products are at the same release level. For example, you can install Oracle Database Client 12.2.0.1 into an existing Oracle Database 12.2.0.1 home but you cannot install Oracle Database Client 12.2.0.1 into an existing Oracle Database 12.1.0.2 home. If you apply a patch set before installing the client, then you must apply the patch set again.
- Structured organization of directories and files, and consistent naming for database files simplify database administration.
- Login home directories are not at risk when database administrators add, move, or delete Oracle home directories.
- You can test software upgrades in an Oracle home in a separate directory from the Oracle home where your production database is located.

About Converting Databases During Upgrades

Review these topics to determine which is the best path for you to select to upgrade Oracle Databases.

- Overview of Converting Databases During Upgrades
  There are four methods you can use to convert databases during Oracle Database upgrades.
- About 32-bit Oracle Databases to 64-bit Oracle Database Conversions
  32-bit Oracle Databases are automatically converted to 64-bit.
- About Upgrading Using Standby Databases
  You can perform rolling upgrades of databases by using Active Oracle Data Guard, or by using Oracle Enterprise Manager Cloud Control.
- Using Oracle GoldenGate for Online Database Upgrades
  The continuous extraction and replication capabilities of Oracle GoldenGate can enable online upgrades of Oracle Database.
- Migrating From Standard Edition to Enterprise Edition of Oracle Database
  Review these options to migrate to Oracle Database Enterprise Edition from Oracle Database Standard Edition

- Migrating from Enterprise Edition to Standard Edition of Oracle Database
  Converting from Enterprise Edition to Standard Edition requires exporting and importing data.
- Migrating from Oracle Database Express Edition (Oracle Database XE) to Oracle Database
  You must upgrade from Oracle Database Express Edition to Oracle Database Enterprise Edition, and then upgrade to the current Oracle Database release.

Overview of Converting Databases During Upgrades

There are four methods you can use to convert databases during Oracle Database upgrades.

The following table lists methods that you can use to convert upgrades, including references to availability issues. It also provides references to the documentation that describes how to carry out each upgrade method.

Table 1-3 Methods for Converting Databases During Upgrades

Method	Description	Reference
Oracle Data Guard Transient Standby (Physical Standby) database	Use an existing physical standby database to perform a database upgrade by temporarily converting it to a logical standby database, and then converting it back to a physical standby.	*Oracle Database Upgrade Guide*, "About Upgrading Using Standby Databases"
Oracle GoldenGate synchronization of production and standby databases for zero downtime upgrades	Use Oracle GoldenGate with software upgrades and with Oracle Database data migration procedures to carry out a synchronization approach to maintaining availability during an upgrade: • Use RMAN restore and upgrade to set up a standby database running the earlier release software using an existing backup • Upgrade the standby database to the new Oracle Database release • Move the entire database and synchronize the standby database with the production database using the following tools: – Oracle Data Pump – Transportable Tablespaces (TTS) – CREATE TABLE AS SELECT (CTIS) to create new tables and populate them with rows from specified queries. – INSERT AS SELECT (IAS) to create nonpartitioned tables • Use Data Load/Unload to load data into the new database release, and unload data from the old database release	Oracle GoldenGate documentation, and relevant Oracle Database documentation
Oracle Enterprise Manager Cloud Control	Starting with Oracle Database 12*c*, Oracle provides Cloud Control support for performing database upgrades. This option requires that you purchase the Enterprise Manager Lifecycle Management Pack.	Online help in Oracle Enterprise Manager Cloud Control

> **Note:**
>
> Upgrades of Oracle Grid Infrastructure (Oracle Clusterware and Oracle Automatic Storage Management) are carried out separately, before Oracle Database upgrades. You must complete Oracle Grid Infrastructure upgrades before you upgrade Oracle Database installations. Other features installed with Oracle Database can have additional upgrade requirements.

Related Topics

- *Oracle Grid Infrastructure Installation Guide* for your platform
- Oracle GoldenGate documentation

About 32-bit Oracle Databases to 64-bit Oracle Database Conversions

32-bit Oracle Databases are automatically converted to 64-bit.

If you are installing 64-bit Oracle Database software, and your existing Oracle Database is a 32-bit Oracle Database installation, then your existing Oracle Database is automatically converted to 64-bit during the upgrade to the new Oracle Database release.

About Upgrading Using Standby Databases

You can perform rolling upgrades of databases by using Active Oracle Data Guard, or by using Oracle Enterprise Manager Cloud Control.

The `DBMS_ROLLING` PL/SQL package enables you to upgrade the database software in an Oracle Data Guard configuration in a rolling fashion. Rolling upgrades using Active Data Guard uses an Oracle Data Guard physical standby database and the SQL Apply process. Using Data Guard for rolling upgrades is supported for Oracle Database 12c release 1 (12.1) and later Oracle Database releases.

With Oracle Database 12*c* release 2 (12.2) and later releases, when you perform a rolling upgrade using the DBMS_ROLLING PL/SQL package, you no longer need to disable the broker. In addition, the broker now reports when a rolling upgrade is in place, and tracks its status. The status information is displayed in the output of the DGMGRL commands SHOW CONFIGURATION and SHOW DATABASE.

Oracle Enterprise Manager Cloud Control provides options to perform a rolling upgrade of databases in a Data Guard configuration. The procedures are described in online help within Cloud Control.

Using Oracle GoldenGate for Online Database Upgrades

The continuous extraction and replication capabilities of Oracle GoldenGate can enable online upgrades of Oracle Database.

Topics:

- About Oracle GoldenGate and Online Database Upgrade
  Using Oracle GoldenGate replication can simplify your upgrade by enabling you to carry out the upgrade online.

- Overview of Steps for Upgrading Oracle Database Using Oracle GoldenGate
  Review these steps to understand how to upgrade Oracle Database using Oracle GoldenGate.

About Oracle GoldenGate and Online Database Upgrade

Using Oracle GoldenGate replication can simplify your upgrade by enabling you to carry out the upgrade online.

In an Oracle GoldenGate replication environment, you can perform an online database upgrade to the current release of Oracle Database. Using an Oracle GoldenGate replication environment minimizes database downtime during upgrading. Oracle GoldenGate is an excellent method to minimize downtime during planned maintenance, including application and database upgrades, in addition to platform migrations. Oracle GoldenGate is an Oracle product sold independently of Oracle Database for Oracle and third-party database management systems.

Overview of Steps for Upgrading Oracle Database Using Oracle GoldenGate

Review these steps to understand how to upgrade Oracle Database using Oracle GoldenGate.

Upgrading to the new Oracle Database release using Oracle GoldenGate consists of the following high-level steps.

1. Set up a standby database running the earlier database software release using an existing database backup.
2. Upgrade the standby database to the new Oracle Database release.
3. Synchronize the standby database with the production database.
4. Test your environment in active/live mode.
5. Switch over the application to the standby database.
6. Carry out comprehensive testing of the new release on the standby database.
7. Upgrade the primary database to the new Oracle Database release

> **See Also :**
>
> *Oracle GoldenGate* documentation library for Oracle GoldenGate procedures, unless otherwise specified
>
> *Oracle Database Testing Guide* for information about testing a database upgrade

Migrating From Standard Edition to Enterprise Edition of Oracle Database

Review these options to migrate to Oracle Database Enterprise Edition from Oracle Database Standard Edition

If you have Oracle Database Standard Edition at a release earlier than the new Oracle Database release, then you can change it from a Standard Edition release to Oracle Database Enterprise Edition by selecting one of the following options:

- Perform a normal upgrade procedure.

  Install Oracle Enterprise Edition software in a new Oracle home, and follow the normal upgrade procedures as described in the "Upgrading Oracle Database" chapter. The Data Dictionary for Standard Edition and Enterprise Edition configurations are the same. The difference between Standard Edition and Enterprise Edition is in the options that are available in the server executable.
- Perform an In-Place Upgrade using the same Oracle home.

  If you have a Standard Edition database at a release earlier than the new release of Oracle Database, and you want to perform an in-place upgrade using the same Oracle home, then you must first upgrade the Standard Edition Database. After you complete the upgrade, use the procedure described here to install Oracle Database Enterprise Edition software and to move to Oracle Database Enterprise Edition.

> **Caution:**
>
> Performing this procedure deinstalls the Oracle Standard Edition software. It results in deleting database files that exist under the Oracle home, and under the Fast Recovery Area (FRA). Back up database files under the current Oracle home before you begin this procedure.

1. Ensure that the release number of your Oracle Standard Edition server software is the same release as your Oracle Enterprise Edition server software.
2. Shut down your database.
3. If your operating system is Windows, then stop all Oracle services, including the `OracleService`*`SID`* Oracle service, where *`SID`* is the instance name.
4. Back up all database files under the current Oracle home that you must keep.
5. Deinstall the Standard Edition server software.

   > **Caution:**
   >
   > This step deletes all existing database files that reside under the Oracle home.

   Run the deinstallation tool from the Oracle home. The deinstallation tool is available as a separate command (`deinstall`) under the Oracle home directory after installation. It is located under *`ORACLE_HOME`*`\deinstall`.

   To deinstall an Oracle home on Windows, use the following syntax:

   ```
   setup.exe -deinstall -home path_of_Oracle_home_to_be_deinstalled
   ```

   To deinstall an Oracle home on Linux and UNIX, use the following syntax:

```
$ ./runInstaller -deinstall -home path_of_Oracle_home_to_be_deinstalled
```

> **Note:**
>
> Starting with Oracle Database 12*c*, the deinstallation tool is integrated with the database installation media. You can run the deinstallation tool using `runInstaller` on Linux and UNIX, or by using `setup.exe` on Windows with the `-deinstall` and `-home` options from the base directory of the Oracle Database, Oracle Database Client, or Oracle Grid Infrastructure installation media.

6. Install Oracle Enterprise Edition server software using Oracle Universal Installer (OUI).

   Select the same Oracle home that was used for the Standard Edition that you uninstalled, or select a new Oracle home. During the installation, be sure to select Enterprise Edition. When prompted, choose `Software Only` from the Database Configuration screen.

7. If you have an existing database, then set your *`ORACLE_SID`* to this preexisting database.

   If your existing database is on Windows, then you must recreate the database service by using the `ORADIM` utility.

8. Start up your database.

Related Topics

- Upgrading Oracle Database
  Oracle provides a comprehensive set of tools for upgrading Oracle Database with minimal downtime and for migrating your applications to the new release.

Migrating from Enterprise Edition to Standard Edition of Oracle Database

Converting from Enterprise Edition to Standard Edition requires exporting and importing data.

To properly convert from an Enterprise Edition database to a Standard Edition database, you must perform an Export/Import operation. Oracle recommends that you use the Standard Edition Export utility to export the data. If you only install Standard Edition software, then some data dictionary objects become invalid. These invalid objects create problems when maintaining the database.

The Export/Import operation does not introduce data dictionary objects specific to the Enterprise Edition, because the `SYS` schema objects are not exported. After the Import in the Standard Edition database, you are only required to drop user schemas related to Enterprise Edition features.

Migrating from Oracle Database Express Edition (Oracle Database XE) to Oracle Database

You must upgrade from Oracle Database Express Edition to Oracle Database Enterprise Edition, and then upgrade to the current Oracle Database release.

Oracle Database Express Edition (Oracle Database XE) is an entry-level edition of Oracle Database.

To upgrade Oracle Database 11*g* release 2 (11.2) Express Edition (Oracle Database XE) to Oracle Database 12*c* release 2 (12.2), you must first upgrade from Oracle Database XE to Oracle Database 12c release 1 (12.1.0.2) Enterprise Edition, and then upgrade to Oracle Database 12c release 2 (12.2).

About Upgrading Platforms for a New Oracle Database Release

Review these topics if you upgrade your operating system or hardware for a new Oracle Database release.

- About Upgrading Your Operating System
  Check operating system requirements for new releases, and if necessary, upgrade your operating system before upgrading Oracle Database.
- Options for Transporting Data to a Different Operating System
  Review these restrictions and guidelines if you want to perform a cross-platform upgrade.

About Upgrading Your Operating System

Check operating system requirements for new releases, and if necessary, upgrade your operating system before upgrading Oracle Database.

When you upgrade to a new release of Oracle software, the operating system requirements may have changed. If required, upgrade the operating system before upgrading Oracle Database.

Options for Transporting Data to a Different Operating System

Review these restrictions and guidelines if you want to perform a cross-platform upgrade.

When using DBUA or when performing a manual upgrade for Oracle Database, you cannot directly migrate or transport data in a database on one operating system to a database on another operating system. For example, you cannot migrate data in an Oracle database on Solaris to an Oracle 12*c* database on Windows using DBUA. You must follow procedures specific to your operating system platforms.

To see the platforms that support cross-platform data transport, run the following query using SQL*Plus:

```
SELECT * FROM V$TRANSPORTABLE_PLATFORM ORDER BY PLATFORM_NAME;
```

Note:

If the source platform and the target platform are of different endianness, then you cannot use the `RMAN CONVERT DATABASE` command. This process requires both the source and target platform to be the same endian value. Your available options are Data Pump replication, Data Pump export/import, or Transportable Tablespace, with an `RMAN CONVERT TABLESPACE`. If the platforms are of the same endianness, then no conversion is necessary and data can be transported as if on the same platform.

2

Preparing to Upgrade Oracle Database

Complete preupgrade tasks and checks to assist you with completing a successful upgrade.

This chapter provides information and procedures for the pre-upgrade tasks, including planning your upgrades, data-gathering, testing, installing the new Oracle software for the upgrade, using the Parallel Upgrade Utility to carry out your upgrade, and performing other checks and tasks.

- About Read-Only Oracle Homes
  Starting with Oracle Database 18c, you can configure an Oracle home in read-only mode.
- About Configuring an Oracle Home in Read-Only Mode
  Starting with Oracle Database 18c, you can configure an Oracle home in read-only mode. A read-only Oracle home prevents creation as well as modification of files inside the Oracle home directory `ORACLE_HOME`. A read-only Oracle home can be used as a software image for simplifying patching and mass rollout of software across multiple database servers.
- About Image-Based Oracle Database Installation
  Starting with Oracle Database 18c, installation and configuration of Oracle Database software is simplified with image-based installation.
- Tasks to Prepare for Oracle Database Upgrades
  Carry out these tasks to prepare your upgrade.
- Checklists for Oracle Database Upgrade
  Use checklists to plan and carry out Oracle Database upgrades.
- Installing the New Oracle Database Software
  Use this procedure overview to assist you to install the software for the new Oracle Database release.
- Database Preparation Tasks to Complete Before Starting Oracle Database Upgrades
  Ensure you have completed these database preparation tasks before starting Oracle Database upgrades.
- Preparing for Database Rolling Upgrades Using Oracle Data Guard
  If you use Database Upgrade Assistant (DBUA) with Oracle Data Guard to carry out a rolling upgrade, then you must move the Data Guard Broker configuration files before starting your upgrade.
- Preparing the New Oracle Home for Upgrading
  After backing up the database that you want to upgrade, prepare the new Oracle home in a new location. Install the software for the new Oracle Database release into the new location.
- Prerequisites for Preparing Oracle Home on Windows
  Your system must meet these requirements before you can upgrade Oracle Database on Microsoft Windows platforms.

- Using the Pre-Upgrade Information Tool for Oracle Database
  Review these topics to understand and to use the Pre-Upgrade information tool (`preupgrade.jar`).
- Testing the Upgrade Process for Oracle Database
  Your test plan for Oracle Database upgrades should include these test procedures.
- Requirements for Upgrading Databases That Use Oracle Label Security and Oracle Database Vault
  You must complete these tasks before starting an upgrade with a database using Oracle Label Security or Oracle Database Vault.

About Configuring an Oracle Home in Read-Only Mode

Starting with Oracle Database 18c, you can configure an Oracle home in read-only mode. A read-only Oracle home prevents creation as well as modification of files inside the Oracle home directory `ORACLE_HOME`. A read-only Oracle home can be used as a software image for simplifying patching and mass rollout of software across multiple database servers.

> **Note:**
>
> You can configure an Oracle home in read-only mode after you have installed the Oracle database in the *software-only* mode, but before creating the listener and the database.

A traditional read-write Oracle home contains instance-specific files. However, when the Oracle home is read-only, instance-specific files are stored separately in the Oracle base directory `ORACLE_BASE`. Therefore, a read-only Oracle home can be used as a software image that can be shared across multiple database servers, as it stores only the static files. This simplifies patching and mass rollout as only one Oracle home image needs to be updated to distribute a patch to multiple database servers.

Apart from the traditional `ORACLE_BASE` and `ORACLE_HOME` directories, the following additional directories exist in a read-only Oracle home:

- `ORACLE_BASE_HOME`: This is a subdirectory within the `ORACLE_BASE` directory. This directory contains user-specific files, instance-specific files, and log files.
- `ORACLE_BASE_CONFIG`: This directory is same as the `ORACLE_BASE` directory. This directory contains instance-specific dynamic files, such as configuration files.

About Read-Only Oracle Homes

Starting with Oracle Database 18c, you can configure an Oracle home in read-only mode.

In a read-only Oracle home, all the configuration data and log files reside outside of the read-only Oracle home. This feature allows you to use the read-only Oracle home as a software image that can be distributed across multiple servers.

Apart from the traditional ORACLE_BASE and ORACLE_HOME directories, the following directories contain files that used to be in ORACLE_HOME:

- ORACLE_BASE_HOME
- ORACLE_BASE_CONFIG

Benefits of a Read-Only Oracle Home

- Enables seamless patching and updating of Oracle databases without extended downtime.
- Simplifies patching and mass rollout as only one image needs to be updated to distribute a patch to many servers.
- Simplifies provisioning by implementing separation of installation and configuration.

> **Note:**
>
> This feature does not affect how database administrators monitor, diagnose, and tune their system performance.

About Image-Based Oracle Database Installation

Starting with Oracle Database 18c, installation and configuration of Oracle Database software is simplified with image-based installation.

To install Oracle Database, create the new Oracle home, extract the image file into the newly-created Oracle home, and run the setup wizard to register the Oracle Database product.

Using image-based installation, you can install and upgrade Oracle Database for single-instance and cluster configurations.

This installation feature streamlines the installation process and supports automation of large-scale custom deployments. You can also use this installation method for deployment of customized images, after you patch the base-release software with the necessary Release Updates (RUs) or Release Update Revisions (RURs).

> **Note:**
>
> You must extract the image software (`db_home.zip`) into the directory where you want your Oracle Database home to be located, and then run the `runInstaller` script to start the Oracle Database installation and configuration. Oracle recommends that the Oracle home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations.

Tasks to Prepare for Oracle Database Upgrades

Carry out these tasks to prepare your upgrade.

Before you upgrade your database, Oracle recommends that you review the new features and determine the best upgrade path and method to use, and carry out procedures to prepare your database for upgrade. Oracle strongly recommends that you test the upgrade process and prepare a backup strategy.

- Become Familiar with New Oracle Database Features
  Before you plan the upgrade process, become familiar with the features of the new Oracle Database release.
- Choose an Upgrade Method for Oracle Database
  Oracle offers several methods to upgrade your database, which support the complexities of your enterprise.
- Choose a New Location for Oracle Home when Upgrading
  You cannot install the new software into the same location for Oracle home as your current release.
- Develop a Test Plan for Upgrading Oracle Database
  Review these topics to understand how to create a series of carefully designed tests to validate all stages of the upgrade process.
- Prepare a Backup Strategy before Upgrading Oracle Database
  You must design and carry out an appropriate backup strategy to ensure a successful upgrade.

Become Familiar with New Oracle Database Features

Before you plan the upgrade process, become familiar with the features of the new Oracle Database release.

Oracle Database New Features Guide is a good starting point for learning the differences between Oracle Database releases. Also, check specific guides in the Oracle Database documentation library to find information about new features for a certain component. For example, see *Oracle Real Application Clusters Administration and Deployment Guide* for changes in Oracle Real Application Clusters.

> **Note:**
>
> Oracle Database training classes are an excellent way to learn how to take full advantage of the features and functions available with Oracle Database. More information can be found at `http://education.oracle.com/`

Choose an Upgrade Method for Oracle Database

Oracle offers several methods to upgrade your database, which support the complexities of your enterprise.

- The Graphical User Interface Method for Upgrading Oracle Database
  Database Upgrade Assistant (DBUA) interactively steps you through the upgrade process and configures the database for the new Oracle Database release.
- The Manual, Command-line Method for Upgrading Oracle Database
  Manual upgrades give you finer control over the upgrade process.

- The Export/Import Method for Migrating Data When Upgrading Oracle Database
  You can use Oracle Data Pump to carry out data exports and imports.

The Graphical User Interface Method for Upgrading Oracle Database

Database Upgrade Assistant (DBUA) interactively steps you through the upgrade process and configures the database for the new Oracle Database release.

DBUA starts the Pre-Upgrade Tool, which fixes some configuration settings to the values required for the upgrade. For example, the Pre-Upgrade Tool can change initialization parameters to values required for the upgrade. The Pre-Upgrade Tool also provides you with a list of items that you need to fix manually before you can continue with the upgrade.

The Manual, Command-line Method for Upgrading Oracle Database

Manual upgrades give you finer control over the upgrade process.

A manual upgrade consists of running SQL scripts and utilities from a command line to upgrade a database to the new Oracle Database release.

Before the Upgrade

- Analyze the database using the Pre-Upgrade Information Tool.

  The Pre-Upgrade Information Tool is a Java JAR file that is supplied with Oracle Database. When you start the tool, it self-extracts, and then executes SQL scripts.

  The Pre-Upgrade Information Tool displays warnings about possible upgrade issues with the database, and generates fixup scripts for you to use to address some issues. It also displays information about required initialization parameters for the new release of Oracle Database.
- Prepare the new Oracle home.
- Perform a backup of the database.

Depending on the Oracle Database release you upgrade, you can be required to perform more pre-upgrade steps. These steps can include adjusting the parameter file for the upgrade, removing desupported initialization parameters, or adjusting initialization parameters that can cause upgrade problems.

The Export/Import Method for Migrating Data When Upgrading Oracle Database

You can use Oracle Data Pump to carry out data exports and imports.

Topics:

- The Effects of Export/Import on Upgraded Oracle Databases
  Review this topic to understand the benefits of Export/Import data migration.
- Export/Import Benefits for Migrating Data for Oracle Database
  Migrating data when upgrading Oracle Database using Export/Import provides benefits that can increase performance.
- Time Requirements for Migrating Data and Upgrading with Export/Import
  Understand the time it takes for data migration and software upgrades.

The Effects of Export/Import on Upgraded Oracle Databases

Review this topic to understand the benefits of Export/Import data migration.

The Export/Import data migration method does not change the current database, which enables the database to remain available throughout the upgrade process. However, if a consistent snapshot of the database is required (for data integrity or other purposes), then the database must run in restricted mode or must otherwise be protected from changes during the export procedure. Because the current database can remain available, you can, for example, keep an existing production database running while the newly upgraded Oracle Database database is being built at the same time by Export/Import. During the upgrade, to maintain complete database consistency, changes to the data in the database cannot be permitted without the same changes to the data in the newly upgraded Oracle database.

Most importantly, the Export/Import operation results in a completely new database. Although the current target database ultimately contains a copy of the specified data that you migrated, the upgraded database can perform differently from the original source database. Although Export/Import creates an identical copy of the database, other factors can cause unexpected performance issues. (For example: disk placement of data, and unset tuning parameters).

Export/Import Benefits for Migrating Data for Oracle Database

Migrating data when upgrading Oracle Database using Export/Import provides benefits that can increase performance.

Using Export/Import to migrate data provides the following benefits:

- Defragments the data. You can compress the imported data to improve performance.
- Restructures the database. You can create new tablespaces or modify existing tables, tablespaces, or partitions that you want to populate with imported data.
- Facilitates side-by-side testing of the old and new releases of Oracle Database because an entirely new database is created.
- Enables the copying of specified database objects or users. Importing only the objects, users, and other items you need is useful for establishing a test environment for the new software on only a subset of the production data. Data Pump Export/Import provides flexible data-subsetting capabilities.
- Serves as a backup archive. You can use a full database export as an archive of the current database.
- Enables you to establish the upgraded database on a different operating system or hardware platform than the platform on which your earlier release database is placed.
- Network-based Data Pump Import enables you to load the new release Oracle Database directly across the network for your earlier release Oracle Database. By using network-based Data Pump import, you are not required to use intervening dump files.

Time Requirements for Migrating Data and Upgrading with Export/Import

Understand the time it takes for data migration and software upgrades.

Migrating data and upgrading an entire Oracle database by using Export/Import can take a long time, especially compared to using DBUA or performing a manual upgrade. You may need to schedule the upgrade during non-peak hours or make provisions for propagating to the new database any changes that are made to the current database during the upgrade.

Related Topics

- Migrating Data Using Oracle Data Pump
  Use the Export and Import utilities in Oracle Data Pump to migrate data from one database to another.

Choose a New Location for Oracle Home when Upgrading

You cannot install the new software into the same location for Oracle home as your current release.

You must choose a location for Oracle home for the new release of Oracle Database that is separate from the Oracle home of your current release.

Using separate installation locations enables you to keep your existing Oracle software installed along with the new Oracle software. This method enables you to test the upgrade process on a test database before replacing your production environment entirely.

Develop a Test Plan for Upgrading Oracle Database

Review these topics to understand how to create a series of carefully designed tests to validate all stages of the upgrade process.

Oracle recommends that you perform rigorous tests of your database and applications. When you run and complete tests successfully, you help to ensure that you understand the process of upgrading the production database, so that the upgrade process is predictable and successful. Oracle strongly recommends that you perform as much testing as possible before upgrading a production database. Do not underestimate the importance of a complete and repeatable testing process.

You can choose to perform tests manually, or you can use utilities to assist your tests, such as Oracle Real Application Testing features like Database Replay or SQL Performance Analyzer. In either case, the types of tests that you perform are the same.

Your test plan must include these types of tests:

- Upgrade Testing
  Create, test, and validate an upgrade plan.
- Minimal Testing
  Minimal testing can find application startup or invocation problems.
- Functional Testing After Upgrades
  Perform functional testing of the upgraded Oracle Database after the upgrade is complete.
- High Availability Testing
  Plan to perform High Availability testing on your upgraded system.

- Integration Testing to Ensure Applications are Compatible
  Integration testing for Oracle Database examines the interactions among components of the system.
- Performance Testing an Upgraded Oracle Database
  Plan performance testing comparisons between your earlier release and new release Oracle Database.
- Volume and Load Stress Testing for Oracle Database Upgrades
  Use Database Replay to perform volume and load stress testing of the entire upgraded Oracle database under high volume and loads.
- Test Plan Guidelines for Oracle Database Upgrade Planning
  Perform planned tests on your current database and on the test database that you upgraded to the new Oracle Database release.

Upgrade Testing

Create, test, and validate an upgrade plan.

Upgrade testing for Oracle Database entails planning and testing the upgrade path from your current software to Oracle Database 12*c*, whether you use Oracle Database Upgrade Assistant (DBUA), perform a manual upgrade, or use Export/Import or other data-copying methods. Regardless of the upgrade method you choose, you must establish, test, and validate an upgrade plan.

Minimal Testing

Minimal testing can find application startup or invocation problems.

Minimal testing for Oracle Database entails moving all or part of an application from the current database to the new database and running the application without enabling any new database features. Minimal testing might not reveal problems that would appear in an actual production environment. However, minimal testing immediately reveals any application startup or invocation problems.

Functional Testing After Upgrades

Perform functional testing of the upgraded Oracle Database after the upgrade is complete.

Functional testing for Oracle Database is a set of tests in which new and existing features and functions of the system are tested after the upgrade. Functional testing includes all database, networking, and application components. The objective of functional testing is to verify that each component of the system functions as it did before upgrading and to verify that new functions are working properly.

High Availability Testing

Plan to perform High Availability testing on your upgraded system.

High Availability testing for Oracle Database ensures that the upgraded database system meets these recovery business requirements:

- Recovery Time Objective (RTO)
- Recovery Point Objective (RPO)

Oracle recommends the following test procedures for high availability testing:

- Create node or instance failures during stress testing. Node or instance failures help to evaluate the Oracle RAC recovery capability.
- Test fallback plans and procedures to ensure that you can minimize downtime on upgraded databases.
- Check database performance and stability, and resolve performance problems. Resolving performance problems helps to ensure that the upgrade process runs within the time that you have allocated.

Integration Testing to Ensure Applications are Compatible

Integration testing for Oracle Database examines the interactions among components of the system.

Oracle recommends that you carry out the following tests as part of your integration testing:

- Test Pro*C/C++ application clients of Oracle Database 12*c* instances to ensure that these applications are compatible with the upgraded database.
- Test graphical user interfaces.
- Test all applications that interact directly or indirectly with the database. Subtle changes in Oracle Database 12*c*, such as data types, data in the data dictionary (additional rows in the data dictionary, object type changes, and so on) can affect front-end applications, even if those applications are not directly connected to a new Oracle Database 12*c* instance.
- Test and stress-test any Oracle Net or Oracle Net Services connections between components.

> **Note:**
>
> See *Pro*C/C++ Programmer's Guide* for more information about Pro*C/C++ applications.
>
> See *Oracle Database Net Services Reference* for more information about upgrade recommendations for Oracle Net Services.

Performance Testing an Upgraded Oracle Database

Plan performance testing comparisons between your earlier release and new release Oracle Database.

Performance testing of the new Oracle Database compares the performance of various SQL statements in the new database with the performance of those same statements in the current database. Before upgrading, Analyze the performance profile of applications under the current database. Specifically, analyze and understand the calls that applications make to the database server.

- Database Replay and Performance Testing
  Use the Database Replay feature to perform real-world testing of a database upgrade on your production workload before actually upgrading the production database.
- SQL Performance Analyzer
  Use the SQL Performance Analyzer to forecast the impact of system changes on a SQL workload.
- SQL Plan Management
  Review this topic to understand how to carry out SQL plan managements after upgrades to avoid performance regressions.

Database Replay and Performance Testing

Use the Database Replay feature to perform real-world testing of a database upgrade on your production workload before actually upgrading the production database.

The Database Replay feature captures the actual database workload on the production system, and replays it on the test system. Database Replay also provides analysis and reporting to highlight potential problems; for example, errors encountered, divergence in performance, and so forth. In addition, all the regular Enterprise Manager performance monitoring and reporting tools such as Automatic Database Diagnostic Monitor, Automatic Workload Repository (AWR), and Active Session History are available to address any problems.

> **Note:**
>
> You can change the stored procedure logic in the database. However, the stored PL/SQL procedures that implement the application logic must maintain the same interfaces as before the upgrade. If an upgrade affects the stored procedures of an application, replaying the workload may not be possible. Using Database Replay tool with the same interfaces provides you with good diagnostics to see if the new application logic in the server is performing as expected after the upgrade.

SQL Performance Analyzer

Use the SQL Performance Analyzer to forecast the impact of system changes on a SQL workload.

SQL Performance Analyzer enables you to evaluate the effect of an upgrade on your SQL workloads. SQL Performance Analyzer finds possible issues by identifying the SQL statements affected by the upgrade. It then measures the performance divergence of SQL workloads before the upgrade, and after the upgrade. The analysis enables you to assess the overall effect of the upgrade on SQL performance. You can then take measures to avoid any negative outcome from SQL workload changes before they can affect users.

SQL Plan Management

Review this topic to understand how to carry out SQL plan managements after upgrades to avoid performance regressions.

A database upgrade that installs a new optimizer version usually results in plan changes for a small percentage of SQL statements. Most plan changes result in no performance change or improvement. However, certain plan changes may cause performance regressions. SQL plan management prevents performance regressions resulting from sudden changes to the execution plan of a SQL statement by providing components for capturing, selecting, and evolving SQL plan information. SQL plan management is a preventative mechanism that records and evaluates the execution plans of SQL statements over time, and builds SQL plan baselines composed of a set of existing plans that are proven efficient after repeated use. SQL plan management uses the SQL plan baselines to preserve the performance of corresponding SQL statements, regardless of changes occurring in the system.

With SQL plan management, the optimizer automatically manages execution plans and ensures that only known or verified plans are used. When SQL Plan management finds a new plan for a SQL statement, it does not use this plan until the database verifies that the new plan has comparable or better performance than the current plan. If you seed SQL plan management with your current execution plans, then those plans becomes the SQL plan baseline for each statement. The optimizer uses these plans after the upgrade. If the Oracle Database 12*c* optimizer determines that a different plan can result in better performance, then the new plan is queued for verification and is not used until it has been confirmed to have comparable or better performance than the current plan.

There are several ways to seed or populate a SQL Management Base (SMB) with execution plans:

Bulk Load a SQL Management Base from the Cursor Cache

Bulk loading of execution plans or SQL plan baselines from the cursor cache is useful when upgrading a database from Oracle Database 11*g* to the latest release of Oracle Database. The cursor cache is a shared SQL area, and SQL plans that are bulk loaded are automatically accepted and added to existing or new plan histories as SQL plan baselines.

1. In the source release of Oracle Database, use the `DBMS_SPM.LOAD_PLAN_FROM_CURSOR_CACHE` procedure or Oracle Enterprise Manager to load all of the execution plans in the cursor cache into the SQL Management Base.
2. Upgrade the database.

> **See Also:**
>
> *Oracle Database SQL Tuning Guide* for more information on how to load plans from the shared SQL area using PL/SQL or Oracle Enterprise Manager

Bulk Load a SQL Management Base with a SQL Tuning Set (STS)

Bulk loading of execution plans or SQL plan baselines may be done with a SQL Tuning Set. This is useful when upgrading from Oracle Database 10*g*, where no SQL Management Base (SMB) exists to directly load from the cursor cache, or to load historic plans from the Automatic Workload Repository.

1. In the source release of Oracle Database, create an STS that includes the execution plan for each of the SQL statements.
2. Load the STS into a staging table and export the staging table into a dump file.
3. Import the staging table from a dump file into the new release of Oracle and unload the STS.
4. Use Oracle Enterprise Manager or `DBMS_SPM.LOAD_PLANS_FROM_SQLSET` to load the execution plans into the SQL Management Base.

> **See Also:**
>
> *Oracle Database SQL Tuning Guide* for the complete procedure for bulk loading execution plans or SQL plan baselines

Unpack Existing SQL Plan Baselines from a Staging Table

You can test and tune all of your critical SQL queries on an Oracle Database test environment and then move those SQL execution plans to your Oracle Database production environment. Alternatively, you can take plans for SQL queries from your pre-upgrade Oracle Database production environment and move them to your post-upgrade production environment.

1. On the Oracle Database 12*c* test system, after completing all testing and tuning, use the `DBMS_SPM.LOAD_PLAN_FROM_CURSOR_CACHE` procedure or Enterprise Manager to load all of the execution plans in the cursor cache into the SQL Management Base.
2. Create a staging table using the `DBMS_SPM.CREATE_STGTAB_BASELINE` procedure.
3. Pack the SQL plan baselines you created in step 1 into the staging table using the `DBMS_SPM.PACK_STGTAB_BASELINE` function.
4. Export the staging table into a flat file using Data Pump.
5. Transfer this flat file to the target system.
6. Import the staging table from the flat file using Data Pump.
7. Unpack the SQL plan baselines from the staging table into the SQL Management Base on the target system using the `DBMS_SPM.UNPACK_STGTAB_BASELINE` function.

Volume and Load Stress Testing for Oracle Database Upgrades

Use Database Replay to perform volume and load stress testing of the entire upgraded Oracle database under high volume and loads.

Volume describes the amount of data being manipulated. Load describes the level of concurrent demand on the system. Volume and load testing can emulate how a production system behaves under various volumes and loads.

Volume and load stress testing is crucial. However, it is commonly overlooked. Oracle has found that customers often do not conduct any kind of volume or load stress testing. Instead, customers often rely on benchmarks that do not characterize business applications. Oracle recommends that you conduct benchmarks of your applications. Benchmarking can help you to uncover problems relating to functions, performance, and integration. However, they cannot replace volume and load stress testing.

Load testing involves running an application load against the new Oracle Database release. The load test ensures that applications do not encounter problems, such as new errors, or performance issues under the load conditions that you think are likely found in production. Many times, problems manifest only under certain load conditions, and are normally not seen in functional testing. The Database Replay feature is ideal for such load testing. Database Replay enables you to capture the system workload from a production environment, and replay it in identical fashion on the test system.

Test Plan Guidelines for Oracle Database Upgrade Planning

Perform planned tests on your current database and on the test database that you upgraded to the new Oracle Database release.

- Compare the test results, noting anomalies.
- Repeat the test upgrade as many times as necessary until issues are resolved.

Test the newly upgraded test database with existing applications to verify that they operate properly with a new Oracle database.

- Test enhanced functions and new capabilities by adding available Oracle Database features.
- Ensure that the applications operate in the same manner as they did in the current database.

Prepare a Backup Strategy before Upgrading Oracle Database

You must design and carry out an appropriate backup strategy to ensure a successful upgrade.

To develop a backup strategy, consider the following questions:

- How long can the production database remain inoperable before business consequences become intolerable?
- What backup strategy is necessary to meet your availability requirements?
- Are backups archived in a safe, offsite location?
- How quickly can backups be restored (including backups in offsite storage)?
- Have recovery procedures been tested successfully?

Your backup strategy should answer all of these questions and include procedures for successfully backing up and recovering your database.

> **See Also::**
>
> *Oracle Database Backup and Recovery User's Guide* for information about implementing backup strategies using RMAN

Checklists for Oracle Database Upgrade

Use checklists to plan and carry out Oracle Database upgrades.

Oracle recommends that you use checklists as part of your upgrade planning and implementation process. Using checklists can help you to use available upgrade utilities, and can help you to ensure you carry out a successful upgrade.

- Source Server Preparation Upgrade Checklist
  To obtain a checklist of tasks you must complete before upgrade, run the Pre-Upgrade Information Tool (`preupgrade.jar`).
- Target Server Post-Upgrade Checklist
  After you configure your environment and install the new release software, complete these checks on the upgraded database in the higher-versioned Oracle Home.

Source Server Preparation Upgrade Checklist

To obtain a checklist of tasks you must complete before upgrade, run the Pre-Upgrade Information Tool (`preupgrade.jar`).

Before starting your upgrade, make sure that you have a new release Oracle Database installed and configured that you can use as the target for your upgrade. When your target Oracle Database is prepared, then run the Pre-Upgrade Information Tool (`preupgrade.jar`), using the instructions that you can find in this guide.

Oracle requires that you run the Pre-Upgrade Information Tool before you upgrade Oracle Database. The tool scripts can resolve many issues, and the tool can identify issues for you to address before you start your upgrade.

> **Tip:**
>
> Consider reviewing Oracle's upgrade blog for tips and suggestions that can assist you with your upgrade preparations.

Related Topics

- Upgrade your Database – NOW! Mike Dietrich's Oracle Database Upgrade Blog
- *Oracle Database PL/SQL Packages and Types Reference*

Target Server Post-Upgrade Checklist

After you configure your environment and install the new release software, complete these checks on the upgraded database in the higher-versioned Oracle Home.

> **Note:**
>
> You must have the upgrade completed before using these scripts. To review the scripts, you must at least have completed a software-only image installation of the new release Oracle Database software.

Table 2-1 Target Server Post-Upgrade Checklist

Task	Description
Run postinstallation SQL scripts	• `$ORACLE_HOME/rdbms/admin/utlrp.sql` • `$ORACLE_HOME/rdbms/admin/utlu122s.sql` • • `$ORACLE_BASE/cfgtoollogs/SID/preupgrade/postupgrade_fixups.sql` The `postupgrade_fixups.sql` script is placed in the directory you specify. The path described here in $ORACLE_BASE is correct if you accepted the default output directory when you started the preupgrade script.
Review upgrade logs and trace files	• `$ORACLE_BASE/cfgtoollogs/DBUA/upgradeTimestamp` (Look under `$ORACLE_HOME` if `$ORACLE_BASE` is not set). Also, folders with the system identifier (SID) of individual database are in this timestamp folder. The SID folders contain files for individual databases for the preupgrade and upgrade process. `alert_SID.log`
Create Oracle Database system files	Create an SPFILE from the PFILE
Back up the database	To ensure that you can recover from data loss if the need arises, back up your database after completing your upgrade.

Installing the New Oracle Database Software

Use this procedure overview to assist you to install the software for the new Oracle Database release.

> **Note:**
>
> You cannot upgrade a database using Database Upgrade Assistant (DBUA) when the source and target Oracle homes are owned by different users. Attempting to do so returns error PRKH-1014. Either ensure that the source and target databases have the same owner, or perform a manual upgrade.

To install the new Oracle Database software for this release:

1. If you are upgrading an Oracle RAC database, then you must perform the following steps in the order shown:

a. Upgrade Oracle Clusterware first as described in the Oracle Grid Infrastructure installation guide for your operating system.

> **Note:**
>
> When upgrading a non-Oracle RAC database, DBUA uses NETCA to enable you to migrate listeners from the source database as part of the entire upgrade process. At the end of the upgrade, listeners are also relocated and upgraded.

b. Mount the Oracle Grid Infrastructure installation media.

c. Perform operating system prerequisite checks on each of the nodes that you intend to upgrade, to ensure that they meet the system prerequisites for Oracle Grid Infrastructure (Oracle Clusterware and Oracle ASM).

d. If necessary, perform patch upgrades of the earlier release of Oracle Clusterware software to the most recent patch version.

e. Ensure that you are logged in as the user that owns the Oracle Grid Infrastructure installation, and run the Oracle Grid Infrastructure installation. Provide information as prompted by the installer.

f. When prompted, open a separate terminal session, log in as `root`, and run `root.sh`.

2. After upgrading Oracle Clusterware, follow the instructions in your Oracle operating system-specific documentation to prepare for installation of Oracle Database software and start Oracle Universal Installer.

   - Oracle recommends that you run the Pre-Upgrade Information Tool before you upgrade using DBUA. You can preview the types of items DBUA checks, and see any issues ahead of time that might be present in the database. The Pre-Upgrade Information Tool helps you fix prerequisite issues that it finds. You can then run DBUA independently after the installation is complete, or run Oracle Universal Installer.
   - If you use Oracle Label Security, Oracle Database Vault, or both, then select **Enterprise Edition** on the Select Database Edition page, click **Select Options**, and enable one or both components from the components list.

   When installation of Oracle Database software has completed successfully, click **Exit** to close Oracle Universal Installer.

Related Topics

- *Oracle Clusterware Installation Guide* for your platform
- *Oracle Real Application Clusters Installation Guide* for your platform

Database Preparation Tasks to Complete Before Starting Oracle Database Upgrades

Ensure you have completed these database preparation tasks before starting Oracle Database upgrades.

- Patch Set Updates and Requirements for Upgrading Oracle Database
  Before starting upgrades, update your new release Oracle Database to the latest Oracle bundle patch, patch set update (BP or PSU) or Release Update (RU) or Release Update Revision (RUR).
- Copying Transparent Encryption Oracle Wallets
  If you use Oracle wallet with Transparent Data Encryption (TDE), and you use Database Upgrade Assistant (DBUA) to upgrade the database, then copy the `sqlnet.ora` and wallet file to the new Oracle home.
- Recommendations for Oracle Net Services When Upgrading Oracle Database
  Review these procedures and parameter changes for Oracle Net Services before you upgrade.
- Understanding Password Case Sensitivity and Upgrades
  By default, Oracle Database 12*c* release 2 (12.2) and later Oracle Database releases are upgraded to an Exclusive Mode. Exclusive Modes do not support case-insensitive password-based authentication.
- Checking for Accounts Using Case-Insensitive Password Version
  Use these procedures to identify if the Oracle Database that you want to upgrade has accounts or configuration parameters that are using a case-insensitive password version.
- Running Upgrades with Read-Only and Offline Tablespaces
  Use the Parallel Upgrade Utility with the `-T` option to take schema-based tablespaces offline during upgrade.

Patch Set Updates and Requirements for Upgrading Oracle Database

Before starting upgrades, update your new release Oracle Database to the latest Oracle bundle patch, patch set update (BP or PSU) or Release Update (RU) or Release Update Revision (RUR).

The software for new Oracle Database releases contains a full release that includes all the latest patches and updates for Oracle Database at the time of the release.

Before you start an upgrade or downgrade process, Oracle strongly recommends that you update both your earlier release and your new release Oracle Database. For Oracle Database 12c or earlier releases, update to the latest Oracle bundle patch or patch set update (BP or PSU). For Oracle Database 12*c* release 2 (12.2), Oracle Database 18c, or later releases, update to the latest quarterly Release Update (RU) or Release Update Revision (RUR).

My Oracle Support provides detailed notes about how you can obtain the latest patches, as well as tools for lifecycle management and automated patching. For example:

- My Oracle Support note 854428.1 contains information about patch sets and updates.
- My Oracle Support note 730365 contains an upgrade reference list for most available Oracle Database releases, including download information, patch numbers, and links to other notes.
- My Oracle Support note 2180188.1 contains lists of one-off patches for upgrades, downgrades, and coexistence with previous releases.
- My Oracle Support note 1227443.1 contains a list of Oracle Database PSU/BP/RU/RUR known issues

Refer to

Related Topics

- https://support.oracle.com/rs?type=doc&id=854428.1
- https://support.oracle.com/rs?type=doc&id=730365.1
- https://support.oracle.com/rs?type=doc&id=2180188.1
- https://support.oracle.com/rs?type=doc&id=1227443.1

Copying Transparent Encryption Oracle Wallets

If you use Oracle wallet with Transparent Data Encryption (TDE), and you use Database Upgrade Assistant (DBUA) to upgrade the database, then copy the `sqlnet.ora` and wallet file to the new Oracle home.

You must copy the `sqlnet.ora` and the wallet file manually before starting the upgrade.

1. Log in as an authorized user.
2. Manually copy the `sqlnet.ora` file, and the wallet file, `ewallet.p12`, to the new release Oracle home.
3. Open the Oracle wallet in mount.

   For example:

   ```
   SQL> STARTUP MOUNT;
   SQL> ALTER SYSTEM SET ENCRYPTION WALLET OPEN
   ```

Recommendations for Oracle Net Services When Upgrading Oracle Database

Review these procedures and parameter changes for Oracle Net Services before you upgrade.

In Oracle Database 12*c*, new, underlying net services parameters enable data compression, which reduces the size of the session data unit that is transmitted over a SQL TCP connection.

The following new parameters for the `sqlnet.ora` file specify compression, and the preferred compression scheme:

- `SQLNET.COMPRESSION`
- `SQLNET.COMPRESSION_LEVELS`
- `SQLNET.COMPRESSION_THRESHOLD`

These new parameters are not supported in earlier releases, and are only available in Oracle Database 12*c*.

If the Oracle Database that you are upgrading does not have a listener configured, then before you run DBUA, you must run Oracle Net Configuration Assistant (NETCA) to configure the listening protocol address and service information for the new release of Oracle Database, including a `listener.ora` file. You must create a new version of the listener for releases of Oracle Database earlier than release 11.2. The new listener is backward-compatible with earlier Oracle databases.

When you upgrade an Oracle RAC database with DBUA, it automatically migrates the listener from your old Oracle home to the new Oracle Grid Infrastructure home. You must administer the listener by using the `lsnrctl` command in the Oracle Grid Infrastructure home. Do not attempt to use the `lsnrctl` commands from Oracle home locations for earlier releases.

> **Note:**
>
> If there are listeners configured on the source home, and the Oracle Database in the source home is older than the target Oracle Database home, then DBUA by default selects the listeners in the source home for migration during the upgrade process .

Understanding Password Case Sensitivity and Upgrades

By default, Oracle Database 12*c* release 2 (12.2) and later Oracle Database releases are upgraded to an Exclusive Mode. Exclusive Modes do not support case-insensitive password-based authentication.

Accounts that have only the `10G` password version become inaccessible when the server runs in an Exclusive Mode.

In previous Oracle Database releases, you can configure the authentication protocol so that it allows case-insensitive password-based authentication by setting `SEC_CASE_SENSITIVE_LOGON=FALSE`. Starting with Oracle Database 12*c* release 2 (12.2), the default password-based authentication protocol configuration excludes the use of the case-insensitive `10G` password version. By default, the `SQLNET.ORA` parameter `SQLNET.ALLOWED_LOGON_VERSION_SERVER` is set to `12`, which is an Exclusive Mode. When the database is configured in Exclusive Mode, the password-based authentication protocol requires that one of the case-sensitive password versions (`11G` or `12C`) is present for the account being authenticated. This mode excludes the use of the `10G` password version used in earlier releases. After upgrading to Oracle Database 12*c* release 2 and later releases, accounts that have only the case-insensitive `10G` password version become inaccessible. This change occurs because the server runs in an Exclusive Mode by default. When Oracle Database is configured in Exclusive Mode, it cannot use the old `10G` password version to authenticate the client. The server is left with no password version with which to authenticate the client.

For greater security, Oracle recommends that you leave case-sensitive password-based authentication enabled. This setting is the default. However, you can temporarily disable case-sensitive authentication during the upgrade to new Oracle Database releases. After the upgrade, you can then decide if you want to enable the case-sensitive password-based authentication feature as part of your implementation plan to manage your password versions.

Before upgrading, Oracle recommends that you determine if this change to the default password-based authentication protocol configuration affects you. Perform the following checks:

- Identify if you have accounts that use only `10G` case-insensitive password authentication versions.

- Identify if you have Oracle Database 11*g* release 2 (11.2.0.3) database or earlier clients that have not applied critical patch update `CPUOct2012`, or a later patch update, and have any account that does not have the case-insensitive `10G` password version.
- Ensure that you do not have the deprecated parameter SEC_CASE_SENSITIVE_LOGON set to FALSE. Setting this parameter to FALSE prevents the use of the case-sensitive password versions (the `11G` and `12C` password versions) for authentication.

Options for Accounts Using Case-Insensitive Versions

If you have user accounts that have only the case-insensitive `10G` password version, then you must choose one of the following alternatives:

- Before upgrade, update the password versions for each account that has only the `10G` password version. You can update the password versions by expiring user passwords using the `10G` password version, and requesting that these users log in to their account. When they attempt to log in, the server automatically updates the list of password versions, which includes the case-sensitive password versions.
- Change the setting of the SQLNET.ORA parameter SQLNET.ALLOWED_LOGON_VERSION_SERVER to any of the settings that are not Exclusive Mode. For example:
  SQLNET.ALLOWED_LOGON_VERSION_SERVER=11

Related Topics

- *Oracle Database 2 Day DBA*
- *Oracle Database Net Services Reference*
- *Oracle Database Security Guide*

Checking for Accounts Using Case-Insensitive Password Version

Use these procedures to identify if the Oracle Database that you want to upgrade has accounts or configuration parameters that are using a case-insensitive password version.

By default, in Oracle Database 12*c* release 2 (12.2) and later releases, the `10G` password version is not generated or allowed.

If you do not set `SQLNET.ALLOWED_LOGON_VERSION_SERVER` to a permissive authentication protocol that permits case-insensitive versions, and you do not want user accounts authenticated with case-insensitive password versions to be locked out of the database, then you must identify affected accounts, and ensure that they are using case-sensitive password versions.

Example 2-1 Finding User Accounts That Use Case-Insensitive (10G) Version

Log in to SQL*Plus as an administrative user, and enter the following SQL query:

```
SELECT USERNAME,PASSWORD_VERSIONS FROM DBA_USERS;
```

following result shows password versions for the accounts:

```
USERNAME                       PASSWORD_VERSIONS
------------------------------ -----------------
JONES                          10G 11G 12C
ADAMS                          10G 11G
```

```
CLARK                          10G 11G
PRESTON                        11G
BLAKE                          10G
```

In this example, the backgrounds for each user account password verification version in use are different:

- JONES was created in Oracle Database `10G`, and the password for JONES was reset in Oracle Database `12C` when the setting for the SQLNET.ALLOWED_LOGON_VERSION_SERVER parameter was set to `8`. As a result, this password reset created all three versions. `11G` and `12C` use case-sensitive passwords.
- ADAMS and CLARK were originally created with the `10G` version, and then `11G`, after they were imported from an earlier release. These account passwords were then reset in `11G`, with the deprecated parameter SEC_CASE_SENSITIVE_LOGON set to TRUE.
- The password for BLAKE was created with the `10G` version, and the password has not been reset. As a result, User BLAKE continues to use the `10G` password version, which uses a case-insensitive password.

The user BLAKE has only the `10G` password version before upgrade:

```
SQL> SELECT USERNAME,PASSWORD_VERSIONS FROM DBA_USERS;

USERNAME PASSWORD_VERSIONS
------------------------------ -----------------
BLAKE 10G
```

If you upgrade to a new Oracle Database release without taking any further action, then this account becomes inaccessible. Ensure that the system is not configured in Exclusive Mode (by setting the `SQLNET.ORA` parameter `SQLNET.ALLOWED_LOGON_VERSION_SERVER` to a more permissive authentication mode) before the upgrade.

Example 2-2 Fixing Accounts with Case-Insensitive Passwords

Complete the following procedure:

1. Use the following SQL query to find the accounts that only have the `10G` password version:

   ```
   select USERNAME
      from DBA_USERS
     where ( PASSWORD_VERSIONS = '10G '
           or PASSWORD_VERSIONS = '10G HTTP ')
       and USERNAME <> 'ANONYMOUS';
   ```

2. Configure the system so that it is not running in Exclusive Mode by editing the setting of the `SQLNET.ORA` parameter `SQLNET.ALLOWED_LOGON_VERSION_SERVER` to a level appropriate for affected accounts. For example:

   ```
   SQLNET.ALLOWED_LOGON_VERSION_SERVER=11
   ```

   After you make this change, proceed with the upgrade.

3. After the upgrade completes, use the following command syntax to expire the accounts you found in step 1, where *`username`* is the name of a user returned from the query in step 1:

   ```
   ALTER USER username PASSWORD EXPIRE;
   ```

4. Ask the users for whom you have expired the passwords to log in.
5. When these users log in, they are prompted to reset their passwords. The system internally generates the missing `11G` and `12C` password versions for their account, in addition to the `10G` password version. The `10G` password version is still present, because the system is running in the permissive mode.
6. Ensure that the client software with which users are connecting has the `O5L_NP` capability flag.

> **Note:**
>
> All Oracle Database release 11.2.0.4 and later clients, and all Oracle Database release 12.1 and later clients have the `O5L_NP` capability. Other clients require the `CPUOct2012` patch to acquire the `O5L_NP` capability.
>
> The `O5L_NP` capability flag is documented in *Oracle Database Net Services Reference*, in the section on the parameter `SQLNET.ALLOWED_LOGON_VERSION_SERVER`.

7. After all clients have the `O5L_NP` capability, raise the server security back to Exclusive Mode by using the following procedure:
   a. Remove the SEC_CASE_SENSITIVE_LOGON setting from the instance initialization file, or set the SEC_CASE_SENSITIVE_LOGON instance initialization parameter to TRUE. For example:

      ```
      SEC_CASE_SENSITIVE_LOGON = TRUE
      ```

   b. Remove the SQLNET.ALLOWED_LOGON_VERSION_SERVER parameter from the server `SQLNET.ORA` file, or set it back to Exclusive Mode by changing the value of `SQLNET.ALLOWED_LOGON_VERSION_SERVER` in the server `SQLNET.ORA` file back to `12`. For example:

      ```
      SQLNET.ALLOWED_LOGON_VERSION_SERVER = 12
      ```

8. Use the following SQL query to find the accounts that still have the 10G password version:

   ```
   select USERNAME
     from DBA_USERS
    where PASSWORD_VERSIONS like '%10G%'
      and USERNAME <> 'ANONYMOUS';
   ```

9. Use the list of accounts returned from the query in step 8 to expire all the accounts that still have the `10G` password version. Expire the accounts using the following syntax, where *`username`* is a name on the list returned by the query:

   ```
   ALTER USER username PASSWORD EXPIRE;
   ```

10. Request the users whose accounts you expired to log in to their accounts.

    When the users log in, they are prompted to reset their password. The system internally generates only the `11G` and `12C` password versions for their account. Because the system is running in Exclusive Mode, the 10G password version is no longer generated.

11. Check that the system is running in a secure mode by rerunning the query from step 1. Ensure that no users are found. When the query finds no users, this result means that no `10G` password version remains present in the system.

Example 2-3 Checking for the Presence of SEC_CASE_SENSITIVE_LOGON Set to FALSE

Oracle Database does not prevent the use of the FALSE setting for `SEC_CASE_SENSITIVE_LOGON` when the `SQLNET.ALLOWED_LOGON_VERSION_SERVER` parameter is set to `12` or `12a`. This setting can result in all accounts in the upgraded database becoming inaccessible.

```
SQL> SHOW PARAMETER SEC_CASE_SENSITIVE_LOGON

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
sec_case_sensitive_logon             boolean     FALSE
```

You can change this parameter by using the following command:

```
SQL> ALTER SYSTEM SET SEC_CASE_SENSITIVE_LOGON = TRUE;

System altered.
```

> **Note:**
>
> Unless the value for the parameter `SQLNET.ALLOWED_LOGON_VERSION_SERVER` is changed to a version that is more permissive than `12`, such as `11`, do not set the `SEC_CASE_SENSITIVE_LOGON` parameter to FALSE.

Related Topics

- *Oracle Database Net Services Reference*
- *Oracle Database Security Guide*

Running Upgrades with Read-Only and Offline Tablespaces

Use the Parallel Upgrade Utility with the `-T` option to take schema-based tablespaces offline during upgrade.

Oracle Database can read file headers created in earlier releases, so you are not required to do anything to them during the upgrade. The file headers of offline data files are updated later when they are brought online. The file headers of `READ ONLY` tablespaces are updated when they are changed to `READ WRITE`. Setting tablespaces offline ensures that your tablespaces are not altered during the upgrade. After the upgrade is complete, any user tablespace that was taken offline during the upgrade is brought back online.

If the upgrade suffers a catastrophic error, so that the upgrade is unable to bring the tablespaces back online, then review the upgrade log files. The log files contain the actual SQL statements required to make the tablespaces available. To bring the tablespaces back online, you must run the SQL statements in the log files for the database, or run the log files for each PDB.

Taking Schema-Based Tablespaces (User Tablespaces) Offline During Upgrade

In Oracle Database 12*c* release 2 (12.2) and later releases, you can run the Parallel Upgrade Utility with the `-T` option to have schema-based tablespaces (user

tablespaces) taken offline during the upgrade. Taking these tablespaces offline can reduce the necessity of backing up before upgrades. The Parallel Upgrade Utility (`catctl.pl`) analyzes tablespaces, and automatically selects the right set of tablespaces to set to read only. The utility does not set to `READ ONLY` any tablespaces that contain Oracle-Maintained objects.

This change enables you to set more tablespaces automatically to `READ ONLY` mode as part of the upgrade. In previous releases, you could set tablespaces to `READ ONLY` or `OFFLINE` mode manually. However, in some cases you had to revert to `READ WRITE` to prevent upgrade failures.

Also in Oracle Database 12c release 2 (12.2), the behavior of the ALTER TYPE statement is changed. During upgrades, if a dependent table is in an accessible tablespace, then it is automatically upgraded to the new version of the type. If the dependent table is in a `READ ONLY` tablespace, then it is not automatically upgraded. In that case, run the `utluptabdata.sql` script after the upgrade is completed to upgrade those tables that were in READ ONLY tablespaces during the upgrade.

To take schema-based tablespaces offline, run the Parallel Upgrade Utility (`catctl.pl`) from the command line, using the `-T` option. You can run `catctl.pl` by using the `dbupgrade` script.

For example, on Linux and UNIX platforms:

```
$ dbupgrade -T
```

Run the `utluptabdata.sql` script after the upgrade completes to upgrade those tables set to `READ ONLY` tablespaces during the upgrade.

Viewing Tablespace Commands In Upgrade Log Files

If a catastrophic upgrade failure occurs, then you can run commands in the log files manually to bring up tablespaces. You can view tablespace commands in the following log files:

- Non-CDB Upgrades: `catupgrd0.log`
- PDB databases: `catupdrd`*`pdbname`*`0.log`, where *`pdbname`* is the name of the PDB that you are upgrading.

At the beginning of each log file, you find SQL statements such as the following, which sets tables to `READ ONLY`:

```
SQL> ALTER TABLESPACE ARGROTBLSPA6 READ ONLY;

Tablespace altered.

SQL> ALTER TABLESPACE ARGROTBLSPB6 READ ONLY;

Tablespace altered.
```

Near the end of each log file, you find SQL statements to reset tables to `READ WRITE`:

```
SQL> ALTER TABLESPACE ARGROTBLSPA6 READ WRITE;

Tablespace altered.

SQL> ALTER TABLESPACE ARGROTBLSPB6 READ WRITE;

Tablespace altered.
```

Preparing for Database Rolling Upgrades Using Oracle Data Guard

If you use Database Upgrade Assistant (DBUA) with Oracle Data Guard to carry out a rolling upgrade, then you must move the Data Guard Broker configuration files before starting your upgrade.

The default location for the `DB_BROKER_CONFIG` files is in the `dbs` directory in the earlier release Oracle Database Oracle home. When you use DBUA to carry out a rolling upgrade of database instances using Oracle Data Guard, you must move the `DG_BROKER_CONFIG` files to a mountpoint location outside of the earlier release Oracle home. Also ensure that the `DG_BROKER_CONFIG_FILE`*n* parameters specify that location, instead of a location in the earlier release Oracle home. During database upgrade don't migrate the listener, Once DBUA completes, stop the listener, shutdown the database, copy over the listener.ora & tnsnames.ora from the old 12.2 environment to the 18.1environment and start the listener and database

Tasks Before Starting Your Upgrade

To enable access to the DB_BROKER_CONFIG files during a rolling upgrade, you must complete the following tasks before starting the upgrade

1. Before you start the upgrade, set the Oracle Data Guard files `DG_BROKER_CONFIG_FILE1` and `DG_BROKER_CONFIG_FILE2` to a separate mountpoint on your server that is outside of the Oracle home path for either the source or target Oracle Database Oracle homes.
2. Complete a successful upgrade of your earlier release Oracle home to the new Oracle Database release.

Tasks During the Upgrade

Do not migrate the listener during the upgrade.

Tasks After Completing Your Upgrade

1. Stop the listener for the new release Oracle Database.
2. Shut down the new release Oracle Database.
3. Copy over the `listener.ora` and `tnsnames.ora` files from the earlier release Oracle Database to the new release Oracle Database.
4. Start the Listener and new release Oracle Database

Refer to *Oracle Data Guard Broker* for information about moving your Data Guard Broker configuration files.

Related Topics

- *Oracle Data Guard Broker*

Preparing the New Oracle Home for Upgrading

After backing up the database that you want to upgrade, prepare the new Oracle home in a new location. Install the software for the new Oracle Database release into the new location.

1. (Manual upgrades only) Copy configuration files from the Oracle home of the database being upgraded to the new release Oracle Database Oracle home. If you are using DBUA, then you can ignore this step, because the configuration files are copied for you automatically.

   Use the following procedure to copy configuration files to the new Oracle home:

   a. If your parameter file resides within the old environment Oracle home, then copy it to the new Oracle home. By default, Oracle looks for the parameter file in the *ORACLE_HOME*/dbs directory on Linux or UNIX platforms and in the *ORACLE_HOME*\database directory on Windows operating systems. After upgrade, the parameter file can reside anywhere else, but it cannot reside in the Oracle home of the old environment.

      > **Note:**
      >
      > If necessary, create a text initialization parameter file (PFILE) from the server parameter file (SPFILE) so that you can edit the initialization parameters.

   b. If your parameter file resides within an Oracle ASM instance, then back up the parameter file using the following command:

      ```
      CREATE pfile FROM spfile;
      ```

      If you must downgrade the database and your SPFILE resided within Oracle ASM, then you must restore the parameter file before the downgrade.

   c. If your parameter file is a text-based initialization parameter file with either an IFILE (include file) or a SPFILE (server parameter file) entry, and the file specified in the IFILE or SPFILE entry resides within the old environment Oracle home, then copy the file specified by the IFILE or SPFILE entry to the new Oracle home. The file specified in the IFILE or SPFILE entry contains additional initialization parameters.

   d. If you have a password file that resides within the old environment Oracle home, then move or copy the password file to the new Oracle home.

      The name and location of the password file are operating system-specific. Where *SID* is your Oracle instance ID, you can find the password file in the following locations:

      - Linux or UNIX platforms: The default password file is orapw *SID*. It is located in the directory *ORACLE_HOME*/dbs.
      - Windows operating systems: The default password file is pwd*SID*.ora. It is located in the directory *ORACLE_HOME*\database.

2. Adjust your parameter file in the new Oracle Database release by completing the following steps:

a. Remove desupported initialization parameters and adjust deprecated initialization parameters. In new releases, some parameters are desupported, and other parameters are deprecated. Remove all desupported parameters from any parameter file that starts the new Oracle Database instance. Desupported parameters can cause errors in new Oracle Database releases. Also, alter any parameter whose syntax has changed in the new release.

   The Pre-Upgrade Information Tool displays any deprecated parameters and desupported parameters it finds in the **Deprecated Parameters** and **Desupported Parameters** sections, respectively.

   Adjust the values of the initialization parameters to at least the minimum values indicated by the Pre-Upgrade Information Tool.

   Make sure that all path names in the parameter file are fully specified. You should not have relative path names in the parameter file.

b. If the parameter file contains an `IFILE` entry, then change the `IFILE` entry in the parameter file. The `IFILE` entry should point to the new location text initialization parameter file that you specified in step 1. Also edit the file specified in the `IFILE` entry in the same way that you edited the parameter file in step 1.

c. If you are upgrading a cluster database, then if necessary, you can modify the `SPFILE` or `init`*`ORACLE_SID`*`.ora` files.

After making these parameter file adjustments, make sure that you save all of the files that you modified.

3. (Manual upgrades only) If you are upgrading a cluster database, and you are not using Database Upgrade Assistant (DBUA) then you must manually separate the database instance from the cluster. Set the CLUSTER_DATABASE initialization parameter to `false`. After the upgrade, you must set this initialization parameter back to `true`. If you are using DBUA, then the assistant takes care of this task for you.

Prerequisites for Preparing Oracle Home on Windows

Your system must meet these requirements before you can upgrade Oracle Database on Microsoft Windows platforms.

For security reasons, different Microsoft Windows user accounts configured as Oracle home users for different Oracle homes are not allowed to share the same Oracle Base.

- Database upgrade is supported when the same Windows user account is used as the Oracle home user in both the *source* and *destination* Oracle homes.
- Database upgrade is supported when the Oracle home from which the database is being upgraded uses the Windows Built-in Account. Releases earlier than Oracle Database 12*c* (release 11.2 and earlier) only supported the built-in account option for the Oracle home user on Windows.
- The Oracle home user may not have access to files outside its own Oracle Base and Oracle home. If that is the case, then if you choose a different Oracle Base during upgrade, it is possible that Oracle Database services cannot access files in the older Oracle Base. Using DBUA for database upgrade ensures that the Oracle

home user has access to files outside of its own Oracle Base and its own Oracle home.

Before upgrading manually, or before using the custom files from the older Oracle Base (for example, wallets, configuration files and other custom files), you must grant access to the Oracle home user for these outside files, or copy these files to the new Oracle Base.

Using the Pre-Upgrade Information Tool for Oracle Database

Review these topics to understand and to use the Pre-Upgrade information tool (`preupgrade.jar`).

- About the Pre-Upgrade Information Tool
  Run the Pre-Upgrade Information Tool on your earlier release Oracle Database to determine if it is ready for upgrading.
- Preupgrade Scripts Generated By the Pre-Upgrade Information Tool
  You can run preupgrade scripts that the Pre-Upgrade Information Tool generates to fix many issues before you upgrade to the new Oracle Database release.
- Postupgrade Scripts Generated By the Pre-Upgrade Information Tool
  After the upgrade, you can run the postupgrade scripts that the Pre-Upgrade Information Tool generates to complete fixups of your upgrade target database.
- Setting Up Environment Variables for the Pre-Upgrade Information Tool
  Before you run the Pre-Upgrade Information Tool, set up the user environment variables for the Oracle user that runs the tool, and open pluggable databases (PDBs) for analysis.
- Pre-Upgrade Information Tool (preupgrade.jar) Command
  Use Pre-Upgrade Information Tool (`preupgrade.jar`) commands to check your system before upgrades.
- Output of the Pre-Upgrade Information Tool
  The Pre-Upgrade Information Tool (`preupgrade.jar`) creates fixup scripts and log files in the output directory that you specify with the DIR command-line option.
- Pre-Upgrade Information Tool Output Example
  In this example, you can see how the Pre-Upgrade Information Tool displays recommended fixes, but does not carry out fixes automatically.
- Pre-Upgrade Information Tool Warnings and Recommendations for Oracle Database
  Use this section to analyze any Pre-Upgrade Information Tool warnings before you upgrade to the new release of Oracle Database.

About the Pre-Upgrade Information Tool

Run the Pre-Upgrade Information Tool on your earlier release Oracle Database to determine if it is ready for upgrading.

To help to ensure a successful upgrade, Oracle strongly recommends that you run the Pre-Upgrade Information Tool before you begin your upgrade, and use the preupgrade and postupgrade scripts that it generates to help to assist you with fixing any issues that the tool discovers.

Oracle Database 12*c* and later releases use the`preupgrade.jar` Pre-Upgrade Information Tool. You can run the tool from the operating system command line. In previous Oracle Database releases, the Pre-Upgrade Information Tool was run within SQL*Plus as a SQL file. The Pre-Upgrade Information Tool creates preupgrade scripts, which fix issues before you start an upgrade, and postupgrade scripts, which fix issues after an upgrade is completed.

The Pre-Upgrade Information Tool (`preupgrade.jar`) creates the following files:

- The log file `preupgrade.log`.

  The log file contains the output of the Pre-Upgrade Information Tool.
- The `preupgrade_fixups_`*`pdbname`*`.sql` (for PDBs, where *`pdbname`* is the name of the PDB) or `preupgrade_fixups.sql` script (Non-CDB databases).

  Before you run the upgrade, you can run the preupgrade fixups script manually in SQL*Plus to resolve many of the issues identified by the preupgrade tool.
- The `postupgrade_fixups_`*`pdbname`*`.sql` (for PDBs, where *`pdbname`* is the name of the PDB) or `postupgrade_fixups.sql` script (Non-CDB databases).

  You can run this script to fix issues after the database upgrade is completed.

Preupgrade Scripts Generated By the Pre-Upgrade Information Tool

You can run preupgrade scripts that the Pre-Upgrade Information Tool generates to fix many issues before you upgrade to the new Oracle Database release.

The location of the `preupgrade_fixups.sql` and log files depends on how you set output folders, or define the Oracle base environment variable.

If you specify an output directory by using the `dir` option with the Pre-Upgrade Information Tool, then the output logs and files are placed under that directory in the file path /`cfgtoollogs`/*`dbunique_name`*/`preupgrade`, where *`dbunique_name`* is the name of your source Oracle Database. If you do not specify an output directory when you run the Pre-Upgrade Information Tool, then the output is directed to one of the following default locations:

- If you do not specify an output directory with `DIR`, but you have set an Oracle base environment variable, then the generated scripts and log files are created in the following file path:

  `Oracle-base``/cfgtoollogs/`*`dbunique_name`*`/preupgrade`
- If you do not specify an output directory, and you have not defined an Oracle base environment variable, then the generated scripts and log files are created in the following file path:

  `Oracle-home``/cfgtoollogs/`*`dbunique_name`*`/preupgrade`

The fixup scripts that the Pre-Upgrade Information Tool creates depend on whether your source database is a Non-CDB database, or a CDB database:

- A log file (`preupgrade.log`).

  The log file contains log output for the Pre-Upgrade Information Tool.
- Pre-upgrade fixups SQL scripts, depending on your source database type:
  - **Non-CDB**: `preupgrade_fixups.sql`
  - **CDB**: Two different sets of scripts:

1. `preupgrade_fixups.sql`: A consolidated script for all PDBs.
2. Multiple `preupgrade_fixups_`*`pdbname`*`.sql` scripts, where*`pdbname`* is the name of the PDB for which a script is generated: Individual scripts, which you run on specific PDBs.

Run the scripts either by using `catcon.pl`, or by using SQL*Plus commands. You must run these scripts to fix issues before you start the database upgrade. The scripts resolve many of the issues identified by the preupgrade tool.

Each issue that the scripts identify includes a description of the problem, and a task that you can carry out to resolve the problem. The preupgrade tool itself does not make changes to your database to correct errors. However, you can run the scripts that it generates to correct identified errors. The scripts fix only those issues that an automated script can fix safely. Preupgrade issues that the automated script cannot fix safely typically require DBA knowledge of user applications. You can address those issues manually.

Postupgrade Scripts Generated By the Pre-Upgrade Information Tool

After the upgrade, you can run the postupgrade scripts that the Pre-Upgrade Information Tool generates to complete fixups of your upgrade target database.

The Pre-Upgrade Information Tool generates postupgrade fixup scripts, which you can run after the upgrade to fix issues that can be fixed after the upgrade.

The location of the postupgrade SQL scripts and log files depends on how you set output folders, or define the Oracle base environment variable. The postupgrade fixup scripts are placed in the same directory path as the preupgrade fixup scripts.

If you specify an output directory by using the `dir` option with the Pre-Upgrade Information Tool, then the output logs and files are placed under that directory in the file path /`cfgtoollogs/`*`dbunique_name`*`/preupgrade`, where *`dbunique_name`* is the name of your source Oracle Database. If you do not specify an output directory when you run the Pre-Upgrade Information Tool, then the output is directed to one of the following default locations:

- If you do not specify an output directory with `DIR`, but you have set an Oracle base environment variable, then the generated scripts and log files are created in the following file path:

  `Oracle-base``/cfgtoollogs/`*`dbunique_name`*`/preupgrade`

- If you do not specify an output directory, and you have not defined an Oracle base environment variable, then the generated scripts and log files are created in the following file path:

  `Oracle-home``/cfgtoollogs/`*`dbunique_name`*`/preupgrade`

The postupgrade fixup scripts that the Pre-Upgrade Information Tool creates depend on whether your source database is a Non-CDB database, or a CDB database:

- **Non-CDB**: `postupgrade_fixups.sql`
- **CDB**: Two different sets of scripts:
  1. `postupgrade_fixups.sql`: A consolidated script for all PDBs
  2. Multiple `postupgrade_fixups_`*`pdbname`*`.sql` scripts, where*`pdbname`* is the name of the PDB for which a script is generated: Individual scripts, which you run on specific PDBs.

Postupgrade issues that the automatic script cannot fix safely typically require DBA knowledge of user applications. You can address those issues manually.

Guidelines for Running Postupgrade Fixup Scripts for Non-CDB Databases

Oracle recommends that when you run the postupgrade scripts, you set the system to spool results to a log file so you can read the output. However, do not spool results to the `admin` directory:

After you run postupgrade scripts, you can run the Post-Upgrade Status Tool to check the status of your server.

Related Topics

- Running Postupgrade Fixup Scripts

Setting Up Environment Variables for the Pre-Upgrade Information Tool

Before you run the Pre-Upgrade Information Tool, set up the user environment variables for the Oracle user that runs the tool, and open pluggable databases (PDBs) for analysis.

You must set up the user environment variables for the Pre-Upgrade information tool. This example shows how to use shell commands to set up user environment variables to point to an earlier release Oracle home. For multitenant architecture upgrades, you must also open up all the PDBs that you want the tool to analyze.

In this example, the operating system is Linux or UNIX, the system identifier is `sales01`, and the earlier release Oracle home path is `/u01/app/oracle/product/12.1.0/dbhome_1`

1. Log in as the Oracle installation owner (`oracle`).
2. Set up the user environment variables to point to the earlier release Oracle home that you want to upgrade.

   For example:

   ```
   $ export ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1
   $ export ORACLE_BASE=/u01/app/oracle
   $ export ORACLE_SID=sales01
   $ export PATH=.:$ORACLE_HOME/bin:$PATH
   ```

3. (Multitenant architecture upgrades): If you are running the Pre-Upgrade Information Tool in a CDB, then use the command `alter pluggable database all open` to open the PDBs so that the tool can analyze them.

   For example: Log in to the database and enter the following command to open all PDBs:

   ```
   $ sqlplus \ as SYSDBA
   .
   .
   .
   SQL> alter pluggable database all open;
   ```

Pre-Upgrade Information Tool (preupgrade.jar) Command

Use Pre-Upgrade Information Tool (`preupgrade.jar`) commands to check your system before upgrades.

Prerequisites

The Pre-Upgrade Information Tool is in the new release Oracle home, in the file path `ORACLE_HOME/rdbms/admin/preupgrade.jar`. Oracle has configured it with the system checks necessary for the new Oracle Database release. However, the checks that the tool performs are carried out on the earlier release Oracle Database home. Set up the Oracle user environment variables so that they point to the earlier release Oracle home.

Run the Pre-Upgrade Information Tool by using the Java version in your earlier release Oracle home. For multitenant architecture (CDB and PDB) upgrades, open up all the PDBs that you want the tool to analyze before you run the tool.

Set the environment variables for your user account to point to the earlier release ORACLE_HOME, ORACLE_BASE, and ORACLE_SID.

File Path

The `preupgrade.jar` file is located in the new Oracle home:

```
New_release_Oracle_home/rdbms/admin/preupgrade.jar
```

You can also copy the `preupgrade.jar` binaries to a path of your choosing. For example:

```
/tmp/preupgrade.jar
```

Syntax

```
$Earlier_release_Oracle_home/jdk/bin/java -jar $New_release_Oracle_home
/rdbms/admin/preupgrade.jar [FILE|TERMINAL] [TEXT|XML] [DIR output_dir]
```

Options

Command Option	Description
`FILE|TERMINAL`	Script output location. Use FILE to direct script output to a file. Use TERMINAL to direct output to the terminal. If you do not specify a value, then the default is FILE. If you specify TERMINAL, then screen output is directed to the display, and scripts and logs are placed in the output directory path.
`TEXT|XML`	Output type. Use TEXT to specify text output. Use XML to specify XML output. If you do not specify an output type, then the default is text.

Command Option	Description
`DIR output_dir`	Directs the output to a specific directory. If you do not specify an output directory with the `DIR` option, then the output is directed to one of the following default locations: • If you do not specify an output directory with `DIR`, but you define an *`ORACLE_BASE`* environment variable, then the generated scripts and log files are created. • If you do not specify an output directory, and *`ORACLE_BASE`* is not defined, then the generated scripts and log files are created in the following path: *`ORACLE_HOME`*`/cfgtoollogs/`*`dbunique_name`*`/preupgrade`
`-c "pdb1 pdb2 pdb3"` (Windows) `-c 'pdb1 pdb2 pdb3'` (Linux and UNIX)	Specifies a list of containers inside a CDB that you want to include for processing (a "White list"). Provide a space-delimited list of PDBs that you want processed. To specify the list, use single quotes on Linux and UNIX operating systems, and use double quotes on Windows systems. If you do not specify either `-c` or `-C`, then all PDBs in a CDB are processed.
`-C "pdb1 pdb2 pdb3"` (Windows) `-C 'pdb1 pdb2 pdb3'` (Linux and UNIX)	Specifies a list of containers inside a CDB that you want to exclude from processing (a "Black list"). Provide a space-delimited list of PDBs that you want to exclude from processing. To specify the list, use single quotes on Linux and UNIX operating systems, and use double quotes on Windows systems. If you do not specify either `-c` or `-C`, then all PDBs in a CDB are processed.
`-loadonly`	Loads the DBMS_PREUP package into the database when it is in READ WRITE mode, without carrying out any other action. Use this parameter to prepare a given Non-CDB or CDB database so that the DBMS_PREUP package is loaded when you run the Pre-Upgrade Information Tool, and the DB (DB or Container) is in READ-ONLY mode. If you want use the tool to analyze a database in read-only mode, then you must use this command to load the DBMS_PREUP package into the database while it is in READ WRITE mode, before you set it to READ-ONLY mode.
`-p password`	Provides the password for the user. If you do not use operating system authentication to connect to the database, then use the `-p` option to specify a password on the command line. If a username is specified on the command line with `-u`, but no password specified with `-p`, then the tool prompts you for a password.
`-u username`	Provides the user name of the user that you want to use to connect as SYSDBA to the database that you want to check. Use this option only if you do not use operating system authentication to connect to the database For example, You log in as a user that is not a member of the OSDBA group for the database that you want to check. In that case, the user account does not have operating system authentication privileges for the SYSDBA system privilege. Use the `-u` and `-p` option to provide data dictionary authentication to log in as a user with SYSDBA system privileges.

Command Option	Description
`-oh oracle_home`	Specifies an Oracle home that you want to check. Provide the path of the Oracle home that you want to check. If you do not specify an Oracle home path to check, then the Pre-Upgrade Information Tool defaults to the path specified by the user environment variable for the Oracle home. That variable is $ORACLE_HOME on Linux and UNIX systems, and %ORACLE_HOME% on Windows systems.
`-sid system_identifier`	Specifies an Oracle system identifier that you want to check. Provide the ORACLE_SID of the database that you want to check.
`-help`	Displays the command-line syntax help text.

Example 2-4 Non-CDB In the Source Oracle Home Example

1. Set your user environment variables to point to the earlier release Oracle home.

```
$ export ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1
$ export ORACLE_BASE=/u01/app/oracle
$ export ORACLE_SID=sales01
$ export PATH=.:$ORACLE_HOME/bin:$PATH
```

2. Run the new release Oracle Database Pre-Upgrade Information Tool on the earlier release Oracle Database server (12.2), using the environment settings you have set to the earlier release Oracle home.

```
$ORACLE_HOME/jdk/bin/java -jar /u01/app/oracle/product/12.2.0/rdbms/admin/
preupgrade.jar TERMINAL TEXT
```

Example 2-5 CDB in a Source Oracle Home

1. Open all the pluggable databases

```
SQL> alter pluggable database all open;
```

2. Set your user environment variables to point to the earlier release Oracle home.

```
$ export ORACLE_HOME=/u01/app/oracle/product/12.1.0/dbhome_1
$ export ORACLE_BASE=/u01/app/oracle
$ export ORACLE_SID=sales01
$ export PATH=.:$ORACLE_HOME/bin:$PATH
```

3. Run the Pre-Upgrade Information Tool with an inclusion list, using the `-c` option. In this example, the inclusion list is PDB1 and PDB2, and the command is run on a Linux or UNIX system. The output of the command is displayed to the terminal, and the output is displayed as text.

```
$ORACLE_HOME/jdk/bin/java -jar /u01/app/oracle/product/12.2.0/dbhome_1/rdbms/
admin/preupgrade.jar TERMINAL TEXT -c 'pdb1 pdb2'
```

Output of the Pre-Upgrade Information Tool

The Pre-Upgrade Information Tool (`preupgrade.jar`) creates fixup scripts and log files in the output directory that you specify with the DIR command-line option.

When you run the Pre-Upgrade Information Tool, it generates the following files inside the directory that you specify as the output directory.

Log File (preupgrade.log)

The file `preupgrade.log` is the report that the Pre-Upgrade Information Tool generates whenever you run the command with the FILE option. The log file contains all the tool recommendations and requirements for upgrade. The log file is located in the following path, where *`timestamp`* is the date and time when the command is run: `$ORACLE_BASE/cfgtoollogs/dbua/upgrade`*`timestamp`*`/SID/`. If you run the command with the TERMINAL option, then the content of this file is output to the display. Refer to the section "Pre-Upgrade Information Tool Output Example" for an example of a log file.

XML DBUA File (upgrade.xml)

If you specify XML file output on the Pre-Upgrade Information Tool command line, then it generates the `upgrade.xml` file instead of `preupgrade.log`.

Preupgrade Fixup File (preupgrade_fixups.sql) and Postupgrade Fixup File (postupgrade_fixups.sql)

The Pre-Upgrade Information Tool identifies issues that can block or hinder an upgrade.

Some issues require a DBA to resolve, because it is not possible for the automated script to understand the specific goals of your application. However, other issues do not present any difficulty in resolving. In these cases, the Pre-Upgrade Information Tool automatically generates scripts that contain the SQL statements necessary to resolve the issues. Using these scripts can perform, track, and simplify the work that DBAs must do to resolve potential upgrade issues. The SQL statements that resolve issues before upgrade are placed in the `preupgrade_fixups.sql` script. The SQL statements that resolve issues after upgrade are placed in the `postupgrade_fixups.sql` script. When you run the Pre-Upgrade Information tool on a multitenant architecture Oracle Database, you can run the consolidated scripts `preupgrade_fixups.sql` script and `postupgrade_fixups.sql` across all the containers. Run the consolidated scripts using `catcon.pl`.

Both of these fixup files are generated in the output directory that you specify with the Pre-Upgrade Information Tool `DIR` command-line option.

The script carries out the following steps to resolve pre-upgrade or post-upgrade issues:

1. For each issue that the Pre-Upgrade Information Tool identifies, it reruns the individual Pre-Upgrade Information Tool check again, to determine if the issue is still present.
2. If the issue is present, then the tool does one of the following, depending on whether there is a fixup routine for the issue:
   - If there is an Oracle-supplied fixup routine for that issue, then the script executes that fixup routine. It then reruns the Pre-Upgrade Information Tool check again, to confirm that the issue is resolved. If the issue is resolved, then the script displays a message that the issue is resolved.
   - If there is no Oracle-supplied fixup routine, then the script displays a message that the issue is still present.

Review the issues that the script indicates are still present after it completes its checks. Resolve all the issues marked `Required` before upgrading. You can choose

to resolve recommended fixes and informational fixes. You can rerun the `preupgrade_fixups.sql` and `postupgrade_fixups.sql` scripts as many times as you want to. You can use the scripts as a progress report to track remaining issues as part of your issue resolution plan.

After you resolve issues identified by the Preupgrade fixup and Postupgrade fixup scripts, Oracle recommends that you rerun the Pre-Upgrade Information Tool (`preupgrade.jar`) one more time before upgrade. Running the tool one more time helps to confirm that you have resolved all issues that you intend to address.

If you are checking a multitenant environment system (CDBs and PDBs), then the `preupgrade_fixups.sql` and `postupgrade_fixups.sql` scripts contain a rollup of the fixup code for all the individual PDBs. They are coded so that only the code for the current PDB runs. You can run the same script in each PDB. The script fixes only the issues in that PDB. As a result, it is easy to use the `preupgrade_fixups.sql` and `postupgrade_fixups.sql` with `catcon.pl` to run fixups across an entire CDB.

Related Topics

- Pre-Upgrade Information Tool Output Example
- Scripts for Upgrading Oracle Database

Pre-Upgrade Information Tool Output Example

In this example, you can see how the Pre-Upgrade Information Tool displays recommended fixes, but does not carry out fixes automatically.

You have control over how and when the fixup scripts are run.

The following example shows the output that is generated and written to `preupgrade.log` by running the Oracle Database 12*c* Pre-Upgrade Information Tool on a release 11.2.0.3 database:

```
Report generated by Oracle Database Pre-Upgrade Information Tool Version
12.2.0.1.0

Upgrade-To version: 12.2.0.1.0

======================================
Status of the database prior to upgrade
======================================

      Database Name:  AIME1
     Container Name:  Not Applicable in Pre-12.1 database
       Container ID:  Not Applicable in Pre-12.1 database
            Version:  11.2.0.3.0
      Compatible:  11.2.0
       Blocksize:  8192
        Platform:  Linux x86 64-bit
     Timezone File:  14
  Database log mode:  NOARCHIVELOG
         Readonly:  FALSE
          Edition:  EE

  Oracle Component                       Upgrade Action    Current Status
  ----------------                       --------------    --------------
  Oracle Server                          [to be upgraded]  VALID
  JServer JAVA Virtual Machine           [to be upgraded]  VALID
  Oracle XDK for Java                    [to be upgraded]  VALID
```

```
  Oracle Workspace Manager              [to be upgraded]  VALID
  OLAP Analytic Workspace               [to be upgraded]  VALID
  Oracle Label Security                 [to be upgraded]  VALID
  Oracle Database Vault                 [to be upgraded]  VALID
  Oracle Enterprise Manager Repository  [to be upgraded]  VALID
  Oracle Text                           [to be upgraded]  VALID
  Oracle XML Database                   [to be upgraded]  VALID
  Oracle Java Packages                  [to be upgraded]  VALID
  Oracle Multimedia                     [to be upgraded]  VALID
  Oracle Spatial                        [to be upgraded]  VALID
  Expression Filter                     [to be upgraded]  VALID
  Rule Manager                          [to be upgraded]  VALID
  Oracle Application Express            [to be upgraded]  VALID
  Oracle OLAP API                       [to be upgraded]  VALID


==============
BEFORE UPGRADE
==============

  Run <preupgradeLogDirPath>/preupgrade_fixups.sql to complete all
  of the BEFORE UPGRADE action items below marked with '(AUTOFIXUP)'.

  REQUIRED ACTIONS
  ================
   + Adjust TABLESPACE SIZES as needed.
                                                 Auto      12.2.0.1.0
     Tablespace                      Size        Extend    Min Size    Action
     ----------                   ----------     --------  ----------  ------

     EXAMPLE                        314 MB       DISABLED      309 MB  None
     SYSAUX                         530 MB       ENABLED      1442 MB  None
     SYSTEM                         720 MB       ENABLED      1228 MB  None
     TEMP                            20 MB       ENABLED       150 MB  None
     UNDOTBS1                        75 MB       ENABLED       400 MB  None

     Note that 12.2.0.1.0 minimum sizes are estimates.
     If you plan to upgrade multiple pluggable databases concurrently,
     then you must ensure that the UNDO tablespace size is equal to at least
     the number of pluggable databases that you upgrade concurrently,
     multiplied by that minimum.  Failing to allocate sufficient space can
     cause the upgrade to fail.



   + Update NUMERIC INITIALIZATION PARAMETERS to meet estimated minimums.

     Parameter                      12.2.0.1.0 minimum
     ---------                      ------------------
     processes                                     300



   + You must rename or drop the USER or ROLE named AUDSYS from the database.


     The database contains a USER or ROLE named AUDSYS. That name was
     reserved to Oracle in release 12.1.0.1.0, and remains reserved in
     release 12.2.0.1.0.
```

```
    Oracle occasionally adds new internal USERs and ROLEs as the database
    evolves.  To avoid a name conflict in the upgraded version, a source
    database must not contain any USER or ROLE with a name that matches one
    reserved by Oracle in the target release.

  + You must rename or drop the USER or ROLE named AUDIT_ADMIN from the
    database.

    The database contains a USER or ROLE named AUDIT_ADMIN. That name was
    reserved to Oracle in release 12.1.0.1.0, and remains reserved in
    release 12.2.0.1.0.

    Oracle occasionally adds new internal USERs and ROLEs as the database
    evolves.  To avoid a name conflict in the upgraded version, a source
    database must not contain any USER or ROLE with a name that matches one
    reserved by Oracle in the target release.

  + Run rdbms/admin/olspreupgrade from the new Oracle Database 12.2.0.1.0
    home.

    olspreupgrade.sql has not been run on this database.  To view the number
    of records that olspreupgrade.sql moves, use the following command:

      SELECT count(*) from system.aud$

    As part of the upgrade to 12.2.0.1.0, records in the 11.2.0.3.0 audit
    table SYSTEM.AUD$ are moved to SYS.AUD$. This step can be manually
    performed before the upgrade to reduce downtime.  Refer to the
    12.2.0.1.0 Oracle Label Security Administrator's Guide, or to Oracle
    Database Upgrade Guide for further details.

  + (AUTOFIXUP) Empty the RECYCLEBIN immediately before database upgrade.

    The database contains 3 objects in the recycle bin.

    The recycle bin must be completely empty before database upgrade.

RECOMMENDED ACTIONS
==================
  + Remove the EM repository.

    - Copy the rdbms/admin/emremove.sql script from the target 12.2.0.1.0
    ORACLE_HOME into the source 11.2.0.3.0 ORACLE_HOME.

    - Stop EM Database Control:

      $> emctl stop dbconsole

    - Connect to the database using the SYS account AS SYSDBA

      SET ECHO ON;
      SET SERVEROUTPUT ON;
      @emremove.sql

    Without the set echo and serveroutput commands, you will not be able to
    follow the progress of the script.

    The database has an Enterprise Manager Database Control repository.

    Starting with Oracle Database 12c, the local Enterprise Manager Database
```

```
  Control does not exist anymore. The repository will be removed from your
  database during the upgrade.  This step can be manually performed before
  the upgrade to reduce downtime.

+ Run 11.2.0.3.0 ORACLE_HOME/rdbms/admin/utlrp.sql to recompile invalid
  objects.  You can view the individual invalid objects with

    SET SERVEROUTPUT ON;
    EXECUTE DBMS_PREUP.INVALID_OBJECTS;

  2 objects are INVALID.

  There should be no INVALID objects in SYS/SYSTEM or user schemas before
  database upgrade.

+ Remove OLAP Catalog by running the SQL script
  $ORACLE_HOME/olap/admin/catnoamd.sql script.

  The OLAP Catalog component, AMD, exists in the database.

  Starting with Oracle Database 12c, the OLAP Catalog (OLAP AMD) is
  desupported and will be removed from the database during the database
  upgrade.  This step can be manually performed before the upgrade to
  reduce downtime.
```

Pre-Upgrade Information Tool Warnings and Recommendations for Oracle Database

Use this section to analyze any Pre-Upgrade Information Tool warnings before you upgrade to the new release of Oracle Database.

Refer to My Oracle Support note 472937.1 for information about installed database components and schemas. Refer to My Oracle Support note 753041.1 for information about diagnosing components with NON VALID status.

- Updating Access Control Lists and Network Utility Packages
  Use this procedure to update access control lists (ACLs) and Network Utility Packages.
- Evaluate Dependencies and Add ACLs for Network Utility Packages
  You can receive a warning about network utility package dependencies. Use this procedure to evaluate the dependencies, and provide access by adding the appropriate access control lists (ACLs).
- About Database Links with Passwords from Earlier Oracle Database Releases
  This information is important only for downgrading to your original database release after performing the upgrade.
- About Oracle Database Warnings for TIMESTAMP WITH TIME ZONE Data Type
  Oracle Database upgrades include updated time zone data types, which may affect existing `TIMESTAMP WITH TIME ZONE` data types.

Related Topics

- https://support.oracle.com/rs?type=doc&id=472937.1
- https://support.oracle.com/rs?type=doc&id=753041.1

Updating Access Control Lists and Network Utility Packages

Use this procedure to update access control lists (ACLs) and Network Utility Packages.

Starting with Oracle Database 12*c*, the access control of the UTL packages is implemented using Oracle Database Real Application Security. UTL packages include UTL_TCP, UTL_SMTP, UTL_MAIL, UTL_HTTP, and UTL_INADDR. The access control does not require Oracle XML DB.

1. Ensure that the logged-in user has the `connect` privilege for the host and port specified by `DBMS_LDAP.init`. There is new behavior for the `DBMS_LDAP` PL/SQL package and the `HttpUriType` type. Because of this new behavior, you must create or update access control lists (ACLs) after you upgrade to the new Oracle Database release.

   For example, if your application depends on the `DBMS_LDAP` package, then the error "ORA-24247: network access denied by access control list (ACL)" can occur. To avoid this error, the logged-in user must have the `connect` privilege for the host and port specified by `DBMS_LDAP.init`.

2. If you have any of the following packages installed, then you can be required to reinstall these packages after upgrade:

   - `UTL_TCP`
   - `UTL_SMTP`
   - `UTL_MAIL`
   - `UTL_HTTP`
   - `UTL_INADDR`

   Ensure that you have the latest version of these packages for the new Oracle Database release.

Evaluate Dependencies and Add ACLs for Network Utility Packages

You can receive a warning about network utility package dependencies. Use this procedure to evaluate the dependencies, and provide access by adding the appropriate access control lists (ACLs).

1. Run the Pre-Upgrade Information Tool.
2. Check the output from the Pre-Upgrade Information Tool (`preupgrade.jar`) for warning messages, such as the following example:

```
WARNING: --> Database contains schemas with objects dependent on network
packages.
.... Refer to the Database Upgrade Guide for instructions to configure Network
ACLs.
.... USER WKSYS has dependent objects.
.... USER SYSMAN has dependent objects.
.... USER FLOWS_010600 has dependent objects.
.
```

3. Query the view `DBA_DEPENDENCIES` to obtain more information about the dependencies. For example:

```
SELECT * FROM DBA_DEPENDENCIES
WHERE referenced_name IN
('UTL_TCP','UTL_SMTP','UTL_MAIL','UTL_HTTP','UTL_INADDR','DBMS_LDAP')
  AND owner NOT IN ('SYS','PUBLIC','ORDPLUGINS');
```

4. To ensure that the new access controls are part of your upgrade testing, prepare a post-upgrade script to make the scripts available in your database environment.

   Use the package `DBMS_NETWORK_ACL_ADMIN` to update your database access control lists (ACLs). You use this package to create, assign, and add privileges to the new access controls so that the updated access control packages can work as they did in prior releases. Refer to the example script provided in *Oracle Database Real Application Security Administrator's and Developer's Guide* to see how to use `DBMS_NETWORK_ACL_ADMIN` to update your access control list.

5. After the upgrade, grant specific required privileges. Access is based on the usage in the original database.

Related Topics

- *Oracle Database Real Application Security Administrator's and Developer's Guide*

About Database Links with Passwords from Earlier Oracle Database Releases

This information is important only for downgrading to your original database release after performing the upgrade.

During the upgrade to the new Oracle Database release, any passwords in database links are encrypted.

- To downgrade to the release from which you upgraded, you must drop all of the database links with encrypted passwords before the downgrade. Consequently, the database links are nonexistent in the downgraded database.
- If you must be able to downgrade to your original release, then save the information about affected database links from the `SYS.LINK$` table, so that you can recreate the database links after the downgrade.
- For information about earlier releases, refer to the original documentation for the Oracle Database release from which you upgraded. Also refer to your platform-specific *Oracle Database Installation Guide* for the earlier release.

About Oracle Database Warnings for TIMESTAMP WITH TIME ZONE Data Type

Oracle Database upgrades include updated time zone data types, which may affect existing `TIMESTAMP WITH TIME ZONE` data types.

The time zone files supplied with Oracle Database 12*c* are updated to reflect changes in transition rules for some time zone regions. The changes may affect existing `TIMESTAMP WITH TIME ZONE` data types.

Oracle recommends that you ensure that you have the latest time zone files before you upgrade the database. If the time zone file version of the database you are upgrading is not the most recent version of the time zone file available for the new release of Oracle Database, then the Pre-Upgrade Information Tool displays a warning and describes how to proceed. The following table describes the warnings and summarizes how to resolve a mismatch in time zone file versions.

> **Caution:**
>
> The `TIMESTAMP WITH TIME ZONE` data stored in the database can become corrupted during the upgrade if there is a time zone file version mismatch.

Table 2-2 Choices for Fixing the Time Zone File Version

Time Zone Version On the Database Being Upgraded	When to Fix the Time Zone Files
Earlier than the most current version included in the new database release and the Pre-Upgrade Information Tool displays "Database is using a time zone file older than version *n*."	After completing the database upgrade. Use the `DBMS_DST` PL/SQL package and follow the instructions in "Steps to Upgrade Time Zone File and Timestamp with Time Zone Data. Refer to the following document: *Oracle Database Globalization Support Guide*.
Later than the version included in the new database release and the Pre-Upgrade Information Tool displays "Database is using a time zone file greater than version *n*."	Before beginning the database upgrade. You must patch the Oracle home by using an `RDBMS DST` patch with the appropriate patch for the time zone file version in use. Apply the patch for each database that you want to upgrade. Otherwise, the upgrade script terminates without upgrading the database. The `RDBMS DST` patches are available from My Oracle Support note ID 412160.1.

Related Topics

- *Oracle Database PL/SQL Packages and Types Reference*
- https://support.oracle.com/rs?type=doc&id=1509653.1
- https://support.oracle.com/rs?type=doc&id=412160.1
- *Oracle Database Globalization Support Guide*

Testing the Upgrade Process for Oracle Database

Your test plan for Oracle Database upgrades should include these test procedures.

Oracle recommends that you create a full working copy of your database environment in which to test all the pre-upgrade, upgrade, and post-upgrade processes.

You can create a test environment that does not interfere with the current production Oracle database. Oracle Data Guard, for example, enables you to create physical and snapshot standby databases.

Your test environment depends on the upgrade method you choose:

- If you plan to use DBUA or perform a manual upgrade, then create a test version of the current production database.
- If you plan to use Data Pump Export/Import, then export and import in stages, using subsets of the current production database.

Practice upgrading the database using the test environment. The best practice is to perform testing of the upgrade process on an exact copy of the database that you want to upgrade, rather than on a downsized copy or test data. If an exact copy is impractical, then carefully chose a representative subset of your data to move over to your test environment and test the upgrade on that data.

- Example of Testing Upgrades Using Priority List Emulation
  You can use the Parallel Upgrade Utility on multitenant architecture Oracle Databases to run upgrade emulations to test your priority list or other parameter settings before you run your upgrade.
- Upgrade Oracle Call Interface (OCI) and Precompiler Applications
  Upgrade any Oracle Call Interface (OCI) and precompiler applications that you plan to use with the new release of Oracle Database.

See Also:

- *Oracle Database Testing Guide* for information about testing a database upgrade
- *Oracle Database Utilities* for information on Data Pump Export and Import utilities
- *Oracle Data Guard Concepts and Administration* for information on physical and snapshot standby databases

Example of Testing Upgrades Using Priority List Emulation

You can use the Parallel Upgrade Utility on multitenant architecture Oracle Databases to run upgrade emulations to test your priority list or other parameter settings before you run your upgrade.

On multitenant architecture Oracle Database systems, starting with Oracle Database 12*c* release 2 (12.2), you can use priority lists to upgrade or exclude specific PDBs, or to set a specific upgrade priority order. Running the Parallel Upgrade Utility using priority emulation is a way to test your priority list without actually running the upgrade. Use the Parallel Upgrade Utility emulation feature to test your upgrade plan using priority lists.

Preparing for Upgrade Emulation Tests

Before you run the emulation, you must set up your source and target upgrade locations, and prepare your database in the same way you prepare for an actual upgrade. No upgrade actually occurs, but the Parallel Upgrade Utility generates log files that show how an actual upgrade is carried out.

> **Note:**
>
> You can use the `-E` parameter to run the Parallel Upgrade Utility in emulation mode to test how priority lists run, or to test how other upgrade parameter selections are carried out during an upgrade. For example, you can run an upgrade emulation to obtain more information about how the resource allocation choices you make using the `-n` and `-N` parameters are carried out.

Syntax for Running Priority List Emulation

You can use any of the parameter settings that you normally use with the Parallel Upgrade Utility, However, you must create a priority list, and you must use the `-L` parameter to call the list when you run the Parallel Upgrade Utility with the `-E` parameter to set it to perform an upgrade emulation.

The following is an example of the minimum required syntax for running the Parallel Upgrade Utility using priority list emulation, where *`priority_list_name`* is the name of your priority list file:

```
catctl -E -L priority_list_name catupgrd.sql
```

Example 2-6 Example of Running the Parallel Upgrade Utility using Priority List Emulation

The following example uses this priority list, which is named `plist.txt`:

```
1,CDB$ROOT
2,PDB$SEED
3,CDB1_PDB2
4,CDB1_PDB4
4,CDB1_PDB3
5,CDB1_PDB5
5,CDB1_PDB1
```

The following command runs a parallel emulation, calling this priority list:

```
$ORACLE_HOME/perl/bin/perl catctl.pl -L plist.txt -E -n 4 -N 2 catupgrd.sql
```

This command uses the following parameter settings:

- `-E` specifies that Parallel Upgrade Utility runs the upgrade procedures in emulation mode.
- `-n 4` specifies that the upgrade allocates four processes to perform parallel upgrade operations.
- `-N 2` specifies that the upgrade runs two SQL processors to upgrade the PDBs. The maximum PDB upgrades running concurrently is the value of `-n` divided by the value of `-N`, so the upgrade runs no more than two concurrent PDB upgrades.
- `-L` specifies the priority list that the command reads to set upgrade priority.

As the Parallel Upgrade Utility carries out the emulated upgrade, it displays on screen the same output that you see during an actual upgrade.

When the upgrade emulation completes, it generates a log file, `catctl_prority_run.list`, which is stored either in the default logging directory, or in a

logging directory location that you specify with the `-l` parameter. Because in this example we did not specify a different log directory, and we are running the upgrade on the container database named `CDB1`, the output is place in the path *`Oracle_base`*`/cfgtoollogs/CDB1/run`, where *`Oracle_base`* is the Oracle base of the user running the upgrade, and `CDB1` is the name of the container database (CDB) on which you are running the upgrade.

The log file `catctl_priority_run.lst` displays the list of how the upgrade priority was carried out during the upgrade emulation. It shows how the Parallel Upgrade Utility grouped PDB upgrades. You can see a priority run that contains the groupings and priorities before you actually carry out the upgrade. The log file generated by the upgrade is also displayed on the screen after the upgrade completes.

The following is the screen output and log file the Parallel Upgrade Utility generates using this upgrade scenario, with the parameter settings and the priority list:

```
Argument list for [catctl.pl]
Run in                c = 0
Do not run in         C = 0
Input Directory       d = 0
Echo OFF              e = 1
Simulate              E = 1
Log Id                i = 0
Child Process         I = 0
Log Dir               l = 0
Priority List Name    L = plist.txt
Upgrade Mode active   M = 0
SQL Process Count     n = 4
SQL PDB Process Count N = 2
Open Mode Normal      o = 0
Reverse Order         r = 0
Start Phase           p = 0
End Phase             P = 0
Script                s = 0
Serial Run            S = 0
RO User Tablespaces   T = 0
Display Phases        y = 0
Debug catcon.pm       z = 0
Debug catctl.pl       Z = 0

catctl.pl VERSION: [12.2.0.1.0]


orahome = [/u01/app/oracle/12.2.0]
catctlGetOrabase = [/u01/app/oracle]

Analyzing file ./catupgrd.sql

Log file directory = [/u01/app/oracle/cfgtoollogs/CDB1/upgrade20151009185119]

catcon: ALL catcon-related output will be written to [/[/u01/app/oracle/cfgtoollogs/
CDB1/upgrade20151009185119/catupgrd_catcon_8126.lst]
catcon: See [/[/u01/app/oracle/cfgtoollogs/CDB1/upgrade20151009185119/catupgrd*.log]
files for output generated by scripts
catcon: See [/[/u01/app/oracle/cfgtoollogs/CDB1/upgrade20151009185119/
catupgrd_*.lst] files for spool files, if any

Number of Cpus        = 2
DATABASE NAME         = CDB1
```

```
DataBase Version      = 12.2.0.1.0
catcon: ALL catcon-related output will be written to [/[/u01/app/oracle/cfgtoollogs/
CDB1/cfgtoollogs/dbopens/upgrade20151009185122/catupgrd_catcon_8126.lst]
catcon: See [/[/u01/app/oracle/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrd*.log] files for output generated by scripts
catcon: See [/[/u01/app/oracle/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrd_*.lst] files for spool files, if any

Log file directory = [/[/u01/app/oracle/cfgtoollogs/CDB1/dbopens/
upgrade20151009185122]

Parallel SQL Process Count (PDB)      = 2
Parallel SQL Process Count (CDB$ROOT) = 4
Concurrent PDB Upgrades               = 2
Generated PDB Inclusion:[NONE]
Generated PDB Inclusion:[PDB$SEED CDB1_PDB2 CDB1_PDB3 CDB1_PDB4 CDB1_PDB1 CDB1_PDB5]

----------------------------------------------------
Phases [0-104]         Start Time:[2015_10_09 18:51:24]
Container Lists Inclusion:[CDB$ROOT] Exclusion:[NONE]
----------------------------------------------------
***********   Executing Change Scripts   ***********
Serial   Phase #:0    [CDB$ROOT] Files:1    Time: 0s
***************   Catalog Core SQL   ***************
Serial   Phase #:1    [CDB$ROOT] Files:5    Time: 0s
Restart  Phase #:2    [CDB$ROOT] Files:1    Time: 0s
***********   Catalog Tables and Views   ***********
Parallel Phase #:3    [CDB$ROOT] Files:20   Time: 0s
Restart  Phase #:4    [CDB$ROOT] Files:1    Time: 1s
*************   Catalog Final Scripts   *************
Serial   Phase #:5    [CDB$ROOT] Files:5    Time: 0s
*****************   Catproc Start   *****************
Serial   Phase #:6    [CDB$ROOT] Files:1    Time: 0s
*****************   Catproc Types   *****************
Serial   Phase #:7    [CDB$ROOT] Files:4    Time: 0s
Restart  Phase #:8    [CDB$ROOT] Files:1    Time: 0s
****************   Catproc Tables   ****************
Parallel Phase #:9    [CDB$ROOT] Files:69   Time: 0s
Restart  Phase #:10   [CDB$ROOT] Files:1    Time: 1s
*************   Catproc Package Specs   *************
Serial   Phase #:11   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:12   [CDB$ROOT] Files:1    Time: 1s
**************   Catproc Procedures   **************
Parallel Phase #:13   [CDB$ROOT] Files:94   Time: 0s
Restart  Phase #:14   [CDB$ROOT] Files:1    Time: 0s
Parallel Phase #:15   [CDB$ROOT] Files:116  Time: 0s
Restart  Phase #:16   [CDB$ROOT] Files:1    Time: 1s
Serial   Phase #:17   [CDB$ROOT] Files:10   Time: 0s
Restart  Phase #:18   [CDB$ROOT] Files:1    Time: 0s
*****************   Catproc Views   *****************
Parallel Phase #:19   [CDB$ROOT] Files:33   Time: 0s
Restart  Phase #:20   [CDB$ROOT] Files:1    Time: 1s
Serial   Phase #:21   [CDB$ROOT] Files:3    Time: 0s
Restart  Phase #:22   [CDB$ROOT] Files:1    Time: 0s
Parallel Phase #:23   [CDB$ROOT] Files:23   Time: 0s
Restart  Phase #:24   [CDB$ROOT] Files:1    Time: 1s
Parallel Phase #:25   [CDB$ROOT] Files:14   Time: 0s
Restart  Phase #:26   [CDB$ROOT] Files:1    Time: 0s
***************   Catproc CDB Views   **************
Serial   Phase #:27   [CDB$ROOT] Files:1    Time: 0s
```

```
Restart  Phase #:28   [CDB$ROOT] Files:1    Time: 1s
Serial   Phase #:30   [CDB$ROOT] Files:1    Time: 0s
*****************   Catproc PLBs   *****************
Serial   Phase #:31   [CDB$ROOT] Files:277  Time: 0s
Serial   Phase #:32   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:33   [CDB$ROOT] Files:1    Time: 1s
Serial   Phase #:34   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:35   [CDB$ROOT] Files:1    Time: 0s
***************   Catproc DataPump   ***************
Serial   Phase #:36   [CDB$ROOT] Files:4    Time: 0s
Restart  Phase #:37   [CDB$ROOT] Files:1    Time: 1s
******************   Catproc SQL   *****************
Parallel Phase #:38   [CDB$ROOT] Files:13   Time: 0s
Restart  Phase #:39   [CDB$ROOT] Files:1    Time: 0s
Parallel Phase #:40   [CDB$ROOT] Files:11   Time: 0s
Restart  Phase #:41   [CDB$ROOT] Files:1    Time: 1s
Parallel Phase #:42   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:43   [CDB$ROOT] Files:1    Time: 0s
*************   Final Catproc scripts   *************
Serial   Phase #:44   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:45   [CDB$ROOT] Files:1    Time: 1s
**************   Final RDBMS scripts   **************
Serial   Phase #:46   [CDB$ROOT] Files:1    Time: 0s
************   Upgrade Component Start   ************
Serial   Phase #:47   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:48   [CDB$ROOT] Files:1    Time: 0s
****************   Upgrading Java   ****************
Serial   Phase #:49   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:50   [CDB$ROOT] Files:1    Time: 1s
*****************   Upgrading XDK   *****************
Serial   Phase #:51   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:52   [CDB$ROOT] Files:1    Time: 0s
*********   Upgrading APS,OLS,DV,CONTEXT   *********
Serial   Phase #:53   [CDB$ROOT] Files:1    Time: 0s
*****************   Upgrading XDB   *****************
Restart  Phase #:54   [CDB$ROOT] Files:1    Time: 1s
Serial   Phase #:56   [CDB$ROOT] Files:3    Time: 0s
Serial   Phase #:57   [CDB$ROOT] Files:2    Time: 0s
Parallel Phase #:58   [CDB$ROOT] Files:11   Time: 0s
Parallel Phase #:59   [CDB$ROOT] Files:24   Time: 0s
Serial   Phase #:60   [CDB$ROOT] Files:4    Time: 0s
Serial   Phase #:61   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:62   [CDB$ROOT] Files:30   Time: 0s
Serial   Phase #:63   [CDB$ROOT] Files:1    Time: 0s
Parallel Phase #:64   [CDB$ROOT] Files:6    Time: 0s
Serial   Phase #:65   [CDB$ROOT] Files:2    Time: 0s
Serial   Phase #:66   [CDB$ROOT] Files:3    Time: 0s
Restart  Phase #:67   [CDB$ROOT] Files:1    Time: 1s
*********   Upgrading CATJAVA,OWM,MGW,RAC   ********
Serial   Phase #:68   [CDB$ROOT] Files:1    Time: 0s
****************   Upgrading ORDIM   ***************
Restart  Phase #:69   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:71   [CDB$ROOT] Files:1    Time: 0s
Parallel Phase #:72   [CDB$ROOT] Files:2    Time: 0s
Serial   Phase #:73   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:74   [CDB$ROOT] Files:1    Time: 1s
Parallel Phase #:75   [CDB$ROOT] Files:2    Time: 0s
Serial   Phase #:76   [CDB$ROOT] Files:2    Time: 0s
*****************   Upgrading SDO   *****************
Restart  Phase #:77   [CDB$ROOT] Files:1    Time: 1s
Serial   Phase #:79   [CDB$ROOT] Files:1    Time: 0s
```

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Serial   Phase #:80   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:81   [CDB$ROOT] Files:1    Time: 0s
Parallel Phase #:82   [CDB$ROOT] Files:3    Time: 0s
Serial   Phase #:83   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:84   [CDB$ROOT] Files:1    Time: 0s
Parallel Phase #:85   [CDB$ROOT] Files:4    Time: 0s
Serial   Phase #:86   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:87   [CDB$ROOT] Files:3    Time: 0s
Restart  Phase #:88   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:89   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:90   [CDB$ROOT] Files:1    Time: 1s
***********   Upgrading Misc. ODM, OLAP   **********
Serial   Phase #:91   [CDB$ROOT] Files:1    Time: 0s
****************   Upgrading APEX   ****************
Restart  Phase #:92   [CDB$ROOT] Files:1    Time: 1s
Serial   Phase #:93   [CDB$ROOT] Files:1    Time: 0s
Restart  Phase #:94   [CDB$ROOT] Files:1    Time: 0s
***********   Final Component scripts    ***********
Serial   Phase #:95   [CDB$ROOT] Files:1    Time: 0s
*************   Final Upgrade scripts   *************
Serial   Phase #:96   [CDB$ROOT] Files:1    Time: 0s
******************   Migration   ******************
Serial   Phase #:97   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:98   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:99   [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:100  [CDB$ROOT] Files:1    Time: 1s
*****************   Post Upgrade   *****************
Serial   Phase #:101  [CDB$ROOT] Files:1    Time: 0s
****************   Summary report   ****************
Serial   Phase #:102  [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:103  [CDB$ROOT] Files:1    Time: 0s
Serial   Phase #:104  [CDB$ROOT] Files:1     Time: 0s

-----------------------------------------------------
Phases [0-104]         End Time:[2015_10_09 18:51:43]
Container Lists Inclusion:[CDB$ROOT] Exclusion:[NONE]
-----------------------------------------------------

Start processing of PDB$SEED
[/u01/app/oracle/12.1.0/CDB1/perl/bin/perl catctl.pl -L plist.txt -E -n 2 -N 2 -I -i
pdb_seed -c 'PDB$SEED' -l /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122 catupgrd.sql]

Start processing of CDB1_PDB2
[/u01/app/oracle/12.1.0/CDB1//perl/bin/perl catctl.pl -L plist.txt -E -n 2 -N 2 -I -
i cdb1_pdb2 -c 'CDB1_PDB2' -l /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122 catupgrd.sql]

Argument list for [catctl.pl]
Run in                c = PDB$SEED
Do not run in         C = 0
Input Directory       d = 0
Echo OFF              e = 1
Simulate              E = 1
Log Id                i = pdb_seed
Child Process         I = 1
Log Dir               l = /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122
Priority List Name    L = plist.txt
Upgrade Mode active   M = 0
SQL Process Count     n = 2
```

```
SQL PDB Process Count N = 2
Open Mode Normal      o = 0
Reverse Order         r = 0
Start Phase           p = 0
End Phase             P = 0
Script                s = 0
Serial Run            S = 0
RO User Tablespaces   T = 0
Display Phases        y = 0
Debug catcon.pm       z = 0
Debug catctl.pl       Z = 0

catctl.pl VERSION: [12.2.0.1.0]



Argument list for [catctl.pl]
Run in                c = CDB1_PDB2
Do not run in         C = 0
Input Directory       d = 0
Echo OFF              e = 1
Simulate              E = 1
Log Id                i = cdb1_pdb2
Child Process         I = 1
Log Dir               l = /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122
Priority List Name    L = plist.txt
Upgrade Mode active   M = 0
SQL Process Count     n = 2
SQL PDB Process Count N = 2
Open Mode Normal      o = 0
Reverse Order         r = 0
Start Phase           p = 0
End Phase             P = 0
Script                s = 0
Serial Run            S = 0
RO User Tablespaces   T = 0
Display Phases        y = 0
Debug catcon.pm       z = 0
Debug catctl.pl       Z = 0

catctl.pl VERSION: [12.2.0.1.0]



orahome = [/u01/app/oracle/12.1.0/CDB1/]
orahome = [/u01/app/oracle/12.1.0/CDB1/]
/u01/app/oracle/12.1.0/CDB1/bin/orabasehome = [/u01/app/oracle/
catctlGetOrabase = [/u01/app/oracle/]

Analyzing file ./catupgrd.sql

Log file directory = [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122]

/u01/app/oracle/12.1.0/CDB1/bin/orabasehome = [/u01/app/oracle]
catctlGetOrabase = [/u01/app/oracle]

Analyzing file ./catupgrd.sql
```

```
Log file directory = [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122]

catcon: ALL catcon-related output will be written to [/u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122/catupgrdpdb_seed_catcon_10120.lst]
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdpdb_seed*.log] files for output generated by scripts
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdpdb_seed_*.lst] files for spool files, if any
catcon: ALL catcon-related output will be written to [/u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122/catupgrdcdb1_pdb2_catcon_10122.lst]
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb2*.log] files for output generated by scripts
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb2_*.lst] files for spool files, if any

Number of Cpus        = 2

Number of Cpus        = 2
DATABASE NAME         = dbopens

DATABASE NAME         = dbopens

DataBase Version      = 12.2.0.1.0
DataBase Version      = 12.2.0.1.0
Generated PDB Inclusion:[CDB1_PDB2]
Generated PDB Inclusion:[PDB$SEED]
CDB$ROOT  Open Mode = [OPEN MIGRATE]

------------------------------------------------------
Phases [0-104]         Start Time:[2015_10_09 18:51:47]
Container Lists Inclusion:[CDB1_PDB2] Exclusion:[NONE]
------------------------------------------------------
***********   Executing Change Scripts   ***********
Serial   Phase #:0    [CDB1_PDB2] Files:1    Time: 0s
***************   Catalog Core SQL   ***************
Serial   Phase #:1    [CDB1_PDB2] Files:5    Time: 0s
Restart  Phase #:2    [CDB1_PDB2] Files:1 CDB$ROOT  Open Mode = [OPEN MIGRATE]

------------------------------------------------------
Phases [0-104]         Start Time:[2015_10_09 18:51:47]
Container Lists Inclusion:[PDB$SEED] Exclusion:[NONE]
------------------------------------------------------
***********   Executing Change Scripts   ***********
Serial   Phase #:0    [PDB$SEED] Files:1    Time: 0s
***************   Catalog Core SQL   ***************
Serial   Phase #:1    [PDB$SEED] Files:5    Time: 0s
Restart  Phase #:2    [PDB$SEED] Files:1    Time: 0s
***********   Catalog Tables and Views   ***********
Parallel Phase #:3    [PDB$SEED] Files:20   Time: 0s
Restart  Phase #:4    [PDB$SEED] Files:1    Time: 0s
***********   Catalog Tables and Views   ***********
Parallel Phase #:3    [CDB1_PDB2] Files:20   Time: 0s
Restart  Phase #:4    [CDB1_PDB2] Files:1    Time: 1s
*************   Catalog Final Scripts   ************
Serial   Phase #:5    [CDB1_PDB2] Files:5    Time: 0s
*****************   Catproc Start   ****************
Serial   Phase #:6    [CDB1_PDB2] Files:1    Time: 0s
*****************   Catproc Types   ****************
Serial   Phase #:7    [CDB1_PDB2] Files:4    Time: 0s
Restart  Phase #:8    [CDB1_PDB2] Files:1    Time: 1s
```

```
*************   Catalog Final Scripts   ************
Serial   Phase #:5    [PDB$SEED] Files:5    Time: 0s
*****************   Catproc Start   ****************
Serial   Phase #:6    [PDB$SEED] Files:1    Time: 0s
*****************   Catproc Types   ****************
Serial   Phase #:7    [PDB$SEED] Files:4    Time: 0s
Restart  Phase #:8    [PDB$SEED] Files:1    Time: 0s
****************   Catproc Tables   ****************
Parallel Phase #:9    [CDB1_PDB2] Files:69   Time: 0s
Restart  Phase #:10   [CDB1_PDB2] Files:1    Time: 0s
****************   Catproc Tables   ****************
Parallel Phase #:9    [PDB$SEED] Files:69   Time: 0s
Restart  Phase #:10   [PDB$SEED] Files:1    Time: 1s
*************   Catproc Package Specs   ************
Serial   Phase #:11   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:12   [CDB1_PDB2] Files:1    Time: 1s
*************   Catproc Package Specs   ************
Serial   Phase #:11   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:12   [PDB$SEED] Files:1    Time: 0s
**************   Catproc Procedures   **************
Parallel Phase #:13   [CDB1_PDB2] Files:94   Time: 0s
Restart  Phase #:14   [CDB1_PDB2] Files:1    Time: 0s
**************   Catproc Procedures   **************
Parallel Phase #:13   [PDB$SEED] Files:94   Time: 0s
Restart  Phase #:14   [PDB$SEED] Files:1    Time: 1s
Parallel Phase #:15   [CDB1_PDB2] Files:116  Time: 0s
Restart  Phase #:16   [CDB1_PDB2] Files:1    Time: 1s
Parallel Phase #:15   [PDB$SEED] Files:116  Time: 0s
Restart  Phase #:16   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:17   [CDB1_PDB2] Files:10   Time: 0s
Restart  Phase #:18   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:17   [PDB$SEED] Files:10   Time: 0s
Restart  Phase #:18   [PDB$SEED] Files:1    Time: 1s
*****************   Catproc Views   ****************
Parallel Phase #:19   [CDB1_PDB2] Files:33   Time: 0s
Restart  Phase #:20   [CDB1_PDB2] Files:1    Time: 1s
*****************   Catproc Views   ****************
Parallel Phase #:19   [PDB$SEED] Files:33   Time: 0s
Restart  Phase #:20   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:21   [PDB$SEED] Files:3    Time: 0s
Restart  Phase #:22   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:21   [CDB1_PDB2] Files:3    Time: 0s
Restart  Phase #:22   [CDB1_PDB2] Files:1    Time: 0s
Parallel Phase #:23   [CDB1_PDB2] Files:23   Time: 0s
Restart  Phase #:24   [CDB1_PDB2] Files:1    Time: 0s
Parallel Phase #:23   [PDB$SEED] Files:23   Time: 0s
Restart  Phase #:24   [PDB$SEED] Files:1    Time: 1s
Parallel Phase #:25   [CDB1_PDB2] Files:14   Time: 0s
Restart  Phase #:26   [CDB1_PDB2] Files:1    Time: 1s
Parallel Phase #:25   [PDB$SEED] Files:14   Time: 0s
Restart  Phase #:26   [PDB$SEED] Files:1    Time: 0s
***************   Catproc CDB Views   **************
Serial   Phase #:27   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:28   [CDB1_PDB2] Files:1    Time: 0s
***************   Catproc CDB Views   **************
Serial   Phase #:27   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:28   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:30   [CDB1_PDB2] Files:1    Time: 0s
*****************   Catproc PLBs   *****************
Serial   Phase #:31   [CDB1_PDB2] Files:277  Time: 0s
Serial   Phase #:32   [CDB1_PDB2] Files:1    Time: 0s
```

```
Restart  Phase #:33   [CDB1_PDB2] Files:1    Time: 1s
Serial   Phase #:30   [PDB$SEED] Files:1    Time: 0s
*****************   Catproc PLBs   *****************
Serial   Phase #:31   [PDB$SEED] Files:277  Time: 0s
Serial   Phase #:32   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:33   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:34   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:35   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:34   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:35   [PDB$SEED] Files:1    Time: 1s
***************   Catproc DataPump   ***************
Serial   Phase #:36   [CDB1_PDB2] Files:4    Time: 0s
Restart  Phase #:37   [CDB1_PDB2] Files:1    Time: 1s
***************   Catproc DataPump   ***************
Serial   Phase #:36   [PDB$SEED] Files:4    Time: 0s
Restart  Phase #:37   [PDB$SEED] Files:1    Time: 0s
******************   Catproc SQL   ******************
Parallel Phase #:38   [CDB1_PDB2] Files:13   Time: 0s
Restart  Phase #:39   [CDB1_PDB2] Files:1    Time: 0s
******************   Catproc SQL   ******************
Parallel Phase #:38   [PDB$SEED] Files:13   Time: 0s
Restart  Phase #:39   [PDB$SEED] Files:1    Time: 1s
Parallel Phase #:40   [CDB1_PDB2] Files:11   Time: 0s
Restart  Phase #:41   [CDB1_PDB2] Files:1    Time: 1s
Parallel Phase #:40   [PDB$SEED] Files:11   Time: 0s
Restart  Phase #:41   [PDB$SEED] Files:1    Time: 0s
Parallel Phase #:42   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:43   [PDB$SEED] Files:1    Time: 0s
Parallel Phase #:42   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:43   [CDB1_PDB2] Files:1    Time: 1s
*************   Final Catproc scripts   *************
Serial   Phase #:44   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:45   [PDB$SEED] Files:1    Time: 1s
*************   Final Catproc scripts   *************
Serial   Phase #:44   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:45   [CDB1_PDB2] Files:1    Time: 0s
**************   Final RDBMS scripts   **************
Serial   Phase #:46   [PDB$SEED] Files:1    Time: 0s
************   Upgrade Component Start   ************
Serial   Phase #:47   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:48   [PDB$SEED] Files:1    Time: 0s
**************   Final RDBMS scripts   **************
Serial   Phase #:46   [CDB1_PDB2] Files:1    Time: 0s
************   Upgrade Component Start   ************
Serial   Phase #:47   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:48   [CDB1_PDB2] Files:1    Time: 1s
****************   Upgrading Java   ****************
Serial   Phase #:49   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:50   [PDB$SEED] Files:1    Time: 1s
****************   Upgrading Java   ****************
Serial   Phase #:49   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:50   [CDB1_PDB2] Files:1    Time: 0s
*****************   Upgrading XDK   *****************
Serial   Phase #:51   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:52   [PDB$SEED] Files:1    Time: 1s
*****************   Upgrading XDK   *****************
Serial   Phase #:51   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:52   [CDB1_PDB2] Files:1    Time: 0s
*********   Upgrading APS,OLS,DV,CONTEXT   *********
Serial   Phase #:53   [CDB1_PDB2] Files:1    Time: 0s
*****************   Upgrading XDB   *****************
```

```
Restart  Phase #:54   [CDB1_PDB2] Files:1    Time: 1s
*********   Upgrading APS,OLS,DV,CONTEXT   *********
Serial   Phase #:53   [PDB$SEED] Files:1    Time: 0s
*****************   Upgrading XDB   ****************
Restart  Phase #:54   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:56   [CDB1_PDB2] Files:3    Time: 0s
Serial   Phase #:57   [CDB1_PDB2] Files:2    Time: 0s
Parallel Phase #:58   [CDB1_PDB2] Files:11   Time: 0s
Parallel Phase #:59   [CDB1_PDB2] Files:24   Time: 0s
Serial   Phase #:60   [CDB1_PDB2] Files:4    Time: 0s
Serial   Phase #:61   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:62   [CDB1_PDB2] Files:30   Time: 0s
Serial   Phase #:63   [CDB1_PDB2] Files:1    Time: 0s
Parallel Phase #:64   [CDB1_PDB2] Files:6    Time: 0s
Serial   Phase #:65   [CDB1_PDB2] Files:2    Time: 0s
Serial   Phase #:66   [CDB1_PDB2] Files:3    Time: 0s
Restart  Phase #:67   [CDB1_PDB2] Files:1    Time: 1s
Serial   Phase #:56   [PDB$SEED] Files:3    Time: 0s
Serial   Phase #:57   [PDB$SEED] Files:2    Time: 0s
Parallel Phase #:58   [PDB$SEED] Files:11   Time: 0s
Parallel Phase #:59   [PDB$SEED] Files:24   Time: 0s
Serial   Phase #:60   [PDB$SEED] Files:4    Time: 0s
Serial   Phase #:61   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:62   [PDB$SEED] Files:30   Time: 0s
Serial   Phase #:63   [PDB$SEED] Files:1    Time: 0s
Parallel Phase #:64   [PDB$SEED] Files:6    Time: 0s
Serial   Phase #:65   [PDB$SEED] Files:2    Time: 0s
Serial   Phase #:66   [PDB$SEED] Files:3    Time: 0s
Restart  Phase #:67   [PDB$SEED] Files:1    Time: 0s
*********   Upgrading CATJAVA,OWM,MGW,RAC   ********
Serial   Phase #:68   [CDB1_PDB2] Files:1    Time: 0s
****************   Upgrading ORDIM   ***************
Restart  Phase #:69   [CDB1_PDB2] Files:1    Time: 0s
*********   Upgrading CATJAVA,OWM,MGW,RAC   ********
Serial   Phase #:68   [PDB$SEED] Files:1    Time: 0s
****************   Upgrading ORDIM   ***************
Restart  Phase #:69   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:71   [CDB1_PDB2] Files:1    Time: 0s
Parallel Phase #:72   [CDB1_PDB2] Files:2    Time: 0s
Serial   Phase #:73   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:74   [CDB1_PDB2] Files:1    Time: 1s
Serial   Phase #:71   [PDB$SEED] Files:1    Time: 0s
Parallel Phase #:72   [PDB$SEED] Files:2    Time: 0s
Serial   Phase #:73   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:74   [PDB$SEED] Files:1    Time: 0s
Parallel Phase #:75   [CDB1_PDB2] Files:2    Time: 0s
Serial   Phase #:76   [CDB1_PDB2] Files:2    Time: 0s
*****************   Upgrading SDO   ****************
Restart  Phase #:77   [CDB1_PDB2] Files:1    Time: 1s
Parallel Phase #:75   [PDB$SEED] Files:2    Time: 0s
Serial   Phase #:76   [PDB$SEED] Files:2    Time: 0s
*****************   Upgrading SDO   ****************
Restart  Phase #:77   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:79   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:80   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:81   [CDB1_PDB2] Files:1    Time: 0s
Parallel Phase #:82   [CDB1_PDB2] Files:3    Time: 0s
Serial   Phase #:83   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:84   [CDB1_PDB2] Files:1    Time: 0s
Parallel Phase #:85   [CDB1_PDB2] Files:4    Time: 0s
Serial   Phase #:86   [CDB1_PDB2] Files:1    Time: 0s
```

```
Serial   Phase #:87   [CDB1_PDB2] Files:3    Time: 0s
Restart  Phase #:88   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:79   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:80   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:81   [PDB$SEED] Files:1    Time: 0s
Parallel Phase #:82   [PDB$SEED] Files:3    Time: 0s
Serial   Phase #:83   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:84   [PDB$SEED] Files:1    Time: 0s
Parallel Phase #:85   [PDB$SEED] Files:4    Time: 0s
Serial   Phase #:86   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:87   [PDB$SEED] Files:3    Time: 0s
Restart  Phase #:88   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:89   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:90   [CDB1_PDB2] Files:1    Time: 1s
Serial   Phase #:89   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:90   [PDB$SEED] Files:1    Time: 0s
***********   Upgrading Misc. ODM, OLAP   **********
Serial   Phase #:91   [CDB1_PDB2] Files:1    Time: 0s
***************   Upgrading APEX   ***************
Restart  Phase #:92   [CDB1_PDB2] Files:1    Time: 0s
***********   Upgrading Misc. ODM, OLAP   **********
Serial   Phase #:91   [PDB$SEED] Files:1    Time: 0s
***************   Upgrading APEX   ***************
Restart  Phase #:92   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:93   [PDB$SEED] Files:1    Time: 0s
Restart  Phase #:94   [PDB$SEED] Files:1    Time: 1s
Serial   Phase #:93   [CDB1_PDB2] Files:1    Time: 0s
Restart  Phase #:94   [CDB1_PDB2] Files:1    Time: 0s
***********   Final Component scripts    ***********
Serial   Phase #:95   [CDB1_PDB2] Files:1    Time: 0s
*************   Final Upgrade scripts   ************
Serial   Phase #:96   [CDB1_PDB2] Files:1    Time: 0s
******************   Migration   ******************
Serial   Phase #:97   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:98   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:99   [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:100  [CDB1_PDB2] Files:1    Time: 0s
*****************   Post Upgrade   *****************
Serial   Phase #:101  [CDB1_PDB2] Files:1    Time: 0s
****************   Summary report   ****************
Serial   Phase #:102  [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:103  [CDB1_PDB2] Files:1    Time: 0s
Serial   Phase #:104  [CDB1_PDB2] Files:1     Time: 0s

-----------------------------------------------------
Phases [0-104]         End Time:[2015_10_09 18:52:04]
Container Lists Inclusion:[CDB1_PDB2] Exclusion:[NONE]
-----------------------------------------------------
   Time: 0s
***********   Final Component scripts    ***********
Serial   Phase #:95   [PDB$SEED] Files:1    Time: 0s
*************   Final Upgrade scripts   ************
Serial   Phase #:96   [PDB$SEED] Files:1    Time: 0s
******************   Migration   ******************
Serial   Phase #:97   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:98   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:99   [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:100  [PDB$SEED] Files:1    Time: 0s
*****************   Post Upgrade   *****************
Serial   Phase #:101  [PDB$SEED] Files:1
Grand Total Time: 17s [CDB1_PDB2]
```

```
 LOG FILES: (/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb2*.log)
   Time: 0s
***************   Summary report   ***************
Serial   Phase #:102  [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:103  [PDB$SEED] Files:1    Time: 0s
Serial   Phase #:104  [PDB$SEED] Files:1     Time: 0s

-----------------------------------------------------
Phases [0-104]         End Time:[2015_10_09 18:52:04]
Container Lists Inclusion:[PDB$SEED] Exclusion:[NONE]
-----------------------------------------------------

Total Upgrade Time:          [0d:0h:0m:17s]

Grand Total Time: 17s [PDB$SEED]

 LOG FILES: (/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdpdb_seed*.log)

Total Upgrade Time:          [0d:0h:0m:17s]

Start processing of CDB1_PDB3
[/ade_autofs/dd19_db/RDBMS/MAIN/LINUX.X64/151007/perl/bin/perl catctl.pl -L
plist.txt -E -n 2 -N 2 -I -i cdb1_pdb3 -c 'CDB1_PDB3' -l /u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122 catupgrd.sql]

Start processing of CDB1_PDB4
[/ade_autofs/dd19_db/RDBMS/MAIN/LINUX.X64/151007/perl/bin/perl catctl.pl -L
plist.txt -E -n 2 -N 2 -I -i cdb1_pdb4 -c 'CDB1_PDB4' -l /u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122 catupgrd.sql]

Argument list for [catctl.pl]
Run in               c = CDB1_PDB3
Do not run in        C = 0
Input Directory      d = 0
Echo OFF             e = 1
Simulate             E = 1
Log Id               i = cdb1_pdb3
Child Process        I = 1
Log Dir              l = /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122
Priority List Name   L = plist.txt
Upgrade Mode active  M = 0
SQL Process Count    n = 2
SQL PDB Process Count N = 2
Open Mode Normal     o = 0
Reverse Order        r = 0
Start Phase          p = 0
End Phase            P = 0
Script               s = 0
Serial Run           S = 0
RO User Tablespaces  T = 0
Display Phases       y = 0
Debug catcon.pm      z = 0
Debug catctl.pl      Z = 0

catctl.pl VERSION: [12.2.0.1.0]
```

```
Argument list for [catctl.pl]
Run in                c = CDB1_PDB4
Do not run in         C = 0
Input Directory       d = 0
Echo OFF              e = 1
Simulate              E = 1
Log Id                i = cdb1_pdb4
Child Process         I = 1
Log Dir               l = /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122
Priority List Name    L = plist.txt
Upgrade Mode active   M = 0
SQL Process Count     n = 2
SQL PDB Process Count N = 2
Open Mode Normal      o = 0
Reverse Order         r = 0
Start Phase           p = 0
End Phase             P = 0
Script                s = 0
Serial Run            S = 0
RO User Tablespaces   T = 0
Display Phases        y = 0
Debug catcon.pm       z = 0
Debug catctl.pl       Z = 0

catctl.pl VERSION: [12.2.0.1.0]


orahome = [/u01/app/oracle]
orahome = [/u01/app/oracle]
/u01/app/oracle/12.1.0/CDB1/bin/orabasehome = [/u01/app/oracle]
catctlGetOrabase = [/u01/app/oracle]

Analyzing file ./catupgrd.sql

Log file directory = [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122]

catcon: ALL catcon-related output will be written to [/u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122/catupgrdcdb1_pdb3_catcon_12150.lst]
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb3*.log] files for output generated by scripts
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb3_*.lst] files for spool files, if any
/u01/app/oracle/12.1.0/CDB1/bin/orabasehome = [/u01/app/oracle]
catctlGetOrabase = [/u01/app/oracle]

Analyzing file ./catupgrd.sql

Log file directory = [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122]

catcon: ALL catcon-related output will be written to [/u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122/catupgrdcdb1_pdb4_catcon_12152.lst]
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb4*.log] files for output generated by scripts
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb4_*.lst] files for spool files, if any

Number of Cpus        = 2
```

```
Number of Cpus        = 2
DATABASE NAME         = dbopens

DATABASE NAME         = dbopens

DataBase Version      = 12.2.0.1.0
DataBase Version      = 12.2.0.1.0
Generated PDB Inclusion:[CDB1_PDB3]
Generated PDB Inclusion:[CDB1_PDB4]
CDB$ROOT  Open Mode = [OPEN MIGRATE]

------------------------------------------------------
Phases [0-104]         Start Time:[2015_10_09 18:52:10]
Container Lists Inclusion:[CDB1_PDB3] Exclusion:[NONE]
------------------------------------------------------
***********   Executing Change Scripts   ***********
Serial   Phase #:0    [CDB1_PDB3] Files:1    Time: 0s
***************   Catalog Core SQL   ***************
Serial   Phase #:1    [CDB1_PDB3] Files:5    Time: 0s
Restart  Phase #:2    [CDB1_PDB3] Files:1    Time: 0s
***********   Catalog Tables and Views   ***********
Parallel Phase #:3    [CDB1_PDB3] Files:20   Time: 0s
Restart  Phase #:4    [CDB1_PDB3] Files:1 CDB$ROOT  Open Mode = [OPEN MIGRATE]

------------------------------------------------------
Phases [0-104]         Start Time:[2015_10_09 18:52:10]
Container Lists Inclusion:[CDB1_PDB4] Exclusion:[NONE]
------------------------------------------------------
***********   Executing Change Scripts   ***********
Serial   Phase #:0    [CDB1_PDB4] Files:1    Time: 0s
***************   Catalog Core SQL   ***************
Serial   Phase #:1    [CDB1_PDB4] Files:5    Time: 0s
Restart  Phase #:2    [CDB1_PDB4] Files:1    Time: 0s
***********   Catalog Tables and Views   ***********
Parallel Phase #:3    [CDB1_PDB4] Files:20   Time: 0s
Restart  Phase #:4    [CDB1_PDB4] Files:1    Time: 1s
*************   Catalog Final Scripts   *************
Serial   Phase #:5    [CDB1_PDB3] Files:5    Time: 0s
*****************   Catproc Start   ****************
Serial   Phase #:6    [CDB1_PDB3] Files:1    Time: 0s
*****************   Catproc Types   ****************
Serial   Phase #:7    [CDB1_PDB3] Files:4    Time: 0s
Restart  Phase #:8    [CDB1_PDB3] Files:1    Time: 1s
*************   Catalog Final Scripts   *************
Serial   Phase #:5    [CDB1_PDB4] Files:5    Time: 0s
*****************   Catproc Start   ****************
Serial   Phase #:6    [CDB1_PDB4] Files:1    Time: 0s
*****************   Catproc Types   ****************
Serial   Phase #:7    [CDB1_PDB4] Files:4    Time: 0s
Restart  Phase #:8    [CDB1_PDB4] Files:1    Time: 0s
****************   Catproc Tables   ****************
Parallel Phase #:9    [CDB1_PDB3] Files:69   Time: 0s
Restart  Phase #:10   [CDB1_PDB3] Files:1    Time: 0s
****************   Catproc Tables   ****************
Parallel Phase #:9    [CDB1_PDB4] Files:69   Time: 0s
Restart  Phase #:10   [CDB1_PDB4] Files:1    Time: 1s
*************   Catproc Package Specs   *************
Serial   Phase #:11   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:12   [CDB1_PDB3] Files:1    Time: 1s
*************   Catproc Package Specs   *************
```

```
Serial   Phase #:11   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:12   [CDB1_PDB4] Files:1    Time: 0s
**************   Catproc Procedures   **************
Parallel Phase #:13   [CDB1_PDB4] Files:94   Time: 0s
Restart  Phase #:14   [CDB1_PDB4] Files:1    Time: 0s
**************   Catproc Procedures   **************
Parallel Phase #:13   [CDB1_PDB3] Files:94   Time: 0s
Restart  Phase #:14   [CDB1_PDB3] Files:1    Time: 1s
Parallel Phase #:15   [CDB1_PDB4] Files:116  Time: 0s
Restart  Phase #:16   [CDB1_PDB4] Files:1    Time: 1s
Parallel Phase #:15   [CDB1_PDB3] Files:116  Time: 0s
Restart  Phase #:16   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:17   [CDB1_PDB3] Files:10   Time: 0s
Restart  Phase #:18   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:17   [CDB1_PDB4] Files:10   Time: 0s
Restart  Phase #:18   [CDB1_PDB4] Files:1    Time: 1s
*****************   Catproc Views   *****************
Parallel Phase #:19   [CDB1_PDB3] Files:33   Time: 0s
Restart  Phase #:20   [CDB1_PDB3] Files:1    Time: 1s
*****************   Catproc Views   *****************
Parallel Phase #:19   [CDB1_PDB4] Files:33   Time: 0s
Restart  Phase #:20   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:21   [CDB1_PDB4] Files:3    Time: 0s
Restart  Phase #:22   [CDB1_PDB4] Files:1    Time: 1s
Serial   Phase #:21   [CDB1_PDB3] Files:3    Time: 0s
Restart  Phase #:22   [CDB1_PDB3] Files:1    Time: 1s
Parallel Phase #:23   [CDB1_PDB4] Files:23   Time: 0s
Restart  Phase #:24   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:23   [CDB1_PDB3] Files:23   Time: 0s
Restart  Phase #:24   [CDB1_PDB3] Files:1    Time: 1s
Parallel Phase #:25   [CDB1_PDB4] Files:14   Time: 0s
Restart  Phase #:26   [CDB1_PDB4] Files:1    Time: 1s
Parallel Phase #:25   [CDB1_PDB3] Files:14   Time: 0s
Restart  Phase #:26   [CDB1_PDB3] Files:1    Time: 0s
***************   Catproc CDB Views   **************
Serial   Phase #:27   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:28   [CDB1_PDB4] Files:1    Time: 0s
***************   Catproc CDB Views   **************
Serial   Phase #:27   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:28   [CDB1_PDB3] Files:1    Time: 1s
Serial   Phase #:30   [CDB1_PDB4] Files:1    Time: 0s
*****************   Catproc PLBs   *****************
Serial   Phase #:31   [CDB1_PDB4] Files:277  Time: 0s
Serial   Phase #:32   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:33   [CDB1_PDB4] Files:1    Time: 1s
Serial   Phase #:30   [CDB1_PDB3] Files:1    Time: 0s
*****************   Catproc PLBs   *****************
Serial   Phase #:31   [CDB1_PDB3] Files:277  Time: 0s
Serial   Phase #:32   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:33   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:34   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:35   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:34   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:35   [CDB1_PDB3] Files:1    Time: 1s
***************   Catproc DataPump   ***************
Serial   Phase #:36   [CDB1_PDB4] Files:4    Time: 0s
Restart  Phase #:37   [CDB1_PDB4] Files:1    Time: 1s
***************   Catproc DataPump   ***************
Serial   Phase #:36   [CDB1_PDB3] Files:4    Time: 0s
Restart  Phase #:37   [CDB1_PDB3] Files:1    Time: 0s
******************   Catproc SQL   ******************
```

```
Parallel Phase #:38   [CDB1_PDB3] Files:13   Time: 0s
Restart  Phase #:39   [CDB1_PDB3] Files:1    Time: 0s
******************   Catproc SQL   ******************
Parallel Phase #:38   [CDB1_PDB4] Files:13   Time: 0s
Restart  Phase #:39   [CDB1_PDB4] Files:1    Time: 1s
Parallel Phase #:40   [CDB1_PDB3] Files:11   Time: 0s
Restart  Phase #:41   [CDB1_PDB3] Files:1    Time: 1s
Parallel Phase #:40   [CDB1_PDB4] Files:11   Time: 0s
Restart  Phase #:41   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:42   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:43   [CDB1_PDB3] Files:1    Time: 0s
Parallel Phase #:42   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:43   [CDB1_PDB4] Files:1    Time: 1s
*************   Final Catproc scripts   *************
Serial   Phase #:44   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:45   [CDB1_PDB3] Files:1    Time: 1s
*************   Final Catproc scripts   *************
Serial   Phase #:44   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:45   [CDB1_PDB4] Files:1    Time: 0s
**************   Final RDBMS scripts   **************
Serial   Phase #:46   [CDB1_PDB3] Files:1    Time: 0s
************   Upgrade Component Start   ************
Serial   Phase #:47   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:48   [CDB1_PDB3] Files:1    Time: 0s
**************   Final RDBMS scripts   **************
Serial   Phase #:46   [CDB1_PDB4] Files:1    Time: 0s
************   Upgrade Component Start   ************
Serial   Phase #:47   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:48   [CDB1_PDB4] Files:1    Time: 1s
****************   Upgrading Java   ****************
Serial   Phase #:49   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:50   [CDB1_PDB3] Files:1    Time: 1s
****************   Upgrading Java   ****************
Serial   Phase #:49   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:50   [CDB1_PDB4] Files:1    Time: 0s
*****************   Upgrading XDK   ****************
Serial   Phase #:51   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:52   [CDB1_PDB4] Files:1    Time: 0s
*****************   Upgrading XDK   ****************
Serial   Phase #:51   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:52   [CDB1_PDB3] Files:1    Time: 1s
*********   Upgrading APS,OLS,DV,CONTEXT   *********
Serial   Phase #:53   [CDB1_PDB4] Files:1    Time: 0s
*****************   Upgrading XDB   ****************
Restart  Phase #:54   [CDB1_PDB4] Files:1    Time: 1s
*********   Upgrading APS,OLS,DV,CONTEXT   *********
Serial   Phase #:53   [CDB1_PDB3] Files:1    Time: 0s
*****************   Upgrading XDB   ****************
Restart  Phase #:54   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:56   [CDB1_PDB3] Files:3    Time: 0s
Serial   Phase #:57   [CDB1_PDB3] Files:2    Time: 0s
Parallel Phase #:58   [CDB1_PDB3] Files:11   Time: 0s
Parallel Phase #:59   [CDB1_PDB3] Files:24   Time: 0s
Serial   Phase #:60   [CDB1_PDB3] Files:4    Time: 0s
Serial   Phase #:61   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:62   [CDB1_PDB3] Files:30   Time: 0s
Serial   Phase #:63   [CDB1_PDB3] Files:1    Time: 0s
Parallel Phase #:64   [CDB1_PDB3] Files:6    Time: 0s
Serial   Phase #:65   [CDB1_PDB3] Files:2    Time: 0s
Serial   Phase #:66   [CDB1_PDB3] Files:3    Time: 0s
Restart  Phase #:67   [CDB1_PDB3] Files:1    Time: 0s
```

```
Serial   Phase #:56   [CDB1_PDB4] Files:3    Time: 0s
Serial   Phase #:57   [CDB1_PDB4] Files:2    Time: 0s
Parallel Phase #:58   [CDB1_PDB4] Files:11   Time: 0s
Parallel Phase #:59   [CDB1_PDB4] Files:24   Time: 0s
Serial   Phase #:60   [CDB1_PDB4] Files:4    Time: 0s
Serial   Phase #:61   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:62   [CDB1_PDB4] Files:30   Time: 0s
Serial   Phase #:63   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:64   [CDB1_PDB4] Files:6    Time: 0s
Serial   Phase #:65   [CDB1_PDB4] Files:2    Time: 0s
Serial   Phase #:66   [CDB1_PDB4] Files:3    Time: 0s
Restart  Phase #:67   [CDB1_PDB4] Files:1    Time: 1s
*********   Upgrading CATJAVA,OWM,MGW,RAC   ********
Serial   Phase #:68   [CDB1_PDB4] Files:1    Time: 0s
****************   Upgrading ORDIM   ***************
Restart  Phase #:69   [CDB1_PDB4] Files:1    Time: 1s
*********   Upgrading CATJAVA,OWM,MGW,RAC   ********
Serial   Phase #:68   [CDB1_PDB3] Files:1    Time: 0s
****************   Upgrading ORDIM   ***************
Restart  Phase #:69   [CDB1_PDB3] Files:1    Time: 1s
Serial   Phase #:71   [CDB1_PDB3] Files:1    Time: 0s
Parallel Phase #:72   [CDB1_PDB3] Files:2    Time: 0s
Serial   Phase #:73   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:74   [CDB1_PDB3] Files:1    Time: 1s
Serial   Phase #:71   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:72   [CDB1_PDB4] Files:2    Time: 0s
Serial   Phase #:73   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:74   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:75   [CDB1_PDB4] Files:2    Time: 0s
Serial   Phase #:76   [CDB1_PDB4] Files:2    Time: 0s
*****************   Upgrading SDO   ****************
Restart  Phase #:77   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:75   [CDB1_PDB3] Files:2    Time: 0s
Serial   Phase #:76   [CDB1_PDB3] Files:2    Time: 0s
*****************   Upgrading SDO   ****************
Restart  Phase #:77   [CDB1_PDB3] Files:1    Time: 1s
Serial   Phase #:79   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:80   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:81   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:82   [CDB1_PDB4] Files:3    Time: 0s
Serial   Phase #:83   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:84   [CDB1_PDB4] Files:1    Time: 0s
Parallel Phase #:85   [CDB1_PDB4] Files:4    Time: 0s
Serial   Phase #:86   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:87   [CDB1_PDB4] Files:3    Time: 0s
Restart  Phase #:88   [CDB1_PDB4] Files:1    Time: 1s
Serial   Phase #:79   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:80   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:81   [CDB1_PDB3] Files:1    Time: 0s
Parallel Phase #:82   [CDB1_PDB3] Files:3    Time: 0s
Serial   Phase #:83   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:84   [CDB1_PDB3] Files:1    Time: 0s
Parallel Phase #:85   [CDB1_PDB3] Files:4    Time: 0s
Serial   Phase #:86   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:87   [CDB1_PDB3] Files:3    Time: 0s
Restart  Phase #:88   [CDB1_PDB3] Files:1    Time: 1s
Serial   Phase #:89   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:90   [CDB1_PDB3] Files:1    Time: 1s
Serial   Phase #:89   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:90   [CDB1_PDB4] Files:1    Time: 0s
***********   Upgrading Misc. ODM, OLAP   **********
```

```
Serial   Phase #:91   [CDB1_PDB3] Files:1    Time: 0s
****************   Upgrading APEX   ****************
Restart  Phase #:92   [CDB1_PDB3] Files:1    Time: 0s
***********   Upgrading Misc. ODM, OLAP   **********
Serial   Phase #:91   [CDB1_PDB4] Files:1    Time: 0s
****************   Upgrading APEX   ****************
Restart  Phase #:92   [CDB1_PDB4] Files:1    Time: 1s
Serial   Phase #:93   [CDB1_PDB3] Files:1    Time: 0s
Restart  Phase #:94   [CDB1_PDB3] Files:1    Time: 1s
Serial   Phase #:93   [CDB1_PDB4] Files:1    Time: 0s
Restart  Phase #:94   [CDB1_PDB4] Files:1    Time: 0s
***********   Final Component scripts    ***********
Serial   Phase #:95   [CDB1_PDB4] Files:1    Time: 0s
*************   Final Upgrade scripts   ************
Serial   Phase #:96   [CDB1_PDB4] Files:1    Time: 0s
******************   Migration   ******************
Serial   Phase #:97   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:98   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:99   [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:100  [CDB1_PDB4] Files:1    Time: 0s
*****************   Post Upgrade   *****************
Serial   Phase #:101  [CDB1_PDB4] Files:1    Time: 0s
****************   Summary report   ****************
Serial   Phase #:102  [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:103  [CDB1_PDB4] Files:1    Time: 0s
Serial   Phase #:104  [CDB1_PDB4] Files:1     Time: 0s

-----------------------------------------------------
Phases [0-104]         End Time:[2015_10_09 18:52:27]
Container Lists Inclusion:[CDB1_PDB4] Exclusion:[NONE]
-----------------------------------------------------

Grand Total Time: 17s [CDB1_PDB4]

 LOG FILES: (/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb4*.log)

Total Upgrade Time:          [0d:0h:0m:17s]
   Time: 0s
***********   Final Component scripts    ***********
Serial   Phase #:95   [CDB1_PDB3] Files:1    Time: 0s
*************   Final Upgrade scripts   ************
Serial   Phase #:96   [CDB1_PDB3] Files:1    Time: 0s
******************   Migration   ******************
Serial   Phase #:97   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:98   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:99   [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:100  [CDB1_PDB3] Files:1    Time: 0s
*****************   Post Upgrade   *****************
Serial   Phase #:101  [CDB1_PDB3] Files:1    Time: 0s
****************   Summary report   ****************
Serial   Phase #:102  [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:103  [CDB1_PDB3] Files:1    Time: 0s
Serial   Phase #:104  [CDB1_PDB3] Files:1     Time: 0s

-----------------------------------------------------
Phases [0-104]         End Time:[2015_10_09 18:52:27]
Container Lists Inclusion:[CDB1_PDB3] Exclusion:[NONE]
-----------------------------------------------------

Grand Total Time: 17s [CDB1_PDB3]
```

```
 LOG FILES: (/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb3*.log)

Total Upgrade Time:          [0d:0h:0m:17s]

Start processing of CDB1_PDB1
[/ade_autofs/dd19_db/RDBMS/MAIN/LINUX.X64/151007/perl/bin/perl catctl.pl -L
plist.txt -E -n 2 -N 2 -I -i cdb1_pdb1 -c 'CDB1_PDB1' -l /u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122 catupgrd.sql]

Start processing of CDB1_PDB5
[/ade_autofs/dd19_db/RDBMS/MAIN/LINUX.X64/151007/perl/bin/perl catctl.pl -L
plist.txt -E -n 2 -N 2 -I -i cdb1_pdb5 -c 'CDB1_PDB5' -l /u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122 catupgrd.sql]

Argument list for [catctl.pl]
Run in                c = CDB1_PDB1
Do not run in         C = 0
Input Directory       d = 0
Echo OFF              e = 1
Simulate              E = 1
Log Id                i = cdb1_pdb1
Child Process         I = 1
Log Dir               l = /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122
Priority List Name    L = plist.txt
Upgrade Mode active   M = 0
SQL Process Count     n = 2
SQL PDB Process Count N = 2
Open Mode Normal      o = 0
Reverse Order         r = 0
Start Phase           p = 0
End Phase             P = 0
Script                s = 0
Serial Run            S = 0
RO User Tablespaces   T = 0
Display Phases        y = 0
Debug catcon.pm       z = 0
Debug catctl.pl       Z = 0

catctl.pl VERSION: [12.2.0.1.0]



Argument list for [catctl.pl]
Run in                c = CDB1_PDB5
Do not run in         C = 0
Input Directory       d = 0
Echo OFF              e = 1
Simulate              E = 1
Log Id                i = cdb1_pdb5
Child Process         I = 1
Log Dir               l = /u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122
Priority List Name    L = plist.txt
Upgrade Mode active   M = 0
SQL Process Count     n = 2
SQL PDB Process Count N = 2
Open Mode Normal      o = 0
Reverse Order         r = 0
```

```
Start Phase           p = 0
End Phase             P = 0
Script                s = 0
Serial Run            S = 0
RO User Tablespaces   T = 0
Display Phases        y = 0
Debug catcon.pm       z = 0
Debug catctl.pl       Z = 0

catctl.pl VERSION: [12.2.0.1.0]


orahome = [/u01/app/oracle]
orahome = [/u01/app/oracle]
/u01/app/oracle/12.1.0/CDB1/bin/orabasehome = [/u01/app/oracle]
catctlGetOrabase = [/u01/app/oracle]

Analyzing file ./catupgrd.sql

Log file directory = [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122]

catcon: ALL catcon-related output will be written to [/u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122/catupgrdcdb1_pdb1_catcon_14178.lst]
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb1*.log] files for output generated by scripts
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb1_*.lst] files for spool files, if any
/u01/app/oracle/12.1.0/CDB1/bin/orabasehome = [/u01/app/oracle]
catctlGetOrabase = [/u01/app/oracle]

Analyzing file ./catupgrd.sql

Log file directory = [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/
upgrade20151009185122]

catcon: ALL catcon-related output will be written to [/u01/app/oracle/12.1.0/CDB1/
cfgtoollogs/dbopens/upgrade20151009185122/catupgrdcdb1_pdb5_catcon_14180.lst]
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb5*.log] files for output generated by scripts
catcon: See [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb5_*.lst] files for spool files, if any

Number of Cpus        = 2

Number of Cpus        = 2
DATABASE NAME         = dbopens

DATABASE NAME         = dbopens

DataBase Version      = 12.2.0.1.0
DataBase Version      = 12.2.0.1.0
Generated PDB Inclusion:[CDB1_PDB5]
Generated PDB Inclusion:[CDB1_PDB1]
CDB$ROOT  Open Mode = [OPEN MIGRATE]

------------------------------------------------------
Phases [0-104]         Start Time:[2015_10_09 18:52:32]
Container Lists Inclusion:[CDB1_PDB5] Exclusion:[NONE]
------------------------------------------------------
***********   Executing Change Scripts   ***********
```

```
Serial   Phase #:0    [CDB1_PDB5] Files:1    Time: 0s
***************   Catalog Core SQL   ***************
Serial   Phase #:1    [CDB1_PDB5] Files:5    Time: 0s
Restart  Phase #:2    [CDB1_PDB5] Files:1 CDB$ROOT  Open Mode = [OPEN MIGRATE]

-----------------------------------------------------
Phases [0-104]         Start Time:[2015_10_09 18:52:32]
Container Lists Inclusion:[CDB1_PDB1] Exclusion:[NONE]
-----------------------------------------------------
***********   Executing Change Scripts   ***********
Serial   Phase #:0    [CDB1_PDB1] Files:1    Time: 0s
***************   Catalog Core SQL   ***************
Serial   Phase #:1    [CDB1_PDB1] Files:5    Time: 0s
Restart  Phase #:2    [CDB1_PDB1] Files:1    Time: 0s
***********   Catalog Tables and Views   ***********
Parallel Phase #:3    [CDB1_PDB5] Files:20   Time: 0s
Restart  Phase #:4    [CDB1_PDB5] Files:1    Time: 0s
***********   Catalog Tables and Views   ***********
Parallel Phase #:3    [CDB1_PDB1] Files:20   Time: 0s
Restart  Phase #:4    [CDB1_PDB1] Files:1    Time: 1s
*************   Catalog Final Scripts   ************
Serial   Phase #:5    [CDB1_PDB1] Files:5    Time: 0s
*****************   Catproc Start   ****************
Serial   Phase #:6    [CDB1_PDB1] Files:1    Time: 0s
*****************   Catproc Types   ****************
Serial   Phase #:7    [CDB1_PDB1] Files:4    Time: 0s
Restart  Phase #:8    [CDB1_PDB1] Files:1    Time: 1s
*************   Catalog Final Scripts   ************
Serial   Phase #:5    [CDB1_PDB5] Files:5    Time: 0s
*****************   Catproc Start   ****************
Serial   Phase #:6    [CDB1_PDB5] Files:1    Time: 0s
*****************   Catproc Types   ****************
Serial   Phase #:7    [CDB1_PDB5] Files:4    Time: 0s
Restart  Phase #:8    [CDB1_PDB5] Files:1    Time: 0s
****************   Catproc Tables   ****************
Parallel Phase #:9    [CDB1_PDB1] Files:69   Time: 0s
Restart  Phase #:10   [CDB1_PDB1] Files:1    Time: 0s
****************   Catproc Tables   ****************
Parallel Phase #:9    [CDB1_PDB5] Files:69   Time: 0s
Restart  Phase #:10   [CDB1_PDB5] Files:1    Time: 1s
*************   Catproc Package Specs   ************
Serial   Phase #:11   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:12   [CDB1_PDB5] Files:1    Time: 1s
*************   Catproc Package Specs   ************
Serial   Phase #:11   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:12   [CDB1_PDB1] Files:1    Time: 0s
**************   Catproc Procedures   **************
Parallel Phase #:13   [CDB1_PDB1] Files:94   Time: 0s
Restart  Phase #:14   [CDB1_PDB1] Files:1    Time: 0s
**************   Catproc Procedures   **************
Parallel Phase #:13   [CDB1_PDB5] Files:94   Time: 0s
Restart  Phase #:14   [CDB1_PDB5] Files:1    Time: 1s
Parallel Phase #:15   [CDB1_PDB1] Files:116  Time: 0s
Restart  Phase #:16   [CDB1_PDB1] Files:1    Time: 1s
Parallel Phase #:15   [CDB1_PDB5] Files:116  Time: 0s
Restart  Phase #:16   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:17   [CDB1_PDB1] Files:10   Time: 0s
Restart  Phase #:18   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:17   [CDB1_PDB5] Files:10   Time: 0s
Restart  Phase #:18   [CDB1_PDB5] Files:1    Time: 1s
*****************   Catproc Views   ****************
```

```
Parallel Phase #:19   [CDB1_PDB1] Files:33   Time: 0s
Restart  Phase #:20   [CDB1_PDB1] Files:1    Time: 1s
*****************   Catproc Views   ****************
Parallel Phase #:19   [CDB1_PDB5] Files:33   Time: 0s
Restart  Phase #:20   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:21   [CDB1_PDB5] Files:3    Time: 0s
Restart  Phase #:22   [CDB1_PDB5] Files:1    Time: 1s
Serial   Phase #:21   [CDB1_PDB1] Files:3    Time: 0s
Restart  Phase #:22   [CDB1_PDB1] Files:1    Time: 1s
Parallel Phase #:23   [CDB1_PDB5] Files:23   Time: 0s
Restart  Phase #:24   [CDB1_PDB5] Files:1    Time: 0s
Parallel Phase #:23   [CDB1_PDB1] Files:23   Time: 0s
Restart  Phase #:24   [CDB1_PDB1] Files:1    Time: 1s
Parallel Phase #:25   [CDB1_PDB1] Files:14    Time: 1s
Parallel Phase #:25   [CDB1_PDB5] Files:14   Time: 0s
Restart  Phase #:26   [CDB1_PDB1] Files:1   Time: 0s
Restart  Phase #:26   [CDB1_PDB5] Files:1    Time: 0s
***************   Catproc CDB Views   **************
Serial   Phase #:27   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:28   [CDB1_PDB1] Files:1    Time: 0s
***************   Catproc CDB Views   **************
Serial   Phase #:27   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:28   [CDB1_PDB5] Files:1    Time: 1s
Serial   Phase #:30   [CDB1_PDB5] Files:1    Time: 0s
*****************   Catproc PLBs   *****************
Serial   Phase #:31   [CDB1_PDB5] Files:277  Time: 0s
Serial   Phase #:32   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:33   [CDB1_PDB5] Files:1    Time: 1s
Serial   Phase #:30   [CDB1_PDB1] Files:1    Time: 0s
*****************   Catproc PLBs   *****************
Serial   Phase #:31   [CDB1_PDB1] Files:277  Time: 0s
Serial   Phase #:32   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:33   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:34   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:35   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:34   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:35   [CDB1_PDB1] Files:1    Time: 1s
***************   Catproc DataPump   ***************
Serial   Phase #:36   [CDB1_PDB5] Files:4    Time: 0s
Restart  Phase #:37   [CDB1_PDB5] Files:1    Time: 1s
***************   Catproc DataPump   ***************
Serial   Phase #:36   [CDB1_PDB1] Files:4    Time: 0s
Restart  Phase #:37   [CDB1_PDB1] Files:1    Time: 0s
******************   Catproc SQL   ******************
Parallel Phase #:38   [CDB1_PDB5] Files:13   Time: 0s
Restart  Phase #:39   [CDB1_PDB5] Files:1    Time: 0s
******************   Catproc SQL   ******************
Parallel Phase #:38   [CDB1_PDB1] Files:13   Time: 0s
Restart  Phase #:39   [CDB1_PDB1] Files:1    Time: 1s
Parallel Phase #:40   [CDB1_PDB5] Files:11   Time: 0s
Restart  Phase #:41   [CDB1_PDB5] Files:1    Time: 1s
Parallel Phase #:40   [CDB1_PDB1] Files:11   Time: 0s
Restart  Phase #:41   [CDB1_PDB1] Files:1    Time: 0s
Parallel Phase #:42   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:43   [CDB1_PDB5] Files:1    Time: 1s
Parallel Phase #:42   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:43   [CDB1_PDB1] Files:1    Time: 1s
*************   Final Catproc scripts   *************
Serial   Phase #:44   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:45   [CDB1_PDB5] Files:1    Time: 0s
*************   Final Catproc scripts   *************
```

```
Serial   Phase #:44   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:45   [CDB1_PDB1] Files:1    Time: 0s
**************   Final RDBMS scripts   *************
Serial   Phase #:46   [CDB1_PDB5] Files:1    Time: 0s
************   Upgrade Component Start   ***********
Serial   Phase #:47   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:48   [CDB1_PDB5] Files:1    Time: 1s
**************   Final RDBMS scripts   *************
Serial   Phase #:46   [CDB1_PDB1] Files:1    Time: 0s
************   Upgrade Component Start   ***********
Serial   Phase #:47   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:48   [CDB1_PDB1] Files:1    Time: 1s
****************   Upgrading Java   ****************
Serial   Phase #:49   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:50   [CDB1_PDB5] Files:1    Time: 0s
****************   Upgrading Java   ****************
Serial   Phase #:49   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:50   [CDB1_PDB1] Files:1    Time: 1s
*****************   Upgrading XDK   ****************
Serial   Phase #:51   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:52   [CDB1_PDB5] Files:1    Time: 1s
*****************   Upgrading XDK   ****************
Serial   Phase #:51   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:52   [CDB1_PDB1] Files:1    Time: 0s
*********   Upgrading APS,OLS,DV,CONTEXT   *********
Serial   Phase #:53   [CDB1_PDB5] Files:1    Time: 0s
*****************   Upgrading XDB   ****************
Restart  Phase #:54   [CDB1_PDB5] Files:1    Time: 0s
*********   Upgrading APS,OLS,DV,CONTEXT   *********
Serial   Phase #:53   [CDB1_PDB1] Files:1    Time: 0s
*****************   Upgrading XDB   ****************
Restart  Phase #:54   [CDB1_PDB1] Files:1    Time: 1s
Serial   Phase #:56   [CDB1_PDB1] Files:3    Time: 0s
Serial   Phase #:57   [CDB1_PDB1] Files:2    Time: 0s
Parallel Phase #:58   [CDB1_PDB1] Files:11   Time: 0s
Parallel Phase #:59   [CDB1_PDB1] Files:24   Time: 0s
Serial   Phase #:60   [CDB1_PDB1] Files:4    Time: 0s
Serial   Phase #:61   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:62   [CDB1_PDB1] Files:30   Time: 0s
Serial   Phase #:63   [CDB1_PDB1] Files:1    Time: 0s
Parallel Phase #:64   [CDB1_PDB1] Files:6    Time: 0s
Serial   Phase #:65   [CDB1_PDB1] Files:2    Time: 0s
Serial   Phase #:66   [CDB1_PDB1] Files:3    Time: 0s
Restart  Phase #:67   [CDB1_PDB1] Files:1    Time: 1s
Serial   Phase #:56   [CDB1_PDB5] Files:3    Time: 0s
Serial   Phase #:57   [CDB1_PDB5] Files:2    Time: 0s
Parallel Phase #:58   [CDB1_PDB5] Files:11   Time: 0s
Parallel Phase #:59   [CDB1_PDB5] Files:24   Time: 0s
Serial   Phase #:60   [CDB1_PDB5] Files:4    Time: 0s
Serial   Phase #:61   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:62   [CDB1_PDB5] Files:30   Time: 0s
Serial   Phase #:63   [CDB1_PDB5] Files:1    Time: 0s
Parallel Phase #:64   [CDB1_PDB5] Files:6    Time: 0s
Serial   Phase #:65   [CDB1_PDB5] Files:2    Time: 0s
Serial   Phase #:66   [CDB1_PDB5] Files:3    Time: 0s
Restart  Phase #:67   [CDB1_PDB5] Files:1    Time: 1s
*********   Upgrading CATJAVA,OWM,MGW,RAC   ********
Serial   Phase #:68   [CDB1_PDB1] Files:1    Time: 0s
****************   Upgrading ORDIM   ***************
Restart  Phase #:69   [CDB1_PDB1] Files:1    Time: 1s
*********   Upgrading CATJAVA,OWM,MGW,RAC   ********
```

```
Serial   Phase #:68   [CDB1_PDB5] Files:1    Time: 0s
****************   Upgrading ORDIM   ***************
Restart  Phase #:69   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:71   [CDB1_PDB1] Files:1    Time: 0s
Parallel Phase #:72   [CDB1_PDB1] Files:2    Time: 0s
Serial   Phase #:73   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:74   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:71   [CDB1_PDB5] Files:1    Time: 0s
Parallel Phase #:72   [CDB1_PDB5] Files:2    Time: 0s
Serial   Phase #:73   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:74   [CDB1_PDB5] Files:1    Time: 1s
Parallel Phase #:75   [CDB1_PDB1] Files:2    Time: 0s
Serial   Phase #:76   [CDB1_PDB1] Files:2    Time: 0s
*****************   Upgrading SDO   ****************
Restart  Phase #:77   [CDB1_PDB1] Files:1    Time: 1s
Parallel Phase #:75   [CDB1_PDB5] Files:2    Time: 0s
Serial   Phase #:76   [CDB1_PDB5] Files:2    Time: 0s
*****************   Upgrading SDO   ****************
Restart  Phase #:77   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:79   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:80   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:81   [CDB1_PDB1] Files:1    Time: 0s
Parallel Phase #:82   [CDB1_PDB1] Files:3    Time: 0s
Serial   Phase #:83   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:84   [CDB1_PDB1] Files:1    Time: 0s
Parallel Phase #:85   [CDB1_PDB1] Files:4    Time: 0s
Serial   Phase #:86   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:87   [CDB1_PDB1] Files:3    Time: 0s
Restart  Phase #:88   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:79   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:80   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:81   [CDB1_PDB5] Files:1    Time: 0s
Parallel Phase #:82   [CDB1_PDB5] Files:3    Time: 0s
Serial   Phase #:83   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:84   [CDB1_PDB5] Files:1    Time: 0s
Parallel Phase #:85   [CDB1_PDB5] Files:4    Time: 0s
Serial   Phase #:86   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:87   [CDB1_PDB5] Files:3    Time: 0s
Restart  Phase #:88   [CDB1_PDB5] Files:1    Time: 1s
Serial   Phase #:89   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:90   [CDB1_PDB1] Files:1    Time: 1s
Serial   Phase #:89   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:90   [CDB1_PDB5] Files:1    Time: 0s
***********   Upgrading Misc. ODM, OLAP   **********
Serial   Phase #:91   [CDB1_PDB1] Files:1    Time: 0s
****************   Upgrading APEX   ****************
Restart  Phase #:92   [CDB1_PDB1] Files:1    Time: 1s
***********   Upgrading Misc. ODM, OLAP   **********
Serial   Phase #:91   [CDB1_PDB5] Files:1    Time: 0s
****************   Upgrading APEX   ****************
Restart  Phase #:92   [CDB1_PDB5] Files:1    Time: 1s
Serial   Phase #:93   [CDB1_PDB1] Files:1    Time: 0s
Restart  Phase #:94   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:93   [CDB1_PDB5] Files:1    Time: 0s
Restart  Phase #:94   [CDB1_PDB5] Files:1    Time: 1s
***********   Final Component scripts    ***********
Serial   Phase #:95   [CDB1_PDB1] Files:1    Time: 0s
*************   Final Upgrade scripts   *************
Serial   Phase #:96   [CDB1_PDB1] Files:1    Time: 0s
******************   Migration   ******************
Serial   Phase #:97   [CDB1_PDB1] Files:1    Time: 0s
```

```
Serial   Phase #:98   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:99   [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:100  [CDB1_PDB1] Files:1    Time: 0s
*****************   Post Upgrade   *****************
Serial   Phase #:101  [CDB1_PDB1] Files:1    Time: 0s
****************   Summary report   ****************
Serial   Phase #:102  [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:103  [CDB1_PDB1] Files:1    Time: 0s
Serial   Phase #:104  [CDB1_PDB1] Files:1     Time: 0s

-----------------------------------------------------
Phases [0-104]         End Time:[2015_10_09 18:52:50]
Container Lists Inclusion:[CDB1_PDB1] Exclusion:[NONE]
-----------------------------------------------------

Grand Total Time: 18s [CDB1_PDB1]

 LOG FILES: (/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb1*.log)

Total Upgrade Time:          [0d:0h:0m:18s]
   Time: 1s
***********   Final Component scripts    ***********
Serial   Phase #:95   [CDB1_PDB5] Files:1    Time: 0s
*************   Final Upgrade scripts   ************
Serial   Phase #:96   [CDB1_PDB5] Files:1    Time: 0s
******************   Migration   ******************
Serial   Phase #:97   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:98   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:99   [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:100  [CDB1_PDB5] Files:1    Time: 0s
*****************   Post Upgrade   *****************
Serial   Phase #:101  [CDB1_PDB5] Files:1    Time: 0s
****************   Summary report   ****************
Serial   Phase #:102  [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:103  [CDB1_PDB5] Files:1    Time: 0s
Serial   Phase #:104  [CDB1_PDB5] Files:1     Time: 0s

-----------------------------------------------------
Phases [0-104]         End Time:[2015_10_09 18:52:50]
Container Lists Inclusion:[CDB1_PDB5] Exclusion:[NONE]
-----------------------------------------------------

Grand Total Time: 18s [CDB1_PDB5]

 LOG FILES: (/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrdcdb1_pdb5*.log)

Total Upgrade Time:          [0d:0h:0m:18s]

Run file is [/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catctl_priority_run.lst]
1,CDB$ROOT
-----------------------------------------------------
3,PDB$SEED
3,CDB1_PDB2
-----------------------------------------------------
4,CDB1_PDB3
4,CDB1_PDB4
-----------------------------------------------------
5,CDB1_PDB1
```

```
5,CDB1_PDB5
--------------------------------------------------
--------------------------------------------------

     Time: 19s For CDB$ROOT
     Time: 68s For PDB(s)

Grand Total Time: 87s

 LOG FILES: (/u01/app/oracle/12.1.0/CDB1/cfgtoollogs/dbopens/upgrade20151009185122/
catupgrd*.log)

Grand Total Upgrade Time:    [0d:0h:1m:27s]
```

In this example, at the conclusion of the upgrade log, you can see that `CDB$ROOT` is upgraded first. After the CDB$ROOT upgrade is completed, the Parallel Upgrade Utility carries out the following concurrent upgrades of PDBs, in accordance with the priority settings in the priority list:

1. PDB$SEED and CDB1_PDB2
2. CDB1_PDB3 and CDB1_PDB4
3. CDB1_PDB1 and CDB1_PDB5

Related Topics

- About the Parallel Upgrade Utility for Oracle Database (CATCTL.PL and DBUPGRADE)
- Parallel Upgrade Utility (catctl.pl) Parameters

Upgrade Oracle Call Interface (OCI) and Precompiler Applications

Upgrade any Oracle Call Interface (OCI) and precompiler applications that you plan to use with the new release of Oracle Database.

Oracle recommends that you test these applications on a test database before you upgrade your current production database.

Related Topics

- About Upgrading Precompiler and OCI Applications in Oracle Database

Requirements for Upgrading Databases That Use Oracle Label Security and Oracle Database Vault

You must complete these tasks before starting an upgrade with a database using Oracle Label Security or Oracle Database Vault.

- Audit Table Preupgrade and Archive Requirements
  For Oracle Database releases earlier than 12.1 using Oracle Label Security and Oracle Database Vault, you must run the OLS preprocess script before you upgrade.
- Oracle Database Vault and Upgrades of Oracle Database Release 11.2
  If Oracle Label Security is installed in the earlier release that you are upgrading, then grant the DV_PATCH_ADMIN role to SYS.

- Granting the DV_PATCH_ADMIN Role to SYS for Oracle Database Vault
  If Oracle Database Vault is enabled, then to perform checks for Oracle Data Vault, the upgrade process requires running three SQL scripts.

Audit Table Preupgrade and Archive Requirements

For Oracle Database releases earlier than 12.1 using Oracle Label Security and Oracle Database Vault, you must run the OLS preprocess script before you upgrade.

If you are upgrading from a database earlier than Oracle Database release 12.1 that uses Oracle Label Security (OLS) and Oracle Database Vault, then you must first run the OLS preprocess script, `olspreupgrade.sql`, to process the `aud$` table contents. The OLS upgrade moves the `aud$` table from the `SYSTEM` schema to the `SYS` schema. The `olspreupgrade.sql` script is a preprocessing script required for this move.

> **Caution:**
>
> Running the `olspreupgrade.sql` script before upgrading is mandatory for upgrading databases earlier than Oracle Database release 12.1 that use Oracle Label Security and Oracle Database Vault. Once you have upgraded to Oracle Database release 12.1, you do not have to perform the OLS preprocessing procedure going forward to patch or upgrade the database.

The `olspreupgrade.sql` script creates a temporary table `PREUPG_AUD$` in the `SYS` schema and moves the `SYSTEM.aud$` records to `SYS.PREUPG_AUD$`. As a safety measure, Oracle recommends that you archive your audit trail before running the `olspreupgrade.sql` script. If Oracle Label Security is installed on your database, and you are upgrading from an earlier release, then you must run the OLS preprocess script before upgrading.

Oracle Database Vault and Upgrades of Oracle Database Release 11.2

If Oracle Label Security is installed in the earlier release that you are upgrading, then grant the DV_PATCH_ADMIN role to SYS.

If Oracle Database Vault is not installed with your release 11.2 database, then you can skip steps 2, 3, 6, and 7 in this section.

To run the OLS preprocess script on a release 11.2 database before upgrading:

1. Copy the following scripts script from the newly installed Oracle home to the Oracle home of the database that y0u want to upgrade:
   - *ORACLE_HOME*`/rdbms/admin/olspreupgrade.sql`
   - *ORACLE_HOME*`/rdbms/admin/emremove.sql`
   - *ORACLE_HOME*`/rdbms/admin/catnoamd.sql`
2. Start SQL*Plus and connect as `DVOWNER` to the database that you want to upgrade.
3. Run the following statement:

```
SQL> GRANT DV_PATCH_ADMIN to SYS;
```

4. At the system prompt, connect SYS as SYSDBA:

   ```
   CONNECT SYS AS SYSDBA
   ```

5. Run the preprocess scripts for Data Vault

   ```
   ORACLE_HOME/rdbms/admin/olspreupgrade.sql
   ORACLE_HOME/rdbms/admin/emremove.sql
   ORACLE_HOME/rdbms/admin/catnoamd.sql
   ```

   You may continue to run your applications on the database while the preprocess scripts are running.

6. After the `olspreupgrade.sql` completes its run successfully, start SQL*Plus and connect to the database as `DVOWNER`.

7. Run the following SQL statement:

   ```
   SQL> REVOKE DV_PATCH_ADMIN from SYS;
   ```

Granting the DV_PATCH_ADMIN Role to SYS for Oracle Database Vault

If Oracle Database Vault is enabled, then to perform checks for Oracle Data Vault, the upgrade process requires running three SQL scripts.

The SYS user requires the DV_PATCH_ADMIN role for the following scripts:

OLS_SYS_MOVE runs `olspreupgrade.sql`:

```
CHECK.OLS_SYS_MOVE.MIN_VERSION_INCLUSIVE=10.2
CHECK.OLS_SYS_MOVE.MAX_VERSION_EXCLUSIVE=12.1
```

EM_PRESENT runs `emremove.sql`:

```
CHECK.EM_PRESENT.MIN_VERSION_INCLUSIVE=NONE
CHECK.EM_PRESENT.MAX_VERSION_EXCLUSIVE=12.1.0.1
```

AMD_EXISTS CHECK runs `catnoamd.sql`:

```
CHECK.AMD_EXISTS.MIN_VERSION_INCLUSIVE=NONE
CHECK.AMD_EXISTS.MAX_VERSION_EXCLUSIVE=NONE
```

3
Upgrading Oracle Database

Oracle provides a comprehensive set of tools for upgrading Oracle Database with minimal downtime and for migrating your applications to the new release.

> **Caution:**
>
> If you retain the old Oracle software, then never start the upgraded database with the old Oracle software. Only start the database with the executables in the new Oracle Database installation.

Topics:

- Backing Up Oracle Database for Upgrading
  Use this procedure to back up your existing Oracle Database before you attempt an upgrade.
- Upgrading with Parallel Upgrade Utility (catctl.pl and dbupgrade Shell Command)
  This section describes how to use the Parallel Upgrade Utility (`catctl.pl`) to run manual upgrades using parallel processing, inclusion and exclusion lists, and other features to manage your upgrade.
- Upgrading with Oracle Database Upgrade Assistant (DBUA)
  Database Upgrade Assistant (DBUA) provides a graphical user interface to guide you through the upgrade of Oracle Database. DBUA works for CDB and non-CDB database systems.
- Upgrade Scenarios for Non-CDB Oracle Databases
  Review these topics to understand the upgrade scenarios and procedures for non-CDB Oracle Databases
- Example of Manual Upgrade of Windows Non-CDB Oracle Database 11.2.0.3
  These examples show the steps to complete preupgrade checks, upgrade, and postupgrade checks for an Oracle Database 11*g* release 2 (11.2.0.3) upgrade to Oracle Database 12*c* release 2 (12.2).
- Manual Upgrade Scenarios for Multitenant Architecture Oracle Databases
  To prepare for manual upgrades, review the manual upgrade scenarios and procedures for Oracle Database deployed with multitenant architecture.
- Improvements to Data Dictionary Upgrade and Upgrade Status Displays
  Oracle Database 12*c* includes improvements to the upgrade process, and to how upgrade status appears for the upgraded database.
- About Dbupgrade Scripts and catupgrd.sql in Earlier Releases of Oracle Database
  The function of the `catupgrd.sql` script is replaced by the Parallel Upgrade Utility, `catctl.pl`, and the `dbupgrade` and `dbupgrade.cmd` scripts.
- About Transporting and Upgrading a Database (Full Transportable Export/Import)
  You can use file-based or nonfile-based modes for transporting data.

- About Log File Location and DIAGNOSTIC_DEST
  The location of the Automatic Diagnostic Repository (ADR) and the diagnostic log files created by the upgrade scripts can vary, depending on your environment variables and parameter settings.
- Troubleshooting the Upgrade for Oracle Database
  Use these troubleshooting tips to address errors or issues that you may encounter while upgrading your database.
- Rerunning Upgrades for Oracle Database
  Use these options to rerun upgrades.
- Restarting the Upgrade from a Specific Phase that Failed Using -p
  Use this option to complete an upgrade after fixing errors.

Backing Up Oracle Database for Upgrading

Use this procedure to back up your existing Oracle Database before you attempt an upgrade.

Oracle recommends that you back up your Oracle database after you run the Pre-Upgrade Information Tool and cleanly shut down the database. To minimize downtime, you may perform an online backup or create a guaranteed restore point. Database Upgrade Assistant (DBUA) enables you to specify your backup and restore point.

> **Caution:**
>
> Before you make any changes to the Oracle software, Oracle recommends that you create a backup of the Oracle software and databases. For Oracle software running on Windows operating systems, you must also take a backup of the Windows registry. Without a registry backup, you cannot restore the Oracle software to a working state if the upgrade to Oracle Database 12*c* fails and you want to revert to the previous software installation.

1. Sign on to Oracle RMAN:

```
rman "target / nocatalog"
```

2. Run the following RMAN commands:

```
RUN
{
    ALLOCATE CHANNEL chan_name TYPE DISK;
    BACKUP DATABASE FORMAT 'some_backup_directory%U' TAG before_upgrade;
    BACKUP CURRENT CONTROLFILE FORMAT 'controlfile location and name';
}
```

Upgrading with Parallel Upgrade Utility (catctl.pl and dbupgrade Shell Command)

This section describes how to use the Parallel Upgrade Utility (`catctl.pl`) to run manual upgrades using parallel processing, inclusion and exclusion lists, and other features to manage your upgrade.

- About the Parallel Upgrade Utility for Oracle Database (CATCTL.PL and DBUPGRADE)
  The Parallel Upgrade Utility (`catctl.pl`, and the `dbupgrade` script) enable you to upgrade simultaneously components that do not require upgrades to occur in a specific order.
- General Steps for Running the Parallel Upgrade Utility
  Review to obtain an overview of how to use the Parallel Upgrade Utility for Oracle Database.
- Parallel Upgrade Utility (catctl.pl) Parameters
  Control how the Parallel Upgrade Utility (`catctl.pl`) runs. You can also use these arguments to run the `dbupgrade` shell command.
- Example of Using the Parallel Upgrade Utility
  Use this example to understand how you can run the parallel upgrade utility manually to perform upgrades.

About the Parallel Upgrade Utility for Oracle Database (CATCTL.PL and DBUPGRADE)

The Parallel Upgrade Utility (`catctl.pl`, and the `dbupgrade` script) enable you to upgrade simultaneously components that do not require upgrades to occur in a specific order.

Oracle Database 12*c* release 1 (12.1) introduced the Parallel Upgrade Utility, `catctl.pl`. This utility reduces the total amount of time it takes to perform an upgrade by loading the database dictionary in parallel, and by using multiple SQL processes to upgrade the database. Performing parallel upgrades of components enables you to take advantage of your CPU capacity. Oracle continues to make improvements to the upgrade process to simplify both manual upgrades, and upgrades performed with the Database Upgrade Assistant (DBUA). DBUA and the manual upgrade procedures take advantage of the new Parallel Upgrade Utility.

You can run a shell command, `dbupgrade`, which starts up `catctl.pl` from the command line, instead of requiring you to run it from Perl.

The `dbupgrade` shell command is located in the file path `$ORACLE_HOME/bin` on Linux and UNIX, and `%ORACLE_HOME%\bin` on Windows. You can provide any command arguments that are valid for `catctl.pl` to the shell command. Either run the command directly from the new Oracle home path, or set a user environment variable to point to the file path.

For example:

Running with default values:

```
$ ./dbupgrade
```

Running to specify a log directory placed in `/tmp`:

```
$ ./dbupgrade -l /tmp
```

You can also run the Parallel Upgrade Utility using priority lists. For example:

```
$ ./dbupgrade -L priority_list_name
```

When you use a priority list, you can include or exclude a specific list of PDBs in your upgrade.

You can also run the Parallel Upgrade Utility using priority emulation, so that you can see how the priority list is read and carried out, without actually performing the upgrade. For example:

```
$ ./dbupgrade -E
```

Related Topics

- Example of Testing Upgrades Using Priority List Emulation

General Steps for Running the Parallel Upgrade Utility

Review to obtain an overview of how to use the Parallel Upgrade Utility for Oracle Database.

The Parallel Upgrade Utility (`catctl.pl`, which you can start with the shell command `dbupgrade`) loads the data dictionary and components in parallel. Loading in parallel reduces the overall upgrade time. Before running the Parallel Upgrade Utility, follow the procedures for backing up your database that you normally do before upgrading. Also, as a prerequisite, you must run the Pre-Upgrade Information Tool to identify any problems that a database administrator must address before the upgrade proceeds.

The general steps for upgrading your database with the Parallel Upgrade Utility are as follows:

1. Back up your current database.
2. Install the Oracle Database software for the new release.
3. Ensure that the Pre-Upgrade Information Tool (`preupgrade.jar`) has run on the source database, and that any issues reported by the tool are addressed.
4. Shut down your current database.
5. Set up the new Oracle home environment to access the new release database, and then start SQL*Plus from the directory *`ORACLE_HOME`*`/rdbms/admin`.
6. Log in to a user account with SYSDBA system privileges, and connect to the database that you want to upgrade:

   ```
   CONNECT / AS SYSDBA
   ```

7. Start the database in upgrade mode. Use the command for your configuration type.

   Multitenant container database (CDB):

   ```
   SQL> startup upgrade;
   SQL> alter pluggable database all open upgrade;
   ```

Non-CDB:

```
SQL> startup upgrade
```

> **Note:**
>
> The UPGRADE keyword performs operations that prepare the environment for the upgrade.

You may be required to use the PFILE option in your startup command to specify the location of your initialization parameter file.

When you start the database in upgrade mode, only queries on fixed views execute without errors until after the `catctl.pl` script is run. Before you run `catctl.pl`, you receive an error if you try to use PL/SQL, or if you try to run queries on any other view.

If errors appear listing desupported initialization parameters, then make a note of the desupported initialization parameters, and continue with the upgrade. Remove the desupported initialization parameters the next time you shut down the database.

8. Exit SQL*Plus.
9. Run the Parallel Upgrade Utility from the new Oracle home.

   You can run the utility as a shell command (`dbupgrade` on Linux and UNIX, and `dbupgrade.cmd` on Windows) or you can run it as a Perl command (`catctl.pl`).

   For example, on Linux and UNIX:

   ```
   cd $ORACLE_HOME/bin
   ./dbupgrade
   ```

   For example, on Windows:

   ```
   cd %ORACLE_HOME%\bin
   dbupgrade
   ```

   The Parallel Upgrade Utility starts the upgrade process.

> **Note:**
>
> The Parallel Upgrade Utility uses other files to carry out the upgrade. On Linux/UNIX systems, these files include `catconst.pm`, `catcom.pm`, `sqlpatch`, `sqlpatch.pl` or `sqlpatch.pm`, and `orahome` on Linux/UNIX systems. On Windows systems, these files include `orahome.exe`. Do not change or remove these files.

Parallel Upgrade Utility (catctl.pl) Parameters

Control how the Parallel Upgrade Utility (`catctl.pl`) runs. You can also use these arguments to run the `dbupgrade` shell command.

> **Note:**
>
> The shell command utility `dbupgrade` starts `catctl.pl`. The dbupgrade utility resides in the `ORACLE_HOME/bin` directory. You can use the shell command utility to start the Parallel Upgrade Utility at the command prompt. You can either run the utility using default values, or you can use `catctl.pl` input parameters to specify Parallel Upgrade Utility arguments.

Table 3-1 Parallel Upgrade Utility (catctl.pl) Parameters

Parameter	Description

`-c`	Specifies a space-delimited inclusion list for PDBs that you want to upgrade. For example, in an Oracle Multitenant deployment with PDB1, PDB2, PDB3, and PDB4, include PDB1 and PDB2, but exclude the PDBs not named. PDB 1 and PDB 2 are upgraded, but PDB 3 and PDB4 are not upgraded.
	Linux and UNIX (use single quotes):
	`-c 'PDB1 PDB2'`
	Windows (use double quotes):
	`-c "PDB1 PDB2"`

`-C`	Specifies a space-delimited exclusion list for PDBs that you want to upgrade. For example, in an Oracle Multitenant deployment with PDB1, PDB2, PDB3, and PDB4, you can use an exclusion list to exclude PDB1 and PDB2, but include the PDBs not named. PDB1 and PDB2 are not upgraded, but PDB3 and PDB4 are upgraded.
	Linux and UNIX (use single quotes):
	`-C 'PDB1 PDB2'`
	Windows (use double quotes):
	`-C "PDB1 PDB2"`
	Note: `-c` and `-C` are mutually exclusive.
	`-C 'CATCTL_LISTONLY'` is an option that specifies that the Parallel Upgrade Utility processes only the PDBs in a priority list. Use this option with the `-L` parameter, specifying a list.

`-d`	Specifies the location of the directory containing the files that you want processed.
`-e`	Sets echo OFF while running the scripts. The default is echo ON.

Table 3-1 (Cont.) Parallel Upgrade Utility (catctl.pl) Parameters

Parameter	Description
`-E`	Enables you to run an upgrade emulation. You can use the `-E` parameter to run the Parallel Upgrade Utility in emulation mode to test how priority lists run, or to test how other upgrade parameter selections are carried out during an upgrade. For example, you can run an upgrade emulation to obtain more information about how the resource allocation choices you make using the `-n` and `-N` parameters are carried out. To carry out an upgrade emulation, complete all upgrade preparations before you run the Parallel Upgrade Utility, and then run the command using `-E`. When you run the Parallel Upgrade Utility with the `-E` parameter, and call a priority list as part of the command using the `-L` parameter, the utility writes the upgrade order to the file `catctl_priority_run.lst`. This list is placed in the file path that you specify by the `-l` parameter, or in the default log file area if you do not specify a different output file path.
`-F`	Forces a cleanup of previous upgrade errors. Non-CDB databases require only the `-F` parameter. For CDBs, use this option with a space-delimited inclusion list, which you specify with `-c`.
`-i`	Specifies an identifier to use when creating spool log files.
`-l`	Specifies the location for the directory to use for spool log files. The default location is *`Oracle_base`*`/cfgtoollogs/dbname/upgrade`*`datetime`*. The *`date`* and *`time`* strings are in the character string format *YYYYMMDDHHMMSC*, in which *YYYY* designates the year, *MM* designates the month, *DD* designates the day, *HH* designates the hour, *MM* designates the minute, and *SC* designates the second. Oracle strongly recommends that you do not write log files to the `/admin` directory.
`-L`	Upgrades PDBs using a priority list during an Oracle Database upgrade, and specifies the priority list name. The priority list updates priority status in the database during upgrade. This priority listing is maintained in future upgrades. By default the CDB$ROOT and PDB$SEED databases are always processed first. They are processed first even if they are not added to a priority list. All PDBs in the priority list are processed before PDBs not in the priority list.
`-M`	Keeps CDB$ROOT in UPGRADE mode while the PDBs are upgraded. For non-CDBs, this parameter is ignored. During CDB upgrades, using this parameter setting places the CDB and all its PDBs in upgrade mode, which can reduce total upgrade time. However, you cannot bring up any of the PDBs until the CDB and all its PDBs are upgraded. By default, if you do not use the `-M` parameter setting, then CDB$ROOT is upgraded and restarted in normal mode, and the normal background processes are started. As each PDB is upgraded, you can bring the PDB online while other PDBs are still being upgraded.

Table 3-1 (Cont.) Parallel Upgrade Utility (catctl.pl) Parameters

Parameter	Description
`-n`	Specifies the number of processes to use for parallel operations. Non-CDBs: The `-n` parameter specifies the number of SQL processes to use when upgrading the database. Multitenant architecture databases (CDBs): The number of PDBs upgraded concurrently is controlled by the value of the `-n` parameter. Multiple PDB upgrades are processed together. Starting in Oracle Database 12*c*, the default value for multitenant architecture databases is the number of CPUs on your system. A `cpu_count` equal to 24 equates to a default value of 24 for `-n`. Values for the `-n` parameter: Non-CDBs: The maximum value for `-n` is 8. The minimum value is 1. The default value is 4. Multitenant architecture databases (CDBs): The maximum value for `-n` is unlimited. The minimum value is 4. The maximum PDB upgrades running concurrently is the value of `-n` divided by the value of `-N`.
`-N`	Specifies the number of SQL processors to use when upgrading PDBs. For non-CDBs, this parameter is ignored. For CDBs, the maximum value is 8. The minimum value is 1. The default value is 2.
`-p`	Restarts from the specified phase. When you re-run an upgrade, it does not restart phases already completed successfully.
`-P`	Stops from the specified phase.
`-R`	Resumes the upgrade from a failed phase. Using the `-R` parameter enables the upgrade to resume at the point of failure, so that only the missing upgrade phases are rerun.
`-s`	Names the SQL script that initializes sessions.
`-S`	Specifies serial upgrade instead of parallel. Starting with Oracle Database 12.2, `catupgrd.sql` is no longer supported using the `-S` option.
`-T`	Takes offline user schema-based table spaces.
`-u`	Specifies user name, and prompts for password.
`-y`	Displays phases only.
`-z`	Turns on production debugging information for `catcon.pm`.
`-Z`	Turns on debug tracing information for `catctl.pl`. For example, to set the number to 1, enter `-Z 1`.

Example of Using the Parallel Upgrade Utility

Use this example to understand how you can run the parallel upgrade utility manually to perform upgrades.

The Parallel Upgrade Utility (`catctl.pl`) is integrated with DBUA. However, you can run the Parallel Upgrade Utility using the command-line script `dbupgrade`. Run the Parallel Upgrade Utility using the command-line parameters to specify how you want

the upgrade to run. For example, to run the utility in serial mode instead of using parallel operations, specify the `-n 1` option.

Example 3-1 Running Parallel Upgrade Utility with Parameters for CDB and Non-CDB Databases

If you use the option `-n 4` when you run the Parallel Upgrade Utility, then the upgrade process creates `catupgrd0.log`, `catupgrd1.log`, `catupgrd2.log`, and `catupgrd3.log`. Check all of the `catupgrd#.log` files to confirm that the upgrade succeeded. If the upgrade failed, and you fix issues and run the Parallel Upgrade Utility again, then the previous log files are overwritten, unless you specify a different log directory by using the `-l` parameter.

For example:

```
cd $ORACLE_HOME/bin
dbupgrade -n 4 -l $ORACLE_HOME/diagnostics
```

Example 3-2 Running Parallel Upgrades on Multiple Pluggable Databases (PDBs) Using Parallel Upgrade Utility

These examples show how parameter settings change the way that the Parallel Upgrade Utility performs the upgrade on multiple PDBs.

> **Note:**
>
> In your upgrade plans, be aware of the following:
>
> - The CDB$ROOT defaults to a minimum value of 4 SQL processes, and to a maximum value of 8
> - The default value for `-N` is 2.
> - PDB$SEED always counts as one (1) PDB in the upgrade cycles
> - The default for the Parallel Upgrade Utility parameter `-n` is the value of the CPU_COUNT parameter

In the following examples, the system is an Oracle Multitenant Oracle Database system that has a CPU_COUNT value of 24.

Run the Parallel Upgrade Utility without specifying values for the parameters `-n` and `-N` (that is, accept the default value of -N, which is 2, and accept the default value of `-n` as the CPU_COUNT parameter value, which is 24). The following parallel processing occurs:

- 12 PDBs are upgraded in parallel (CPU_COUNT divided by 2)
- 2 parallel processes run for each PDB

Specify the value of `-n` as 64, and `-N` as 4. The following parallel processing occurs:

- 16 PDBs are upgraded together (64 divided by 4)
- 4 parallel processes run for each PDB

Specify the value of `-n` as 20, and `-N` as 2. The following parallel processing occurs:

- 10 PDBs are upgraded together (20 divided by 2)

- 2 parallel processes run for each PDB

Specify the value of `-n` as 10, and `-N` as 4. The following parallel processing occurs:

- 2 PDBs are upgraded together (10 divided by 4), rounded down.
- 4 parallel processes run for each PDB

Do not specify the value of `-n` (that is, accept the default value of `-n`, which is the value of the CPU_COUNT parameter), and specify the value of `-N` as 1. The following parallel processing occurs:

- 24 PDBs are upgraded together (CPU_COUNT value divided by 1)
- 1 process runs for each PDB

Specify a value for `-n` as 20, and do not specify the value for `-N` (that is, accept the default value of `-N`, which is 2). The following parallel processing occurs:

- 10 PDBs are upgraded together (20 divided by 2)
- 2 parallel processes run for each PDB

Upgrading with Oracle Database Upgrade Assistant (DBUA)

Database Upgrade Assistant (DBUA) provides a graphical user interface to guide you through the upgrade of Oracle Database. DBUA works for CDB and non-CDB database systems.

> **Note:**
>
> You can start DBUA in silent mode, which does not present a user interface. Silent mode can be useful for large roll-outs and scripts.

- Recommendations for Using DBUA
  Review this topic to use Database Upgrade Assistant (DBUA) for multitenant architecture and non-CDB Oracle Database upgrades.
- About Stopping DBUA When Upgrading
  You must complete an upgrade manually if you stop DBUA.
- How DBUA Processes the Upgrade for Oracle Database
  You can start DBUA as part of the database software installation, or you can start it manually after installing the software.
- Upgrade Scripts Started by DBUA
  During the upgrade, DBUA automatically runs the appropriate upgrade scripts to automate the upgrade and minimize downtime.
- Using DBUA to Upgrade the Database on Linux, UNIX, and Windows Systems
  To upgrade a database using the DBUA graphical user interface, perform these steps from within the new Oracle home.
- Moving a Database from an Existing Oracle Home
  Use this procedure to migrate Oracle Database 18c databases to another Oracle Database 18c home.

- Using DBUA in Silent Mode to Upgrade Oracle Database
  You can DBUA with the `-silent` command line option to carry out noninteractive ("silent") upgrades using DBUA.

Related Topics

- Using DBUA in Silent Mode to Upgrade Oracle Database
  You can DBUA with the `-silent` command line option to carry out noninteractive ("silent") upgrades using DBUA.

Recommendations for Using DBUA

Review this topic to use Database Upgrade Assistant (DBUA) for multitenant architecture and non-CDB Oracle Database upgrades.

You can use DBUA to upgrade multitenant architecture container databases (CDB), pluggable databases (PDBs), and non-CDB databases. The procedures are the same, but the choices you must make and the behavior of DBUA are different, depending on the type of upgrade:

> **Note:**
>
> Starting with Oracle Database 12*c*, release 1 (12.1), non-CDB architecture is deprecated. It can be desupported in a future release.

- For all upgrades, before using DBUA to upgrade your system, Oracle strongly recommends that you run the Pre-Upgrade Information Tool manually. DBUA runs the Pre-Upgrade Information Tool as part of the prerequisite checks it performs before starting the upgrade. However, to reduce downtime, Oracle recommends that you run the Pre-Upgrade Information Tool as part of your upgrade planning, so that you can analyze the database, and take proactive steps before your planned upgrade date.
- To use guaranteed restore points, ensure that the database ARCHIVE LOG and FLASHBACK modes are on during upgrade. You can confirm that they are on by entering the following SQL command:

  ```
  SQL> select log_mode,flashback_on from v$database;
  ```

- If the database instance is not running, then DBUA tries to start the instance. If the instance is up and running, then DBUA connects to it.
- If you restore your database manually (not using DBUA), then before starting DBUA, remove the `Welcome_`*SID*`.txt` file, which is located in the directory *ORACLE_HOME*`/cfgtoollogs/dbua/logs/`. If DBUA finds this file, then DBUA starts in a re-run operation.
- Restore scripts generally enable you to restore your database (Non-CDB single instance, high availability, or Oracle RAC) back to the earlier release and earlier Oracle home location. However, if you have registered your database with Oracle Internet Directory (OID), then the restore script cannot unregister Oracle Internet Directory. You must log in as an authorized user, and unregister the later release database manually.
- If Oracle Database Vault is enabled, then review in this document "Requirement for Upgrading Oracle Databases That Use Oracle Database Vault".

About Stopping DBUA When Upgrading

You must complete an upgrade manually if you stop DBUA.

If you stop the upgrade, but do not restore the database, then you cannot continue to upgrade using DBUA. You must instead continue the upgrade using the manual (command line) upgrade procedure. You cannot go back to the original Oracle Database server unless you restore your database.

Related Topics

- Manually Upgrading a Multitenant Container Oracle Database (CDB)

How DBUA Processes the Upgrade for Oracle Database

You can start DBUA as part of the database software installation, or you can start it manually after installing the software.

If you install the new Oracle Database software, and you specify that you are upgrading an existing Oracle database, then DBUA starts automatically. You can also start DBUA independently after the installation is completed.

While the upgrade is in process, DBUA shows the upgrade progress for each component. DBUA writes detailed trace and log files and produces a complete HTML report for later reference. To enhance security, DBUA automatically locks new user accounts in the upgraded database. DBUA then proceeds to create new configuration files (parameter and listener files) in the new Oracle home.

DBUA does not begin the upgrade process until all the pre-upgrade steps are completed.

Related Topics

- Rerunning Upgrades for Oracle Database
- Tasks to Prepare for Oracle Database Upgrades

Upgrade Scripts Started by DBUA

During the upgrade, DBUA automatically runs the appropriate upgrade scripts to automate the upgrade and minimize downtime.

During the prerequisite phase, DBUA runs the Pre-Upgrade Information Tool script, and uses the following logic to modify or create new required tablespaces:

- If the data files are auto-extensible and have enough disk space to grow, then DBUA continues with the upgrade.
- If the data files are not auto-extensible, then DBUA prompts you and makes the files auto-extensible.
- If the tablespaces are auto-extensible and the `MAXSIZE` initialization parameter needs adjustment, then DBUA prompts you to for this adjustment, and adjusts the `MAXSIZE` parameter.

- If there is not enough disk space to grow, then DBUA prompts you to create space by adding more data files. DBUA does not automatically add new data files, because DBUA cannot determine where to create the files.

DBUA addresses many issues found during the prerequisite phase. For example, DBUA can ensure that the correct time zone file is used, and make ACL adjustments for network access control lists.

During the upgrade phase, DBUA runs `catctl.pl`, which runs the upgrade processes in parallel instead of serially. Parallel runs optimize utilization of CPU resources to hasten the upgrade and minimize downtime.

Using DBUA to Upgrade the Database on Linux, UNIX, and Windows Systems

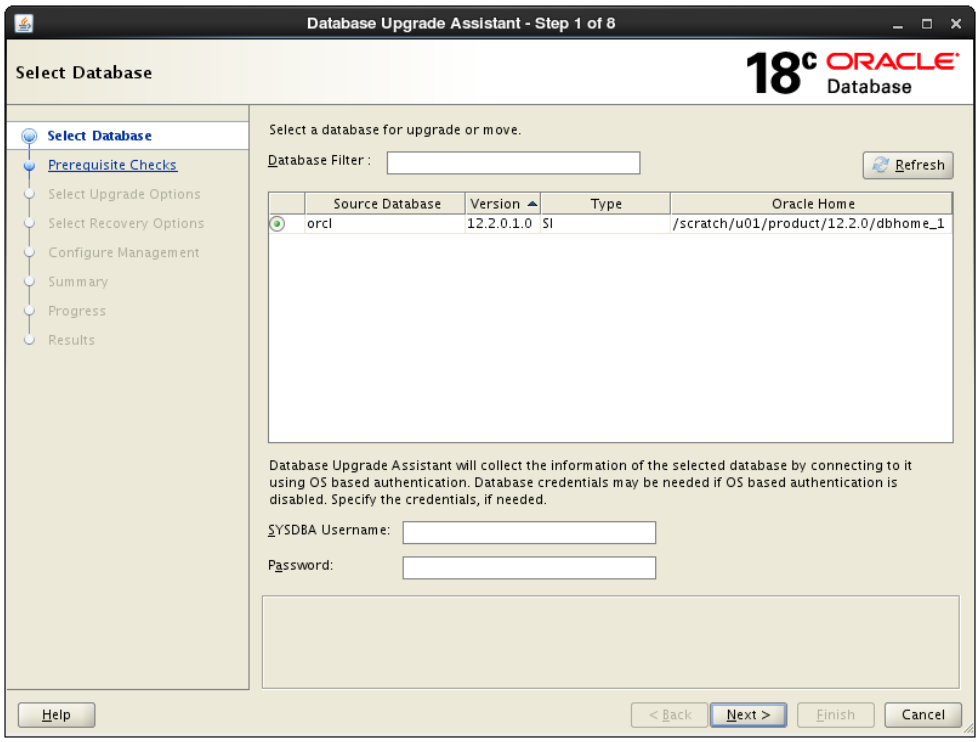
To upgrade a database using the DBUA graphical user interface, perform these steps from within the new Oracle home.

On Windows systems, run DBUA either as an Oracle Database administrative user (a user with the operating system-assigned `ORA_DBA` role), or the Oracle installation owner account installation.

1. Start Database Upgrade Assistant (DBUA) from the Oracle home where the new database software is installed. The `dbua` executable is located in the directory path *`ORACLE_HOME`*`/bin`.
   - On Linux or UNIX platforms, log in as a user with SYSDBA privileges, and enter the following command at a system prompt in the new home for Oracle Database 18c:

     ```
     ./dbua
     ```

   - On Windows operating systems, select **Start**, then **Programs**, then **Oracle *HOME_NAME***, then **Configuration and Migration Tools**, and then **Database Upgrade Assistant**.
2. The Select Database window displays. If you have earlier release Oracle Database installations, then these installations are listed as available to upgrade.



If you need help on any DBUA window, or if you want to consult more documentation about DBUA, then click **Help** to open the online help.

Enter the SYSDBA user name and password for the database that you select. If you run DBUA from a user account that does not have `SYSDBA` privileges, or if the source database does not have operating system authentication, then you must enter the user name and password credentials to enable `SYSDBA` privileges for the selected database.

Click **Next** after making your selection.

Note:

- You can select only one database at a time.
- With single-instance upgrades, if the database does not appear in the list, then check to see if an entry with the database name exists in `etc/oratab`. If the database is not listed there, then direct DBUA to upgrade particular databases:
  - If your single-instance database is not listed in `/etc/oratab`, and DBUA can connect to the database, then you can direct DBUA to upgrade that database explicitly by starting DBUA using the command-line arguments `-sid` *`Oracle_SID`* and `-oracleHome` *`Oracle_home`* as a command-line argument. For example:

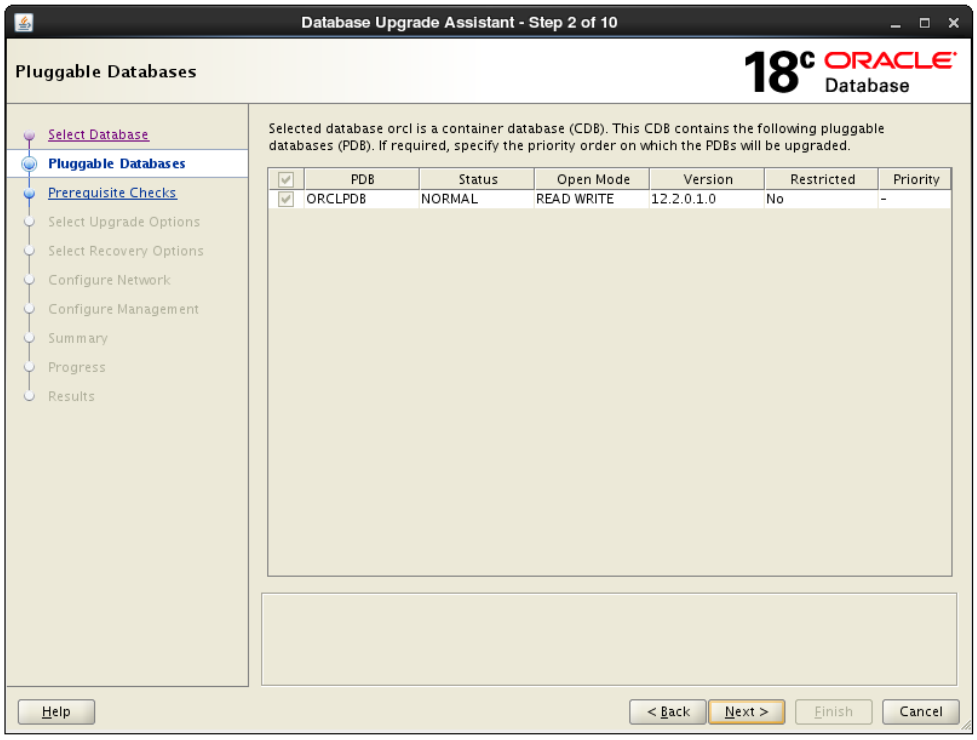
    ```
    dbua -sid mydb –oracleHome /u01/app/oracle/18.1.0/dbhome1
    ```
- Oracle Real Application Clusters (Oracle RAC) upgrades: If the database does not appear on the list, then enter the following `crsctl` command to check for Oracle RAC instances:

  ```
  crsctl status resource -t
  ```

  You can also enter the following command to check for a particular Oracle RAC database, where *`db_name`* is the Oracle RAC database name:

  ```
  crsctl status resource ora.db_name.db
  ```
- On Microsoft Windows, the following security changes affect authentication and user accounts:
  - Starting with Oracle Database 12*c*, and later releases, for security reasons, Windows NTS authentication using the NTLM protocol is no longer supported. Kerberos authentication is the only supported authentication. In this release, NTS does not work either in Windows NT domains, or in domains with Windows NT controllers.
  - Starting with Oracle Database 12*c*, and later releases, Oracle uses standard Microsoft Windows user accounts instead of the Windows `LocalSystem` account to run Oracle database services. Reducing the account access privileges for the Oracle installation owner provides better security on Microsoft Windows.

3. If the selected database is a multitenant container database (CDB), then DBUA displays the Pluggable Databases window. The Pluggable Databases window lists the pluggable databases contained in the CDB. The listed PDBs are upgraded as part of the upgrade for the selected CDB.

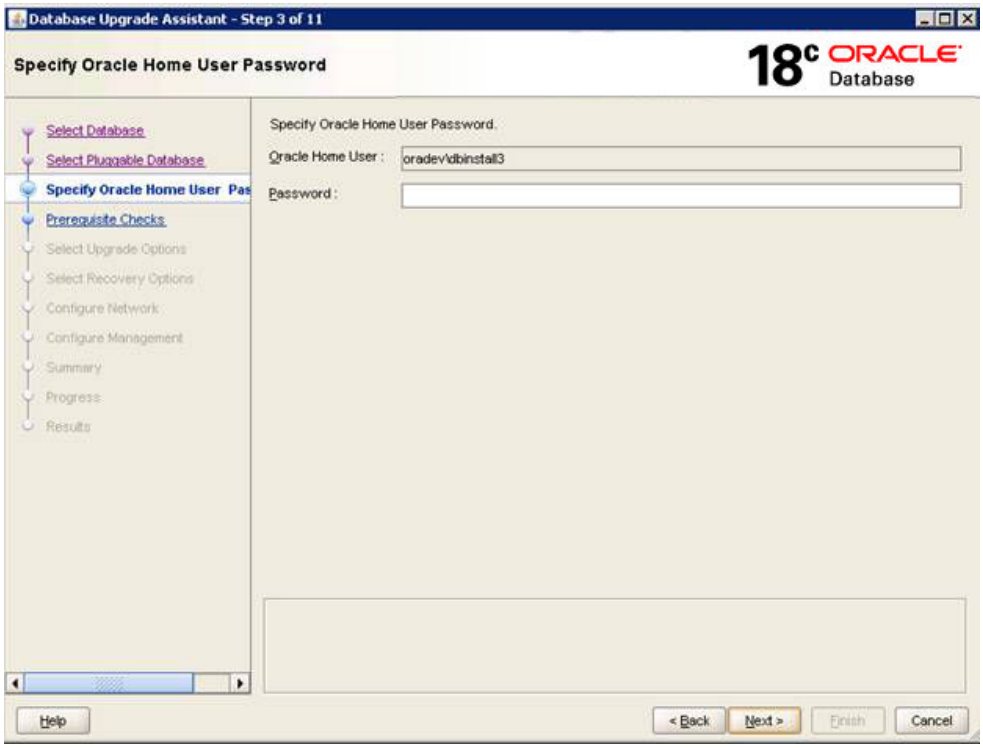


Starting in release 12.2, you can select the upgrade priority for PDBs. Click in the priority column for each PDB, and enter a numeric value for upgrade priority, where 1 is upgraded first, 2 is upgraded second, and so on.

By default, CDB$ROOT, PDB$SEED, and all PDBs that are plugged into the CDB are upgraded. If you do not want some PDBs to be upgraded now, then unplug those PDBs.

When you have completed selecting PDBs and upgrade priorities, click **Next**.

4. Windows platforms only: If the upgrade target home is a secure home that is associated with an Oracle home user, then the Specify Oracle Home User Password window opens. For other platforms, proceed to the next step.



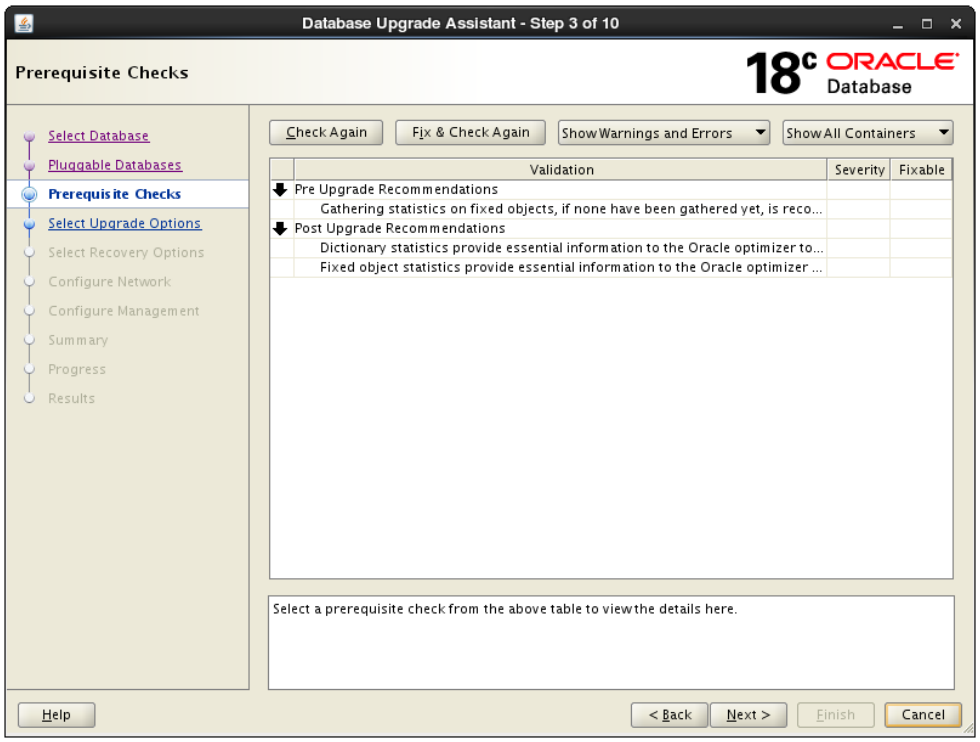
Provide the Oracle home user name, and provide the password for this user account, and click **Next**.

5. The Prerequisite Checks window opens. DBUA analyzes the databases, performing pre-upgrade checks and displaying warnings as necessary. The following is a list of examples of DBUA checks and actions DBUA performs on the database:

   - Empty database recycle bin.
   - Identify invalid objects.
   - Identify deprecated and desupported initialization parameters.
   - Identify time zone data file version.

   The analysis takes several minutes to complete.

   When DBUA finishes its analysis, the Prerequisite Checks window displays again, showing the results of the checks.



The Prerequisite Checks window shows that the checks DBUA has completed, and the severity of any errors discovered. When DBUA finds errors, it indicates which errors are fixable, and what action you can take to correct the error.

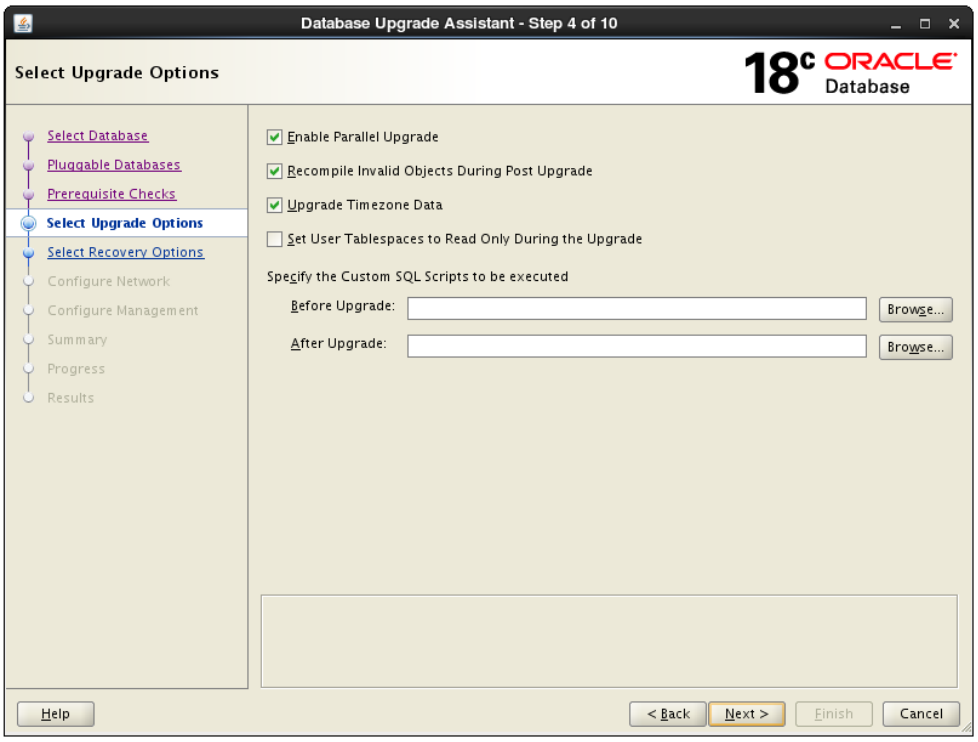
Select **Fix & Check Again** if any errors that DBUA can fix appear.

If DBUA detects errors that it cannot correct, then fix the cause of the error manually, and select **Check Again**.

If DBUA finds no errors or warnings, then the DBUA automatically bypasses this window and proceeds to the next window.

When you have fixed detected errors, click **Next**.

6. The Select Upgrade Options window displays.



This window provides the following options:

Enable Parallel Upgrade.

Select this option if you want to enable parallelism during the upgrade process. Running upgrade processes in parallel reduces the time required to perform the upgrade, based on the number of CPUs available to handle the running of scripts and processes simultaneously.

Recompile Invalid Objects During Post Upgrade.

This option recompiles all invalid PL/SQL modules after the upgrade is complete. If you do not have DBUA recompile invalid objects in its post-upgrade phase, then you must manually recompile invalid objects after the database is upgraded.

Upgrade Time Zone Data.

This option updates the time zone data file for this release. If you do not select this option, then you must update the time zone configuration file manually after the upgrade.

Specify custom SQL scripts to be executed.

If you want to run custom SQL scripts as part of your upgrade, then select this box. As needed, click **Browse** for the **Before Upgrade** or **After Upgrade** input fields. Navigate to the location where your custom SQL scripts are located.

When you have made your selections, click **Next**.

7. The Select Recovery Options window appears. To recover the database if a failure occurs during upgrade, select from one of the following options:

   - **Use Flashback and Guaranteed Restore Point**.

You can create a new Guaranteed Restore Point, or use an existing one. If you use an existing restore point, then click the selection field to select the restore point that you want to use.

> **Note:**
>
> If the database that you are upgrading has Oracle Data Guard physical standbys, then you must first create a guaranteed restore point on each standby before you create one on the Primary database. If you do not create restore points on each standby first, then you must recreate all standby databases again after using the guaranteed restore point to downgrade the primary database. After the upgrade is successful, you must manually drop all guaranteed restore points on the standbys.

- **Use RMAN Backup**

  You can create a new offline RMAN backup, or use an existing backup. Click **Browse** to specify a path for the backup.

- **Use Latest Available RMAN Backup**

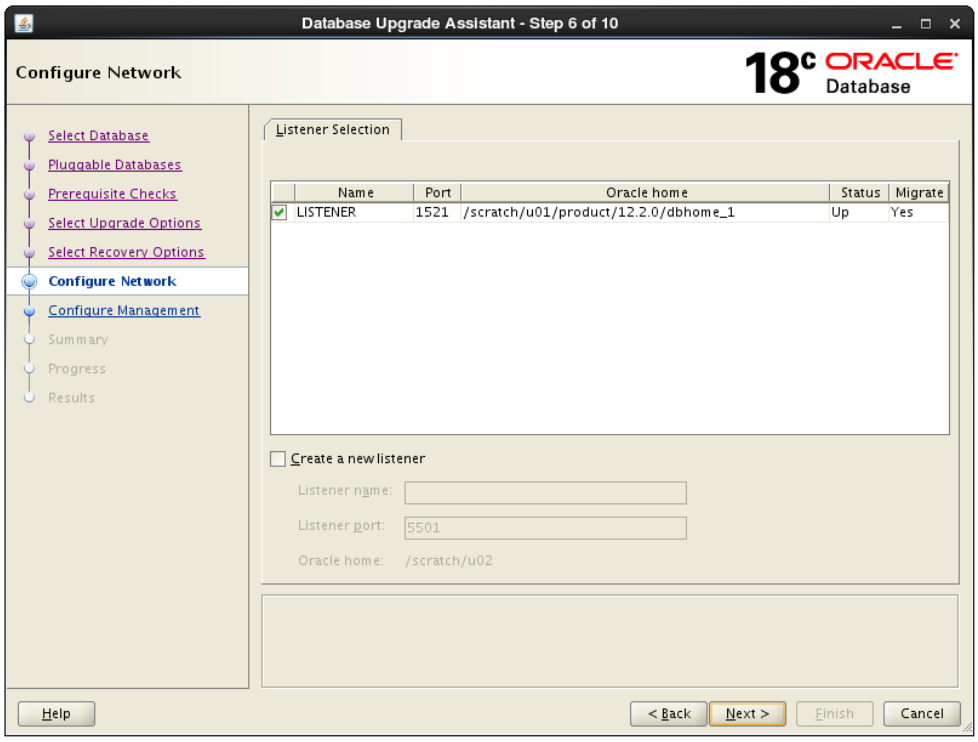
  You can use an existing backup. Click **View/Edit Restore Script** to select the backup that you want to use.

- **I have my own backup and restore strategy**.

  Select this option only if you have a third-party backup solution in place for your existing database.

When you have made your selections, click **Next**.

8. For single-instance database installations, the Configure Network window opens. Select one or more listeners from the source Oracle home that you want to migrate to the new upgraded Oracle home, or create a new listener during installation.



The Listener Selection area of the Network Configuration window shows a table with the following columns:

- Select column. Select the listeners that you want to update.
- **Name**. This column shows listener names.
- **Port**. This column shows the ports on which listeners are configured.
- **Oracle Home**. This column shows the Oracle home where listeners are configured.
- **Status**. This column shows the listener status (up or down).
- **Migrate**. Select this column, and choose `Yes` to migrate, or `No` if you do not want to migrate.

You can also select to create a new listener. If you create a new listener, then provide the listener name, the Oracle home where you want it placed, and the port that you want to configure the listener to monitor.

After you make your choices, DBUA completes the following steps for any listeners that you migrate:

a. DBUA adds the selected listener to the `listener.ora` file of the target Oracle home, and starts it.

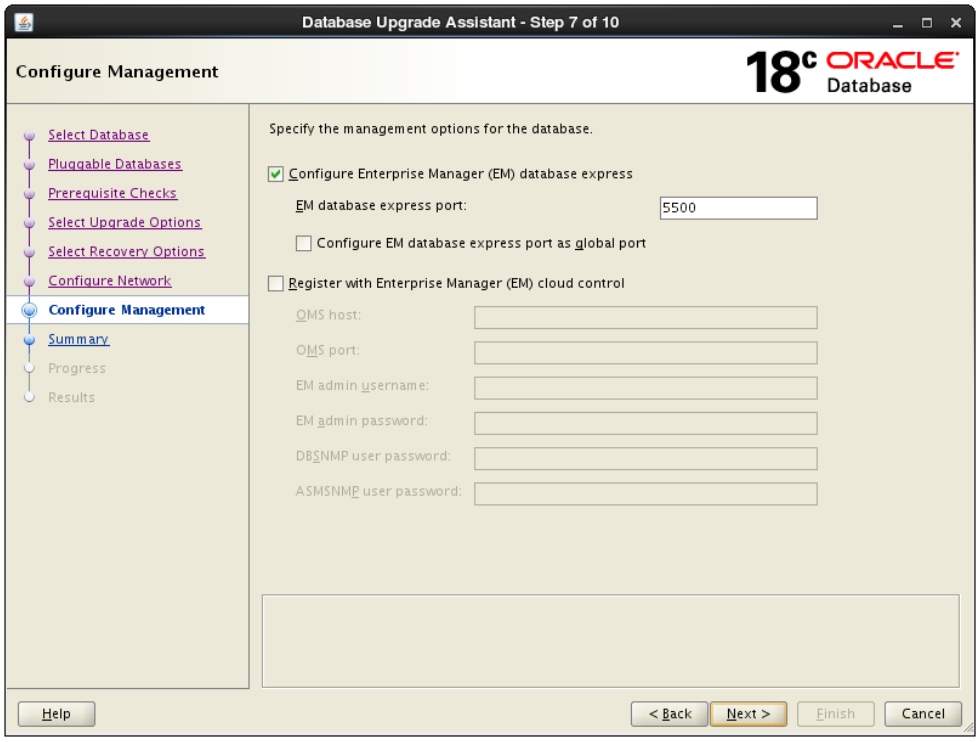
b. DBUA removes the entry of the upgraded database from the old (source) `listener.ora` file.

c. DBUA reloads the `listener.ora` file in both the source and target Oracle Database environments.

> **Note:**
>
> If there are other databases registered with the same listener, then their new client connection requests can be affected during listener migration.

Click **Next** when you have completed your choices.

9. The Configure Management window appears. In the Configure Management window, select the management options:



- **Configure Enterprise Manager (EM) database express**

  Oracle Enterprise Manager Database Express is a web-based database management application that is built into Oracle Database 12*c*. EM Express replaces the DB Control component that was available in releases 10*g* and 11*g*. Enter the EM Database Express Port number. For example: 5500. You can also select the checkbox to configure the express port as the global port.

- **Register with Enterprise Manager (EM) Cloud Control**

  Registering with Oracle Enterprise Manager Cloud Control adds the database and its related entities, such as Listener, Oracle ASM disk groups, and Oracle Clusterware, as targets that you can manage with EM Cloud Control.

  If you select this option, then you must provide information in the following fields:

  – OMS Host

  – OMS Port

  - EM Admin Username
  - EM Admin Password
  - DBSNMP User Password
  - ASMSNMP User Password

When you have completed entering information, click **Next**.

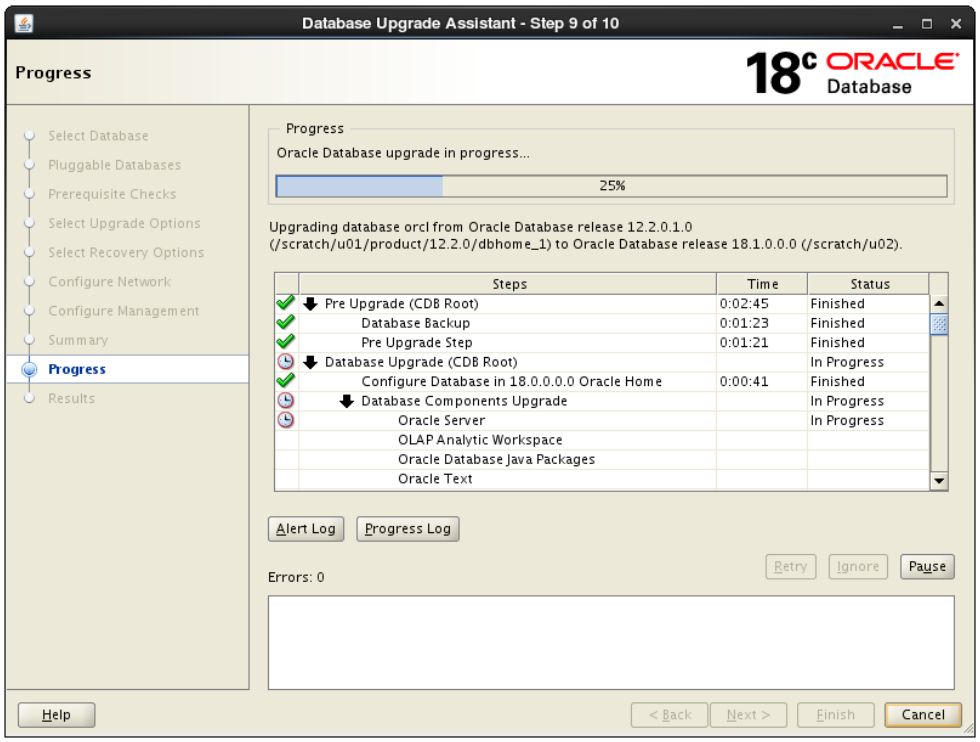
10. The Summary window opens. The Summary window shows the information that you have provided for the upgrade. Scroll down the list to review the information. The summary includes information such as the following:

    - Source Database
    - Target Database
    - Pluggable Databases
    - Pre-Upgrade Checks
    - Initialization Parameters changes
    - Timezone Upgrade

    To ensure that the selections are the ones you want, check your selections. Then either select a link to the item that you want to change, or click **Back** to go to earlier pages, or select **Finish**:

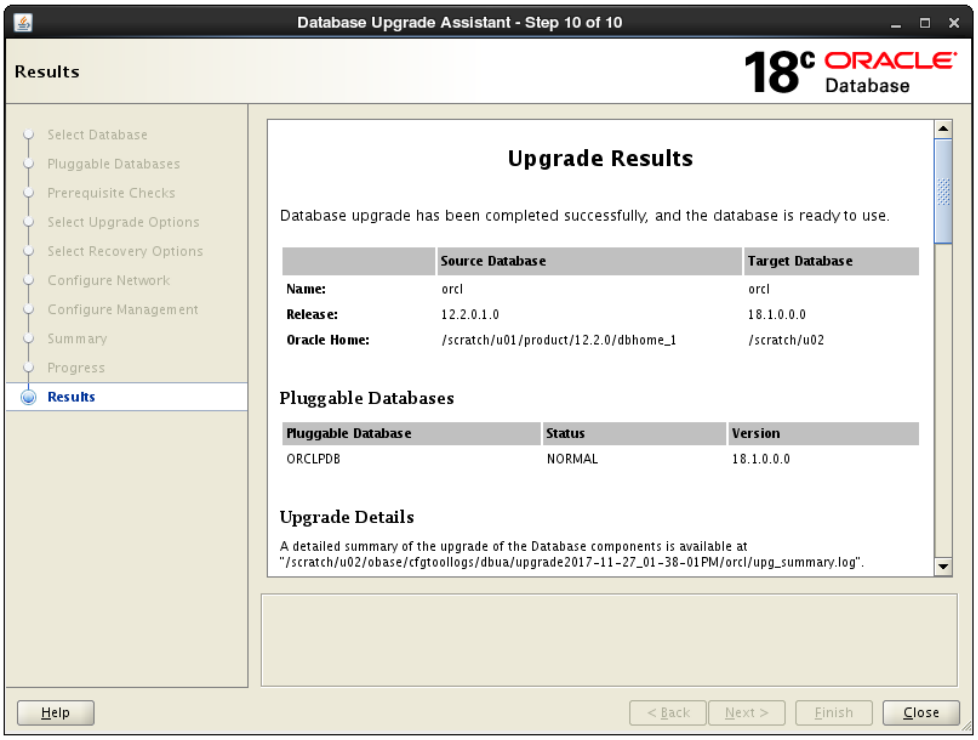
    - If you see information in the Summary window that you want to correct, then click a link on an item that you want to update, or click **Back** to navigate backward through the DBUA configuration interview.
    - Click **Finish** if the information that you see in the Summary window is correct. The upgrade begins after you select **Finish**.

    The Progress window displays with the progress bar, as DBUA begins the upgrade. The Progress window displays a table that shows the steps DBUA is completing during the upgrade. This table shows the time duration, and the upgrade steps status as the upgrade proceeds. DBUA provides a **Stop** button in case you must cancel the upgrade at this point.



When the upgrade has progressed through finishing the upgrade of the CDB root and each PDB seed, the Progress window marks the status as **Finished**.

11. After the upgrade is complete, the Results window opens. The Results window displays information about the original database, and about the upgraded database. The Upgrade Results report and it also shows changes that DBUA made to the initialization parameters. If you are upgrading a multitenant architecture database, then the Results window also shows pluggable databases, and the directory where log files are stored after the upgrade. Scroll down to see more details about preupgrade checks. If the upgrade is successful, then the Upgrade Results field reports the results, and you do not see warning messages. If the upgrade was unsuccessful, as this example image shows, then the **Restore Database** button is displayed on the lower right corner below the display field. You can click this button to start a database restoration.



12. Optional: Examine the log files to obtain more details about the upgrade process. If the Oracle base environment variable is set, then the DBUA log files are located in the path `/ORACLE_BASE/cfgtoollogs/dbua/upgradesession_timestamp/SID`. If Oracle base is not set, then the DBUA log files are located in the path `/ORACLE_HOME/cfgtoollogs/dbua/upgradesession_timestamp/SID`

> **Note:**
>
> An HTML version of the Upgrade Results window is also saved in the log files directory. You can click the links in this HTML window to view the log windows in your browser.

If you are satisfied with the upgrade results, then click **Close** to quit DBUA.

13. After your upgrade is completed, carry out post-upgrade procedures described in this book. When you have completed post-upgrade procedures, your upgraded database is ready to use.

> **Caution:**
>
> To prevent unauthorized use of the database, Oracle recommends that you change all user passwords immediately after you upgrade your database.
>
> If the default security settings for Oracle Database 12*c* are in place, then passwords must be at least eight characters. Passwords such as `welcome` and `oracle` are not allowed.

Moving a Database from an Existing Oracle Home

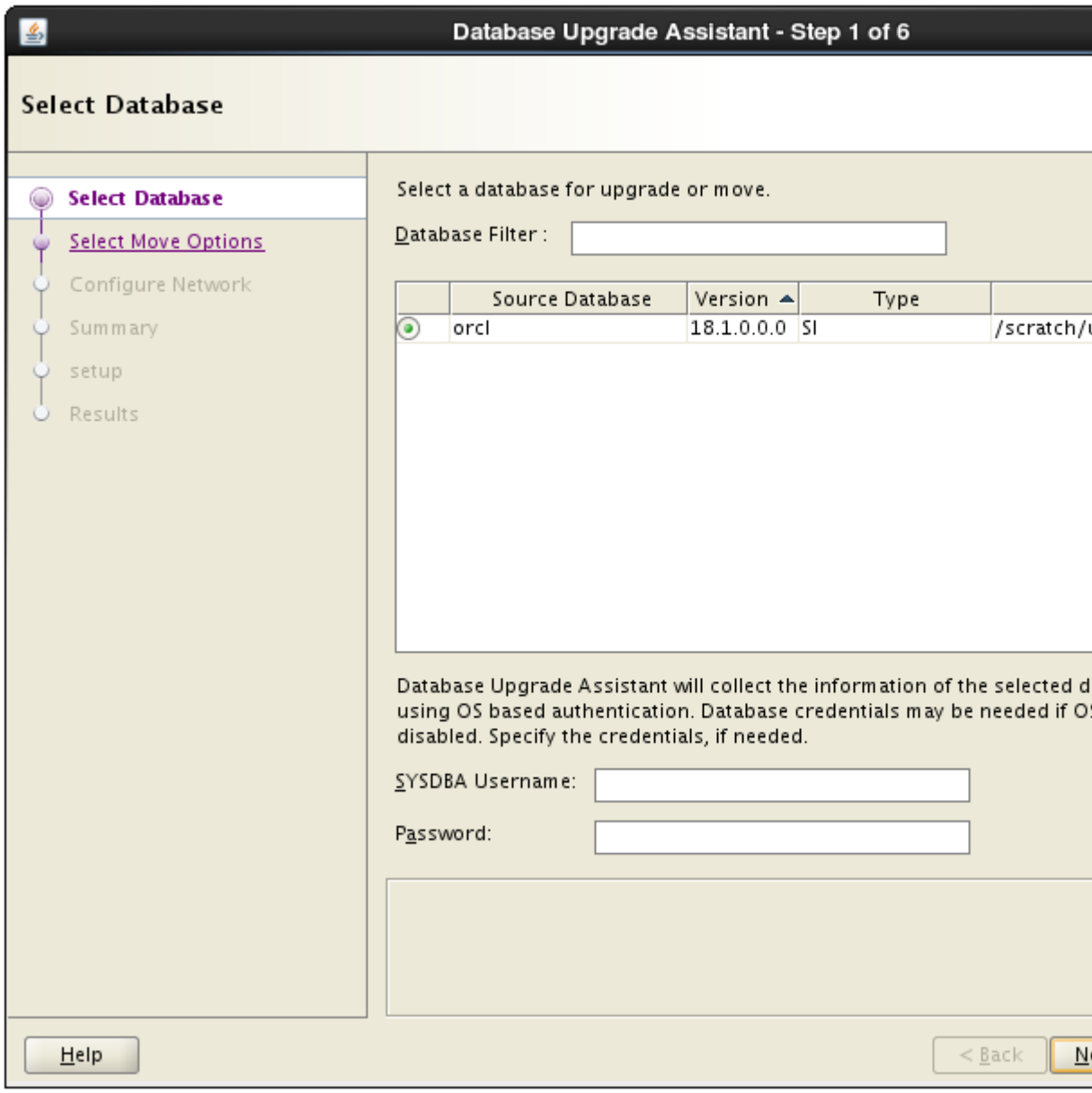
Use this procedure to migrate Oracle Database 18c databases to another Oracle Database 18c home.

You can use Database Upgrade Assistant (DBUA) to migrate Oracle Database databases from an existing Oracle home to another Oracle home.

1. Start DBUA.

   DBUA opens the Select Database window.

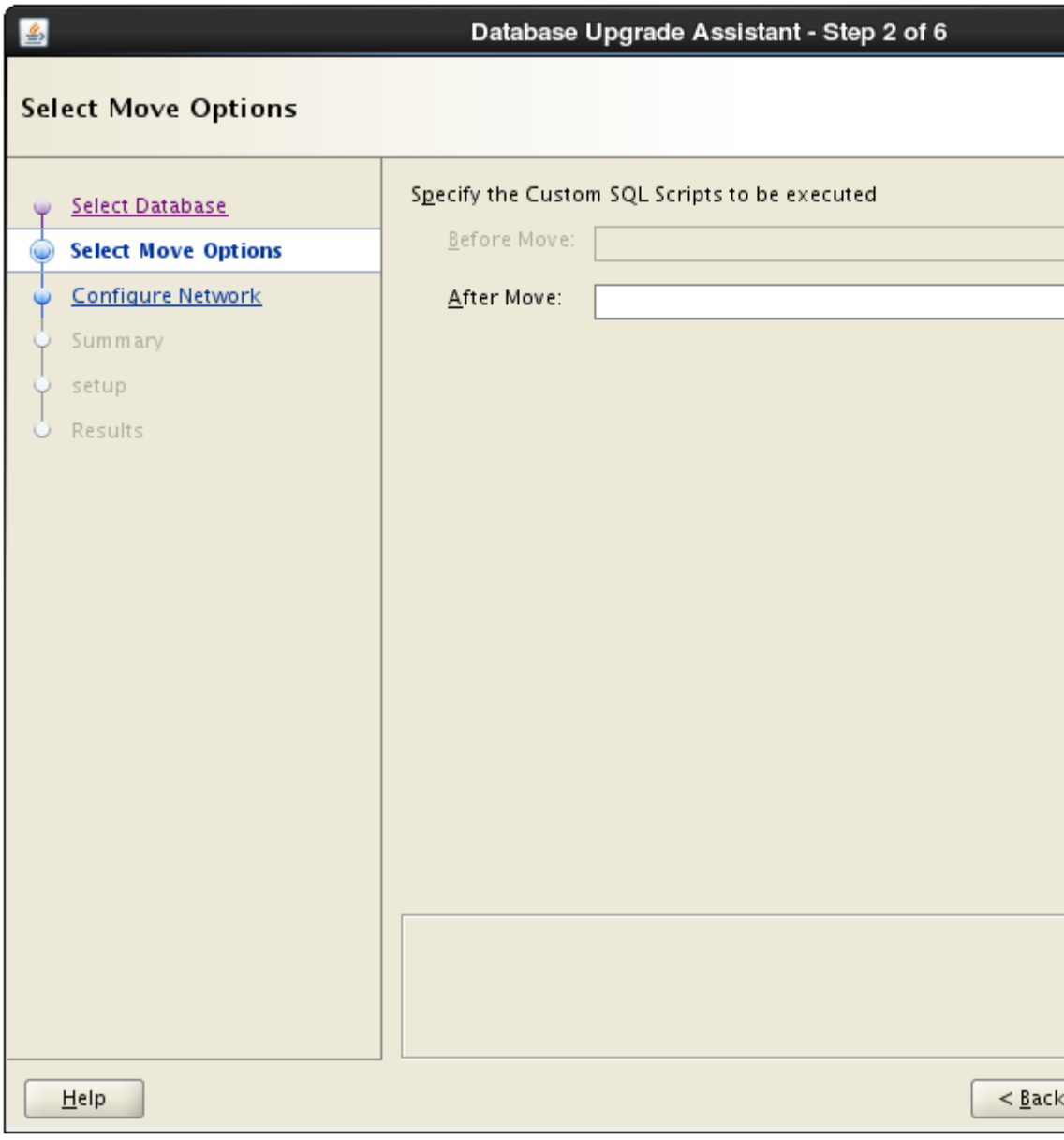
   All databases on the server are listed. DBUA indicates the type of operation that you can perform for each database (upgrade, move, in place), depending on the database release and location.



Select a database that you want to move to the new Oracle home. If you have not enabled operating system authentication for the database, then provide the SYSDBA user name and password for the database that you select.

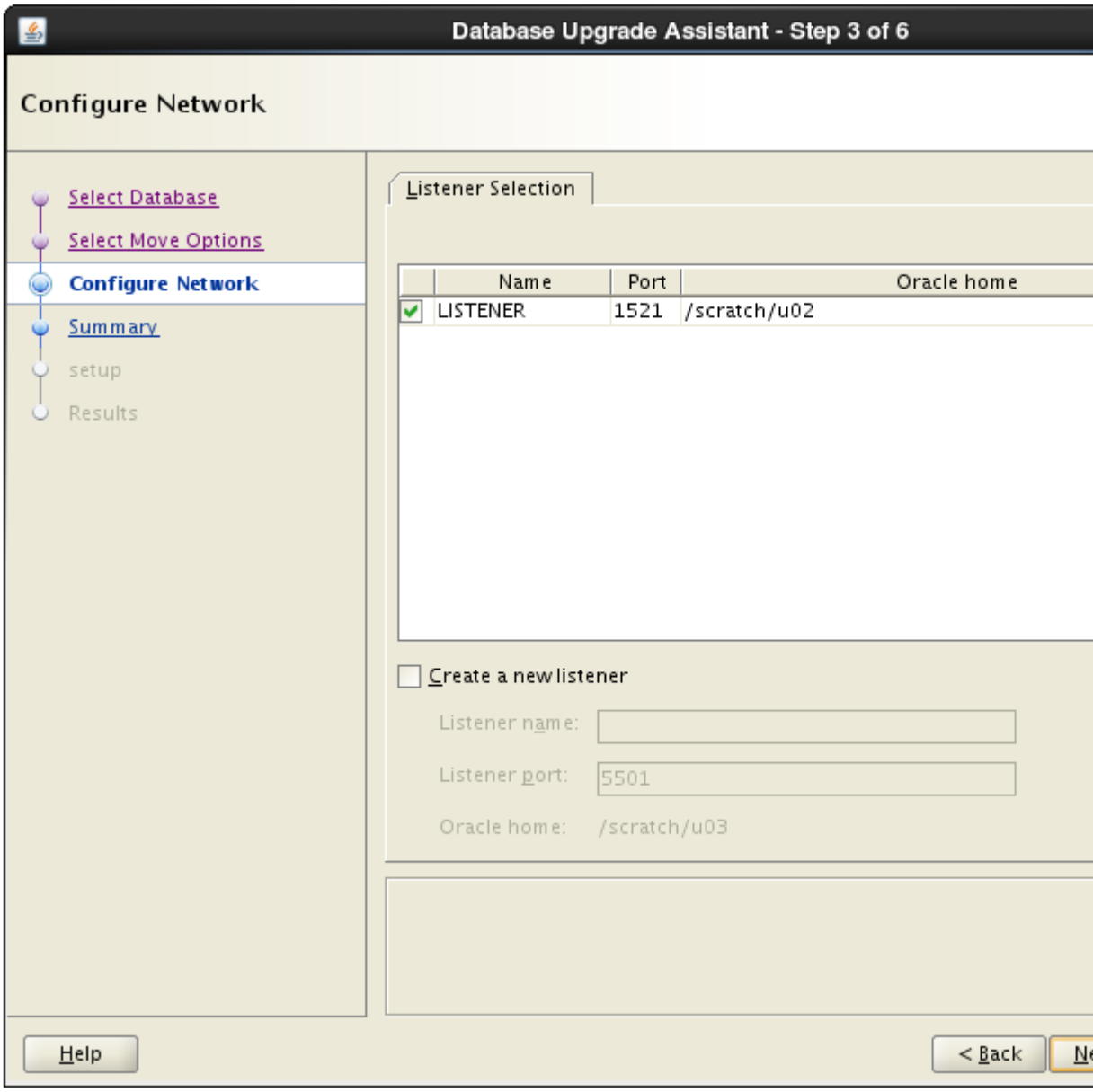
Click **Next**. The Move Database Options window appears.

2. In the Select Move Options window, you can specify custom SQL scripts that you want to run after moving the database, and identify where the files are located.



Click **Next**. The Configure Network window appears.

3. On single-instance systems, you can either select an existing listener, or create a new listener. If you create a new listener, then you must provide a listener name, and a port number for the listener.



Click **Next**. The Database Move Summary window appears.

4. Review the summary for the move operation and click **Next**. The Progress window appears, which shows DBUA processes as it moves the database.
5. When the move operation completes, click **Finish**.

Using DBUA in Silent Mode to Upgrade Oracle Database

You can DBUA with the `-silent` command line option to carry out noninteractive ("silent") upgrades using DBUA.

. In silent mode, DBUA does not present a user interface. DBUA writes messages (including information, errors, and warnings) to a log file in *`ORACLE_HOME`*`/cfgtools/dbua/upgrade`*`session_timestamp`*, where *`session_timestamp`* represents the timestamp for the

upgrade that DBUA has run. Oracle strongly recommends that you read the resulting DBUA log files to ensure a successful upgrade.

- Running DBUA in Silent Mode
  Use this procedure to start DBUA in noninteractive (or “silent”) mode.
- DBUA Command-Line Syntax for Silent Mode
  Use this syntax to run Database Upgrade Assistant (DBUA) by using the `-silent` option.

Running DBUA in Silent Mode

Use this procedure to start DBUA in noninteractive (or “silent”) mode.

1. To start DBUA in silent mode, enter the `dbua -silent -sid` command. The command starts DBUA in silent mode, and identifies the database that you want to upgrade.

   For example, enter the following command, where the database name is ORCL:

   ```
   dbua -silent -sid ORCL &
   ```

DBUA Command-Line Syntax for Silent Mode

Use this syntax to run Database Upgrade Assistant (DBUA) by using the `-silent` option.

Purpose

When you run DBUA by using the command-line option, you can specify all valid DBUA options in a script form. The script form enables you to avoid entering configuration information in a graphic user interface dialog.

File Path

$ORACLE_HOME/directory_name

Syntax

```
dbua [ -silent ] [ -sid SID ] [-oracleHome Oraclehome_path_and_name] [-oracleBase
Oraclebase_path_and_name]
[-asmsnmpPassword - password]
[-auditFileDest - Database_Audit_File_path]
[-backupLocation - backup_directory_filepath]
[-changeUserTablespacesReadOnly - [true | false]]
[-createGRP - true | false]
[-createListener - true | false] [- listener_name:listener_port]]
[-dbName - database_name]
[-dbsnmpPassword - password]
[-diagnosticDest - database_diagnostic_path]
[-disableArchiveLogMode - true | false]
[-disableUpgradeScriptLogging - true | false]
][-emConfiguration - [DBEXPRESS | CENTRAL | BOTH | NONE]
[-emExpressPort - port]
[-emPassword - password]
[-emUser - Enterprise_Manager_Admin_User]
[-enablePasswordProfile - true | false]
[-gatheringStatistics - true | false]
[-ignorePreReqs - true | false]
```

```
[-ignoreScriptErrors - true | false]
[-initParam - initname=value,initname=value,initname=value, . . .]
[-initParamsEscapeChar - character]
[-keepDeprecatedParams - true | false]
[-keepHiddenParams - true | false]
[-listeners -
listenerName:Oracle_home,listenerName:Oracle_home,listenerName:Oracle_home,. . .]
[-localRacSid - localSID]
[-logDir - custom_log_path]
[-newGlobalDbName - GlobalDBname](Oracle Express Edition upgrades only)
[-newSid - sid] (Oracle Express Edition upgrades only)
[-omsHost - Enterprise_Management_Server_Hostname]
[-omsPort - Enterprise_Management_Server_port]
[-oracleHome - Oracle_DB_Oracle_home]
[-oracleHomeUserPassword - Oracle_home_installation_owner_password]
[-pdbs - pdb-A,pdb-B,pdb-C, . . .| ALL | NONE]
-pdbsWithPriority - pdb-A:1,pdb-B:2,pdb-C:3, . . . ]
[-performFixUp - true | false]
[-postUpgradeScripts - filepath/script1,filepath/script2, . . .]
[-preUpgradeScripts - filepath/script1,filepath/script2, . . .]
[-recompile_invalid_objects - true | false]
[-sid - SID]
[-sysDBAPassword - SYSDBA_UserName_password]
[-sysDBAUserName - SYSDBA_UserName_password]
[-upgrade_parallelism - cpu_number_for_parallel_upgrade]
[-upgradeTimezone - true | false]
[-useExistingBackup - true | false]
[-useGRP - true | false]
```

Options

The following table lists DBUA command-line options:

Table 3-2 DBUA Command-Line Syntax for Silent Mode

Command Option	Description
`-asmsnmpPassword`	Specifies the password for the ASMSNMP user.
`-auditFileDest`	Specifies the Oracle Database Audit File Destination.
`-backupLocation`	(Optional) Specifies the directory where you want your database backed up before starting the upgrade.
`-changeUserTablespacesReadOnly`	Options `true` | `false`. When `true`, changes the user tablespaces to read-only during the upgrade.
`-createGRP`	When `true`, specifies that DBUA creates a guaranteed restore point (GRP) when the database is in archive log and flashback mode.
`-createListener`	Options `true` | `false`. When `true`, specifies to create a listener in the new Oracle home release. Provide the listener name and port in the format *`listener_name`*`:`*`listener_port`*

Table 3-2 (Cont.) DBUA Command-Line Syntax for Silent Mode

Command Option	Description
`-dbName`	Specifies the database name that you want to upgrade.
`-dbsnmpPassword`	Specifies the DBSNMP user password
`-diagnosticDest`	Specifies the Oracle Database Diagnostic Destination
`-disableArchiveLogMode`	Options `true` | `false`. When `true`, turns off Archiving and Flashback Logging during the upgrade.
`-disableParallelUpgrade`	Disables the parallel execution of database upgrades
`-disableUpgradeScriptLogging`	Options `true` | `false`. By default, this option is `true`. When set to `false`, disables the detailed log generation for running SQL scripts during the upgrade process.
`-emConfiguration`	Options `DBEXPRESS` | `CENTRAL` | `BOTH` | `NONE`. Specify the type of Oracle Enterprise Manager deployment that you want to implement with the upgrade.
`-emExpressPort`	Specifies the Enterprise Manager Express port. Set only if you use the `-emConfiguration` option with `dbua -silent`.
`-emPassword`	Specifies the Enterprise Manager Administrator user password. Set only if you use the `-emConfiguration` option with `dbua -silent`.
`-emUser`	Specifies the Enterprise Manager user with Administrator privileges to add or modify targets. Set only if you use the `-emConfiguration` option with `dbua -silent`.
`-enablePasswordProfile`	When `true`, enables the password profile for administrative users as part of the database upgrade.
`-executePreReqs -sid` *`name`*`|-dbName` *`name`*	Runs only the preupgrade checks for the specified database.
`-gatheringStatistics`	Options `true` | `false`. When `true`, DBUA gathers database statistics before upgrading the database. (default should be `true`.).
`-help`	Displays command syntax and explanation for its use.
`-ignorePreReqs`	Options `true` | `false`. When `true`, DBUA ignores error conditions in pre-upgrade checks.
`-ignoreScriptErrors`	Options `true` | `false`. When `true`, DBUA ignores `ORA-` errors when you run custom scripts.

Table 3-2 (Cont.) DBUA Command-Line Syntax for Silent Mode

Command Option	Description
`-initParam`	Specifies a comma-delimited list of initialization parameter values, using the format *`name=value,name=value`*
`-initParamsEscapeChar`	Specifies an escape character for commas when an initialization parameter has multiple values. If you do not specify an escape character, then the default escape character is a backslash [/].
`-keepDeprecatedParams`	Options `true` | `false`. When `true`, DBUA retains deprecated parameters during database upgrade.
`-keepHiddenParams`	Options `true` | `false`. When `true`, DBUA retains hidden parameters during database upgrade.

`-listeners`	Migrates and registers specified existing earlier-release listeners with the upgraded database. Specify listeners using one of the following options:listener names, o a comma-delimited list in the format *listenerName*:*Oraclehome*.
	• A comma-delimited list of listener names, in the following format:
	`-lisnrName1,LsnrName2, LsnrName3`
	• A comma-delimited list of listener names qualified by Oracle homes, in the following format:
	`-listeners lsnrName1:Oracle_home_path, -listeners lsnrName2:Oracle_home_path`
	When you select this option, DBUA searches for the specified listeners in the following order: In the Oracle Grid Infrastructure home (Grid home), in the target home, and then in the source home.

`-localListenerWithoutAlias`	Sets LOCAL_LISTENER without using the TNS alias.
`-localRacSid`	If the Oracle RAC database is not registered in the cluster Oracle Cluster Registry (OCR), then this option specifies the local System Identifier (SID) of an Oracle Real Application Clusters (Oracle RAC) database.
`-logDir`	Specifies the path to a custom log directory.
`-newGlobalDbName`	Specifies a new Global Database Name. You can use this option only with Oracle Express Edition upgrades.
`-newSid`	Specifies a new System Identifier (SID). You can use this option only with Oracle Express Edition upgrades.

Table 3-2 (Cont.) DBUA Command-Line Syntax for Silent Mode

Command Option	Description
`-omsHost`	Specifies the Oracle Enterprise Manager management server host name.
`-omsPort`	Specifies the Oracle Enterprise Manager management server port number.
`-oracleHome -sid` *id* `|` `dbName` *name*	Specifies the Oracle home path of the database..Identify the database either by using the `-sid` flag, and providing a system identifier, or by using the `-dbName` flag, and specifying a database name.
`-oracleHomeUserPassword`	Specifies the password for the Oracle installation owner for the Oracle Database that you are upgrading.
`-pdbs`	Specifies which PDBs are upgraded. Specify your choice with the following options: • A comma-delimited list of the names of pluggable databases (PDBs) that you want DBUA to upgrade with the CDB. • `ALL`, which designates that you want all the PDBs upgraded with the CDB. • `NONE`, which designates that you want only the CDB upgraded. None of the PDBs are upgraded.
`-pdbsWithPriority`	Specifies the priority order in which you want DBUA to upgrade PDBs. Specify the priority order with a comma-delimited list of pluggable database (PDB) names in the following format, where 1 is the top priority: `pdb-A:1,pdb-B:2,pdb-C:3`. In this example, PDB-A is upgraded first, and pdb-C is upgraded last.
`-performFixUp`	Options `true` | `false`. When `true`, DBUA is enabled to perform fixups during silent upgrade mode.
`-postUpgradeScripts`	Specifies SQL scripts that you want to run after DBUA completes the upgrade. Provide a comma-delimited list of scripts with their complete file paths.
`preUpgradeScripts`	Specifies SQL scripts that you want to run before DBUA completes the upgrade. Provide a comma-delimited list of SQL scripts with their complete filepaths.
`-recompile_invalid_objects`	Options `true` | `false`. When `true`, DBUA recompiles invalid objects as part of the upgrade.
`-sid`	Specifies the system identifier (SID) of the database that you want to upgrade.
`-sysDBAPassword`	Specifies the password for the user name you designate as the SYSDBA privileges user with `sysDBAUserName`.

Table 3-2 (Cont.) DBUA Command-Line Syntax for Silent Mode

Command Option	Description
`-sysDBAUserName`	Specifies a user name that is granted the SYSDBA system privilege for the database.
`-upgrade_parallelism`	Specifies the number of CPUs that you want DBUA to use for parallel upgrading.
`-upgradeTimezone`	Options `true` | `false`. When `true`, DBUA upgrades the Oracle Database time zone files.
`-useExistingBackup`	When `true`, specifies that DBUA uses an existing RMAN backup to restore the database.
`-useGRP`	Options `true` | `false`. When `true`, specifies that DBUA uses a named guaranteed restore point to restore the database.

Examples

Example 3-3 Selecting a Database for Upgrade with DBUA

The following command selects the database `orcl` for upgrade:

```
dbua -sid orcl
```

> **Note:**
>
> You can use DBUA commands to set passwords. If the default Oracle Database security settings are in place, then passwords must be at least eight characters, and passwords such as `welcome` and `oracle` are not allowed.

Example 3-4 Selecting a Database for Upgrade with DBUA Using Noninteractive ("Silent") Option

The following command selects the database `orcl` for upgrade using the noninteractive ("silent") option:

```
dbua -silent -sid orcl
```

Example 3-5 Use Cases for Running DBUA in Noninteractive (”Silent") Mode

The examples that follow illustrate how you can use DBUA with the noninteractive (”silent") option to carry out a variety of upgrade scenarios.

```
dbua -silent -sid sidb112 -backupLocation /u01/sidb1123/backup -sysDBAUserName sys -
sysDBAPassword r3aDy2upg -oracleHome /u01/app/product/11.2.0/dbhome_1 -
upgradeTimezone true dbua -silent -sid sidb1123 -backupLocation /u01/sidb1123/backup
-sysDBAUserName sys -sysDBAPassword r3aDy2upg -oracleHome /u01/app/product/11.2.0/
dbhome_1 -upgrade_parallelism 1 -upgradeTimezone true

dbua -silent -sid db1124 -backupLocation /u01/sidb1123/backup -sysDBAUserName sys -
sysDBAPassword r3aDy2upg -performFixUp true -upgradeTimezone true
```

```
dbua -silent -dbName rdbcdb -oracleHome /u01/app/product/11.2.0/dbhome_1 -
sysDBAUserName sys -sysDBAPassword r3aDy2upg -backupLocation /u01/sidb1123/backup -
recompile_invalid_objects true -upgradeTimezone true

dbua -silent -dbName amdb -oracleHome /u01/app/product/11.2.0/dbhome_1 -
sysDBAUserName sys -sysDBAPassword r3aDy2upg -recompile_invalid_objects true -useGRP
GRP_20170620bfupgrade -upgradeTimezone true

dbua -silent -dbName rdb121 -oracleHome /u01/app/product/12.1.0/dbhome_2 -
sysDBAUserName sys -sysDBAPassword r3aDy2upg -backupLocation /u01/sidb1123/backup -
recompile_invalid_objects true -upgradeTimezone true

dbua -silent -dbName ronedb -oracleHome /u01/app/product/12.1.0/dbhome_2 -
sysDBAUserName sys -sysDBAPassword r3aDy2upg -changeUserTablespacesReadOnly true -
recompile_invalid_objects true -upgradeTimezone true -createGRP true
```

Note:

Refer to *Oracle Database Security Guide* for information about security best practices.

Related Topics

- *Oracle Database Security Guide*

Upgrade Scenarios for Non-CDB Oracle Databases

Review these topics to understand the upgrade scenarios and procedures for non-CDB Oracle Databases

Note:

Starting with Oracle Database 12*c*, release 1 (12.1), non-CDB architecture is deprecated. It can be desupported in a future release. Oracle Database deployed with the multitenant architecture is the default configuration option. All Oracle Database releases earlier than Oracle Database 12*c* release 1 (12.1.0.1) use non-CDB architecture.

Caution:

You cannot downgrade a database after you have set the compatible initialization parameter to 12.1.0.2. Only if the compatibility is set to 12.1.0.1 will a downgrade be possible for a pluggable database (PDB), and there may still be restrictions on downgrading.

Before starting an upgrade or a downgrade, Oracle strongly recommends that you upgrade your source and target databases to the most recent quarterly release update (RU), release update revision (RUR), bundle patch or patch set update (BP or PSU).

- About Upgrading Non-CDB Oracle Databases
  You can upgrade non-CDB Oracle Databases using either Oracle Database Upgrade Assistant (DBUA), or using a manual upgrade procedure.
- Manually Upgrading Non-CDB Architecture Oracle Databases
  This procedure provides steps for upgrading non-CDB architecture Oracle Databases.
- Upgrading a Non-CDB Oracle Database To a PDB on a CDB
  Use this procedure to upgrade an earlier release non-CDB architecture Oracle Database, making it a Pluggable Database (PDB) and plugging the PDB into a container database (CDB).
- Upgrading a Non-CDB Oracle Database Using Rapid Home Provisioning
  In Oracle Database 12*c* release 2 (12.2) and later releases, you can use Rapid Home Provisioning (RHP) to upgrade an earlier release Non-CDB Oracle Database.
- Variables for Using ORADIM When Upgrading Oracle Database on Windows
  Review these variables if you want to use the ORADIM utility for upgrading Oracle Database on Windows systems.

About Upgrading Non-CDB Oracle Databases

You can upgrade non-CDB Oracle Databases using either Oracle Database Upgrade Assistant (DBUA), or using a manual upgrade procedure.

A non-CDB architecture Oracle Database cannot use the multitenant architecture, and does not contain pluggable databases (PDBs). You can upgrade the database either by using Oracle Database Upgrade Assistant (DBUA), or by performing a manual upgrade.

Related Topics

- Upgrading with Oracle Database Upgrade Assistant (DBUA)
- Manually Upgrading Non-CDB Architecture Oracle Databases
- Downgrading Oracle Database to an Earlier Release

Manually Upgrading Non-CDB Architecture Oracle Databases

This procedure provides steps for upgrading non-CDB architecture Oracle Databases.

> **Note:**
>
> Starting with Oracle Database 12*c*, release 1 (12.1), non-CDB architecture is deprecated. It can be desupported in a future release.

Before using this procedure, complete the following steps:

- Install the software for Oracle Database 12*c* or later
- Prepare the new Oracle home
- Run the Pre-Upgrade Information Tool

1. If you have not done so, run the Pre-Upgrade Information Tool. Review the Pre-Upgrade Information tool output and correct all issues noted in the output before proceeding.
2. Ensure that you have a proper backup strategy in place.
3. If you have not done so, prepare the new Oracle home.
4. (Conditional) For Oracle RAC environments only, enter the following commands to set the initialization parameter value for CLUSTER_DATABASE to FALSE:

   ```
   ALTER SYSTEM SET CLUSTER_DATABASE=FALSE SCOPE=SPFILE;
   ```

5. Shut down the database. For example:

   ```
   SQL> SHUTDOWN IMMEDIATE
   ```

6. If your operating system is Windows, then complete the following steps:
   a. Stop the `OracleService`*`SID`* Oracle service of the database you are upgrading, where *`SID`* is the instance name. For example, if your *`SID`* is `ORCL`, then enter the following at a command prompt:

      ```
      C:\> NET STOP OracleServiceORCL
      ```

   b. Delete the Oracle service at a command prompt using `ORADIM`. Refer to your platform guide for a complete list of the `ORADIM` syntax and commands.

      For example, if your *`SID`* is `ORCL`, then enter the following command.

      ```
      C:\> ORADIM -DELETE -SID ORCL
      ```

   c. Create the service for the new release Oracle Database at a command prompt using the `ORADIM` command of the new Oracle Database release.

      For example:

      ```
      C:\> ORADIM -NEW -SID SID -SYSPWD PASSWORD -MAXUSERS USERS
           -STARTMODE AUTO -PFILE ORACLE_HOME\DATABASE\INITSID.ORA
      ```

      Most Oracle Database services log on to the system using the privileges of the Oracle software installation owner. The service runs with the privileges of this user. The `ORADIM` command prompts you to provide the password to this user account. You can specify other options using `ORADIM`.

      In the following example, if your *`SID`* is `ORCL`, your *`password`* (`SYSPWD`) is `TWxy5791`, the maximum number of users (`MAXUSERS`) is 10, and the Oracle home path is `C:\ORACLE\PRODUCT\12.2.0\DB`, then enter the following command:

      ```
      C:\> ORADIM -NEW -SID ORCL -SYSPWD TWxy5791 -MAXUSERS 10
      -STARTMODE AUTO -PFILE C:\ORACLE\PRODUCT\12.2.0\DB\DATABASE\INITORCL.ORA
      ```

      `ORADIM` writes a log file to the `ORACLE_HOME\database` directory. The log file contains the name of the PDB in the multitenant container database.

      > **Note:**
      >
      > If you use an Oracle Home User account to own the Oracle home, then the ORADIM command prompts you for that user name and password.

7. If your operating system is Linux or UNIX, then perform the following checks:

a. Your `ORACLE_SID` is set correctly

b. The `oratab` file points to the new Oracle home

c. The following environment variables point to the new Oracle Database directories:

- `ORACLE_HOME`
- `PATH`

d. Any scripts that clients use to set the `$ORACLE_HOME` environment variable must point to the new Oracle home.

> **Note:**
>
> If you are upgrading an Oracle Real Application Clusters database, then perform these checks on all Oracle Grid Infrastructure nodes where the Oracle Real Application Clusters database has instances configured.

> **See Also:**
>
> Oracle Database and Oracle Grid Infrastructure installation guides for your platform to obtain operating system-specific information about setting environment variables:
>
> Oracle Database and Oracle Clusterware installation guides

8. Log in to the system as the Oracle installation owner for the new Oracle Database release.
9. Start SQL*Plus in the new Oracle home from the path *`Oracle_home`*`/rdbms/admin` directory.

   For example:

   ```
   $ cd $ORACLE_HOME/rdbms/admin
   $ pwd
   /u01/app/oracle/product/12.2.0/dbhome_1/rdbms/admin
   $ SQLPLUS
   ```

10. Copy the SPFILE.ORA or INIT.ORA file from the old Oracle home to the new Oracle home.
11. Connect to the database that you want to upgrade using an account with SYSDBA privileges:

    ```
    SQL> CONNECT / AS SYSDBA
    ```

12. Start the non-CDB Oracle Database in upgrade mode:

    ```
    SQL> startup upgrade
    ```

    If errors appear listing desupported initialization parameters, then make a note of the desupported initialization parameters and continue with the upgrade. Remove the desupported initialization parameters the next time you shut down the database.

> **Note:**
>
> Starting up the database in `UPGRADE` mode enables you to open a database based on an earlier Oracle Database release. It also restricts log-ins to `AS SYSDBA` sessions, disables system triggers, and performs additional operations that prepare the environment for the upgrade.

13. Exit SQL*Plus.

    For example:

    ```
    SQL> EXIT
    ```

14. Run the Parallel Upgrade Utility (`catctl.pl`) script, using the upgrade options that you require for your upgrade.

    With Oracle Database 12*c* release 2 (12.2) and later releases, you can run the Parallel Upgrade Utility as a command-line shell command by using the `dbupgrade` shell command. For example:

    ```
    $ ./dbupgrade -d /u01/app/oracle/12.1.0/dbhome_1
    ```

    > **Note:**
    >
    > - When you run the Parallel Upgrade Utility command, use the `-d` option to specify the directory that contains the files you want to process, and use the `-l` option to specify the directory you want to use for spool log files.

15. The upgraded database is shut down after running the Parallel Upgrade Utility command. Restart the instance so that you reinitialize the system parameters for normal operation. For example:

    ```
    SQL> STARTUP
    ```

    This restart, following the database shutdown performed as part of the Parallel Upgrade Utility script, flushes all caches, clears buffers, and performs other housekeeping activities. These measures are an important final step to ensure the integrity and consistency of the upgraded Oracle Database software.

    > **Note:**
    >
    > If you encountered a message listing desupported initialization parameters when you started the database, then remove the desupported initialization parameters from the parameter file before restarting. If necessary, convert the `SPFILE` to a `PFILE`, so that you can edit the file to delete parameters.

16. Run `catcon.pl` to start `utlrp.sql`, and to recompile any remaining stored PL/SQL and Java code.

    For example:

```
$ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlrp -d '''.''' utlrp.sql
```

Because you run the command using `-b utlrp`, the log file `utlrp0.log` is generated as the script is run. The log file provides results of the recompile.

17. Run `postupgrade_fixups.sql`. For example:

```
SQL> @postupgrade_fixups.sql
```

18. Run `utlu122s.sql`. The script verifies that all issues are fixed.

For example:

```
SQL> @$ORACLE_HOME/rdbms/admin/utllu122s.sql
```

The log file `utlu122s0.log` is generated as the script is run, which provides the upgrade results. You can also review the upgrade report in `upg_summary.log`.

To see information about the state of the database, run `utlu122s.sql` as many times as you want, at any time after the upgrade is completed. If the `utlu122s.sql` script returns errors, or shows components that do not have the status `VALID`, or if the version listed for the component is not the most recent release, then refer to the troubleshooting section in this guide.

19. Ensure that the time zone data files are current by using the `DBMS_DST PL/SQL` package to upgrade the time zone file. You can also adjust the time zone data files after the upgrade. If you update the time zone, then you must update the time zone in both `CDB$ROOT` and the PDBs.

20. Exit from SQL*Plus

For example:

```
SQL> EXIT
```

21. (Conditional) If you are upgrading an Oracle Real Application Clusters database, then use the following command syntax to upgrade the database configuration in Oracle Clusterware:

```
srvctl upgrade database -db db-unique-name -oraclehome oraclehome
```

where *db-unique-name* is the database name assigned to it (not the instance name), and *oraclehome* is the Oracle home location in which the database is being upgraded. The SRVCTL utility supports long GNU-style options, in addition to short CLI options used in earlier releases.

22. (Conditional) For Oracle RAC environments only, after you have upgraded all nodes, enter the following commands to set the initialization parameter value for CLUSTER_DATABASE to TRUE, and start the database, where *db_unique_name* is the name of the Oracle RAC database:

```
ALTER SYSTEM SET CLUSTER_DATABASE=TRUE SCOPE=SPFILE;
srvctl start database -db db_unique_name
```

Your database is now upgraded. You are ready to complete post-upgrade procedures.

> **Note:**

> **Caution:**
>
> If you retain the old Oracle software, then never start the upgraded database with the old software. Only start Oracle Database using the start command in the new Oracle Database home.
>
> Before you remove the old Oracle environment, relocate any data files in that environment to the new Oracle Database environment.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for information about relocating data files

Upgrading a Non-CDB Oracle Database To a PDB on a CDB

Use this procedure to upgrade an earlier release non-CDB architecture Oracle Database, making it a Pluggable Database (PDB) and plugging the PDB into a container database (CDB).

You can upgrade earlier releases of Oracle Database using either DBUA or the Parallel Upgrade Utility, and then make the upgraded database a Pluggable Database (PDB). You can then plug the upgraded database into a multitenant container database (CDB).

The following procedure assumes the following conditions:

- You have completed all pre-upgrade procedures described in Oracle Database documentation for your operating system.
- The earlier database and the upgraded database are located on the same system.
- The data files remain in the same location before and after upgrade.

  If the data files have been copied to a different location (for example, stored with Oracle ASM), then you must specify the parameter `SOURCE_FILE_NAME_CONVERT` in step 8.

1. Install the new Oracle Database 12*c* software.
2. Upgrade the database as described in this guide.
3. Set the `COMPATIBLE` parameter to 12.0.0, if you have not already done so as part of the upgrade process.
4. Use the following SQL command to ensure that the database is in read-only mode:

   ```
   SQL> startup mount
   SQL> alter database open read only;
   ```

5. Ensure that the prerequisites for plugging an unplugged PDB are met.
6. Create the XML file for the PDB. The root name for the XML file matches the name of the PDB. In the following syntax example, the value for *path* is the location

where the XML is saved, and *myPDB*.xml is the name of the pluggable database file. You can choose where you want to place the file.

```
SQL> exec DBMS_PDB.DESCRIBE('path/myPDB.xml');
```

For example, where *path* is `/home/oracle`, and *myPDB* is `salespdb`:

```
SQL> exec DBMS_PDB.DESCRIBE('/home/oracle/salespdb.xml');
```

7. Use the following command to shut down the database in the old (source) Oracle home:

```
SQL> SHUTDOWN IMMEDIATE
```

8. Change directory to the new Oracle home, and run the DBMS_PDB.CHECK_PLUG_COMPATIBILITY function.

   When you run the function, set the following parameters:

   - `pdb_descr_file` Set this parameter to the full path to the XML file.
   - `pdb_name` Specify the name of the new PDB. If this parameter is omitted, then the PDB name in the XML file is used.

   For example, to determine if a PDB described by the file `/disk1/usr/salespdb.xml` is compatible with the current CDB, run the following PL/SQL block from the new Oracle home:

```
sqlplus / as sysdba
SQL> set serveroutput on
SQL> r
  1  DECLARE
  2    compatible CONSTANT VARCHAR2(3) :=
  3 CASE DBMS_PDB.CHECK_PLUG_COMPATIBILITY(
  4  pdb_descr_file => '/home/oracle/ORAOP2.xml',
  5 pdb_name       => 'SALESPDB')
  6 WHEN TRUE THEN 'YES'
  7 ELSE 'NO'
  8  END;
  9  BEGIN
 10    DBMS_OUTPUT.PUT_LINE(compatible);
 11* END;
YES

PL/SQL procedure successfully completed.
```

   If the output is YES, then the PDB is compatible, and you can continue with the next step.

   If the output is NO, then the PDB is not compatible, and you can check the PDB_PLUG_IN_VIOLATIONS view to see why it is not compatible.

9. Use the following command syntax to create the pluggable database, and to plug the database into the CDB:

```
SQL> CREATE PLUGGABLE DATABASE SALESPDB USING 'pathmyPDB.xml' NOCOPY TEMPFILE
REUSE;
```

   The following example shows the command to create the pluggable database `salespdb`:

```
SQL> CREATE PLUGGABLE DATABASE salespdb USING '/home/oracle/salespdb.xml' NOCOPY
TEMPFILE REUSE;
```

You can use any name for your PDB, but the name you use must be unique within this CDB. `TEMPFILE REUSE` specifies that the existing `TEMP` tablespaces can be reused.

When this SQL command completes, the following message should appear:

```
Pluggable database created.
```

The upgraded database is now a PDB, and it is ready for you to place in a CDB.

> **Caution:**
>
> Oracle strongly recommends that you have a valid backup in place before you use the NOCOPY option. If this command fails, for whatever reason, then your database can become damaged and unrecoverable.

10. Connect to the PDB using the following command:

```
SQL> ALTER SESSION set container=salespdb;
```

11. Convert the dictionary to the PDB type. From the `admin` directory, run the `noncdb_to_pdb.sql` script. You must run this script before you can open the PDB for the first time.

    For example:

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

> **Note:**
>
> Be aware that the runtime of this script can vary from several minutes to over an hour, depending on the number and type of objects in the new PDB dictionary that must be converted.

12. Start up and open the new PDB in read/write mode. You must open the new PDB in read/write mode for Oracle Database to complete the integration of the new PDB into the CDB.

    For example, because you have already set the PDB container to `salespdb`, enter the following command to start the PDB:

```
SQL> STARTUP
```

13. Back up the PDB with RMAN (Recovery Manager).

    Oracle strongly recommends that you perform a backup of the PDB using RMAN, because you can no longer use the ARCHIVELOG and backups that you took from the database before converting it to a PDB.

> **Caution:**
>
> You must perform an immediate backup to ensure recoverability.

Related Topics

- *Oracle Database Backup and Recovery User's Guide*
- *Oracle Database Administrator's Guide*
- The COMPATIBLE Initialization Parameter in Oracle Database
  Review to understand how to set the COMPATIBLE initialization parameter for non-CDB and multitenant architecture containers.

Upgrading a Non-CDB Oracle Database Using Rapid Home Provisioning

In Oracle Database 12*c* release 2 (12.2) and later releases, you can use Rapid Home Provisioning (RHP) to upgrade an earlier release Non-CDB Oracle Database.

You upgrade a database with Rapid Home Provisioning by creating a copy of the new Oracle Database release, and using the command `rhpctl upgrade database` to upgrade the earlier release Oracle Database. The upgrade is an out-of-place upgrade. After the upgrade is complete, listeners and other initialization variables are set to point to the new Oracle home.

Use this overview of the steps to understand how to upgrade a non-CDB Oracle Database 11*g* release 2 (11.2.0.3) by using Rapid Home Provisioning:

1. Install a new Oracle Database release.
2. Patch, test, and configure the database to your specifications for a standard operating environment (SOE).
3. Create an RHP Gold Image from the SOE release Oracle Database home.
4. Complete an upgrade to a new Oracle Grid Infrastructure release on the servers where the databases you want to upgrade are located. You can complete this upgrade by using Rapid Home Provisioning. (Note: Your Oracle Grid Infrastraucture software must always be the same or a more recent release than Oracle Database software.)
5. Deploy a copy of the new release Oracle Database RHP gold image to the servers with release 11.2.0.3 Oracle Databases that you want to upgrade.
6. Run the Rapid Home Provisioning command `rhpctl upgrade database`. This command use the new release RHP gold image to upgrade the earlier release databases. You can upgrade one, many or all the Oracle Database 11.2.0.3 instances on the servers provisioned with the new release Oracle Database gold image.

Example 3-6 Upgrading Non-CDB 11.2.0.3 to 12.2.0.1 PDB on a CDB

This example shows the command and the screen output for an upgrade from Oracle Database 11*g* release 2 (11.2.0.3) to Oracle Database 12c releases 2 (12.2.0.1):

```
[Wed Jun 01 02:19:43][gridusr@example.com:/u01/app/grid/bin]$ date;./rhpctl add
workingcopy -workingcopy db12c -image db12c -oraclebase /u01/app/oraInventory -user
dbusr -node node3 -root -path /u01/app/rachome/122/dbhome_1 -storagetype LOCAL
Wed Jun  1 03:15:03 PDT 2016
Enter user "root" password:
server17.example.com: Storing metadata in repository for working copy "db12c" ...
server17.example.com: Connecting to node node3 ...
server17.example.com: Starting transfer for remote copy ...
server17.example.com: Starting clone operation...
```

```
server17.example.com: Using inventory file /etc/oraInst.loc to clone ...
server13: Starting Oracle Universal Installer...
server13:
server13: Checking Temp space: must be greater than 500 MB.   Actual 13485 MB
Passed
server13: Checking swap space: must be greater than 500 MB.   Actual 13653 MB
Passed
server13: Preparing to launch Oracle Universal Installer from /tmp/
OraInstall2016-06-01_10-20-22AM. Please wait ...You can find the log of this install
session at:
server13:  /u01/app/rachome/oraInventory/logs/cloneActions2016-06-01_10-20-22AM.log
server13: .............................................   5% Done.
server13: .............................................   10% Done.
server13: .............................................   15% Done.
server13: .............................................   20% Done.
server13: .............................................   25% Done.
server13: .............................................   30% Done.
server13: .............................................   35% Done.
server13: .............................................   40% Done.
server13: .............................................   45% Done.
server13: .............................................   50% Done.
server13: .............................................   55% Done.
server13: .............................................   60% Done.
server13: .............................................   65% Done.
server13: .............................................   70% Done.
server13: .............................................   75% Done.
server13: .............................................   80% Done.
server13: .............................................   85% Done.
server13: ..........
server13: Copy files in progress.
server13:
server13: Copy files successful.
server13:
server13: Link binaries in progress.
server13:
server13: Link binaries successful.
server13:
server13: Setup files in progress.
server13:
server13: Setup files successful.
server13:
server13: Setup Inventory in progress.
server13:
server13: Setup Inventory successful.
server13:
server13: Finish Setup successful.
server13: The cloning of db12c was successful.
server13: Please check '/u01/app/rachome/oraInventory/logs/
cloneActions2016-06-01_10-20-22AM.log' for more details.
server13:
server13: Setup Oracle Base in progress.
server13:
server13: Setup Oracle Base successful.
server13: .............................................   95% Done.
server13:
server13: As a root user, execute the following script(s):
server13:      1. /u01/app/rachome/122/dbhome_1/root.sh
server13:
server13:
server13:
server13: .............................................   100% Done.
```

```
server17.example.com: Successfully executed clone operation.
server17.example.com: Executing root script on nodes server13.
server13: Check /u01/app/rachome/122/dbhome_1/install/
root_node3_2016-06-01_10-22-13-284882809.log for the output of root script
server17.example.com: Successfully executed root script on nodes server13.
server17.example.com: Working copy creation completed.


[crsusr@rwsdcvm17 bin]$ date;./rhpctl upgrade database -sourcehome /u01/app/rachome/
dbusr/product/11.2.0/dbhome_1 -destwc wc1db12c -dbname t2db -root -targetnode
node33Wed Jun  1 05:38:52 PDT 2016
Enter user "root" password:
server17.example.com: Connecting to node node3 ...
server17.example.com: Starting to upgrade database from path "/u01/app/rachome/dbusr/
product/11.2.0/dbhome_1" to path "/u01/app/rachome/122/dbhome_2" on node "node3"
server13: Logs directory:  /u01/app/oraInventory/cfgtoollogs/dbua/
upgrade2016-06-01_12-38-46-PM
server13: Preupgrade generated files:
server13:     /u01/app/oraInventory/cfgtoollogs/dbua/upgrade2016-06-01_12-38-46-PM/
t2db/preupgrade.log
server13:     /u01/app/oraInventory/cfgtoollogs/dbua/upgrade2016-06-01_12-38-46-PM/
t2db/preupgrade_fixups.sql
server13:     /u01/app/oraInventory/cfgtoollogs/dbua/upgrade2016-06-01_12-38-46-PM/
t2db/postupgrade_fixups.sql
server13: Gathering Dictionary Statistics
server13: 12% complete
server13: Pre Upgrade Step
server13: 15% complete
server13: 25% complete
server13: Configure Database in 12.2.0.1.0 Oracle Home
server13: 37% complete
server13: Database Components Upgrade
server13: 37% complete
server13: 38% complete
server13: 38% complete
server13: 38% complete
server13: 38% complete
server13: 39% complete
server13: 39% complete
server13: 39% complete
server13: 39% complete
server13: 40% complete
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server13: 43% complete
server13: 43% complete
server13: 43% complete
server13: 43% complete
server13: 44% complete
server13: 44% complete
server13: 44% complete
server13: 44% complete
```

```
server13: 45% complete
server13: 45% complete
server13: 45% complete
server13: 45% complete
server13: 46% complete
server13: 46% complete
server13: 46% complete
server13: 46% complete
server13: 47% complete
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server13: 47% complete
server13: 47% complete
server13: 48% complete
server13: 48% complete
server13: 48% complete
server13: 48% complete
server13: 49% complete
server13: 49% complete
server13: 49% complete
server13: 49% complete
server13: 50% complete
server13: Recompile Invalid Objects
server13: 62% complete
server13: Timezone Upgrade
server13: 75% complete
server13: Executing Post Upgrade Tasks
server13: 76% complete
server13: 77% complete
server13: 87% complete
server13: Generate Summary
server13: Database upgrade has been completed successfully, and the database is
ready to use.
server13: 100% complete
server17.example.com: Completed the upgrade database operation


[Wed Jun 01 07:51:58][dbusr@server13:/u01/app/rachome/122/dbhome_2/bin][1]$ export
ORACLE_HOME=/u01/app/rachome/122/dbhome_2
[Wed Jun 01 07:52:38][dbusr@node3:/u01/app/rachome/122/dbhome_2/bin][0]$ export
ORACLE_SID=t2db
[Wed Jun 01 07:52:59][dbusr@node3:/u01/app/rachome/122/dbhome_2/bin][0]$ ./sqlplus /
as sysdba

SQL*Plus: Release 12.2.0.1.0 Production on Wed Jun 1 07:53:19 2016

Copyright (c) 1982, 2016, Oracle.  All rights reserved.


Connected to:
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production

SQL>
```

Variables for Using ORADIM When Upgrading Oracle Database on Windows

Review these variables if you want to use the ORADIM utility for upgrading Oracle Database on Windows systems.

On Windows platforms, `ORADIM` provides a command-line interface to manually perform administrative tasks for Windows databases and services. Database Configuration Assistant (DBCA) provides a graphical user interface to perform the same tasks. The variables for ORADIM that you must know about when upgrading Oracle Database include the SID of the database you are upgrading, the new Oracle home location, and the password for the new database instance. Also, `ORADIM` writes a log file to the `ORACLE_HOME\database` directory.

The following table describes the variables for using `ORADIM` when upgrading:

Table 3-3 ORADIM Variables and Functions

ORADIM Variable	Description
SID	The same SID name as the SID for the database that you are upgrading
PASSWORD	The password for the new Oracle Database 12*c* database instance. This is the password for the user connected with `SYSDBA` privileges. The `-SYSPWD` option is required. The default Oracle Database 12*c* security settings require that passwords must be at least eight characters. You are not permitted to use passwords such as `welcome` and `oracle`.
USERS	The password for the new Oracle Database 12*c* database instance. This is the password for the user connected with `SYSDBA` privileges. The `-SYSPWD` option is required. The default Oracle Database 12*c* security settings require that passwords must be at least eight characters. You are not permitted to use passwords such as `welcome` and `oracle`.
ORACLE_HOME	The Oracle home location for Oracle Database 12*c*. Ensure that you specify the full path name with the `-PFILE` option, including the drive letter of the Oracle home location.

Example of Manual Upgrade of Windows Non-CDB Oracle Database 11.2.0.3

These examples show the steps to complete preupgrade checks, upgrade, and postupgrade checks for an Oracle Database 11*g* release 2 (11.2.0.3) upgrade to Oracle Database 12*c* release 2 (12.2).

The specific examples in these topics show an upgrade on the Microsoft Windows platform. They use tools specific to the Windows environment. However, these example provide an overview of a manual installation experience.

- Preparing to Upgrade Windows Non-CDB Using Command-Line Utilities
  This example shows the preupgrade steps to carry out before upgrading a Non-CDB Oracle Database 11*g* release 2 (11.2.0.3) to a Non-CDB Oracle Database 12*c* or later release.
- Manually Upgrading Windows Non-CDB Using Command-Line Utilities
  These examples show upgrade steps to upgrade a Non-CDB Oracle Database 11*g* release 2 (11.2.0.3) to a Non-CDB Oracle Database
- Running Postupgrade Fixup Scripts After Upgrading a Non-CDB Database
  These examples show the process of running the `postupgrade_fixups.sql` script for Non-CDB to Non-CDB upgrades.

Preparing to Upgrade Windows Non-CDB Using Command-Line Utilities

This example shows the preupgrade steps to carry out before upgrading a Non-CDB Oracle Database 11*g* release 2 (11.2.0.3) to a Non-CDB Oracle Database 12*c* or later release.

This procedure provides an example of how to use command-line utilities to prepare your system to carry out a manual upgrade of a Non-CDB Oracle Database to a current release Non-CDB Oracle Database on Windows. In this example, the Oracle Database that you are upgrading is Oracle Database 11*g* release 2 (11.2.0.3). The upgrade example is to Oracle Database 12*c*, but the procedure is the same for Oracle Database 18c.

Log in as a user that is a member of the ORA_DBA group. Oracle recommends that you install the new release Oracle Database binaries on the server. Refer to the Oracle Database installation guide for Windows to complete that procedure.

The Preupgrade consists of the following steps:

1. Reset the user environment variables from the new release Oracle home to the 11.2.0.3 Oracle home for the Oracle Installation Owner User Account (Oracle user).
2. Test the connection to the 11.2.0.3 Oracle Database.
3. Run the Pre-Upgrade Information Tool on the 11.2.0.3 Oracle Database home.
4. Review the Pre-Upgrade Information Tool log (`preupgrade.log`). If there are `preupgrade_fixups.sql` scripts that you must run, then run them. In this example, we show manual fixes for the following errors:
   - Oracle Enterprise Manager is present (`em_present`).
   - The OLAP catalog is present (`amd_exists`).
   - The ADMINISTER DATABASE TRIGGER privilege must be granted (`trgowner_no_admndbtrg`).
   - Materialized views are not refreshed (`mv_refresh`).
   - Oracle Application Express is not upgraded (`apex_upgrade_msg`)
5. Run `preupgrade_fixups.sql` scripts.
6. Back up your database.

These examples use the following systems, paths, and users:

Oracle Database 11*g* release 2 (11.2.0.3)

- Oracle Installation Owner user account: `oracle1`, which is a member of the ORA_DBA group.
- Oracle home: `C:\app\oracle\product\11.2.0\dbhome_1`

Oracle Database 12*c* release 2 (11.2.0.3)

- Oracle Installation Owner user account: `oracle2`, which is a member of the ORA_DBA group.
- Oracle home: `C:\app\oracle1\product\12.2.0\dbhome_1`

Example 3-7 Resetting the User Environment Variables

This example shows how to change the environment variables from values set for the 12.2.0.1 installation:

```
C:\app\oracle1\product\12.2.0\dbhome_1\rdbms\admin>set ORACLE_HOME=C:\app
\oracle2\product\11.2.0\dbhome_1
C:\app\oracle1\product\12.2.0\dbhome_1\rdbms\admin>set ORACLE_SID=orcl11
```

Example 3-8 Testing the Connection to the Database

This example shows how to test the connection to the database, and ensure that you are connecting to the release 11.2.0.3 database that you want to upgrade.

```
C:\app\oracle1\product\12.2.0\dbhome_1\rdbms\admin>sqlplus / as sysdba

    SQL*Plus: Release 11.2.0.3.0 Production on Tue Jul 5 12:14:49 2016

    Copyright (c) 1982, 2011, Oracle.  All rights reserved.


    Connected to:
    Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production
    With the Partitioning, OLAP, Data Mining and Real Application Testing options

    SQL> select version from v$instance;

    VERSION
    -----------------
    11.2.0.3.0

    SQL>
```

Example 3-9 Running the Pre-Upgrade Information Tool (preupgrade.jar)

This example shows how to run the tool using the command `java -jar %ORACLE_HOME12.2%\rdbms\admin\preupgrade.jar`.

The Preupgrade Information Tool prints the path to the log file, and prints the path to the fixup scripts. By default, these fixup scripts are placed in `%ORACLE_BASE%`.

```
C:\app\oracle1\product\12.2.0\dbhome_1\rdbms\admin>java -jar preupgrade.jar

Preupgrade generated files:
        C:\app\oracle2\cfgtoollogs\orcl11\preupgrade\preupgrade.log
        C:\app\oracle2\cfgtoollogs\orcl11\preupgrade\preupgrade_fixups.sql
        C:\app\oracle2\cfgtoollogs\orcl11\preupgrade\postupgrade_fixups.sql
C:\app\oracle1\product\12.2.0\dbhome_1\rdbms\admin>
```

Example 3-10 Reviewing the Pre-Upgrade Information Tool Log (preupgrade.log)

In this example, the log file `preupgrade.log` is generated in the following path: `C:\app\oracle2\cfgtoollogs\orcl11\preupgrade\preupgrade.log`.

The log file can direct you to run some SQL fixup files manually. If it directs you to run SQL files, then copy these files to the earlier release 11.2.0.3 Oracle home, and then run the scripts.

Example 3-11 Running the Preupgrade Fixup SQL script (preupgrade_fixups.sql)

```
C:\app\oracle1\product\12.2.0\dbhome_1\rdbms\admin>sqlplus / as sysdba @C:\app
\oracle2\cfgtoollogs\orcl11\preupgrade\preupgrade_fixups.sql

    SQL*Plus: Release 11.2.0.3.0 Production on Tue Jul 5 12:34:08 2016

    Copyright (c) 1982, 2011, Oracle.  All rights reserved.


    Connected to:
    Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production
    With the Partitioning, OLAP, Data Mining and Real Application Testing options

    Executing Oracle PRE-Upgrade Fixup Script

    Auto-Generated by:       Oracle Preupgrade Script
                             Version: 12.2.0.1.0 Build: 1
    Generated on:            2016-07-05 12:18:06

    Source Database:         ORCL11
    Source Database Version: 11.2.0.3.0
    For Upgrade to Version:  12.2.0.1.0
                              Fixup
    Check Name                Status  Further DBA Action
    ----------                ------  ------------------
    em_present                Failed  Manual fixup recommended.
    amd_exists                Failed  Manual fixup recommended.
    dictionary_stats          Failed  Manual fixup recommended.
    trgowner_no_admndbtrg     Failed  Manual fixup recommended.
    mv_refresh                Failed  Manual fixup recommended.
    apex_upgrade_msg          Failed  Manual fixup recommended.

    PL/SQL procedure successfully completed.
```

In this example, some automatic checks failed, and required manual fixups. Refer to the examples that follow to see how to perform manual fixups.

Example 3-12 Manually Removing Oracle Enterprise Manager (em_present)

The `preupgrade_fixups.sql` log file provides you with instructions to remove Oracle Enterprise Manager manually (`em_present`):

```
+ Remove the EM repository.

        - Copy the rdbms/admin/emremove.sql script from the target 12.2.0.1.0
        ORACLE_HOME into the source 11.2.0.3.0 ORACLE_HOME.

        Step 1: If database control is configured, stop EM Database Control,
```

```
 using the following command

   $> emctl stop dbconsole

 Step 2: Connect to the database using the SYS account AS SYSDBA

   SET ECHO ON;
   SET SERVEROUTPUT ON;

  @emremove.sql
...
...
...

Execution:

Step 1 - Stop dbconsole:

    C:\app\oracle1\product\12.1.0\dbhome_1\rdbms\admin> emctl stop dbconsole

    Oracle Enterprise Manager 11g Database Control Release 11.2.0.3.0
    Copyright (c) 1996, 2011 Oracle Corporation.  All rights reserved.
    https://db01.example.com:1158/em/console/aboutApplication
    The OracleDBConsoleorcl11 service is stopping...........
    The OracleDBConsoleorcl11 service was stopped successfully.

Step 2 - Remove em (provide credentials if needed)

    ...
    ...
    ...

    Dropping synonym : SETEMVIEWUSERCONTEXT ...
    Dropping synonym : SMP_EMD_AVAIL_OBJ ...
    Dropping synonym : SMP_EMD_DELETE_REC_ARRAY ...
    Dropping synonym : SMP_EMD_INTEGER_ARRAY ...
    Dropping synonym : SMP_EMD_INTEGER_ARRAY_ARRAY ...
    Dropping synonym : SMP_EMD_NVPAIR ...
    Dropping synonym : SMP_EMD_NVPAIR_ARRAY ...
    Dropping synonym : SMP_EMD_STRING_ARRAY ...
    Dropping synonym : SMP_EMD_STRING_ARRAY_ARRAY ...
    Dropping synonym : SMP_EMD_TARGET_OBJ ...
    Dropping synonym : SMP_EMD_TARGET_OBJ_ARRAY ...
    Finished phase 5
    Starting phase 6 : Dropping Oracle Enterprise Manager related other
roles ...
    Finished phase 6
    The Oracle Enterprise Manager related schemas and objects are dropped.
    Do the manual steps to studown the DB Control if not done before running
this
    script and then delete the DB Control configuration files

    PL/SQL procedure successfully completed.

    SQL>
```

Example 3-13 Manually Removing the OLAP Catalog (amd_exists)

The `preupgrade_fixups.sql` log file provides you with instructions to remove the OLAP catalog manually (`amd_exists`):

```
 + Remove OLAP Catalog by running the 11.2.0.3.0 SQL script
     $ORACLE_HOME/olap/admin/catnoamd.sql script.

     The OLAP Catalog component, AMD, exists in the database.

     sqlplus / as sysdba @%ORACLE_HOME%\olap\admin\catnoamd.sql
        ...
        ...
        ...

        Synonym dropped.

        User dropped.

        Role dropped.

        SQL>
```

Example 3-14 Gathering Current Dictionary Statistics (dictionary_stats)

The `preupgrade_fixups.sql` log file provides you with instructions to gather directory statistics (`dictionary_stats`).

```
       + Gather dictionary statistics prior to database upgrade in off-peak time
     using:

       EXECUTE dbms_stats.gather_dictionary_stats;

        SQL> EXECUTE dbms_stats.gather_dictionary_stats;

        PL/SQL procedure successfully completed.
```

Example 3-15 Granting the ADMINISTER DATABASE TRIGGER privilege (trgowner_no_admndbtrg)

The `preupgrade_fixups.sql` log file provides you with instructions to grant the ADMINISTER DATABASE TRIGGER privilege (`trgowner_no_admndbtrg`):

```
+ Directly grant ADMINISTER DATABASE TRIGGER privilege to the owner of the
         trigger or drop and re-create the trigger with a user that was granted
         directly with such. You can list those triggers using "SELECT OWNER,
         TRIGGER_NAME FROM DBA_TRIGGERS WHERE BASE_OBJECT_TYPE='DATABASE' AND
         OWNER NOT IN (SELECT GRANTEE FROM DBA_SYS_PRIVS WHERE
         PRIVILEGE='ADMINISTER DATABASE TRIGGER')"

            SQL> SELECT OWNER,
              2       TRIGGER_NAME FROM DBA_TRIGGERS WHERE
BASE_OBJECT_TYPE='DATABASE' AND
              3       OWNER NOT IN (SELECT GRANTEE FROM DBA_SYS_PRIVS WHERE
              4       PRIVILEGE='ADMINISTER DATABASE TRIGGER');

            OWNER                          TRIGGER_NAME
            ------------------------------ ------------------------------
            MDSYS                          SDO_DROP_USER
            MDSYS                          SDO_ST_SYN_CREATE
            MDSYS                          SDO_TOPO_DROP_FTBL
            MDSYS                          SDO_GEOR_BDDL_TRIGGER
            MDSYS                          SDO_GEOR_ADDL_TRIGGER
            MDSYS                          SDO_NETWORK_DROP_USER

            6 rows selected.
```

```
SQL> grant ADMINISTER DATABASE TRIGGER to MDSYS;

Grant succeeded.
```

Example 3-16 Refreshing Materialized Views (mv_refresh)

The `preupgrade_fixups.sql` log file provides you with instructions to refresh materialized views (`mv_refresh`):

```
+ Please make sure that all the MVs are refreshed and sys.sumdelta$
        becomes empty before doing upgrade, unless you have strong business
        reasons not to do so. You can use dbms_mview.refresh() to refresh the
        MVs except those stale ones  to be kept due to business need. If there
        are any stale MVs depending on changes in sys.sumdelta$, do not truncate
        it, because doing so will cause wrong results after refresh.

   SQL> declare
     2  num_failures integer(3) :=0;
     3  begin
     4  DBMS_MVIEW.REFRESH_ALL_MVIEWS(num_failures,'C','', TRUE, FALSE);
     5  end;
     6  /

   PL/SQL procedure successfully completed.

   SQL> select count(1) from sumdelta$;

     COUNT(1)
   ----------
            0

   SQL>
```

Example 3-17 Upgrading Oracle Application Express (apex_upgrade_msg)

`preupgrade_fixups.sql`apex_upgrade_msg

```
+ Consider upgrading APEX manually, before the database upgrade.

        The database contains APEX version 3.2.1.00.12 and will need to be
        upgraded to at least version 5.0.4.00.11.

        To reduce database upgrade time, you can upgrade APEX manually before
        the database upgrade.  Refer to My Oracle Support Note 1088970.1 for
        information on APEX installation upgrades.

       Download: http://www.oracle.com/technetwork/developer-tools/apex/downloads/
index.html provide credentials.

       Then go to: http://www.oracle.com/technetwork/developer-tools/apex/
application-express/upgrade-apex-for-xe-154969.html and
                  https://docs.oracle.com/cd/E59726_01/install.50/e39144/toc.htm
to guide you to do the upgrade.

       Once downloaded, please go to the directory and unzip the files, run the
apex upgrade from there.

       ...
       ...
           Completing registration process. 12:07:41
           Validating installation.  12:07:41
```

```
            ...Starting validation 12:07:41
            ...Database user "SYS", database schema "APEX_050000", user# "90"
12:07:41
            ...272 packages
            ...265 package bodies
            ...465 tables
            ...8 functions
            ...16 procedures
            ...4 sequences
            ...497 triggers
            ...1582 indexes
            ...255 views
            ...0 libraries
            ...14 types
            ...5 type bodies
            ...0 operators
            ...0 index types
            ...Begin key object existence check 12:07:53
            ...Completed key object existence check 12:07:54
            ...Setting DBMS Registry 12:07:54
            ...Setting DBMS Registry Complete 12:07:54
            ...Exiting validate 12:07:54

            PL/SQL procedure successfully completed.

            timing for: Validate Installation
            Elapsed: 00:00:13.00

            Session altered.

            timing for: Complete Installation
            Elapsed: 00:18:40.49

        ...
        ...
```

> **Caution:**
>
> After you complete preupgrade steps, Oracle recommends that you back up your database before proceeding with the upgrade.

Related Topics

- Backing Up Oracle Database for Upgrading

Manually Upgrading Windows Non-CDB Using Command-Line Utilities

These examples show upgrade steps to upgrade a Non-CDB Oracle Database 11*g* release 2 (11.2.0.3) to a Non-CDB Oracle Database

After you complete running preupgrade steps, you can upgrade the Non-CDB Oracle Database to the new release Non-CDB Oracle Database. Before starting the upgrade, you must stop the database services. You can stop database services either by using command-line commands, or by using Microsoft Windows PowerShell scripting.

The sequence of steps to complete the upgrade is as follows:

1. Stop the database service, using either command-line commands, or PowerShell.
2. Delete the database service from the earlier release Oracle home.
3. Stop the listener from the earlier release Oracle home
4. Set the environment variables to the new Oracle home.
5. Copy database files, such as `tnsnames.ora`, `listener.ora`, password files, wallets, and other similar files to the new Oracle home.
6. Copy the PFILE to the new Oracle Database Oracle home, and create a new service using the Oracle Database binary in the new Oracle home. (In this example, we assume that the PFILE is compatible. It is possible that your PFILE is not compatible with the new release.)
7. Start the database upgrade.
8. Complete the post-upgrade steps.

Example 3-18 Stopping the Database Service Using Command-Line Commands

1. If you do not know the service name, then identify the service name.

```
c:\apex\apex>sc query type= service | find /i "orcl11"
               SERVICE_NAME: OracleServiceORCL11
               DISPLAY_NAME: OracleServiceORCL11
```

2. Using the service name, find out what the status is of the service.

```
c:\apex\apex>sc query  OracleServiceORCL11

               SERVICE_NAME: OracleServiceORCL11
                   TYPE               : 10  WIN32_OWN_PROCESS
                   STATE              : 4  RUNNING
                                           (STOPPABLE, PAUSABLE,
ACCEPTS_SHUTDOWN)
                   WIN32_EXIT_CODE    : 0  (0x0)
                   SERVICE_EXIT_CODE  : 0  (0x0)
                   CHECKPOINT         : 0x0
                   WAIT_HINT          : 0x0
```

3. Stop the service

```
c:\apex\apex>sc stop  OracleServiceORCL11

               SERVICE_NAME: OracleServiceORCL11
                   TYPE               : 10  WIN32_OWN_PROCESS
                   STATE              : 3  STOP_PENDING
                                           (STOPPABLE, PAUSABLE,
ACCEPTS_SHUTDOWN)
                   WIN32_EXIT_CODE    : 0  (0x0)
                   SERVICE_EXIT_CODE  : 0  (0x0)
                   CHECKPOINT         : 0x5
                   WAIT_HINT          : 0x15f90
```

4. Wait for a few minutes, and then check the status.

```
c:\apex\apex>sc query  OracleServiceORCL11

               SERVICE_NAME: OracleServiceORCL11
                   TYPE               : 10  WIN32_OWN_PROCESS
                   STATE              : 1  STOPPED
                   WIN32_EXIT_CODE    : 0  (0x0)
```

```
SERVICE_EXIT_CODE  : 0  (0x0)
CHECKPOINT         : 0x0
WAIT_HINT          : 0x0
```

After the services are stopped, you can proceed to delete the services.

Example 3-19 Stopping the Database Service Using Microsoft Windows PowerShell Scripting

1. Check the status of the service.

```
PS C:\app\oraclbm\cfgtoollogs\orcl\preupgrade> Get-Service | Where-Object
{$_.displayName.Contains("ORCL11")}

                Status   Name               DisplayName
                ------   ----               -----------
                Stopped  OracleJobSchedu... OracleJobSchedulerORCL11
                Running  OracleServiceOR... OracleServiceORCL11
                Running  OracleVssWriter... Oracle ORCL11 VSS Writer Service
```

2. Stop the service.

```
PS C:\app\oraclbm\cfgtoollogs\orcl\preupgrade> Get-Service | Where-Object
{$_.displayName.Contains("ORCL11")} | Stop-Ser
                vice
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
                WARNING: Waiting for service 'OracleServiceORCL11
(OracleServiceORCL11)' to stop...
```

After the services are stopped, you can proceed to delete the database service.

Example 3-20 Deleting the Database Service from the Earlier Release Oracle Home

For Oracle Database 11*g* release 2 (11.2.0.3) on Windows, use ORADIM from the earlier release Oracle home. ORADIM is a Windows-specific utility that you can use to administer the Windows service.

```
c:\apex\apex>oradim -delete -sid orcl11
            Unable to stop service, OS Error = 1062
            Instance deleted.
```

Example 3-21 Stopping the Listener for the Earlier Release Oracle Home

```
c:\apex\apex>lsnrctl status

            LSNRCTL for 64-bit Windows: Version 11.2.0.3.0 - Production on 13-
JUL-2016 13:58:52

            Copyright (c) 1991, 2011, Oracle.  All rights reserved.

            Connecting to (DESCRIPTION=(ADDRESS=(PROTOCOL=IPC)(KEY=EXTPROC1522)))
            STATUS of the LISTENER
            ------------------------
            Alias                     LISTENER
            Version                   TNSLSNR for 64-bit Windows: Version 11.2.0.3.0
- Production
            Start Date                05-JUL-2016 10:01:30
            Uptime                    8 days 3 hr. 57 min. 23 sec
            Trace Level               off
            Security                  ON: Local OS Authentication
            SNMP                      OFF
            Listener Parameter File   C:\app\oracle2\product\11.2.0\dbhome_1\network
\admin\listener.ora
            Listener Log File         C:\app\oracle2\diag\tnslsnr\slc01auu\listener
\alert\log.xml
            Listening Endpoints Summary...
              (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(PIPENAME=\\.\pipe
\EXTPROC1522ipc)))
              (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=db01.example.com)
(PORT=1522)))
            Services Summary...
            Service "CLRExtProc" has 1 instance(s).
              Instance "CLRExtProc", status UNKNOWN, has 1 handler(s) for this
service...
            The command completed successfully

c:\apex\apex>lsnrctl stop

            LSNRCTL for 64-bit Windows: Version 11.2.0.3.0 - Production on 13-
JUL-2016 13:59:00

            Copyright (c) 1991, 2011, Oracle.  All rights reserved.

            Connecting to (DESCRIPTION=(ADDRESS=(PROTOCOL=IPC)(KEY=EXTPROC1522)))
            The command completed successfully
```

Example 3-22 Setting the environment variables to the new Oracle home

```
c:\apex\apex>set ORACLE_HOME=C:\app\oracle1\product\18.1.0\dbhome_1

c:\apex\apex>SET PATH=%ORACLE_HOME%\BIN;%PATH%

c:\apex\apex>SET ORACLE_SID=ORCL11
```

Example 3-23 Copying the PFILE to the New Oracle home, and Creating a New Service Using the New Oracle Database binary

This example shows how to use the Windows-specific ORADIM utility to create a new database service. In this example, the PFILE from the earlier release is compatible with the new release.

```
c:\apex\apex>C:\app\oracle1\product\18.1.0\dbhome_1\bin\oradim -new -sid orcl11 -
syspwd
My-sys-password -maxusers 1000 -startmode auto -pfile  C:\app\oracle1\product
\18.1.0\dbhome_1\database\initorcl11.ora

            Enter password for Oracle service user:
            Instance created.
```

Example 3-24 Starting the Database Upgrade

Start the upgrade using the Parallel Upgrade Utility.

> **Note:**
>
> You can find that you have to change the folder symbolic links on the PFILE for paths such as DIAGNOSTIC_DEST. If this is the case, then you see errors such as the following examples:
>
> ```
> ORA-48173: error checking directory existence during ADR initialization [C:
> \app\oracle2\diag\rdbms\orcl11]
> ORA-00205: error in identifying control file, check alert log for more info
> ```
>
> If you see these errors, then grant permissions to the user on the earlier release Oracle home, and on all the related folders with inheritance. Make this change also on any access control list (ACL) that the database accesses, such as wallet files. This step is particularly necessary if you are using the earlier release Oracle home as an ORADATA location.

If you are using the built-in account, then the service runs as `LocalSystem`. If you are using a virtual account, then services run using the Windows virtual accounts, with names derived from the service name. If the Oracle Database release 2 (12.2) binaries owner is a virtual account, then you must add that virtual account to the group `ORA_`*`Homename`*`_SVCAACCTS`, instead of adding the Oracle Home User.

Oracle Database 12*c* release 2 (12.2) includes a new shell script, `dbupgrade`. The shell script calls the Parallel Upgrade Utility (`catctl.pl`), so that you can run the upgrade as a command. This example shows the upgrade of Oracle Database from release 11.2.0.4 to release 12.2. The upgrade time for your system can vary from the results in this example.

```
C:\app\oracle1\product\18.1.0\dbhome_1\bin>dbupgrade
            ...
            ...
            ...
                C:\app\oracle1\product\18.1.0\dbhome_1\bin>REM Batch file to execute
catctl.pl

                Argument list for [C:\app\oracle1\product\18.1.0\dbhome_1\rdbms\admin
\catctl.pl]
                Run in                  c = 0
                Do not run in           C = 0
                Input Directory         d = 0
                Echo OFF                e = 1
                Simulate                E = 0
                Forced cleanup          F = 0
                Log Id                  i = 0
                Child Process           I = 0
```

```
                Log Dir               l = c:\temp2
                Priority List Name    L = 0
                Upgrade Mode active   M = 0
                SQL Process Count     n = 4
                SQL PDB Process Count N = 0
                Open Mode Normal      o = 0
                Start Phase           p = 0
                End Phase             P = 0
                Reverse Order         r = 0
                AutoUpgrade Resume    R = 0
                Script                s = 0
                Serial Run            S = 0
                RO User Tablespaces   T = 0
                Display Phases        y = 0
                Debug catcon.pm       z = 0
                Debug catctl.pl       Z = 0

                catctl.pl VERSION: [18.1.0]
                    STATUS: [production]
                    BUILD: [RDBMS_MAIN_WINDOWS.X64_160624]


                C:\app\oracle1\product\12.2.0\dbhome_1\rdbms\admin\orahome.exe = [C:
\app\oracle1\product\18.1.0\dbhome_1]
                C:\app\oracle1\product\12.2.0\dbhome_1\bin\orabasehome.exe = [C:\app
\oracle1\product\18.1.0\dbhome_1]
                catctlGetOrabase = [C:\app\oracle1\product\18.1.0\dbhome_1]

                Analyzing file C:\app\oracle1\product\18.1.0\dbhome_1\rdbms\admin
\catupgrd.sql

                Log file directory = [c:\temp2]

                catcon: ALL catcon-related output will be written to [c:\temp2/
catupgrd_catcon_3252.lst]
                catcon: See [c:\temp2/catupgrd*.log] files for output generated by
scripts
                catcon: See [c:\temp2/catupgrd_*.lst] files for spool files, if any

                Number of Cpus        = 2
                Database Name         = orcl11
                DataBase Version      = 11.2.0.3.0
                Parallel SQL Process Count            = 4
                Components in [orcl11]
                    Installed [APEX APS CATALOG CATJAVA CATPROC CONTEXT JAVAVM ORDIM
OWM SDO XDB XML XOQ]
                Not Installed [DV EM MGW ODM OLS RAC WK]

                -----------------------------------------------------
                Phases [0-109]         Start Time:[2016_07_13 15:49:40]
                -----------------------------------------------------
                ***********   Executing Change Scripts   ***********
                Serial   Phase #:0    [orcl11] Files:1

            ...
            ...
            ...
                -----------------------------------------------------
                Phases [0-109]         End Time:[2016_07_13 16:53:27]
                -----------------------------------------------------
```

```
Grand Total Time: 3830s

 LOG FILES: (c:\temp2\catupgrd*.log)

Upgrade Summary Report Located in:
c:\temp2\upg_summary.log

Grand Total Upgrade Time:    [0d:1h:3m:50s]
```

Example 3-25 Completing the Post-Upgrade Checks

Start the upgraded Oracle Database, and check the version and status.

```
C:\app\oracle1\product\18.1.0\dbhome_1\bin>sqlplus / as sysdba

SQL*Plus: Release 18.1.0 Production on Thu Jul 14 09:38:50 2016

Copyright (c) 1982, 2018, Oracle.  All rights reserved.

Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area 1828716544 bytes
Fixed Size                  8740096 bytes
Variable Size             503317248 bytes
Database Buffers         1308622848 bytes
Redo Buffers                8036352 bytes
Database mounted.
Database opened.
SQL> select open_mode from v$database;

OPEN_MODE
--------------------
READ WRITE

SQL> select version from v$instance;

VERSION
-----------------
18.0.0.0.0

SQL>
```

After the upgrade is complete, carry out post-upgrade checks to ensure that objects are valid, and that there are no remaining issues.

Running Postupgrade Fixup Scripts After Upgrading a Non-CDB Database

These examples show the process of running the `postupgrade_fixups.sql` script for Non-CDB to Non-CDB upgrades.

The examples show an upgrade from a Non-CDB Oracle Database 11*g* release 2 (11.2.0.3) to a Non-CDB Oracle Database 12*c* release 2 (12.2).

Example 3-26 Running the Postupgrade Fixups Script

Run the `postupgrade_fixups.sql` script that you generated with the Pre-Upgrade Information Tool in the earlier release Oracle home before starting the upgrade:

```
SQL> @C:\app\oracle\cfgtoollogs\orcl11\preupgrade\postupgrade_fixups.sql

                SQL> REM

                SQL> REM    Oracle POST-Upgrade Fixup Script

                SQL> REM

                SQL> REM    Auto-Generated by: Oracle Preupgrade Script

                SQL> REM    Version: 12.2.0.1.0 Build: 1

                SQL> REM    Generated on:            2016-07-05 12:18:07

                SQL> REM

                SQL> REM    Source Database:         ORCL11

                SQL> REM    Source Database Version: 11.2.0.3.0

                SQL> REM    For Upgrade to Version:    12.2.0.1.0

                SQL> REM

                SQL>

                SQL> REM

                SQL> REM    Setup Environment

                SQL> REM

                SQL> SET ECHO OFF SERVEROUTPUT ON FORMAT WRAPPED TAB OFF LINESIZE
200;

                Executing Oracle POST-Upgrade Fixup Script

                Auto-Generated by:       Oracle Preupgrade Script

        Version: 12.2.0.1.0 Build: 1

                Generated on:            2016-07-05 12:18:07


                Source Database:         ORCL11

                Source Database Version: 11.2.0.3.0

                For Upgrade to Version:  12.2.0.1.0

        Fixup

                   Check Name                Status  Further DBA Action

                   ----------                ------  ------------------
```

```
                    depend_usr_tables         Failed  Manual fixup recommended.

                    old_time_zones_exist      Failed  Manual fixup recommended.

                    post_dictionary           Failed  Manual fixup recommended.

                    fixed_objects             Passed  None

                    upg_by_std_upgrd          Passed  None

                    PL/SQL procedure successfully completed.

                    Elapsed: 00:00:11.26

 SQL>
```

In this example, the `postupgrade_fixup.sql` script could not complete three fixes. so you are instructed to carry out manual fixups. This outcome is normal. To carry out the manual fixups, look at the log file, `preupgrade.log`. It contains instructions and script information for how to run manual fixup scripts. These fixup scripts are generated for you by the `postupgrade_fixups.sql` script. Follow the instructions provided in the log file to fix the issues.

Example 3-27 Manual Fixup Instructions for Oracle-Maintained Types In User Tables (depend_usr_tables)

```
    + If you use the -T option for the database upgrade, then run

                    @?/rdbms/admin/utluptabdata.sql after the upgrade is complete, to

                    VALIDATE and UPGRADE any user tables affected by changes to

                    Oracle-Maintained
types.


  SQL> @C:\app\oracle\product\12.2.0\dbhome_1\rdbms\admin\utluptabdata.sql

  PL/SQL procedure successfully completed.

                    SQL>
```

Example 3-28 Manual Fixup Instructions for Time Zone Version (old_time_zones_exist)

```
+ Upgrade the database time zone version using the DBMS_DST package.


                    The database is using timezone datafile version 14 and the target

                    12.2.0.1.0 database ships with timezone datafile version 26.

                    Oracle recommends using the most recent timezone data.  For
further

                    information, refer to My Oracle Support Note 1585343.1


                    SQL> @C:\Users\oracle\Downloads
\DBMS_DST_scriptsV1.9\DBMS_DST_scriptsV1.9\countstatsTSTZ.sql
```

```
                    .

                    Amount of TSTZ data using num_rows stats info in DBA_TABLES.

                    .

                    For SYS tables first...

                    Note: empty tables are not listed.

                    Stat date  - Owner.Tablename.Columnname - num_rows

                    05/07/2016 - SYS.AQ$_ALERT_QT_S.CREATION_TIME - 5

                    ...


                    Total numrow of SYS TSTZ columns is : 14652

                    There are in total 154 non-SYS TSTZ columns.

                    .

                    ...

                    For non-SYS tables ...

                    Note: empty tables are not listed.

                    ...

                    ...

                    Stat date  - Owner.Tablename.Columnname - num_rows

                    Total numrow of non-SYS TSTZ columns is : 17

                    There are in total 32 non-SYS TSTZ columns.

                    Total Minutes elapsed : 0

                    SQL>

                    SQL> spool upg_tzv_check.log

                    SQL> @C:\Users\oracle\Downloads
\DBMS_DST_scriptsV1.9\DBMS_DST_scriptsV1.9\upg_tzv_check.sql

                    INFO: Starting with RDBMS DST update preparation.

                    INFO: NO actual RDBMS DST update will be done by this script.

                    INFO: If an ERROR occurs the script will EXIT sqlplus.

                    INFO: Doing checks for known issues ...

                    INFO: Database version is 12.2.0.1 .

                    INFO: Database RDBMS DST version is DSTv14 .
```

```
                    INFO: No known issues detected.

                    INFO: Now detecting new RDBMS DST version.

                    A prepare window has been successfully started.

                    INFO: Newest RDBMS DST version detected is DSTv26 .

                    INFO: Next step is checking all TSTZ data.

                    INFO: It might take a while before any further output is seen ...

                    A prepare window has been successfully ended.

                    INFO: A newer RDBMS DST version than the one currently used is
found.

                    INFO: Note that NO DST update was yet done.

                    INFO: Now run upg_tzv_apply.sql to do the actual RDBMS DST update.

                    INFO: Note that the upg_tzv_apply.sql script will

                    INFO: restart the database 2 times WITHOUT any confirmation or
prompt.

                    SQL> spool
off

                    SQL> @C:\Users\oracle\Downloads
\DBMS_DST_scriptsV1.9\DBMS_DST_scriptsV1.9\upg_tzv_apply.sql

                    INFO: If an ERROR occurs the script will EXIT sqlplus.

                    INFO: The database RDBMS DST version will be updated to DSTv26 .

                    WARNING: This script will restart the database 2 times

                    WARNING: WITHOUT asking ANY confirmation.

                    WARNING: Hit control-c NOW if this is not intended.

                    INFO: Restarting the database in UPGRADE mode to start the DST
upgrade.

                    Database closed.

                    Database dismounted.  <--------- you might need to wait a couple
of minutes and hit enter a couple of times.

                    ORACLE instance shut down.

                    ORACLE instance started.


                   Total System Global Area 1828716544 bytes

                   Fixed Size                  8740096 bytes

                   Variable Size             503317248 bytes
```

```
                  Database Buffers         1308622848 bytes

                  Redo Buffers                8036352 bytes

                  Database mounted.

                  Database opened.

                  INFO: Starting the RDBMS DST upgrade.

                  INFO: Upgrading all SYS owned TSTZ data.

                  INFO: It might take time before any further output is seen ...
<--------- you might need to wait a couple of minutes
                  and hit enter a couple of times.

                  An upgrade window has been successfully started.

                  INFO: Restarting the database in NORMAL mode to upgrade non-SYS
TSTZ data.

                  Database closed.

                  Database dismounted.

                  ORACLE instance shut down.

                  ORACLE instance started.


                  Total System Global Area 1828716544 bytes

                  Fixed Size                  8740096 bytes

                  Variable Size             503317248 bytes

                  Database Buffers         1308622848 bytes

                  Redo Buffers                8036352 bytes

                  Database mounted.

                  Database opened.   ... <--------- you might need to wait a couple
of minutes and hit enter a couple of times.

                  INFO: Upgrading all non-SYS TSTZ data.

                  INFO: It might take time before any further output is seen ...

                  INFO: Do NOT start any application yet that uses TSTZ data! ...
<--------- you might need to wait a couple of minutes
                  and hit enter a couple of times.

                  INFO: Next is a list of all upgraded tables:

                  Table list: "IX"."AQ$_ORDERS_QUEUETABLE_L"

                  Number of failures: 0

                  Table list: "IX"."AQ$_ORDERS_QUEUETABLE_S"
```

```
                Number of failures: 0

                Table list: "IX"."AQ$_STREAMS_QUEUE_TABLE_L"

                Number of failures: 0

                Table list: "IX"."AQ$_STREAMS_QUEUE_TABLE_S"

                Number of failures: 0

                Table list: "APEX_050000"."WWV_FLOW_DEBUG_MESSAGES"

                Number of failures: 0

                Table list: "APEX_050000"."WWV_FLOW_DEBUG_MESSAGES2"

                Number of failures: 0

                Table list: "APEX_050000"."WWV_FLOW_FEEDBACK"

                Number of failures: 0

                Table list: "APEX_050000"."WWV_FLOW_FEEDBACK_FOLLOWUP"

                Number of failures: 0

                Table list: "APEX_050000"."WWV_FLOW_WORKSHEET_NOTIFY"

                Number of failures: 0

                Table list: "GSMADMIN_INTERNAL"."AQ$_CHANGE_LOG_QUEUE_TABLE_L"

                Number of failures: 0

                Table list: "GSMADMIN_INTERNAL"."AQ$_CHANGE_LOG_QUEUE_TABLE_S"

                Number of failures: 0

                INFO: Total failures during update of TSTZ data: 0 .

                An upgrade window has been successfully ended.

                INFO: Your new Server RDBMS DST version is DSTv26 .

                INFO: The RDBMS DST update is successfully finished.

                INFO: Make sure to exit this sqlplus session.

                INFO: Do not use it for timezone related selects.

        SQL>
```

Example 3-29 Manual Fixup for Refreshing Dictionary Statistics (post_dictionary)

```
+ Gather dictionary statistics after the upgrade using the command:

                EXECUTE DBMS_STATS.GATHER_DICTIONARY_STATS;
```

```
                    This recommendation is given for all preupgrade
runs.

         SQL> EXECUTE DBMS_STATS.GATHER_DICTIONARY_STATS;

         PL/SQL procedure successfully completed.


SQL>
```

Manual Upgrade Scenarios for Multitenant Architecture Oracle Databases

To prepare for manual upgrades, review the manual upgrade scenarios and procedures for Oracle Database deployed with multitenant architecture.

Starting with Oracle Database 12*c*, multitenant architecture enables Oracle Database deployments using multitenant container databases (CDB) that contain pluggable databases (PDBs). All Oracle Database releases earlier than Oracle Database 12*c* release 1 (12.1.0.1) use non-CDB architecture.

> **Caution:**
>
> You cannot downgrade a database after you have set the compatible initialization parameter to 12.1.0.2 or later releases. A downgrade is possible for a pluggable database (PDB) only if the compatibility is set to 12.1.0.1. There can still be restrictions on downgrading.
>
> Oracle strongly recommends that you upgrade your source and target databases to the most recent bundle patch set update (BP, PSU) before starting an upgrade, and before starting a downgrade.

- About Oracle Multitenant Oracle Database Upgrades
  You can upgrade Oracle Databases installed on multitenant architecture either in parallel, or in sequence.
- Coordinate Upgrades of Proxy PDBs with Multitenant Upgrades
  Coordinate upgrades of the CDB so that proxy PDB and PDB targets are the same version.
- Manually Upgrading a Multitenant Container Oracle Database (CDB)
  The procedure in this section provides steps for upgrading a CDB manually using a command-line procedure.
- About Upgrading PDBs Using the Parallel Upgrade Utility with Priority Lists
  In Oracle Database 12.2 and later releases, you can upgrade PDBs using a priority list to upgrade a set of PDBs ahead of other PDBs, and you can modify that upgrade priority.
- About PDB Upgrades Using Priority Lists, Inclusion Lists, and Exclusion Lists
  Starting in Oracle Database 12*c* release 2 (12.2), you can use inclusion and exclusion lists with priority lists to control how your PDBs are upgraded.

- Upgrading Multitenant Architecture In Parallel
  Use this technique to upgrade Oracle Database release 12*c* (12.1.0.1 and later releases) by upgrading container databases (CDBs), and then upgrading multiple pluggable databases (PDBs) in parallel.
- Upgrading Multitenant Architecture Sequentially Using Unplug-Plug
  Use this technique to upgrade Oracle Database release 12*c* (12.1.0.1 and later releases) by unplugging pluggable databases (PDBs) in earlier release container databases (CDBs), and plugging into later release CDBs

> **See Also:**
>
> *Oracle Database Concepts* for an overview of multitenant architecture
>
> *Oracle Database Administrator's Guide* for complete information about creating and configuring a CDB

About Oracle Multitenant Oracle Database Upgrades

You can upgrade Oracle Databases installed on multitenant architecture either in parallel, or in sequence.

Starting with Oracle Database 12*c* release 1 (12.1), Oracle provides multitenant architecture, which enables the creation and administration of pluggable databases (PDBs) in a container database (CDB). You can upgrade multitenant architecture systems using either Oracle Database Upgrade Assistant (DBUA), or using the Parallel Upgrade Utility to carry out manual upgrades.

There are two techniques for upgrading Oracle Databases using the multitenant architecture:

- In parallel. With this technique, you carry out one upgrade operation that upgrades the CDB, and then upgrades the PDBs in parallel.
- Sequentially. With this technique, you install a new release CDB, prepare and unplug PDBs from the earlier release CDB, plug the PDBs into a later release CDB, and then complete the upgrade for each PDB.

The following sections provide a high-level summary of each upgrade technique.

Upgrading Oracle Multitenant In Parallel

With the In Parallel technique, you first upgrade CDB$ROOT using the Parallel Upgrade Utility (catctl.pl), using parameters to set the degree of parallel processing and availability:

- The `-n` parameter defines how many parallel processes run the upgrade, up to 8.
- The `-M` parameter determines if the CDB$ROOT stays in UPGRADE mode through the entire upgrade, or becomes available for access after the CDB upgrade is complete. If you do not run the upgrade with the `-M` parameter, then when the CDB$ROOT upgrade is complete, PDBs then become available for access as soon as each PDB completes its upgrade. If you run the upgrade with the -M parameter, then CDB$ROOT stays in UPGRADE mode, and PDBs do not become available until upgrade of all PDBs is complete.

Upgrading Oracle Multitenant In Sequence

With the In Sequence technique, you install the new release multitenant architecture CDB. Next, in the earlier release multitenant architecture CDB, you issue SQL commands to run preupgrade scripts to prepare one or more PDBs to upgrade, and shut them down. You then unplug PDBs, plug them into the new release multenant architecture CDB, and complete the upgrade sequentially for each PDB.

Coordinate Upgrades of Proxy PDBs with Multitenant Upgrades

Coordinate upgrades of the CDB so that proxy PDB and PDB targets are the same version.

During upgrades, upgrade of a Proxy PDB does not upgrade its corresponding target PDB. Upgrade of the target PDB has to be done separately.

Manually Upgrading a Multitenant Container Oracle Database (CDB)

The procedure in this section provides steps for upgrading a CDB manually using a command-line procedure.

You must complete the following steps before using this procedure:

- Install the new release software for Oracle Database
- Prepare the new Oracle home
- Run the Pre-Upgrade Information Tool

Oracle Database 12*c* introduced multitenant architecture, which enables Oracle Database to function as a multitenant container database (CDB) with pluggable databases. You can upgrade the CDB using DBUA, and in the process, upgrade all the pluggable databases attached to the CDB at the same time. Or, after you install the software for Oracle Database and prepare the new Oracle home, you can proceed with a manual, command-line upgrade.

1. If you have not done so, run the Pre-Upgrade Information Tool. Review the Pre-Upgrade Information tool output and correct all issues noted in the output before proceeding.
2. Back up the source database.
3. If you have not done so, prepare the new Oracle home.
4. (Conditional) For Oracle RAC environments only, enter the following commands to set the initialization parameter value for CLUSTER_DATABASE to FALSE:

   ```
   ALTER SYSTEM SET CLUSTER_DATABASE=FALSE SCOPE=SPFILE;
   ```

   Restart the database after changing the `CLUSTER_DATABASE` parameter.
5. Shut down the database. (The syntax is the same for a non-CDB and a CDB.)

   ```
   SQL> SHUTDOWN IMMEDIATE
   ```

> **Note:**
>
> To close a PDB, you can specify it from the CDB root: `alter pluggable database PDBname close`.

6. If your operating system is Windows, then complete the following steps:
   a. Stop the `OracleService SID` Oracle service of the database you are upgrading, where `SID` is the instance name. For example, if your `SID` is `ORCL`, then enter the following at a command prompt:

      ```
      C:\> NET STOP OracleServiceORCL
      ```

   b. Delete the Oracle service at a command prompt using `ORADIM`.

      If your `SID` is `ORCL`, then enter the following command, substituting your SID for `SID`.

      ```
      C:\> ORADIM -DELETE -SID ORCL
      ```

   c. Create the service for the new release Oracle Database at a command prompt using the `ORADIM` command of the new Oracle Database release.

      For example:

      ```
      C:\> ORADIM -NEW -SID SID -SYSPWD PASSWORD -MAXUSERS USERS
           -STARTMODE AUTO -PFILE ORACLE_HOME\DATABASE\INITSID.ORA
      ```

      Most Oracle Database services log on to the system using the privileges of the Oracle Home User. The service runs with the privileges of this user. The `ORADIM` command prompts you for the password to this user account. You can specify other options using `ORADIM`.

      In this example, if your `SID value` is `ORCL`, your `password` (`SYSPWD`) value is `TWxy5791`, the maximum number of users (`MAXUSERS`) value is 10, and the Oracle home path is `C:\ORACLE\PRODUCT\18.1.0\DB`, then enter the following command:

      ```
      C:\> ORADIM -NEW -SID ORCL -SYSPWD TWxy5791 -MAXUSERS 10
      -STARTMODE AUTO -PFILE C:\ORACLE\PRODUCT\18.1.0\DB\DATABASE\INITORCL.ORA
      ```

      `ORADIM` writes a log file to the `ORACLE_HOME\database` directory. The log file contains the name of the PDB in the multitenant database.

7. If your operating system is Linux or UNIX, then perform the following checks:
   a. Your `ORACLE_SID` is set correctly
   b. The `oratab` file points to the Oracle home for Oracle Database 12*c*
   c. The following environment variables point to the Oracle Database 12*c* directories:
      - `ORACLE_HOME`
      - `PATH`
   d. Any scripts that clients use to set `$ORACLE_HOME` environment variable must point to the new Oracle home.

> **Note:**
>
> If you are upgrading an Oracle Real Application Clusters database, then perform these checks on all nodes where the Oracle Real Application Clusters database has instances configured.

> **See Also:**
>
> Oracle Database and Oracle Clusterware installation guides for information about setting other important environment variables on your operating system

8. Log in to the system as the owner of the Oracle home under the new Oracle Database release.
9. Start SQL*Plus in the new Oracle home from the path *Oracle_home*`/rdbms/admin` directory.

   For example:

   ```
   $ cd $ORACLE_HOME/rdbms/admin
   $ pwd
   /u01/app/oracle/product/12.2.0/dbhome_1/rdbms/admin
   $ sqlplus
   ```

   On Windows platforms, to access SQL*Plus, change directory to `%ORACLE_HOME %//bin`
10. Connect to the database that you want to upgrade using an account with SYSDBA privileges:

    ```
    SQL> CONNECT / AS SYSDBA
    ```
11. Start the CDB in upgrade mode:

    ```
    SQL> startup upgrade
    ```
12. Start the instance by issuing the following command in SQL*Plus:

    ```
    SQL> alter pluggable database all open upgrade;
    ```

    If errors appear listing desupported initialization parameters, then make a note of the desupported initialization parameters and continue with the upgrade. Remove the desupported initialization parameters the next time you shut down the database.

> **Note:**
>
> Starting up the database in `UPGRADE` mode does the following:
>
> - Starts up the database with a new version of the Oracle Database instance
> - Restricts logins to SYSDBA
> - Disables system triggers
> - Performs additional operations that prepare the database for upgrades

13. Exit SQL*Plus before proceeding to the next step.

    For example:

    ```
    SQL> EXIT
    ```

14. To upgrade an entire CDB, run the Parallel Upgrade Utility (`catctl.pl`) from the new Oracle home. The Parallel Upgrade Utility provides parallel upgrade options that reduce downtime. You can run the command by using the command-line script `dbupgrade` from the new Oracle home.

    For example:

    Linux:

    ```
    cd $ORACLE_HOME/bin
    ./dbupgrade
    ```

    Windows:

    ```
    cd %ORACLE_HOME%\bin
    dbupgrade
    ```

    > **Note:**
    >
    > - Use the `-d` option to specify the directory that contains the files that you want to process. Use the `-l` option to specify the directory that you want to use for spool log files.
    > - If you are upgrading an entire CDB, and there are errors in CDB$ROOT, then the upgrade aborts.

15. To upgrade a subset of PDBs within a CDB, specify either an inclusion list, or an exclusion list.

    - This example for a Linux or UNIX system uses an inclusion list to upgrade `PDB1` only:

      ```
      cd $ORACLE_HOME/bin
      ./dbupgrade -c 'PDB1'
      ```

    - This example for a Windows system uses an exclusion list to upgrade everything in the CDB except `PDB1`:

```
cd $ORACLE_HOME\bin
dbupgrade -C "PDB1"
```

> **Note:**
>
> You can upgrade an individual PDB by unplugging it from the earlier release CDB, and plugging it into a later release CDB.
>
> For Windows, when you run the `dbupgrade` command with the inclusion (`-c`) or the exclusion (`-C`) options, you must specify the option with quotes around the CDB root name and PDB seed name.
>
> For example:
>
> ```
> ... -C "CDB$ROOT PDB$SEED"
> ```

16. For CDBs, log in to the CDB as SYSDBA and run the command alter pluggable database all open to make databases available for recompiling code. For example:

    ```
    $ sqlplus / as sysdba

    SQL> alter pluggable database all open;
    ```

17. Run `catcon.pl`. This command starts `utlrp.sql` and recompiles any remaining stored PL/SQL and Java code.

    For example:

    ```
    $ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlrp -d '''.''' utlrp.sql
    ```

    Because you run the command using `-b utlrp0`, the log file `utlrp0.log` is generated with the recompile results.

18. Run `postupgrade_fixups.sql`.

    For example:

    ```
    $ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b postupgrade_fixups -d '''.'''
    postupgrade_fixups.sql
    ```

19. Run `utlu122s.sql`. This command verifies that all issues are fixed.

    For example, in a CDB:

    ```
    $ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlu122s -d '''.''' utlu122s.sql
    ```

    Because you run the command using `-b utlu122s`, the log file `utlu122s0.log` is generated with the upgrade results. You can review the `upg_summary.log` file to review the upgrade report.

    To see information about the state of the database, run `utlu122s.sql` as many times as you want, at any time after you complete the upgrade. If the `utlu122s.sql` script returns errors, or if it shows components that are not marked as `VALID`, or if the SQL script you run is not from the most recent release, then refer to the troubleshooting section in this guide.

20. Ensure that the time zone data files are current by using the `DBMS_DST` PL/SQL package to upgrade the time zone file. You can also update the time zone after the upgrade. If you update the time zone, then you must update the time zone in both `CDB$ROOT` and the PDBs.

21. Exit SQL*Plus.

For example:

```
SQL> EXIT
```

22. (Conditional) If you are upgrading an Oracle Real Application Clusters database, then use the following command syntax to upgrade the database configuration in Oracle Clusterware:

    ```
    $ srvctl upgrade database -db db-unique-name -oraclehome oraclehome
    ```

    In this example, *db-unique-name* is the assigned database name (not the instance name), and *oraclehome* is the Oracle home location in which the database is being upgraded. The SRVCTL utility supports long GNU-style options, in addition to the short CLI options used in earlier releases.

Your database is now upgraded. You are ready to complete post-upgrade procedures.

> **Caution:**
>
> If you retain the old Oracle software, then never start the upgraded database with the old software. Only start Oracle Database using the start command in the new Oracle Database home.
>
> Before you remove the old Oracle environment, relocate any data files in that environment to the new Oracle Database environment.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for information about relocating data files

About Upgrading PDBs Using the Parallel Upgrade Utility with Priority Lists

In Oracle Database 12.2 and later releases, you can upgrade PDBs using a priority list to upgrade a set of PDBs ahead of other PDBs, and you can modify that upgrade priority.

Priority lists enable you to group and upgrade PDBs according to their priority. A priority list is a text file with comma-delimited lists defining the order of upgrade priority, and the PDBs in each numeric priority group. You run the Parallel Upgrade Utility (`dbupgrade`, `dbupgrade.cmd`, or `catctl.pl`) using the `-L` option to run the upgrade using a priority list, and to call that list as the upgrade runs.

Create the list using the following format. In this format example, the variable *numeral* is a numeric value, and *pdbx* is the name of a PDB.

Number, Pdb
numeral,*pdb1*,*pdb2*,*pdb3*
numeral,*pdb4*
numeral,*pdb5*,*pdb6*,*pdb7*,*pdb8*

.
.
.

The numeral represents the priority for the PDB.

PDB priorities are as follows:

1. CDB$ROOT: Priority 1. Upgrading the container database first is a mandatory priority. You cannot change the priority for the container database upgrade. CDB$ROOT is always processed first.
2. PDB$SEED: Priority 1. Upgrading the PDB seed database is a mandatory priority. You cannot change the priority for the PDB seed upgrade. PDB$SEED always upgraded after CDB$ROOT, and with the first batch of PDB upgrades.
3. Priority List 1 PDBs: Priority 1 is the highest user-selected priority. These PDBs are upgraded second after CDB$ROOT, in the batch where the PDB$SEED PDB is upgraded.
4. Priority List 2 PDBs: Priority 2 is the second-highest priority PDB set. These PDBs are upgraded after the Priority 1 PDBs.
5. Priority List 3 PDBs: Priority 3 is the third-highest priority PDB set. These PDBS are upgraded after priority 2 PDBs.
6. Priority List 4 PDBs: Priority 4 is the fourth-highest priority PDB set. These PDBS are upgraded after priority 3 PDBs.
7. Priority List 5 PDBs: Priority 5 is the fifth-highest priority PDB set. These PDBS are upgraded after priority 4 PDBs.
8. Priority List 6 PDBs: Priority 6 is the sixth-highest priority PDB set. These PDBS are upgraded after priority 7 PDBs.

When you run the Parallel Upgrade Utility, the following processing rules apply:

- CDB$ROOT and PDB$SEED are always processed first, even if they are not present in the priority list.
- All PDBs that are in priority lists are processed in order of priority
- Any PDBs that are not listed in priority lists are processed after the PDBs named in the priority list.

For example:

```
Number,Pdb
1,sales1,region2,receivables1
2,sales2
3,dss1,region3,region2,dss2,dss3
```

Use the following syntax to run the Parallel Upgrade utility using a priority list:

```
dbupgrade -L priority_list_name
```

For example, to run the Parallel Upgrade Utility on a Windows system using the Parallel Upgrade Utility batch command and a priority list named `My122Upgrade`, enter the following command:

```
C:>\u01\app\18.1.0\db_home1\rdbms\admin\dbupgrade -L MyUpgrade
```

After you complete an upgrade using a priority list to set upgrade priorities, these PDB priority states are maintained in the CDB for the PDBs. The next upgrade honors the priorities set for the PDBs in the previous upgrade.

Use the following SQL command syntax to change PDB upgrade priority states, where *PDBName* is the name of the PDB whose upgrade priority you want to change, and *PDBPriorityNumber* is the new priority value you want to assign:

```
SQL> alter session set container = CDB$ROOT
SQL> alter pluggable database PDBName upgrade priorityPDBPriorityNumber
```

For example:

```
SQL> alter session set container = CDB$ROOT
SQL> alter pluggable database region2 upgrade priority 2
```

In this example, the PDB named region 2 that was set to upgrade priority 1 in the previous example is changed to upgrade priority 2.

About PDB Upgrades Using Priority Lists, Inclusion Lists, and Exclusion Lists

Starting in Oracle Database 12*c* release 2 (12.2), you can use inclusion and exclusion lists with priority lists to control how your PDBs are upgraded.

Upgrade Processing and Lists

The following terms designate types of upgrade list processing:

- **Priority lists**: Comma-delimited lists that designate the upgrade priority of PDBs in the list.
- **Inclusion lists**: Comma-delimited lists that designate PDBs that you want to upgrade. PDBs in these lists are upgraded after the PDBs listed in priority lists.
- **Exclusion lists**: Comma-delimited lists that designate PDBs that you do not want to be upgraded.

You can use inclusion lists and exclusion lists in the following ways:

- On their own, to include or exclude a set of PDBs from an upgrade
- In conjunction with priority lists to provide detailed specifications for the order in which PDBs are upgraded, and which PDBs are excluded from an upgrade.

  When inclusion lists are used with priority lists, the PDBs listed in inclusion lists are upgraded according to the priority value they are assigned in the priority lists. PDBs listed in inclusion lists but not listed in priority lists are upgraded after all PDBs in the priority lists are upgraded.

  When exclusion lists are used with priority lists, the PDBs listed in exclusion lists are not upgraded.

> **Note:**
>
> Create priority lists using a plain text editor, such as `vi` on Linux and UNIX, or Notepad on Windows.
>
> In the examples in this topic, the `cpu_count` value is equal to 2.

Upgrade Priority using Default Processing

Default processing is the upgrade processing that is carried out if you do not designate how you want to upgrade PDBs in your CDBs using lists.

With default processing, CDB$ROOT is upgraded, and then PDB$SEED. Depending on the degree of parallelism you set, one or more PDBs may be updated in parallel with PDB$SEED. As upgrades complete, PDBs are upgraded as upgrade processors become available.

The examples that follow use the following multitenant configuration of CDB and PDBs:

```
CDB$ROOT
PDB$SEED
CDB1_PDB1
CDB1_PDB2
CDB1_PDB3
CDB1_PDB4
CDB1_PDB5
```

In default processing, you specify no preference for which PDBs you want upgraded or excluded from upgrade. With default processing, CDB$ROOT is upgraded first, and PDB$SEED is updated in the first group of PDBs upgraded.

Example 3-30 Specifying Complete PDB Upgrade Priority

The following example of a priority list, where the priority setting for all PDBs is set by the list:

```
1,CDB$ROOT
1,PDB$SEED
1,CDB1_PDB1
1,CDB1_PDB2
2,CDB1_PDB3
2,CDB1_PDB4
3,CDB1_PDB5
```

Here is another way of writing the same list, in which you group PDBs in priority order:

```
1,CDB$ROOT
1,PDB$SEED
1,CDB1_PDB1,CDB1_PDB2
2,CDB1_PDB3,CDB1_PDB4
3,CDB1_PDB5
```

In the preceding example, the PDBs listed in priority 1 are CDB1_PDB1 and CDB1_PDB2. These PDBs are upgraded before CDB1_PDB3 and CDB1_PDB4.

Here is another way of writing the same list, using container ID values (CON_ID) to set the priority order:

```
1,CDB$ROOT
1,PDB$SEED
1,3,4
2,5,6
3,7
```

In the preceding example, the PDBs listed in priority 1 are CDB1_PDB1 (identified by CON_ID 3) and CDB1_PDB2 (identified by CON_ID 4). These PDBs are upgraded before CDB1_PDB3 (CON_ID 5) and CDB1_PDB4 (CON_ID 6).

When you use CON_IDs to specify priority, the first number specifies the priority of the group of PDBs. The second value or number specifies the PDBs (by CON_ID) number that are in that priority grouping. CDB$ROOT is always updated first, and PDB$SEED is always updated in the first upgrade priority group.

These examples all show a priority list upgrade with the following characteristics:

- Exclusion processing: None
- Inclusion processing: None
- Default processing: None

The upgrade order is carried out in the following sequence:

1. CDB$ROOT
2. PDB$SEED, CDB1_PDB1
3. CDB1_PDB2, CDB1_PDB3
4. CDB1_PDB4, CDB1_PDB5

Example 3-31 Specifying a Priority Subset of PDBs, and Upgrading Other PDBs with Default Processing

The following example specifies a priority list called `priority.lst`, which specifies a subset of PDBs for upgrade:

```
catctl -L priority.lst catupgrd.sql
1,CDB$ROOT
1,PDB$SEED
1,CDB1_PDB1,CDB1_PDB2
```

This example shows a priority list upgrade with the following characteristics:

- Exclusion processing: None
- Inclusion processing: None
- Default processing: CDB1_PDB3,CDB1_PDB4,CDB1_PDB5

The upgrade order is carried out in the following sequence:

1. CDB$ROOT
2. PDB$SEED, CDB1_PDB1
3. CDB1_PDB2, CDB1_PDB3
4. CDB1_PDB4, CDB1_PDB5

Example 3-32 Specifying a Priority Subset of PDBs, and Upgrading Other PDBs with an Inclusion List

The following example specifies a priority list called `priority.lst`, which specifies a priority subset of PDBs for upgrade:

```
catctl -L priority.lst -c 'CDB1_PDB2 CDB1_PDB4 CDB1_PDB5' catupgrd.sql
```

This command refers to the following priority list:

```
1,CDB$ROOT
1,PDB$SEED
1,CDB1_PDB2,CDB1_PDB4
2.CDB1_PDB5
```

This example shows a priority list upgrade with the following characteristics:

- Exclusion processing: None
- Inclusion processing: CDB1_PDB2 CDB1_PDB4 CDB1_PDB5
- Default processing: None

The upgrade order is carried out in the following sequence:

1. CDB1_PDB2, CDB1_PDB4
2. CDB1_PDB5

The Parallel Upgrade Utility processes only the PDBs that are in the inclusion list, and in the order of the priority list.

Example 3-33 Specifying a Priority Subset of PDBs, and Excluding CDB$ROOT with an Exclusion List

The following example runs `catctl` using a priority list called `priority.lst`. Because this command runs with the `-C` option, it excludes CDB$ROOT from the upgrade:

```
catctl -L priority.lst -C 'CDB$ROOT' catupgrd.sql
```

This is the priority list:

```
1,CDB$ROOT
1,PDB$SEED
1,CDB1_PDB1,CDB1_PDB2
2,CDB1_PDB3,CDB1_PDB4
3,CDB1_PDB5
```

The upgrades are processed using the priority list to specify upgrade priority.

- Inclusion processing: None
- Exclusion processing: CDB$ROOT
- Priority processing: PDB$SEED, CDB1_PDB1, CDB1_PDB2, CDB1_PDB3, CDB1_PDB4, CDB1_PDB5

Because CDB$ROOT is excluded, the priority processing shifts. The upgrade order is carried out in the following sequence:

1. PDB$SEED, CDB_PDB1
2. CDB_PDB2, CDB_PDB3
3. CDB1_PDB4, CDB1_PDB5

Example 3-34 Specifying an Exclusion List using CATCTL_LISTONLY

The following example specifies a priority list called `priority.lst`, which specifies a subset of PDBs for upgrade. With the CATCTL_LISTONLY option, PDBs that are not in the priority list are excluded from the upgrade:

```
catctl -L priority.lst -C 'CATCTL_LISTONLY' catupgrd.sql
```

Priority list:

```
1,CDB$ROOT
1,PDB$SEED
1,CDB1_PDB1,CDB1_PDB2
2,CDB1_PDB3
3,CDB1_PDB5
```

- Exclusion processing: CATCTL_LISTONLY (Only process inclusion priority list)
- Inclusion processing: None
- Default processing: None

The upgrade order is carried out in the following sequence:

1. CDB$ROOT
2. PDB$SEED, CDB1_PDB1,CDB1_PDB2
3. CDB1_PDB3, CDB1_PDB5

> **Note:**
>
> Specifying the keyword CATCTL_LISTONLY in the exclusion list turns the priority list into an inclusion priority list. Only PDBs in the list are processed. No default processing occurs in this scenario, so in this example, CDB1_PDB4 is not processed.

Example 3-35 Specifying a Priority List using CON_ID Values

The following example specifies a priority list called `priority.lst`, which specifies a subset of PDBs for upgrade:

```
catctl -L priority.lst -C 'CATCTL_LISTONLY' catupgrd.sql
```

The upgrade order is determined by the priority list priority number. In the list called by the `-L` parameter, `priority.lst`, the numbers following the upgrade priority number are the CON_ID values associated with PDB names:

```
1,3,4
2,5,CDB1_PDB4
3,7
```

In the preceding list example, note that you can use a mix of CON_ID numbers and PDB names.

The PDBs listed in priority 3 are CDB1_PDB1 (identified by CON_ID 3) and CDB1_PDB2 (identified by CON_ID 4). These PDBs are upgraded before CDB1_PDB3 (CON_ID 5), CDB1_PDB4, which is identified by name, and CDB1_PDB5 (CON_ID 7).

- Exclusion processing: `-C CATCTL_LISTONLY` (Only process PDBs in the inclusion priority list)
- Exclusion Processing: None
- Inclusion processing: Specified in `priority.lst`
- Default processing: CDB$ROOT, PDB$SEED

The upgrade order is determined by the priority list, which uses the CON_ID numbers associated with the PDB.

1. CDB$ROOT
2. PDB$SEED, CDB1_PDB1
3. CDB1_PDB2, CDB1_PDB3
4. CDB1_PDB4, CDB1_PDB5

> **Note:**
>
> This example demonstrates the use of CON_IDs to specify the PDBs, and omits CDB$ROOT and PDB$SEED from the priority list. CDB$ROOT and PDB$SEED are processed using default processing.

Upgrading Multitenant Architecture In Parallel

Use this technique to upgrade Oracle Database release 12*c* (12.1.0.1 and later releases) by upgrading container databases (CDBs), and then upgrading multiple pluggable databases (PDBs) in parallel.

- About Upgrading Pluggable Databases (PDBs) In Parallel
  Using the In-Parallel technique, you can upgrade the CDB, and then immediately upgrade PDBs using parallel SQL processors.
- Upgrading Multitenant Container Databases In Parallel
  Use this technique to upgrade CDB$ROOT, PDB$SEED, and all PDBS in the CDB in one upgrade operation.

About Upgrading Pluggable Databases (PDBs) In Parallel

Using the In-Parallel technique, you can upgrade the CDB, and then immediately upgrade PDBs using parallel SQL processors.

Container databases (CDBs) can contain zero, one, or more pluggable databases (PDBs). If you use the In Parallel upgrade technique, then you can use the upgrade automation features built into the Parallel Upgrade Utility (`catctl.pl`) to update the CDB and all of its PDBs in the same upgrade window. The In Parallel technique runs upgrade processes in parallel, based on the resource settings you provide. If you choose to use all of your available system resources for upgrade, then parallel processing is limited only by your system CPU power, and the number of cores.

For example, you can use the In-Parallel technique to patch all of your PDBs at the same time with one quarterly release update (RU), release update revision (RUR), bundle patch, or patch set update (BP or PSU). You can also upgrade the entire

multitenant architecture to a later release, including CDB$ROOT, PDB$SEED, and all of the PDBs plugged into the CDB, using parallel processing to limit your downtime.

> **Note:**
>
> The advantage of this technique is simplicity and ease of maintenance that it provides. However, you must plan your upgrade window to accommodate a common downtime for all of the database services that the PDBs on the CDB are providing.

You can upgrade the entire multitenant architecture database in parallel using Parallel Upgrade Utility (`catctl.pl`), which you can start from the command line using the `dbupgrade` shell script. The following syntax shows the key parameters for in-parallel processing:

`dbupgrade [-M] -n` [-N]

- `-M` specifies if CDB$ROOT is kept in upgrade mode, or if it becomes available when it completes upgrade:
  - If you run the Parallel Upgrade Utility with the `-M` parameter, then the upgrade places CDB$ROOT and all of its PDBs in upgrade mode, which may reduce total upgrade time. However, you cannot bring up any of the PDBs until the CDB and all of its PDBs are upgraded.
  - If you do not run the Parallel Upgrade Utility with the `-M` parameter, then CDB$ROOT is upgraded and restarted in normal mode, and the normal background processes are started. As each PDB is upgraded, you can bring each PDB online while other PDBs are still being upgraded.
- `-n` specifies the number of in-parallel PDB upgrade processors.

  The number of PDBs upgraded concurrently is controlled by the value you provide for the `-n` parameter.

  Starting in Oracle Database 12*c*, the default value for Oracle Multitenant databases is the number of CPUs on your system. A `cpu_count` value equal to 24 equates to a default value of 24 for `-n`. The maximum value is now unlimited. The minimum value is 4. The maximum PDB upgrades running concurrently is the value of `-n` divided by the value of `-N`.
- `-N` Specifies the number of SQL processors to use when upgrading PDBs. The maximum value is 8. The minimum value is 1. If you do not specify a value for `-N`, then the default value is 2.

The following is a high-level list of actions during the In Parallel PDB upgrade technique:

1. Make sure that your backup strategy is complete.
2. Copy and run the preupgrade scripts from the new Oracle Database release, and fix any issues that they uncover.
3. Run the Parallel Upgrade Utility. In sequence, the following upgrades are carried out:
   a. Cycle 1: CDB$ROOT is upgraded to the new Oracle release

b. Cycle 2: PDB$SEED...cycle *x*: PDBs are upgraded in parallel, with the number of cycles of upgrades as determined by the parameter settings you provide.

If you do not specify `-M`, then PDBs become available to bring online as they complete upgrade.

4. Complete post-upgrade steps.

Upgrading Multitenant Container Databases In Parallel

Use this technique to upgrade CDB$ROOT, PDB$SEED, and all PDBS in the CDB in one upgrade operation.

Oracle recommends that you use this approach if you can schedule downtime, because it provides a direct procedure for upgrades and simplicity of maintenance. Using this procedure upgrades in parallel all the PDBs in the multitenant architecture container database, depending on your server's available processors (CPUs).

> **Note:**
>
> When you upgrade the entire container using the In Parallel upgrade method, all the PDBs must be down. Perform the upgrade in a scheduled upgrade window so that you can bring all the PDBs down.

> **Caution:**
>
> - Always create a backup of existing databases before starting any configuration change.
> - You cannot downgrade a database after you have set the compatible initialization parameter to 12.1.0.2. A downgrade is possible for a pluggable database (PDB) only if the compatibility is set to 12.1.0.1 or later. There can still be additional downgrading restrictions .
> - Oracle strongly recommends that you upgrade your source and target databases to the most recent bundle patch or patch set update (BP or PSU) before starting an upgrade, and to the most recent release update before starting a downgrade.

1. Ensure that you have a proper backup strategy in place.
2. (Conditional) For Oracle RAC environments only, enter the following commands to set the initialization parameter value for `CLUSTER_DATABASE` to `FALSE`:

   ```
   ALTER SYSTEM SET CLUSTER_DATABASE=FALSE SCOPE=SPFILE;
   ```

   Restart the database after changing the `CLUSTER_DATABASE` parameter.
3. Open all PDBs.

   For example:

   ```
   SQL> alter pluggable database all open;
   ```

4. Run the Pre-Upgrade Information Tool (`preupgrade.jar`), using the following syntax:

   `/java -jar` *`$New_release_Oracle_home`*`/rdbms/admin/preupgrade.jar [TERMINAL|FILE| DIR outputdir] [TEXT|XML] [-c` *`InclusionListOfPDBs`*`] [-C` *`ExclusionListOfPDBs`*`]`
   Use space-delimitation for lists. On Linux and UNIX, define the list by placing the list inside single quotes: `'`. On Windows systems, define the list by placing the list inside double quotes `"`.

   For example, run the following command to run the Pre-Upgrade Information tool on PDBs PDB1 through PDB25, where you have set up an environment variable `$ORACLE_HOME_12.1` for your Oracle Database Oracle home in `/u01/app/oracle/product/12.1.0/dbhome_1/`, and you have set up an environment variable `$ORACLE_HOME_18.1` for your new Oracle Database Oracle home in `/u01/app/oracle/product/18.1.0/dbhome_1/`:
   Linux and UNIX:

   ```
   java -jar $ORACLE_HOME_18.1/rdbms/admin/preupgrade.jar \
   -c 'pdb1 pdb2 pdb3 pdb4 pdb5 pdb6 pdb7 pdb8 pdb9 pdb10 pdb11 pdb12 pdb13\
   pdb14 pdb15 pdb16 pdb17 pdb18 pdb19 pdb20 pdb21 pdb22 pdb23 pdb24 pdb25'
   ```

   Windows:

   ```
   java -jar %ORACLE_HOME_18.1%/rdbms/admin/preupgrade.jar \
   -c "pdb1 pdb2 pdb3 pdb4 pdb5 pdb6 pdb7 pdb8 pdb9 pdb10 pdb11 pdb12 pdb13\
   pdb14 pdb15 pdb16 pdb17 pdb18 pdb19 pdb20 pdb21 pdb22 pdb23 pdb24 pdb25"
   ```

   > **Note:**
   >
   > You must use Java 1.5 or later to run the Pre-Upgrade Information tool. By default, the Java releases in Oracle Database releases that you can upgrade directly support the tool.

5. Read any generated fixup scripts and log files.

   By default, if ORACLE_BASE is defined, then the fixup files are placed in one of the following paths:

   - Linux and UNIX:

     `$ORACLE_BASE/cfgtoollogs/`*`db_unique_name`*`/preupgrade`

   - Windows

     `%ORACLE_BASE%\cfgtoollogs\`*`db_unique_name`*`\preupgrade`

   If ORACLE_BASE is not defined, then fixup files are placed in one of the following paths:

   - Linux and UNIX:

     `$ORACLE_HOME/cfgtoollogs/`*`db_unique_name`*`/preupgrade`

   - Windows:

     `%ORACLE_HOME\cfgtoollogs\`*`db_unique_name`*`\preupgrade`

   On multitenant architecture Oracle Databases, the Pre-Upgrade Information Tool also creates a consolidated `preupgrade_fixups.sql` script. You can run the consolidated fixup script by using `catcon.pl`. The consolidated fixup script runs

on every container that was open at the time that you ran the `preupgrade.jar` command.

6. Run the `preupgrade_fixups` script, or individual PDB scripts. The `preupgrade_fixups` SQL scripts resolve some of the issues reported by the `preupgrade` script.

   On multitenant environment Oracle Database deployments, you can run `preupgrade_fixups`*pdb-name*`.sql` scripts on the source database, where *pdb-name* is the PDB name. If you generate fixup scripts for PDBs, then the PDB name is added to the fixup filename.

   In addition to the individual PDB fixup scripts, you can use `catcon.pl` to run the consolidated `preupgrade_fixups.sql` script. The consolidated script runs on every container that was open at the time that you ran `preupgrade.jar`.

   > **Note:**
   >
   > Because $ is a reserved symbol on operating systems, the fixup script for PDB$SEED is `preupgrade_fixups_pdb_seed.sql`.

   Complete any other preupgrade tasks that the Pre-Upgrade Information Tool identifies.

7. Switch to the new $ORACLE_HOME, and set any other needed environment variables.

8. Connect with SQL*Plus:

   ```
   sqlplus / as sysdba
   ```

9. Bring the CDB$ROOT instance into upgrade mode:

   ```
   STARTUP UPGRADE
   ```

10. Bring all PDBs into upgrade mode:

    ```
    ALTER PLUGGABLE DATABASE ALL OPEN UPGRADE;
    ```

11. Check the status of PDBs to confirm that they are ready to upgrade:

    ```
    SHOW PDBS
    ```

    For all PDBs, ensure that the status is set to MIGRATE.

12. Exit from SQL*Plus, and change directory to the new Oracle home `$ORACLE_HOME/rdbms/admin`:

    ```
    SQL> EXIT
    $ ORACLE_HOME/bin
    ```

13. Start the upgrade using the Parallel Upgrade Utility (`catctl.pl`, using the shell command `dbupgrade`), where `-d` specifies the location of the directory:

    ```
    dbupgrade -d $ORACLE_HOME/rdbms/admin
    ```

    If you do not specify any parameters, then the Parallel Upgrade Utility runs the upgrade in parallel on the number of PDBs equivalent to the number of CPUs divided by 2. On a server with 64 CPUs, 64 divided by 2 equals 32 PDBs upgraded in parallel, carried out with two SQL processors for each PDB. CDB$ROOT remains in NORMAL mode for the duration of the upgrade.

14. Open all PDBs, so that you can recompile the databases:

```
ALTER PLUGGABLE DATABASE ALL OPEN;
```

15. Exit from SQL*Plus, and change directory to the new Oracle home path `$ORACLE_HOME/rdbms/admin`:

```
SQL> EXIT
cd $ORACLE_HOME/rdbms/admin
```

16. Run the `catcon.pl` script and the `postupgrade_fixups.sql` script that is supplied with the new release Oracle Database.

    The following example shows the command strings for running `catcon.pl`, using the `-n` parameter to specify one parallel processor for each PDB, using the `-d` parameter to specify the path where the preupgrade script that you want to run is located, using the `-l` parameter to specify the location where you want the scripts to place log files, and using the `-b` flag to specify the log file prefixes for the `postupgrade_fixups.sql` script:

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -n 1 -d \
$ORACLE_HOME/cfgtoollogs/cdbupgr/preupgrade -l /home/oracle/upgrdDBA -b \
postupgrade_fixups postupgrade_fixups.sql
```

17. Run the `catcon.pl` script:

```
$ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlrp -d '''.''' utlrp.sql
```

    The `catcon.pl` script runs `utlrp.sql` from the `$ORACLE_HOME/rdbms/admin` directory.

    The script recompiles any remaining stored PL/SQL and Java code. Note the following conditions of this use case:

    - The `-n` parameter is set to 1, so the script runs each PDB recompilation in sequence.
    - Expect a time delay for the serial recompilation of PDBs to complete. Depending on the number of PDBs that you are upgrading, the recompilation can extend significantly beyond the time required for the upgrade scripts to complete.

18. Run `postupgrade_fixups.sql`.

    Non- CDB:

```
SQL> @rdbms/admin/postupgrade_fixups.sql
```

    CDB:

```
$ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b postupgradefixups -d '''.'''
postupgradefixups.sql
```

19. Run `utlu122s.sql` to verify that all issues have been fixed.

    Non-CDB:

```
SQL> @rdbms/admin/utlu122s.sql
```

    CDB:

```
$ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlu122s -d '''.''' utlu122s.sql
```

When you use `catcon.pl` to run `utlu122s.sql`, the log file `utlu122s0.log` is generated. The log file provides the upgrade results. You can also review the upgrade report, `upg_summary.log`.

To see information about the state of the database, run `utlu122s.sql` as many times as you want, at any time after the upgrade is completed. If the `utlu122s.sql` script returns errors, or shows components that do not have the status `VALID`, or if the version listed for the component is not the most recent release, then perform troubleshooting.

20. (Conditional) For Oracle RAC environments only, enter the following commands to set the initialization parameter value for `CLUSTER_DATABASE` to `TRUE`, and to start the Oracle RAC database, where *`dbname`* is the name of the Oracle RAC database:

```
ALTER SYSTEM SET CLUSTER_DATABASE=TRUE SCOPE=SPFILE;
srvctl start database -db db_unique_name
```

Your database is now upgraded.

> **Caution:**
>
> If you retain the old Oracle software, then never start the upgraded database with the old software. Only start Oracle Database using the start command in the new Oracle Database home.
>
> Before you remove the old Oracle environment, relocate any data files in that environment to the new Oracle Database environment.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for information about relocating data files

Upgrading Multitenant Architecture Sequentially Using Unplug-Plug

Use this technique to upgrade Oracle Database release 12*c* (12.1.0.1 and later releases) by unplugging pluggable databases (PDBs) in earlier release container databases (CDBs), and plugging into later release CDBs

- About Upgrading Pluggable Databases (PDBs) Sequentially
  Using the unplug-plug technique, you upgrade PDBs after you upgrade the CDB. Use this overview to understand PDB sequential upgrades.
- Unplugging the Earlier Release PDB from the Earlier Release CDB
  Unplugging the PDB is the first of three upgrade tasks.
- Plugging in the Earlier Release PDB to the Later Release CDB
  Plugging the PDB from the earlier release PDB to the later release CDB is the second of three upgrade tasks.
- Upgrading the Earlier Release PDB to the Later Release
  In the third of three PDB upgrade steps, you upgrade the earlier-release PDB to the release level of the CDB.

- Use Inclusion or Exclusion Lists for PDB Upgrades
  If you want to upgrade a subset of earlier release PDBs, then use inclusion or exclusion lists to avoid reupgrading the CDB or PDBs that are at the new release level.

About Upgrading Pluggable Databases (PDBs) Sequentially

Using the unplug-plug technique, you upgrade PDBs after you upgrade the CDB. Use this overview to understand PDB sequential upgrades.

Container databases (CDBs) can contain zero, one, or more pluggable databases (PDBs). You can upgrade one PDB without upgrading the whole CDB. For example, you can unplug a PDB from a release 12.1.0.2 CDB, plug it into a release 12.2.0.1 CDB, and then upgrade that PDB to release 12.2.0.1.

Starting with Oracle Database 12.2, you can use DBUA to upgrade PDBs, or upgrade PDBs manually. You can upgrade the CDB and all PDBs (an In Parallel manual upgrade), or you can upgrade the CDB, and then upgrade PDBs sequentially (a Sequential manual upgrade).

The following is a high-level list of the steps required for sequential PDB upgrades:

1. Unplug the earlier release PDB from the earlier release CDB.
2. Drop the PDB from the CDB.
3. Plug the earlier release PDB into the later release CDB.
4. Upgrade the earlier release PDB to a later release.

Starting in Oracle Database 12*c* release 2 (12.2), you can provide lists to the Parallel Upgrade Utility to upgrade PDBs:

- Priority lists, to set the order in which PDBs are upgraded
- Inclusion lists, which enable you to designate a set of PDBs to upgrade after the PDBs listed in the priority list are upgraded
- Exclusion lists, which enable you to designate a set of PDBs that are not upgraded

> **Note:**
>
> A PDB cannot be recovered unless it is backed up. After upgrading using the method of creating a CDB and plugging in a PDB, be sure to back up the PDB.

Related Topics

- *Oracle Database Backup and Recovery User's Guide*
- *Oracle Database Administrator's Guide*
- Manually Upgrading a Multitenant Container Oracle Database (CDB)

Unplugging the Earlier Release PDB from the Earlier Release CDB

Unplugging the PDB is the first of three upgrade tasks.

1. Run the Pre-Upgrade Information Tool on the PDB.

For example, where the PDB named `salespdb` is running in the CDB in `$ORACLE_HOME_12.1`:

```
$ORACLE_HOME_12.1/jdk/bin/java -jar
$ORACLE_HOME_12.2/rdbms/admin/preupgrade.jar dir /tmp -c salespdb
```

2. Run `preupgrade_fixups.sql` on your source database.

   For example:

   ```
   CONNECT / AS SYSDBA
   SQL> ALTER SESSION SET CONTAINER=SALESPDB;

   SQL> @/tmp/preupgrade_fixups_salespdb.sql
   ```

3. Close the PDB you want to unplug.

   For example, use the following command to close the PDB `salespdb`:

   ```
   SQL> alter pluggable database salespdb close;
   ```

4. Follow all recommendations listed in `preupgrade.log`.

5. Log back in to CDB$ROOT:

   ```
   CONNECT / AS SYSDBA
   SQL> ALTER SESSION SET CONTAINER=CDB$ROOT;
   ```

6. Unplug the earlier release PDB using the following SQL command syntax, where *pdb* is the name of the PDB, and *path* is the location of the PDB XML file:

   ```
   alter pluggable database pdb unplug into 'path/pdb.xml';
   ```

   For example, where the pdb name is `salespub` and path is `/home/oracle/salespdb.xml`:

   ```
   SQL> alter pluggable database salespdb unplug into '/home/oracle/salespdb.xml';
   ```

   The following response displays when the command is completed:

   ```
   Pluggable database altered
   ```

7. Drop the pluggable database SALESPDB, but keep data files.

   Oracle recommends that you drop SALESPDB after this procedure to clean up leftover information in the CDB views, and to help to avoid future issues. As a best practice guideline, back up your PDB in the destination CDB first, and then issue the DROP command on the source.

   > **Caution:**
   >
   > After you drop the PDB from its original CDB, you cannot revert to it using previously taken backup, because the DROP command removes backup files.

   To drop the pluggable database, enter the following command:

   ```
   SQL> drop pluggable database salespdb keep datafiles;
   ```

8. Exit.

Plugging in the Earlier Release PDB to the Later Release CDB

Plugging the PDB from the earlier release PDB to the later release CDB is the second of three upgrade tasks.

This procedure example shows how to plug in a PDB when you are using Oracle-Managed Files. Refer to *Oracle Database Administrator's Guide* for additional information about plugging in PDBs.

1. Connect to the later release CDB.
2. Plug in the earlier release PDB using the following SQL command, where *pdb* is the name of the PDB, and *path* is the path where the PDB XML file is located:

   ```
   create pluggable database pdb using 'path/pdb.xml';
   ```

   For example:

   ```
   SQL> create pluggable database salespdb using '/home/oracle/salespdb.xml';
   ```

   The following response displays when the command is completed:

   ```
   Pluggable database created.
   ```

> **Note:**
>
> When you plug in an earlier release PDB, the PDB is in restricted mode. You can only open the PDB for upgrade.

Related Topics

- *Oracle Database Administrator's Guide*

Upgrading the Earlier Release PDB to the Later Release

In the third of three PDB upgrade steps, you upgrade the earlier-release PDB to the release level of the CDB.

1. If needed, switch to the PDB that you want to upgrade. For example, enter the following command to switch to the PDB `salespdb`:

   ```
   SQL> alter session set container=salespdb;
   ```

2. Open the PDB in UPGRADE mode.

   ```
   SQL> alter pluggable database open upgrade;
   ```

3. Upgrade the PDB using the Parallel Upgrade Utility command (`catctl.pl`, or the shell utility `dbupgrade`).

   When you upgrade a PDB, you use the commands you normally use with the Parallel Upgrade Utility. However, you also add the option `-c PDBname` to specify which PDB you are upgrading. Capitalize the name of your PDB as shown in the following example using the PDB named `salespdb`:

   ```
   $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catctl.pl -d  \
   $ORACLE_HOME/rdbms/admin -c 'SALESPDB' -l $ORACLE_BASE catupgrd.sql
   ```

4. Review results.

   The default file path for the logs is in the path *Oracle_base*/cfgtoollogs/*dbname*/*upgradedatetime*, where *Oracle_base* is the Oracle base path, *dbname* is the database name, and *upgradedatetime* is the date and time for the upgrade. The date and time strings are in the character string format *YYYYMMDDHHMMSC*, in which *YYYY* designates the year, *MM* designates the month, *DD* designates the day, *HH* designates the hour, *MM* designates the minute, and *SC* designates the second.

   For example:

   ```
   $ORACLE_BASE/cfgtoollogs/salespdb/upgrade20160815120001/upg_summary.log
   ```

5. Log in to SQL*Plus, and open the PDB to execute post-upgrade fixups, and to recompile the INVALID objects in the database:

   ```
   SQL> STARTUP;
   SQL> ALTER SESSION SET CONTAINER=SALESPDB;
   ```

6. Use the utility catcon.pl to run the script postupgrade_fixups.sql:

   ```
   $ORACLE_HOME/perl/bin/perl catcon.pl –c 'SALESPDB' -n 1 -e -b postfixups -d
   '''.''' /tmp/cfgtoollogs/SALESPDB/preupgrade/postupgrade_fixups.sql
   ```

7. Use the utility catcon.pl to run utlrp.sql from the $ORACLE_HOME/rdbms/admin directory:

   ```
   $ORACLE_HOME/perl/bin/perl catcon.pl –c 'SALESPDB'-n 1 -e -b comp -d '''.'''
   utlrp.sql
   ```

   The script recompiles INVALID objects in the database.

Related Topics

- Parallel Upgrade Utility (catctl.pl) Parameters

Use Inclusion or Exclusion Lists for PDB Upgrades

If you want to upgrade a subset of earlier release PDBs, then use inclusion or exclusion lists to avoid reupgrading the CDB or PDBs that are at the new release level.

Oracle recommends that you record the containers that you upgrade, and use inclusion or exclusion lists to exclude these containers from successive bulk upgrades. Excluding upgraded containers from successive bulk upgrades ensures that the upgrade only runs on PDBs that require the upgrade. Avoiding reupgrades minimizes the overall upgrade time, and avoids unnecessary unavailability.

For example: If you have installed Oracle Database 12*c* release 12.2.0.1, then the containers CDB$ROOT, PDB$SEED, and any other PDBs created when the CDB was created, are part of the new release multitenant architecture. If you upgraded a CDB, and at the same time upgraded a set of PDBs to release 12.2.0.1, then you do not need to upgrade either the CDB containers or the upgraded PDBs again.

In either case, when you plug in earlier release PDBs and then upgrade them, upgrade the PDBs with either an exclusion list, or an inclusion list:

- Use an inclusion list to specify the only the set of PDBs that you want to upgrade
- Use an exclusion list to exclude the CDB and PDB containers that are already upgraded

If you do not use an inclusion list or an exclusion list to limit the upgrade scope, then the Parallel Upgrade Utility (`catctl.pl`) attempts to upgrade the entire CDB, not just the PDBs that require the upgrade. During that upgrade process, your system undergoes needless downtime. The inclusion list and the exclusion list options are mutually exclusive.

Improvements to Data Dictionary Upgrade and Upgrade Status Displays

Oracle Database 12*c* includes improvements to the upgrade process, and to how upgrade status appears for the upgraded database.

- Upgrading the Data Dictionary in Parallel with Parallel Upgrade Utility
  Upgrading the data dictionary in Oracle Database is now done in parallel with the Parallel Upgrade Utility, which speeds up the upgrade process.
- Change to Upgrade Status Setting
  Starting in Oracle Database 12*c* release 1 and later releases, the meaning of the UPGRADED status has changed.
- Change to Status After Running the Re-compilation utlrp.sql Script
  The meaning of the `VALID` status has changed in Oracle Database 12*c*.

Upgrading the Data Dictionary in Parallel with Parallel Upgrade Utility

Upgrading the data dictionary in Oracle Database is now done in parallel with the Parallel Upgrade Utility, which speeds up the upgrade process.

Instead of one SQL process loading the data dictionary, you can now have multiple processes, depending on your server's CPU capacity. The Parallel Upgrade Utility (`catctl.pl`, which you can run from the command line using `dbupgrade` on Linux and UNIX, and `dbupgrade.com` on Windows) loads data into the dictionary as fast as possible, and defers any work that can be done in `normal` mode instead of `upgrade` mode. Upgrading the database using the Parallel Upgrade Utility reduces overall downtime.

Change to Upgrade Status Setting

Starting in Oracle Database 12*c* release 1 and later releases, the meaning of the UPGRADED status has changed.

When the upgrade is complete, and if there are no errors during the upgrade, then the status of the Oracle Server, Oracle Multimedia (ORDIM), Spatial (SDO) and XDB are all set to `UPGRADED`. This behavior is different from releases earlier than 12.1. In earlier releases, the status of the Oracle Server, Oracle Multimedia (ORDIM), Spatial (SDO) and XDB was set to `VALID` after upgrading. In 12.1 and later releases, the `UPGRADED` status indicates that the data dictionary has loaded without any errors. If any errors are logged to `registry$error`, then the status of the upgrade is set to `INVALID`.

When the upgrade is complete and if there are no errors, then the status of the database is set to `UPGRADED`. This behavior differs from earlier releases where the status of the database was set to `VALID` after upgrading. The `UPGRADED` status indicates that the data dictionary has been loaded without any errors. If any errors are logged to `registry$error`, then the status of the upgrade is set to `INVALID`.

Change to Status After Running the Re-compilation utlrp.sql Script

The meaning of the `VALID` status has changed in Oracle Database 12*c*.

In earlier releases of Oracle Database after upgrading a database, `VALID` meant that all objects in the data dictionary have been recompiled and are ready for use. In Oracle Database 12*c*, obtaining a `VALID` status has a different meaning. Running the `utlrp.sql` script in *normal* mode, recompiles data dictionary objects and moves the data dictionary from an `UPGRADED` status to a `VALID` status.

Oracle cannot guarantee that the database upgrade is *valid* unless `utlrp.sql` has been run after upgrading and before starting the upgraded database for the first time. Not running `utlrp.sql` after performing an upgrade forces data dictionary objects that you want to compile during their first access. The first user accessing the database suffers the performance cost for each invalid object accessed during this initial access. After these invalid objects are recompiled, normal processing returns. Running `utlrp.sql` ensures that the database is ready for use after upgrading. Any errors found are reported immediately. You can fix them before users of the upgraded database encounter problems.

About Dbupgrade Scripts and catupgrd.sql in Earlier Releases of Oracle Database

The function of the `catupgrd.sql` script is replaced by the Parallel Upgrade Utility, `catctl.pl`, and the `dbupgrade` and `dbupgrade.cmd` scripts.

In earlier releases of Oracle Database, the `catupgrd.sql` Upgrade Utility processed the upgrade. Starting with Oracle Database 12*c* release 1 (12.1), this script is replaced by the `catctl.pl` Parallel Upgrade Utility, and its command-line script, `dbupgrade`. The Parallel Upgrade Utility provides both parallel processing mode and serial modes.

The `dbupgrade` script calls `catctl.pl` to create and alter a set of data dictionary tables. The upgrade scripts also call `catctl.pl` to upgrade or install the following database components in the new Oracle Database 12*c* database:

- Oracle Database Catalog Views
- Oracle Database Packages and Types
- JServer JAVA Virtual Machine
- Oracle Database Java Packages
- Oracle XDK
- Oracle Real Application Clusters
- Oracle Workspace Manager
- Oracle Multimedia
- Oracle XML Database
- OLAP Analytic Workspace
- Oracle OLAP API
- Oracle Text

- Oracle Spatial and Graph
- Oracle Data Mining
- Oracle Label Security
- Messaging Gateway
- Oracle Database Vault

About Transporting and Upgrading a Database (Full Transportable Export/Import)

You can use file-based or nonfile-based modes for transporting data.

The Full Transportable Export/Import feature of Oracle Data Pump provides two options.

- Using a file-based Oracle Data Pump export/import
- Using a nonfile-based network mode Oracle Data Pump import

About Log File Location and DIAGNOSTIC_DEST

The location of the Automatic Diagnostic Repository (ADR) and the diagnostic log files created by the upgrade scripts can vary, depending on your environment variables and parameter settings.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for more information about using the `DIAGNOSTIC_DEST` initialization parameter and the ADR

DIAGNOSTIC_DEST and Automatic Diagnostic Repository (ADR) Home

The `DIAGNOSTIC_DEST` initialization parameter sets the location of the Automatic Diagnostic Repository (ADR), which is a directory structure that is stored outside of the database.

Beginning with Oracle Database 12*c* release 2, if the `DIAGNOSTIC_DEST` initialization parameter is omitted or left null, then the database uses the Oracle base environment variable to define `DIAGNOSTIC_DEST`.

If you have set the environment variable `ORACLE_BASE`, then `DIAGNOSTIC_DEST` defaults to the directory designated by `ORACLE_BASE`. The generated scripts and log files are created under *`Oracle_Base`*`/cfgtoollogs/`*`tool_name`*`/`*`SID`*`/upgrade`*`n`*, where *`n`* represents the consecutive number for the upgrade that you performed on this system.

For example, during the upgrade, logs created by DBUA on a system with `ORACLE_BASE` defined appear under the following path:

`ORACLE_BASE``/cfgtoollogs/dbua/`*`SID`*`/upgrade`*`n`*

Before running the actual upgrade, DBUA logs are saved under *Oracle_Base*/cfgtoollogs/dbua/logs.

> **Note:**
>
> Beginning with Oracle Database 11*g*, because all diagnostic data, including the alert log, are stored in the ADR, the initialization parameters BACKGROUND_DUMP_DEST and USER_DUMP_DEST are deprecated. They are replaced by the initialization parameter DIAGNOSTIC_DEST, which identifies the location of the ADR.

Upgrade Script Diagnostic Log Files and Unique Database Name

You can set log file paths when you run the Parallel Upgrade Utility (catctl) by setting the -l option to define a log file path.

If you do not set a log file path, then starting with Oracle Database 12c release 2, the Parallel Upgrade Utility attempts to locate a valid path for log files in the following order:

1. If ORACLE_BASE is not defined, then the Parallel Upgrade Utility determines the Oracle home from which it is being run, and places log files in the path *Oracle_Base*/cfgtoollogs/dbib/upgrade*n*, where *n* represents the consecutive number for the upgrade that you performed on this system.
2. If there is no ORACLE_BASE found on the server, then by default the log files are sent on Linux and UNIX systems to /tmp. On Windows systems, the log files are sent by default to the path defined by the TEMP environment variable. For example: C:\TEMP
3. The Parallel Upgrade Utility obtains the unique database name for the database from the V$parameter view to create the directory scheme. The path it creates is as follows where *Oracle_base* is the Oracle base for the Oracle Database installation owner, and *dbname* is the database name obtained from the V$parameter view:

   Oracle_base/cfgtoollogs/*dbname*/upgrade

   The first valid path is used for default logging:

   ```
   Oracle_base/cfgtoollogs/dbname/upgrade
   Oracle_base/rdbms/log
   /tmp
   ```

Troubleshooting the Upgrade for Oracle Database

Use these troubleshooting tips to address errors or issues that you may encounter while upgrading your database.

Also review the related links to learn about changes that affect this release, which may be related to errors you receive, and to see how to rerun the upgrade after you resolve errors.

- About Starting Oracle Database in Upgrade Mode
  When you start Oracle Database in upgrade mode, you can only run queries on fixed views. If you attempt to run other views or PL/SQL, then you receive the errors described here.
- Running DBUA with Different ORACLE_HOME Owner
  Review this topic if your Oracle Database homes are owned by different operating system user accounts, or you encounter an `upgrade.xml not found` error.
- Invalid Object Warnings and DBA Registry Errors
  Before you start your upgrade, Oracle strongly recommends that you run the preupgrade information tool (`preupgrd.jar`).
- Invalid Objects and Premature Use of Postupgrade Tool
  Never run the postupgrade status tool for the new Oracle Database release (`utlu122s.sql`) until after you complete the upgrade.
- Resolving Oracle Database Upgrade Script Termination Errors
  Review this section if you encounter ORA-00942, ORA-00904, or ORA-01722 errors.
- Troubleshooting Causes of Resource Limits Errors while Upgrading Oracle Database
  Review this section if you encounter ORA-01650, ORA-01651, ORA-01652, ORA-01653, ORA-01654, ORA-01655, ORA-0431, ORA-01562, ORA-19815, or other errors that suggest resource limit errors.
- Resolving SQL*Plus Edition Session Startup Error for Oracle Database
  Use this section to understand and resolve SP2–1540: "Oracle Database cannot startup in an Edition session."
- Error ORA-00020 Maximum Number of Processes Exceeded When Running utlrp.sql
  This error may indicate that your Oracle configuration does not have sufficient number of processes available for the recompile.
- Fixing ORA-01822 with DBMS_DST Package After Upgrades
  Use this procedure to fix `ORA-01822` and `ORA-16512` errors involving time zone file mismatches.
- Fixing ORA-28365: Wallet Is Not Open Error
  If you use Oracle wallet with Transparent Data Encryption (TDE), and you use Database Upgrade Assistant (DBUA) to upgrade the database, then you can encounter an ORA-28365 "wallet is not open" error.
- Resolving issues with view CDB_JAVA_POLICY
  If the view CDB_JAVA_POLICY becomes invalid, then use this procedure.
- Continuing Upgrades After Server Restarts (ADVM/ACFS Driver Error)
  On Windows platforms, an error may occur related to ADVM or ACFS drivers if a server restarts during an upgrade.
- Component Status and Upgrades
  Component status settings are affected both by the components that you previously installed, and by the support of those components for upgrades.
- Standard Edition Starter Database and Components with Status OPTION OFF
  Upgrades of Oracle Database Standard Edition (SE) does not include upgrades of components that are not included with starter databases.

- Adjusting Oracle ASM Password File Location After Upgrade
  You must create a new password file for Oracle ASM after an Oracle Grid Infrastructure upgrade.
- Fixing "Warning XDB Now Invalid" Errors with Pluggable Database Upgrades
  Review this topic if you encounter "Warning: XDB now invalid, invalid objects found" errors when upgrading pluggable databases (PDBs).
- Fixing ORA-27248: sys.dra_reevaluate_open_failures is running
  Use this procedure to identify `DRA_REEVALUATE_OPEN_FAILURES` jobs that block upgrades.
- Fixing ORA-22288: File or LOB Operation FILEOPEN Failed Soft Link in Path
  ORA-22288 occurs when symbolic links are in directory object paths or filenames when opening BFILES.
- Fixing Oracle Database Enterprise User Security, OLS-OID, and Provisioning Profile Error
  Review to understand `ORA-16000: database open for read-only access` errors.
- Fixing 32K Migration Error with utl32k.sql and MAX_STRING_SIZE
  Use this procedure to fix `ORA-01722: invalid number` upgrade errors.
- Recovering from a CRS Shutdown and Oracle ASM Losing Rolling Migration
  A Cluster Ready Services (CRS) shutdown on all cluster member nodes can place the cluster in a heterogeneous state. Use this procedure to recover from that problem.
- Data Type Versioning Could Cause Cross-Version Replication (ORA-26656)
  Review the user-defined object types affected by versioning.
- Referenced Symbol Count is Undefined Error libclntsh.so.11.1
  Review this topic if you encounter errors that reference `libclntsh.so.11.1` with "referenced symbol count is undefined", "cannot open shared object file", or similar errors.
- Resolving Timestamp Errors Due to ISO 8601 Timestamps
  Review this topic if you encounter timestamp errors with applications after upgrading to Oracle Database 12*c*, 18c, or later releases.
- Fixing Failed Upgrades Where Only Datapatch Fails
  If only datapatch fails during an upgrade, then rerun datapatch directly.
- Error "Timezone Datafiles May Not Be Downgraded To a Lower Version"
  You encounter a time zone error that prohibits the upgrade if the daylight savings time (DST) version in the database you are upgrading is newer than the DST in the database release to which you are upgrading.
- Fixing Failures to Complete Registration of Listeners with DBUA
  On the Database Upgrade Assistant Progress step, a window appears with this warning: "Unable to create database entry in the directory service. No Listeners configured."

Related Topics

- Rerunning Upgrades for Oracle Database
  Use these options to rerun upgrades.

About Starting Oracle Database in Upgrade Mode

When you start Oracle Database in upgrade mode, you can only run queries on fixed views. If you attempt to run other views or PL/SQL, then you receive the errors described here.

When the database is started in upgrade mode, only queries on fixed views execute without errors until after you run the Parallel Upgrade Utility (`catctl.pl`directly, or with the `dbupgrade` script). Before running an upgrade script, queries on any other view or the use of PL/SQL returns an error.

Errors described in this section can occur when you attempt to start the new Oracle Database release. Some of these errors write to the alert log, and not to your session. If you receive any of these errors, then issue the `SHUTDOWN ABORT` command to shut down the database and correct the problem.

- `ORA-00401: the value for parameter compatible is not supported by this release`

  The `COMPATIBLE` initialization parameter is set to a value less than `11.2.0`.

- `ORA-39701: database must be mounted EXCLUSIVE for UPGRADE or DOWNGRADE`

  The `CLUSTER_DATABASE` initialization parameter is set to `TRUE` instead of `FALSE`.

- `ORA-39700: database must be opened with UPGRADE option`

  The `STARTUP` command was issued without the `UPGRADE` keyword.

- `Ora-00704: bootstrap failure`

  The path variable can be pointing to the earlier release Oracle home.

- `ORA-00336: log file size xxxx blocks is less than minimum 8192 blocks`

  A redo log file size is less than 4 MB.

If errors appear listing desupported initialization parameters, then make a note of the desupported initialization parameters and continue with the upgrade. Remove the desupported initialization parameters the next time you shut down the database.

Related Topics

- https://support.oracle.com/rs?type=doc&id=1349722.1

Running DBUA with Different ORACLE_HOME Owner

Review this topic if your Oracle Database homes are owned by different operating system user accounts, or you encounter an `upgrade.xml not found` error.

DBUA upgrades by default assume that both the source (release earlier than Oracle Database 12*c*) Oracle home and the destination (new 12*c*) Oracle home are owned by the same user. If each Oracle home is not owned by the same user, then you must change to database file permissions and pass additional parameters to DBUA. If you do not do this, then during upgrade, the DBUA Prerequisite Checks page reports `upgrade.xml not found` errors. You are not permitted to proceed with the upgrade until this error is corrected.

- All Oracle Database installation owners should have the group that you designate as the OINSTALL group (or Oracle Inventory group) as their primary group. Ensure all database files (data files, the redo file, control files, archive log

destination, recovery area, SPFILE, and password file) are readable and writable by both the new 12*c* and pre-12*c* binary owners. If this is not the case, then confirm that each installation owner has the same group as their primary group, and ensure that members of the OINSTALL group have read/write access to all the earlier release and later release Oracle Database files and directories.

- Run DBUA by specifying the `-logdir` command line option, and provide a directory to which both the new release and earlier release binary owners can write. For example: `/tmp`. DBUA uses the directory you designate with the `logdir` parameter to store the output from the Pre-upgrade Information Tool, and to store any DBUA log files generated during the upgrade. You run the Pre-Upgrade Information tool from the earlier release Oracle Database instance as the earlier release Oracle Database installation owner user account.

  For example:

  ```
  dbua -logdir /tmp
  ```

Invalid Object Warnings and DBA Registry Errors

Before you start your upgrade, Oracle strongly recommends that you run the preupgrade information tool (`preupgrd.jar`).

The preupgrade information tool identifies invalid SYS and SYSTEM objects, as well as other invalid objects. Use `utlrp.sql` to recompile invalid objects. If you fail to do this before an upgrade, then it becomes difficult to determine which objects in your system were invalid before starting the upgrade, and which objects become invalid as a result of the upgrade.

Related Topics

- Using the Pre-Upgrade Information Tool for Oracle Database

Invalid Objects and Premature Use of Postupgrade Tool

Never run the postupgrade status tool for the new Oracle Database release (`utlu122s.sql`) until after you complete the upgrade.

Oracle recommends that you run the postupgrade status tool only after the upgrade process is complete, and after you have run `utlrp.sql`. If the postupgrade status tool is run before you run `@utlrp.sql`, then the output of tool may not display the accurate final component status value. If the tool is run before running `utlrp.sql`, then the component status values may not properly reflect the final state. You can only determine the final component state after running `utlrp.sql`.

Resolving Oracle Database Upgrade Script Termination Errors

Review this section if you encounter ORA-00942, ORA-00904, or ORA-01722 errors.

If you do not run the Pre-Upgrade Information Tool before starting the upgrade, then the `catctl.pl` and `catupgrd.sql` scripts terminate with errors as follows:

```
ORA-00942: table or view does not exist
ORA-00904: "TZ_VERSION": invalid identifier
ORA-01722: invalid number
```

If you receive any of these errors, then complete the following procedure:

1. Enter a `SHUTDOWN ABORT` command, and wait for the command to complete running.
2. Revert to the original Oracle home directory
3. Run the Pre-Upgrade Information Tool.

Related Topics

- Pre-Upgrade Information Tool for Oracle Database
  Review these topics to understand and to use the Pre-Upgrade information tool (`preupgrade.jar`).

Troubleshooting Causes of Resource Limits Errors while Upgrading Oracle Database

Review this section if you encounter ORA-01650, ORA-01651, ORA-01652, ORA-01653, ORA-01654, ORA-01655, ORA-0431, ORA-01562, ORA-19815, or other errors that suggest resource limit errors.

If you run out of resources during an upgrade, then increase the resource allocation. After increasing the resource allocation, shut down the instance with `SHUTDOWN ABORT`, and restart the instance in `UPGRADE` mode before re-running the `catupgrd.sql` script.

The resources that generally require increases for a new Oracle Database release are as follows:

- `SYSTEM` and `SYSAUX` tablespaces

  If your `SYSTEM` tablespace size is insufficient, then typically you receive the following error message:

  ```
  ORA-01650: unable to extend rollback segment string by string in tablespace
  string
  ORA-01651: unable to extend save undo segment by string for tablespace string
  ORA-01652: unable to extend temp segment by string in tablespace string
  ORA-01653: unable to extend table string.string by string in tablespace string
  ORA-01654: unable to extend index string.string by string in tablespace string
  ORA-01655: unable to extend cluster string.string by string in tablespace string
  ```

  To avoid these errors, set `AUTOEXTEND ON MAXSIZE UNLIMITED` for the `SYSTEM` and `SYSAUX` tablespaces.

- Shared memory

  In some cases, you may require larger shared memory pool sizes. The error message indicates which shared memory initialization parameter you must increase, in the following format:

  ```
  ORA-04031: unable to allocate string bytes of shared memory
  ("string","string","string","string")
  ```

> **See Also:**
>
> *Oracle Database Administrator's Guide* for information about using manual shared memory management

- Rollback segments/undo tablespace

  If you are using rollback segments, then you must have a single large (100 MB) `PUBLIC` rollback segment online while the upgrade scripts are being run. Smaller public rollback segments should be taken offline during the upgrade. If your rollback segment size is insufficient, then typically you encounter the following error:

  ```
  ORA-01562: failed to extend rollback segment number string
  ```

  If you are using an undo tablespace, then be sure it is at least 400 MB.

- Fast Recovery Area

  If you are using a Fast Recovery Area and it fills up during the upgrade, then the following error appears in the alert log, followed by suggestions for recovering from the problem:

  ```
  ORA-19815: WARNING: db_recovery_file_dest_size of string bytes is 98.99%
  used, and has string remaining bytes available.
  ```

  Identify the root cause of the problem, and take appropriate actions to proceed with the upgrade. To avoid issues during the upgrade, increase the amount of space available in your Fast Recovery Area before starting the upgrade.

Resolving SQL*Plus Edition Session Startup Error for Oracle Database

Use this section to understand and resolve SP2–1540: "Oracle Database cannot startup in an Edition session."

If an upgrade script or a command running in SQL*Plus set the `EDITION` parameter, then Oracle Database cannot start properly afterward. When you attempt to start the database, you receive the following error:

```
SP2-1540: "Oracle Database cannot startup in an Edition session"
```

To avoid this problem, after running `catugrd.sql` or any SQL*Plus session where this parameter is changed, exit the SQL*Plus session and restart the instance in a different session.

Error ORA-00020 Maximum Number of Processes Exceeded When Running utlrp.sql

This error may indicate that your Oracle configuration does not have sufficient number of processes available for the recompile.

Refer to Oracle documentation for more details about setting the `PROCESSES` parameter.

Fixing ORA-01822 with DBMS_DST Package After Upgrades

Use this procedure to fix `ORA-01822` and `ORA-16512` errors involving time zone file mismatches.

Running the `DBMS_DST` package after upgrading to Oracle Database 12*c* can result in an `ORA-01882: time zone region not found` error.

This error is returned if the time zone file version is set incorrectly. An incorrect time zone setting results in the region IDs of several time zone regions being stored incorrectly in the database. For example:

```
ERROR at line 1:
@  ORA-01882: time zone region not found
@  ORA-06512: at "SYS.DBMS_DST", line 113
@  ORA-06512: at "SYS.DBMS_DST", line 1101
@  ORA-06512: at line 1
```

To fix this problem, update the time zone version, and re-run the upgrade.

Fixing ORA-28365: Wallet Is Not Open Error

If you use Oracle wallet with Transparent Data Encryption (TDE), and you use Database Upgrade Assistant (DBUA) to upgrade the database, then you can encounter an ORA-28365 "wallet is not open" error.

To avoid this problem, complete the following tasks before upgrading:

1. Log in as an authorized user.
2. Manually copy the `sqlnet.ora` file, and the wallet file, `ewallet.p12`, to the new release Oracle home.
3. Open the Oracle wallet in mount.

   For example:

   ```
   SQL> STARTUP MOUNT;
   SQL> ALTER SYSTEM SET ENCRYPTION WALLET OPEN
   ```
4. Start the upgrade as usual.

Resolving issues with view CDB_JAVA_POLICY

If the view CDB_JAVA_POLICY becomes invalid, then use this procedure.

After an upgrade to Oracle Database 12*c* release 2 (12.2) and later releases, or a downgrade from release 12.2 or later releases to 12.1, you can encounter issues with the CDB_JAVA_POLICY view. CDB_JAVA_POLICY can become invalid, or it can encounter errors when you use it in a manner that normally works. If this happens, then connect as SYS, and run the following commands.

Non-CDBs:

```
alter session set "_ORACLE_SCRIPT"=true;

exec CDBView.create_cdbview(false,'SYS','dba_java_policy','CDB_java_policy');

grant select on SYS.CDB_java_policy to select_catalog_role
/
create or replace public synonym CDB_java_policy for SYS.CDB_java_policy
/
```

Multitenant architecture systems:

Run these same commands, but run them first in CDB$ROOT, and then in other containers in the CDB.

Continuing Upgrades After Server Restarts (ADVM/ACFS Driver Error)

On Windows platforms, an error may occur related to ADVM or ACFS drivers if a server restarts during an upgrade.

If a server restarts during the upgrade, then you may see one of the following error messages:

```
ACFS-9427: Failed to unload ADVM/ACFS drivers. A system reboot is recommended

ACFS-9428 Failed to load ADVM/ACFS drivers. A system reboot is recommended.
```

- Cause

  The ADVM and ACFS drivers are still in use. You must restart the system to start the new drivers.

- Action

  Complete the steps as described in the following procedures.

For nodes other than the first node (the node on which the upgrade is started):

1. Restart the node where the error occurs.
2. Run the root script on that node again.

For first nodes (the node on which the upgrade is started):

1. Complete the upgrade of all other nodes in the cluster.
2. Restart the first node.
3. Run the root script on the first node again.
4. To complete the upgrade, log in as root, and run the script `configToolAllCommands`, located in the path *`Grid_home`*`/cfgtoollogs/configToolAllCommands`.

Component Status and Upgrades

Component status settings are affected both by the components that you previously installed, and by the support of those components for upgrades.

Topics:

- Understanding Component Status With the Post-Upgrade Status Tool
  The Post-Upgrade Status tool, `utlu122s.sql`, reports database component status after an upgrade is completed.
- Component OPTION OFF Status and Upgrades
  The upgrade status of `OPTION OFF` components is affected both by the support in the target release for a component, and if a component must be upgraded as part of an upgrade.
- Example of an Upgrade Summary Report
  Upgrade summary reports provide information about the upgrade status of components.

Understanding Component Status With the Post-Upgrade Status Tool

The Post-Upgrade Status tool, `utlu122s.sql`, reports database component status after an upgrade is completed.

You can run the Post-Upgrade Status Tool `utlu122s.sql` anytime after upgrade, post-upgrade, or after recompiling invalid objects with `utlrp.sql`.

The following list briefly describes the status values that the Post-Upgrade Status tool reports:

- `INVALID`

  When the upgrade completed, some objects for the component remained in an invalid state. If you find no errors in the log file for component upgrades then run the script `utlrp.sql`. Running this script may change the status of invalid components to `VALID` without rerunning the entire upgrade. Check the `DBA_REGISTRY` view after running `utlrp.sql`.

- `VALID`

  The component is valid with no errors.

- `LOADING`

  The component is loading

- `LOADED`

  The component has successfully finished loading.

- `UPGRADING`

  The component is in process being upgraded.

- `UPGRADED`

  The component has completed upgrading with no errors.

- `DOWNGRADING`

  The component is in process being downgraded.

- `DOWNGRADED`

  The component has completed downgrading with no errors.

- `REMOVING`

  The component is in process being removed.

- `REMOVED`

  The component was not upgraded because it was removed from the database.

- `OPTION OFF`

  The server option required for the component was not installed or was not linked with the server. Check the `V$OPTION` view and the install logs. Install the component or relink the server with the required option, and then re-run the Parallel Upgrade Utility.

- `NO SCRIPT`

The component upgrade script was not found in $ORACLE_HOME. Check the install logs, install the component software, and then re-run the Parallel Upgrade Utility.

> **Note:**
>
> You can run the Parallel Upgrade Utility (`catctl.pl` using the command-line scripts `dbupgrade` on Linux and UNIX, and `dbupgrade.cmd` on Windows) .

Related Topics

- Scripts for Upgrading Oracle Database
- Change to Upgrade Status Setting

Component OPTION OFF Status and Upgrades

The upgrade status of `OPTION OFF` components is affected both by the support in the target release for a component, and if a component must be upgraded as part of an upgrade.

There are three cases where OPTION OFF components are upgraded, or are not upgraded.

Unsupported Components With Status `OPTION OFF`

If there is a component in the database that is in the status OPTION OFF, and that component is no longer supported for database upgrades to the target release, then this component is not upgraded. After the upgrade, its version and status remain unchanged..

Supported Components With Status `OPTION OFF`

If there is a component in the database that is in the status `OPTION OFF`, but that component is supported for database upgrades to the target release, then this component is upgraded. After the upgrade, the component's version matches the target release version. The status for this component is either `UPGRADED` (a successful upgrade), or `INVALID` (errors). Rerun the upgrade as needed, until all the upgraded components have a status of `UPGRADED`. Then run `utlrp.sql`. If a component was in the status `OPTION OFF` before the upgrade, then after it is upgraded, and its compile and validation is successful, its status reverts back to OPTION OFF.

Supported Components With Required Options That Must Be Upgraded

Starting with Oracle Database 18.1, all components with required options must be upgraded. These components are:

- `RAC`
- `SDO`
- `APO`
- `XOQ`

Components that must be upgraded follow the same procedure for upgrades as for standard supported components with status `OPTION OFF`

Example of an Upgrade Summary Report

Upgrade summary reports provide information about the upgrade status of components.

After the upgrade completes, starting with Oracle Database 12*c* release 2, the upgrade utility script (for example, in 12.2, `utlu1212.sql`) writes a copy of the report using the following write order:

1. `ORACLE_BASE/cfgtoollogs/`*`db_unique_name`*`/upgrade`*`YYMMDDHHMMSC`*`/upg_summary.rpt`
2. `$ORACLE_HOME/rdbms/log/upg_summary.rpt`
3. Linux and UNIX:

   ```
   /tmp/upg_summary.rpt
   ```

   Windows:

   ```
   \TEMP\upg_summary.rpt
   ```

If the utility script cannot create the report under the first directory scheme, then it attempts to write to the second location, and then the third location. If it cannot write to any of these paths, then it does not write an upgrade summary report. The examples here are from 12.2.0.1 (`utlu1212.sql`).

Example 3-36 Upgrade Summary Report for the Post-Upgrade Status Tool

```
Oracle Database 12.2 Post-Upgrade Status Tool           06-05-2015 08:53:44

Component                               Current         Version  Elapsed Time
Name                                    Status          Number   HH:MM:SS

Oracle Server                          UPGRADED      12.2.0.0.0  00:14:49
JServer JAVA Virtual Machine           UPGRADED      12.2.0.0.0  00:04:01
Oracle Real Application Clusters     OPTION OFF      12.2.0.0.0  00:00:02
Oracle Workspace Manager               UPGRADED      12.2.0.0.0  00:01:07
OLAP Analytic Workspace                UPGRADED      12.2.0.0.0  00:00:36
Oracle OLAP API                        UPGRADED      12.2.0.0.0  00:00:39
Oracle Label Security                  UPGRADED      12.2.0.0.0  00:00:15
Oracle XDK                             UPGRADED      12.2.0.0.0  00:00:51
Oracle Text                            UPGRADED      12.2.0.0.0  00:01:05
Oracle XML Database                    UPGRADED      12.2.0.0.0  00:01:45
Oracle Database Java Packages          UPGRADED      12.2.0.0.0  00:00:17
Oracle Multimedia                      UPGRADED      12.2.0.0.0  00:04:03
Spatial                                UPGRADED      12.2.0.0.0  00:05:13
Oracle Database Vault                  UPGRADED      12.2.0.0.0  00:00:28
Final Actions                                                    00:01:29
Post Upgrade                                                     00:02:28

Total Upgrade Time: 01:02:01
```

Standard Edition Starter Database and Components with Status OPTION OFF

Upgrades of Oracle Database Standard Edition (SE) does not include upgrades of components that are not included with starter databases.

When you upgrade Oracle Database Standard Edition (SE) starter databases, the SE server cannot upgrade components that are not included with starter databases, because these components require options that are not installed in the Standard Edition release.

After you upgrade an Oracle Database Standard Edition database, components may have a STATUS value of `OPTION OFF` in the `DBA_REGISTRY` view. You may also see invalid objects in the associated component schemas. Oracle Database Upgrade Assistant (DBUA) shows unsuccessful upgrades for these components.

Adjusting Oracle ASM Password File Location After Upgrade

You must create a new password file for Oracle ASM after an Oracle Grid Infrastructure upgrade.

The Oracle ASM password file location is not shown in the command output when you run `srvctl config asm` after a Grid Infrastructure upgrade. The location of the password file is not automatically passed to the new Oracle ASM disk group. To enable SRVCTL to have the password file location after upgrade, you must advance the diskgroup compatibility setting and create a PWFILE in the disk group. Then SRVCTL reports the configured location of the shared PWFILE.

Fixing "Warning XDB Now Invalid" Errors with Pluggable Database Upgrades

Review this topic if you encounter "Warning: XDB now invalid, invalid objects found" errors when upgrading pluggable databases (PDBs).

You can encounter XML object errors when you plug an Oracle Database 12*c* release 1 (12.1) pluggable database (PDB) into an Oracle Database 12*c* release 2 (12.2) or later release multitenant container database (CDB).

Common objects (objects with `sharing='METADATA LINK'` in `dba_objects`) are created by registering system-generated names in an object-relational XML schema. Those common types are created by registering some ORDSYS schemas with object-relational storage.

The names of these common objects are system-generated, and the names generated in release 12.1 can be different from the names used for these objects in release 12.2 and later releases. Because of these possible name changes, you can find that the release 12.1 object types do not have matching common types in the release 12.2 or later release CDB root.

Resolve this issue using the following procedure:

1. Query the view `PDB_PLUG_IN_VIOLATIONS` in the target CDB root to see if there is any action containing `'GetTypeDDL'`

If you find `'GetTypeDDL'` actions, then the upgraded PDB has the common objects issue.

2. Run the PL/SQL packages `SET SERVEROUTPUT ON` and `exec xdb.DBMS_XMLSTORAGE_MANAGE.GetTypeDDL` in the target PDB to generate a user-named SQL script (for example, `script1.sql`).
3. Run the script you created in step 2 (for example, `script1.sql` in the source 12.1 CDB to obtain the type creation script for each of the common types for which you are encountering errors
4. Generate another user-named SQL script (for example, `script2.sql`) that contains these creation scripts.
5. Run the script that you created on the source 12.1 CDB (for example, `script2.sql`) in the target PDB.

The script that you generate from the release 12.1 source CDB type creation scripts generates all of these objects in the target PDB. Making these common objects available in the target PDB should eliminate the invalid XDB errors.

Fixing ORA-27248: sys.dra_reevaluate_open_failures is running

Use this procedure to identify `DRA_REEVALUATE_OPEN_FAILURES` jobs that block upgrades.

During an upgrade, if DBUA fails with the error `ORA-27248: sys.dra_reevaluate_open_failures is running`, then the job `DRA_REEVALUATE_OPEN_FAILURES` is running, which causes upgrade failures. Ensure that the job is stopped before continuing the upgrade.

In a job definition, if `ALLOW_RUNS_IN_RESTRICTED_MODE` is set to TRUE, and the job owner is permitted to log in during restricted mode, then that job is permitted to run when the database is in restricted or upgrade mode. The default setting for this parameter is FALSE.

Use the following query to see the state of any running jobs:

```
SQL> select OBJECT_NAME, Owner, OBJECT_TYPE from dba_objects whereobject_name like
'%DRA_REEVA%';
```

Fixing ORA-22288: File or LOB Operation FILEOPEN Failed Soft Link in Path

ORA-22288 occurs when symbolic links are in directory object paths or filenames when opening BFILES.

When you create a directory object or BFILE objects, you must meet the following conditions.

- The operating system file must not be a symbolic or hard link.
- The operating system directory path named in the Oracle DIRECTORY object must be an existing operating system directory path.
- The operating system directory path named in the Oracle DIRECTORY object should not contain any symbolic links in its components.

When a BFILE is opened, the entire directory path and filename is checked. If any symbolic link is found, then you receive the following error.

```
ORA-22288: file or LOB operation FILEOPEN failed soft link in path
```

To resolve this error, remove symbolic links, and comply with other requirements for creating BFILEs.

Related Topics

- *Oracle Database SecureFiles and Large Objects Developer's Guide*

Fixing Oracle Database Enterprise User Security, OLS-OID, and Provisioning Profile Error

Review to understand `ORA-16000: database open for read-only access` errors.

After upgrading databases that use OLS and a standby database, you may see ORA-16000 (database open for read-only access). After switchover, update the Provisioning profile with the connect information of the new primary. If you do not update the Provisioning profile, then the policies continue to be propagated to the new standby (old primary) and the database continues to fail with ORA-16000 errors.

Fixing 32K Migration Error with utl32k.sql and MAX_STRING_SIZE

Use this procedure to fix `ORA-01722: invalid number` upgrade errors.

If the initialization parameter `MAX_STRING_SIZE` is set to `EXTENDED`, but the 32K migration that the `utl32k.sql` script carries out is not completed, then the database upgrade fails with the following error:

```
SELECT TO_NUMBER('32K_MIGRATION_NOT_COMPLETED')
                 *
      ERROR at line 1:
      ORA-01722: invalid number
```

The database upgrade does not automatically run the `utl32k.sql` script, and does not perform the 32K migration.

Complete the upgrade and the 32K migration by using this manual procedure:

1. Reset the initialization parameter `MAX_STRING_SIZE` to `STANDARD`.
2. Restart the database in `UPGRADE` mode.
3. Rerun the upgrade using the manual procedure.
4. After the database is upgraded, set the initialization parameter `MAX_STRING_SIZE` to `EXTENDED`.
5. Restart the database in `UPGRADE` mode.
6. Run the SQL script `../rdbms/admin/utl32k.sql`.

After you run the `utl32k.sql` script, the upgraded database completes the 32K migration and supports the `EXTENDED` parameter.

Recovering from a CRS Shutdown and Oracle ASM Losing Rolling Migration

A Cluster Ready Services (CRS) shutdown on all cluster member nodes can place the cluster in a heterogeneous state. Use this procedure to recover from that problem.

Oracle Automatic Storage Management (Oracle ASM) loses the rolling migration state if CRS shuts down on all nodes. This CRS shutdown can create a heterogeneous state, so that you cannot restart all cluster member nodes. You cannot start two nodes of different versions in the cluster. If you attempt to start nodes running different versions of Oracle ASM, then one of the sets of heterogeneous nodes running Oracle ASM nodes fails, generating either ORA-15153 or ORA-15163 error messages.

Consider the following scenario of four nodes (node1, node2, node3, and node4) that are at Oracle Database release 11.2.0.2 and being upgraded to release 12.1.0.2.

- Node1 and node2 are upgraded to 12.1.0.2 and running.
- Node3 and node 4 are still at 11.2.0.2 and running.
- Now consider that there is an outage where all CRS stacks are down, which leaves the cluster in a heterogeneous state (that is, two nodes at 11.2.0.2 and two nodes at 12.1.0.2).

Using this scenario as an example, complete the following procedure:

1. Restart only the nodes that are in the earlier release. In this scenario, start the nodes in release 11.2.0.2 (node3 or node4, or both).
2. run the following SQL command on the Oracle ASM instance on node3 or node4 before starting any 12.1.0.2 node:

   ```
   ALTER SYSTEM START ROLLING MIGRATION TO '12.1.0.2'
   ```

3. Continue the documented upgrade procedure from the point of failure.

Data Type Versioning Could Cause Cross-Version Replication (ORA-26656)

Review the user-defined object types affected by versioning.

Release 12.1.0.2 introduces versioning of data types that can be attributes of Oracle object types (reference Bug 18897657). Because of this feature, cross-version replication between release 12.1.0.1 and release 12.1.0.2 databases may be affected, resulting in ORA-26656 errors.

If any user-defined object types contain attributes of `DATE`, `TIMESTAMP`, `TIMESTAMP WITH TIME ZONE`, `TIMESTAMP WITH LOCAL TIME ZONE`, `BINARY_FLOAT`, `BINARY_DOUBLE`, `NCHAR`, `NVARCHAR2`, `NCLOB`, `ANYDATA`, and similar objects, then you must apply the mandatory Patch Set Update 18038108 to all release 12.1.0.1 instances.

Referenced Symbol Count is Undefined Error libclntsh.so.11.1

Review this topic if you encounter errors that reference `libclntsh.so.11.1` with "referenced symbol count is undefined", "cannot open shared object file", or similar errors.

During an upgrade to Oracle Database 12*c* or 18c, client applications linked against the `libclntsh.so.11.1` file may fail to run on Oracle Solaris, HP-UX Itanium or IBM AIX platforms. In that event, you see error messages similar to the following:

```
referenced symbol count is undefined
```

Workaround

Relink affected client applications against the new `libclntsh.so.12.2` for Oracle Database 12*c*, or `libclntssh.so.18.1` file for Oracle Database 18c.

Resolving Timestamp Errors Due to ISO 8601 Timestamps

Review this topic if you encounter timestamp errors with applications after upgrading to Oracle Database 12*c*, 18c, or later releases.

ISO 8601 is an international standard for exchanging date and time-related data, established by the International Organization for Standardization (ISO), and the International Electrotechnical Commission (IEC). The purpose of this standard is to provide a common international standard for representing dates and times, to avoid misinterpretation of dates and times with data used between countries using different conventions for writing numeric dates and times. For example:

```
2015-09-23T19:25:25.123456+00:00
```

Oracle recommends that you use this standard.

By default, the initialization parameter UNIFORM_LOG_TIMESTAMP_FORMAT is set to TRUE. If using the ISO 8601 standard causes scripts to break, then you can set UNIFORM_LOG_TIMESTAMP_FORMAT to FALSE to cause the Oracle Database 12.2 release or later releases to revert to the timestamp format used in Oracle Database 12.1. After you change the initialization parameter, fix your scripts so that they can use ISO 8601 timestamps. When your scripts can use the ISO 8601 standard, change the parameter back to the default value of TRUE.

Fixing Failed Upgrades Where Only Datapatch Fails

If only datapatch fails during an upgrade, then rerun datapatch directly.

The Datapatch script, `datapatch.pl` , is a PERL script. In some patching operations, the final post-upgrade patches may not run, due to errors such as ORA-20001. If only the Datapatch script fails, then you do not need to run the upgrade again to fix this issue. Instead, run `datapatch.pl` directly.

To fix a failed datapatch, log in as the Oracle user, and complete this procedure:

1. Change directory to Opatch inside the upgraded Oracle home.

   ```
   $ cd $ORACLE_HOME/OPatch
   ```

2. Run the datapatch command.

   ```
   $ ./datapatch -verbose
   ```

Error "Timezone Datafiles May Not Be Downgraded To a Lower Version"

You encounter a time zone error that prohibits the upgrade if the daylight savings time (DST) version in the database you are upgrading is newer than the DST in the database release to which you are upgrading.

Scenario: You run Database Upgrade Assistant (DBUA) to upgrade from an earlier release Oracle Database to a later release Oracle Database, and encounter the following error:

```
SEVERE: Timezone datafiles may not be downgraded to a lower version as a
result of an Oracle Database upgrade.
```

This error occurs if you upgrade from an earlier Oracle Database release to a later Oracle Database release, and your earlier release Oracle Database Oracle home has a more recent DST patch than the new upgrade Oracle Database Oracle home. In the log file, `preupgrade.log`, you are instructed to patch the new Oracle Database Oracle home with the updated DST patch from the old Oracle home. For example:

```
+ Patch the new 12.2.0.1.0 $ORACLE_HOME/oracore/zoneinfo/ with the version
29 time zone data file from the 12.1.0.2.0
$ORACLE_HOME/oracore/zoneinfo/.

The database is using a time zone file version that is newer than the
version shipped with the 12.2.0.1.0 release.

Timezone datafiles may not be downgraded to a lower version as a result
of an Oracle Database upgrade.
```

However, this error can persist, even if you patch the new Oracle home to the same version as the earlier release Oracle Database Oracle home.

Workaround:

If you continue to encounter this error after patching the new Oracle home with the current time zone file, then run Oracle Database Upgrade Assistant with the flag `-ignorePreReqs true` flag. Running the assistant with tis

```
$ dbua -sid mydb -oracleHome /u02/product/12.2.0/dbhome_1/ -ignorePreReqs - true
```

> **Caution:**
>
> Only use this workaround of turning off prerequisite checks for this specific scenario. Ignoring valid failed checks that report timezone version errors between Oracle homes results in upgrade failures.

Fixing Failures to Complete Registration of Listeners with DBUA

On the Database Upgrade Assistant Progress step, a window appears with this warning: "Unable to create database entry in the directory service. No Listeners configured."

In this scenario, you have completed the following steps:

1. Created a listener in your earlier release Oracle home using Net Configuration Assistant (NetCA) or Net Manager.
2. Installed the new Oracle Database release in the new Oracle home, and registered it against the listener.
3. You want to register the listener to Oracle Internet Directory (OID), and upgrade the database, or you want to register the listener on OID on the new Oracle home.

> **Note:**
>
> If the listener is running from another Oracle home on the server, or the listener is running from the current Oracle home, but it is not configured in the `LISTENER.ORA` file (that is, it uses an automatically generated default configuration), then DBCA is unable to locate the listener.

DBUA is no longer performing direct registration of the upgraded database to OID during the upgrade itself.

To resolve this issue, complete the following tasks:

1. De-register the listener from OID.
2. Perform the database upgrade.
3. Register again the migrated listener to the OID registry on the new release Oracle Database Oracle home.

Rerunning Upgrades for Oracle Database

Use these options to rerun upgrades.

- About Rerunning Upgrades for Oracle Database
  Oracle provides the features listed here to rerun or restart Oracle Database upgrades, including after failed phases.
- Rerunning Upgrades with the Upgrade (catctl.pl) Script
  You can fix upgrade issues and then rerun the upgrade with the `catctl.pl` script, or the `dbupgrade` shell command.
- Options for Rerunning the Upgrade for Multitenant Databases (CDBs)
  There are four options you can use to rerun upgrades on multitenant database architecture (CDBs) for Oracle Database 12*c* release 2 (12.2).

About Rerunning Upgrades for Oracle Database

Oracle provides the features listed here to rerun or restart Oracle Database upgrades, including after failed phases.

Parallel Upgrade Utility and Restarts or Reruns

You can re-run or restart Oracle Database upgrade phases by using either Database Upgrade Assistant (DBUA), or by using the Parallel Upgrade Utility (`catctl.pl`) script. You can also run commands on PDBs that failed to upgrade in an initial attempt, so that you can complete the upgrade.

Parallel Upgrade Utility Resume Option

Oracle Database 12*c* release 2 (12.2) includes a new Resume option for Parallel Upgrade Utility. This option is available for both CDBs and Non-CDBs. You are not required to identify failed or incomplete phases when you rerun or restart the upgrade. When you use the Parallel Upgrade Utility using the resume option (`-R`), the utility automatically detects phases from the previous upgrade that are not completed successfully. The Parallel Upgrade Utility then reruns or restarts just these phases that did not complete successfully, so that the upgrade is completed. Bypassing steps that already completed successfully reduces the amount of time it takes to rerun the upgrade.

To use the Resume option, run the Parallel Upgrade Utility using the -R parameter. For example:

```
$ORACLE_HOME/perl/bin/perl catctl.pl -L plist.txt -n 4 -N 2 -R -l $ORACLE_HOME/
cfgtoollogs catupgrd.sql
```

You can rerun the entire upgrade at any time, regardless of which phase you encountered a failure in your upgrade. If you plan to rerun the entire upgrade, instead of rerunning only failed phases, then run the Parallel Upgrade Utility without using the Resume (`-R`) option.

Rerunning Upgrades with the Upgrade (catctl.pl) Script

You can fix upgrade issues and then rerun the upgrade with the `catctl.pl` script, or the `dbupgrade` shell command.

> **Note:**
>
> Starting with Oracle Database 12*c*, release 1 (12.1), non-CDB architecture is deprecated. It can be desupported in a future release.

1. Shut down the database. For a non-CDB and a CDB, the syntax is the same.

   ```
   SQL> SHUTDOWN IMMEDIATE
   ```

2. Restart the database in UPGRADE mode.

   For a non-CDB:

   ```
   SQL> STARTUP UPGRADE
   ```

For a CDB:

```
SQL> STARTUP UPGRADE
SQL> alter pluggable database all open upgrade;
```

3. Rerun the Parallel Upgrade utility (`catctl.pl`, or `dbupgrade` shell command).

   You can rerun the Parallel Upgrade Utility as many times as necessary.

   With CDBs, you can use the Resume option (`-R`) to rerun the Parallel Upgrade Utility. The script resumes the upgrades from failed phases.

   For example:

   ```
   $ORACLE_HOME/perl/bin/perl catctl.pl -n 4 -R -l $ORACLE_HOME/cfgtoollogs
   catupgrd.sql
   ```

   You can also provide the name of one or more specific PDBs on which you want to rerun the upgrade.

   For example, this command reruns the upgrade on the PDB named `cdb1_pdb1`:

   ```
   $ORACLE_HOME/perl/bin/perl catctl.pl -n 4 -R -l $ORACLE_HOME/cfgtoollogs -c
   'cdb1_pdb1' catupgrd.sql
   ```

   You can use the `dbupgrade` shell command to run the same commands:

   ```
   dbupgrade -n 4 -R -l $ORACLE_HOME/diagnostics
   dbupgrade -n 4 -R -l $ORACLE_HOME/diagnostics -c 'cdb1_pdb1'
   ```

4. Run `utlu122s.sql`, the Post-Upgrade Status Tool, which provides a summary of the status of the upgrade in the spool log. You can run `utlu122s.sql` any time before or after you complete the upgrade, but not during the upgrade.

   In a non-CDB:

   ```
   SQL> @$ORACLE_HOME/rdbms/admin/utlu122s.sql
   ```

   In a CDB:

   ```
   $ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlu122s -d '''.''' utlu122s.sql
   ```

   If the `utlu122s.sql` script returns errors or shows components that are not `VALID` or not the most recent release, then follow troubleshooting procedures for more information.

5. Run `utlrp.sql` to recompile any remaining stored PL/SQL and Java code.

   ```
   $ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlrp -d '''.''' utlrp.sql
   ```

   The script generates the log file `utlrp0.log` , which shows the results of the re-compilations.

   Use the following SQL commands to verify that all expected packages and classes are valid,

   In a single PDB (`cdb1_pdb1` in this example), open the PDB in normal mode as follows:

   ```
   alter pluggable database cdb1_pdb1 open;
   ```

   Run `catcon.pl` to start`utlrp.sql` in the PDB to recompile any remaining stored PL/SQL and Java code. Use the following syntax:

```
$ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlrp -d '''.''' -c 'cdb1_pdb1'
 utlrp.sql
```

In a non-CDB:

```
SQL> SELECT count(*) FROM dba_invalid_objects;
SQL> SELECT distinct object_name FROM dba_invalid_objects;
```

In an entire CDB:

```
SQL> ALTER SESSION SET CONTAINER = "CDB$ROOT"
SQL> SELECT count(*) FROM dba_invalid_objects;
SQL> SELECT distinct object_name FROM dba_invalid_objects;
SQL> ALTER SESSION SET CONTAINER = "PDB$SEED"
SQL> SELECT count(*) FROM dba_invalid_objects;
SQL> SELECT distinct object_name FROM dba_invalid_objects;
SQL> ALTER SESSION SET CONTAINER = "cdb1_pdb1"
SQL> SELECT count(*) FROM dba_invalid_objects;
SQL> SELECT distinct object_name FROM dba_invalid_objects;
```

6. Run `utlu122s.sql` again to verify that all issues have been fixed.

   In a non-CDB:

   ```
   SQL> @$ORACLE_HOME/rdbms/admin/utlu122s.sql
   ```

   In a CDB:

   ```
   $ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlu122s -d '''.''' utlu122s.sql
   ```

7. Exit SQL*Plus.
8. If you are upgrading a cluster database from release 11.2, then upgrade the database configuration in Oracle Clusterware using the following command syntax, where *db-unique-name* is the database name assigned to it (not the instance name), and *Oracle_home* is the Oracle home location in which the database is being upgraded.

   ```
   $ srvctl upgrade database -d db-unique-name -o Oracle_home
   ```

Your database is now upgraded to Oracle Database 12*c*. You are ready to complete post-upgrade tasks for Oracle Database.

Related Topics

- Options for Rerunning the Upgrade for a Multitenant Database (CDB)
  There are four options you can use to rerun upgrades on multitenant database architecture (CDBs) for Oracle Database 12*c* release 2 (12.2).
- Troubleshooting the Upgrade for Oracle Database
  Use these troubleshooting tips to address errors or issues that you may encounter while upgrading your database.
- Post-Upgrade Tasks for Oracle Database
  After you upgrade Oracle Database, complete required post-upgrade tasks, and consider recommendations for the new release.

Options for Rerunning the Upgrade for Multitenant Databases (CDBs)

There are four options you can use to rerun upgrades on multitenant database architecture (CDBs) for Oracle Database 12*c* release 2 (12.2).

- Rerun the Entire Upgrade for the CDB
  If several different issues occur during the first upgrade attempt, then use this procedure to re-run the entire upgrade.
- Rerun the Upgrade Only on Specified CDBs
  You can rerun upgrades on specified multitenant containers by running the Parallel Upgrade Utility with either the Resume option (`-R`), or with the exclusion list option (`-C`).
- Rerun the Upgrade While Other PDBs Are Online
  You can rerun PDB upgrades by using the Parallel Upgrade Utility Resume option, or by explicitly including or excluding online PDBs using with inclusion or exclusion lists.
- Rerun the Upgrade Using an Inclusion List to Specify a CDB or PDBs
  Use this example as a model for rerunning an upgrade on a PDB by using an inclusion list.

Rerun the Entire Upgrade for the CDB

If several different issues occur during the first upgrade attempt, then use this procedure to re-run the entire upgrade.

This example demonstrates running the upgrade again on the `CDB$ROOT`, `PDB$SEED` and all PDBs after correcting for a problem occurring during the initial upgrade attempt, such as running out of shared pool.

1. Start the upgrade again. For example:

   ```
   SQL> startup upgrade;
   alter pluggable database all open upgrade;
   ```

2. Run the Parallel Upgrade Utility (`catctl.pl`, or the `dbupgrade` shell script. For example:

   ```
   cd $ORACLE_HOME/bin/
   ./dbupgrade -d $ORACLE_HOME/rdbms/admin -l $ORACLE_HOME/rdbms/log
   ```

   The upgrade runs again on all the containers, including `CDB$ROOT` , `PDB$SEED`, and all PDBs in the CDB.

Rerun the Upgrade Only on Specified CDBs

You can rerun upgrades on specified multitenant containers by running the Parallel Upgrade Utility with either the Resume option (`-R`), or with the exclusion list option (`-C`).

In both the examples that follow, the multitenant container database contains five PDBs. All upgrades ran successfully except for `CDB1_PDB1` and `CDB1_PDB2`, which failed with an upgrade error. To run the upgrade on these two containers, you shut down the entire multitenant database and restart only the PDBs you want to upgrade.

> **Note:**
>
> Parallel Upgrade Utility parameters are case-sensitive.

Example 3-37 Rerunning Upgrades With the Resume Option

You can use the Parallel Upgrade Utility Resume parameter option `-R` to rerun the upgrade only on one or more multitenant containers (CDBs).

In the following example, the upgrade script detects that it should run on `CDB1_PDB1` and `CDB1_PDB2` containers only.

1. Shut down the multitenant database, start up the database in upgrade mode, and then start up the PDBs on which the upgrade did not complete. For example:

```
SQL> shutdown immediate;
     startup upgrade;
     alter pluggable database CDB1_PDB1 open upgrade;
     alter pluggable database CDB1_PDB2 open upgrade;
```

2. Show the CDB and PDB status:

```
 SQL> show pdbs

      CON_ID CON_NAME                       OPEN MODE  RESTRICTED
      ------ ------------------------------ ---------- ----------
          2 PDB$SEED                       MIGRATE    YES
          3 CDB1_PDB1                      MIGRATE    YES
          4 CDB1_PDB2                      MIGRATE    YES
          5 CDB1_PDB3                      MOUNTED
          6 CDB1_PDB4                      MOUNTED
          7 CDB1_PDB5                      MOUNTED
```

3. Rerun the upgrade. The upgrade automatically detects from the previous upgrade logs that CDB$ROOT and PDB$SEED are upgraded successfully. The upgrade bypasses CDB$ROOT and PDB$SEED, and only runs on CDB1_PDB1 and CDB_PDB2. The command example here is for Linux/UNIX systems:

```
cd $ORACLE_HOME/bin
./dbupgrade -d $ORACLE_HOME/rdbms/admin -l $ORACLE_HOME/cfgtoollogs -R
```

The Parallel Upgrade Utility completes the upgrade on `CDB1_PDB1` and `CDB1_PDB2`.

Example 3-38 Rerunning Upgrades With an Exclusion List

An exclusion list contains containers that you do not want to upgrade. An exclusion list uses the Parallel Upgrade Utility `-C` parameter option. Run the Parallel Upgrade utility by changing directory to *`Oracle_home`*`/rdbms/admin/` and running the utility in Perl using `catctl.pl`, or by changing directory to *`Oracle_home`*`/bin` and running the command-line script, `dbupgrade -C`. This method is useful when you have many PDBs on which you want to rerun the upgrade.

In this following example, you provide an exclusion list to exclude the upgrade script from running on containers where you do not require it to run.

1. Shut down the multitenant database, start up the database in upgrade mode, and then start up the PDBs on which the upgrade did not complete. For example:

```
SQL> shutdown immediate;
     startup upgrade;
     alter pluggable database CDB1_PDB1 open upgrade;
     alter pluggable database CDB1_PDB2 open upgrade;
```

2. Show the CDB and PDB status:

```
 SQL> show pdbs
```

```
CON_ID CON_NAME                       OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
    2 PDB$SEED                       MIGRATE    YES
    3 CDB1_PDB1                      MIGRATE    YES
    4 CDB1_PDB2                      MIGRATE    YES
    5 CDB1_PDB3                      MOUNTED
    6 CDB1_PDB4                      MOUNTED
    7 CDB1_PDB5                      MOUNTED
```

3. Rerun the upgrade, excluding `CDB$ROOT` and `PDB$SEED` from the upgrade in a space-delimited exclusion list that you specify with single quote marks. The command example here is for Linux/UNIX systems:

```
$ORACLE_HOME/bin/dbupgrade -d $ORACLE_HOME/rdbms/admin -l $ORACLE_HOME/rdbms/log
-C 'CDB$ROOT PDB$SEED'
```

The upgrade reruns, and completes on `CDB1_PDB1` and `CDB1_PDB2`.

> **Note:**
>
> For Windows, you must specify the `-C` option exclusion list by using with double quote marks to specify the exclusion list. For example:
>
> ```
> ... -C "CDB$ROOT PDB$SEED"
> ```

Rerun the Upgrade While Other PDBs Are Online

You can rerun PDB upgrades by using the Parallel Upgrade Utility Resume option, or by explicitly including or excluding online PDBs using with inclusion or exclusion lists.

Use these examples as a model for running upgrades on PDBs, where you want to rerun upgrades on some PDBs while other PDBs are open.

In the examples, the upgrade failed in containers `CDB1_PDB1` and `CDB1_PDB2`, but succeeded in containers `CDB1_PDB3`, `CDB1_PDB4`, and `CDB1_PDB5`.

You start up `CDB$ROOT` in normal mode. You find that the following containers are online: `CDB1_PDB3`, `CDB1_PDB4`, and `CDB1_PDB5` . You review the upgrade logs for `CDB1_PDB3`, `CDB1_PDB4`, and `CDB1_PDB5` and bring these containers online.

Example 3-39 Rerunning Upgrades on PDBs Using the Resume Option

The following example shows how to complete the upgrade for `CDB1_PDB1` and `CDB1_PDB2` by using the Parallel Upgrade Utility Resume option. The Resume option excludes PDBs that are already upgraded:

1. Bring up `CDB$ROOT` in normal mode, and open `CDB1_PDB1` and `CDB1_PDB2` in upgrade mode. `CDB1_PDB3`, `CDB1_PDB4`, `CDB1_PDB5` are in normal mode. For example:

```
SQL> startup;
      alter pluggable database CDB1_PDB1 open upgrade;
      alter pluggable database CDB1_PDB2 open upgrade;
      alter pluggable database cdb1_pdb3 open;
      alter pluggable database cdb1_pdb4 open;
      alter pluggable database cdb1_pdb5 open;
```

2. Use the SQL command `show pdbs` to show the status of PDBs. For example:

```
SQL> show pdbs

    CON_ID CON_NAME                       OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  NO
         3 CDB1_PDB1                      MIGRATE    YES
         4 CDB1_PDB2                      MIGRATE    YES
         5 CDB1_PDB3                      READ WRITE NO
         6 CDB1_PDB4                      READ WRITE NO
         7 CDB1_PDB5                      READ WRITE NO
```

3. Rerun the upgrade, excluding `CDB$ROOT` from the upgrade, using the Parallel Upgrade Utility command-line script `dbupgrade`.

```
cd $ORACLE_HOME/bin
./dbupgrade -d $ORACLE_HOME/rdbms/admin/ -l $ORACLE_HOME/cfgtoollogs -R
```

Because you run the upgrade using the Resume option, the Parallel Upgrade Utility checks the logs and identifies that `CDB1_PDB1` and `CDB1_PDB2` are the only two containers in `CDB1` that are not upgraded. The upgrade script runs on just those two PDBs. The upgrade does not rerun on `PDB$SEED`, `CDB$ROOT`, `CDB_PDB3`, `CDB_PDB4`, and `CDB_PDB5`.

Example 3-40 Rerunning Upgrades on PDBs Using Exclusion Lists

The following example shows how to complete the upgrade for `CDB1_PDB1` and `CDB1_PDB2` by using an exclusion list to exclude the PDBs on which you do not want the upgrade script to run:

1. Bring up `CDB$ROOT` in normal mode, and open `CDB1_PDB1` and `CDB1_PDB2` in upgrade mode. `CDB1_PDB3`, `CDB1_PDB4`, `CDB1_PDB5` are in normal mode. For example:

```
SQL> startup;
     alter pluggable database CDB1_PDB1 open upgrade;
     alter pluggable database CDB1_PDB2 open upgrade;
     alter pluggable database cdb1_pdb3 open;
     alter pluggable database cdb1_pdb4 open;
     alter pluggable database cdb1_pdb5 open;
```

2. Use the SQL command `show pdbs` to show the status of PDBs. For example:

```
SQL> show pdbs

    CON_ID CON_NAME                       OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       READ ONLY  NO
         3 CDB1_PDB1                      MIGRATE    YES
         4 CDB1_PDB2                      MIGRATE    YES
         5 CDB1_PDB3                      READ WRITE NO
         6 CDB1_PDB4                      READ WRITE NO
         7 CDB1_PDB5                      READ WRITE NO
```

3. Rerun the upgrade, excluding `CDB$ROOT` from the upgrade, using the Parallel Upgrade Utility command-line script `dbupgrade`:

```
cd $ORACLE_HOME/bin
./dbupgrade -d $ORACLE_HOME/rdbms/admin -l $ORACLE_HOME/cfgtoollogs -R -C
'CDB$ROOT'
```

The Parallel Upgrade Utility runs with the Resume option (`-R`), and identifies from the logs that CDB1_PDB1 and

CDB1_PDB2 have not completed the upgrade. Because the Parallel Upgrade Utility runs with the Exclude option (-C), and you specify that CDB$ROOT is excluded, the upgrade script is also explicitly excluded from running on CDB$ROOT.

For Windows, when you run the Parallel Upgrade Utility with the Exclude option (-C), you must specify the targets -C option using double quotes around the CDB root name and PDB seed name. For example:

```
. . . -C "CDB$ROOT PDB$SEED"
```

4. The upgrade reruns and completes on CDB1_PDB1 and CDB1_PDB2.

Rerun the Upgrade Using an Inclusion List to Specify a CDB or PDBs

Use this example as a model for rerunning an upgrade on a PDB by using an inclusion list.

You can use an inclusion list to specify a list of CDBs and PDBs where you want to re-run an upgrade, and exclude nodes not on the inclusion list. Specify the inclusion list by running the Parallel Upgrade Utility with the inclusion option (-c), followed by a space-delimited list designated by single quotes of the containers that you want to upgrade.

In the examples, the upgrade failed in containers CDB1_PDB1 and CDB1_PDB2, but succeeded in containers CDB1_PDB3, CDB1_PDB4, and CDB1_PDB5. You start up CDB$ROOT in normal mode. You find that the following containers are online: CDB1_PDB3, CDB1_PDB4, and CDB1_PDB5 . You review the upgrade logs for CDB1_PDB3, CDB1_PDB4, and CDB1_PDB5 and bring these containers online.

Example 3-41 Rerunning Upgrades on PDBs Using an Inclusion List

For example:

1. Bring up CDB$ROOT in normal mode, and open CDB1_PDB1 and CDB1_PDB2 in upgrade mode. CDB1_PDB3, CDB1_PDB4, CDB1_PDB5 are in normal mode. For example:

```
SQL> startup;
      alter pluggable database CDB1_PDB1 open upgrade;
      alter pluggable database CDB1_PDB2 open upgrade;
      alter pluggable database cdb1_pdb3 open;
      alter pluggable database cdb1_pdb4 open;
      alter pluggable database cdb1_pdb5 open;
```

2. Use the SQL command show pdbs to show the status of PDBs. For example:

```
SQL> show pdbs

        CON_ID CON_NAME                       OPEN MODE  RESTRICTED
        ---------- ------------------------------ ---------- ----------
             2 PDB$SEED                       READ ONLY  NO
             3 CDB1_PDB1                      MIGRATE    YES
             4 CDB1_PDB2                      MIGRATE    YES
             5 CDB1_PDB3                      READ WRITE NO
             6 CDB1_PDB4                      READ WRITE NO
             7 CDB1_PDB5                      READ WRITE NO
```

3. Rerun the Parallel Upgrade Utility with the inclusion (-c) option, followed by a space-delimited inclusion list that you specify with single quote marks. This option runs the upgrade only on the PDBs that you list in the inclusion list.

   For example:

```
cd $ORACLE_HOME/bin
./dbupgrade -d $ORACLE_HOME/rdbms/admin -l ORACLE_HOME/cfgtoollogs -R -c
'CDB1_PDB1 CDB1_PDB2'
```

For Windows, when you run the Parallel Upgrade Utility with the inclusion option, you must specify the `-c` option targets by using double quotes around the inclusion list. For example:

```
. . . -C "CDB1_PDB1 CDB1_PDB2"
```

4. The upgrade reruns and completes on `CDB1_PDB1` and `CDB1_PDB2`.

Restarting the Upgrade from a Specific Phase that Failed Using -p

Use this option to complete an upgrade after fixing errors.

You can run the Parallel Upgrade Utility (`catctl.pl`, or the shell scripts `dbupgrade` or `dbupgrade.cmd`) with the `-p` option to rerun an upgrade and skip upgrade phases that already have run successfully. You can also rerun the upgrade on one phase to test the fix for failed phases.

To determine the phase number to restart, examine the upgrade log to identify where the first error occurred, and in what phase. You can then fix the cause of the error, and test the fix or rerun the upgrade to completion.

- Reviewing CDB Log Files for Failed Phases
  Identify your log file location, and review the CDB and PDB log files.
- Reviewing Non-CDB Log Files for Failed Phases
  Identify your log file location, and review the Non-CDB log files.
- Procedure for Finding and Restarting Multitenant Upgrades from a Failed Phase
  To restart a multitenant upgrade from a failed phase, first identify which PDB created the error and then search its appropriate log file for the error.

Reviewing CDB Log Files for Failed Phases

Identify your log file location, and review the CDB and PDB log files.

The location of the Automatic Diagnostic Repository (ADR) and the diagnostic log files created by the upgrade scripts can vary, depending on your environment variables and parameter settings.

You can set log file paths when you run the Parallel Upgrade Utility (`catctl`) by setting the `-l` option to define a log file path.

Log files for CDB$ROOT (CDBs) can span from `catupgrd0...catupgrd7.log`. Log files for pluggable databases (PDBs) are identified by the PDB container name (*dbname*), and span from `catupgrdp`*dbname*`0...catupgrdp`*dbname*`7.log`.

Related Topics

- About Log File Location and DIAGNOSTIC_DEST

Reviewing Non-CDB Log Files for Failed Phases

Identify your log file location, and review the Non-CDB log files.

The location of the Automatic Diagnostic Repository (ADR) and the diagnostic log files created by the upgrade scripts can vary, depending on your environment variables and parameter settings.

You can set log file paths when you run the Parallel Upgrade Utility (`catctl`) by setting the -l option to define a log file path.

> **Note:**
>
> Starting with Oracle Database 12*c*, release 1 (12.1), non-CDB architecture is deprecated. It can be desupported in a future release.

Log files can span from `catupgrd0...catupgrd7.log`.

Related Topics

- About Log File Location and DIAGNOSTIC_DEST

Procedure for Finding and Restarting Multitenant Upgrades from a Failed Phase

To restart a multitenant upgrade from a failed phase, first identify which PDB created the error and then search its appropriate log file for the error.

To identify the PDB that caused a multitenant upgrade failure, look at the upgrade summary report, or review catupgrd0.log; this log contains the upgrade summary report at the end of the file.

Use this procedure to check each log file looking for errors.

1. Locate log files with errors.

   For example:

   Linux and UNIX

   ```
   $ grep -i 'error at line' catupgrd*.log
   ```

   Windows

   ```
   C:\> find /I "error at line" catupgrd*.log
   ```

   The `grep` or `find` command displays the filenames of log files in which an error is found.

2. Check each log file that has an error and identify where the first error occurred. Use the text editor of your choice to review each log file. Search for the first occurrence of the phrase `error at line`'. When you find the phrase, then search backwards from the error (reverse search) for `PHASE_TIME___START`.

   For example:

```
PHASE_TIME___START 15 15-01-16 08:49:41
```

The number after `PHASE_TIME___START` is the phase number where the error has occurred. In this example, the phase number is 15.

Each log file can have an error in it. Repeat checking for the phrase `PHASE_TIME___START`, and identify the phase number with errors for each log file that contains an error, and identify the log file that contains the lowest phase number.

The log file that contains the lowest phase number is restart phase number, which is the phase number from which you restart the upgrade.

For example:

```
catupgrd0.log error occurred in phase 15:

PHASE_TIME___START 15 15-01-16 08:49:41

catupgrd1.log error occurred in phase 19:

PHASE_TIME___START 19 15-01-16 08:50:01
```

In this example, the restart phase number is 15. Ensure that you identify the first error seen in all the log files, so that you can restart the upgrade from that phase.

3. Restart the upgrade from the failed phase by changing directory to the running the Parallel Upgrade Utility (`catctl.pl`, which you can run from the command line using `dbupgrade` on Linux and UNIX, and `dbupgrade.cmd` on Windows). Use the `-p` flag to indicate that you want to restart the upgrade from a phase, and provide the restart phase number. In multitenant databases, also use the `-c` flag using the syntax `-c 'PDBname'`, where *`PDBname`* is the name of the PDB where the failure occurred.

   For example:

   Non-CDB Oracle Database on a Linux or UNIX system:

   ```
   cd $ORACLE_HOME/bin
   dbupgrade -p 15
   ```

   PDB in a multitenant Oracle Database (CDB) on a Windows system:

   ```
   cd $ORACLE_HOME/bin
   dbupgrade -p 15 -c 'PDB1'
   ```

   In both examples, the upgrade is restarted from phase 15, identified with the `-p` flag. In the multitenant example, the PDB with the error is identified with the `-c` flag.

   In these examples, the upgrade starts from phase 15 and runs to the end of the upgrade.

4. (Optional) You can also run the phase that contained an error by specifying a stop phase, using the `-P` flag. Using a stop phase allows the upgrade to just rerun that phase in which the error occurred. You can determine quickly if the error is fixed by running it on the phase with the error, without running the entire upgrade.

   For example, using the Perl script Parallel Upgrade Utility command option:

   ```
   cd $ORACLE_HOME/rdbms/admin
   $ORACLE_HOME/perl/bin/perl catctl.pl -p 15 -P 15 -c 'PDB1'
   ```

After you confirm that the error is fixed in the phase with the error, you can then resume the upgrade after that phase.

For example, if you have confirmed that the error in phase 15 of your multitenant database upgrade of PDB1 is fixed, then you can use the following command on Linux and UNIX systems to continue the upgrade at phase 16:

```
cd $ORACLE_HOME/bin dbupgrade -p 16 -c 'PDB1'
```

4

Post-Upgrade Tasks for Oracle Database

After you upgrade Oracle Database, complete required post-upgrade tasks, and consider recommendations for the new release.

Topics:

- Check the Upgrade With Post-Upgrade Status Tool
  Review the upgrade spool log file and use the Post-Upgrade Status Tool, `utlu122s.sql`.
- How to Show the Current State of the Oracle Data Dictionary
  Use one of three methods to check the state of the Oracle Data Dictionary for diagnosing upgrades and migrations.
- Required Tasks to Complete After Upgrading Oracle Database
  Review and complete these required tasks that are specified for your environment after you complete your upgrade.
- Recommended and Best Practices to Complete After Upgrading Oracle Database
  Oracle recommends that you complete these good practices guidelines for updating Oracle Database. These practices are recommended for both manual and DBUA upgrades.
- Recommended Tasks After Upgrading an Oracle RAC Database
  Decide if you want to configure clients to use SCAN or node listeners for connections.
- Recommended Tasks After Upgrading Oracle ASM
  After you have upgraded Oracle ASM, Oracle recommends that you perform tasks such as resetting the Oracle ASM passwords and configuring disk groups.
- Recommended Tasks After Upgrading Oracle Database Express Edition
  Use DBCA or run manual scripts to install additional components into Oracle Database.
- Tasks to Complete Only After Manually Upgrading Oracle Database
  After you complete your upgrade, you must perform the tasks described here if you upgrade your database manually instead of using DBUA.

Check the Upgrade With Post-Upgrade Status Tool

Review the upgrade spool log file and use the Post-Upgrade Status Tool, `utlu122s.sql`.

The Post-Upgrade Status Tool is a SQL script that is included with Oracle Database. You run the Post-Upgrade Status Tool in the environment of the new release. You can run the Post-Upgrade Status Tool at any time after you upgrade the database.

How to Show the Current State of the Oracle Data Dictionary

Use one of three methods to check the state of the Oracle Data Dictionary for diagnosing upgrades and migrations.

Running the `dbupgdiag.sql` Script

The `dbupgdiag.sql` script collects upgrade and migration diagnostic information about the current state of the data dictionary.

You can run the script in SQL*Plus both before the upgrade on the source database, and after the upgrade on the upgraded database as the SYS user. Refer to My Oracle Support note 556610.1 for more information about using the `dbupgdiag.sql` script to collect upgrade and migrate diagnostic information.

Running a SQL Query on DBA_REGISTERY

To show the current state of the dictionary, perform a SQL query similar to the following example:

```
SQL> spool /tmp/regInvalid.out
SQL> set echo on
-- query registry
SQL> set lines 80 pages 100
SQL> select substr(comp_id,1,15) comp_id,substr(comp_name,1,30)
      comp_name,substr(version,1,10) version,status
from dba_registry order by modified;
```

Running a Query to Check for Invalid Objects

To query invalid objects, perform a SQL query similar to the following example:

```
SQL> select owner, object_name, object_type from dba_invalid_objects order by owner,
object_type;
```

After you have upgraded the database, and you have run `utlrp.sql`, this view query should return no rows.

Related Topics

- https://support.oracle.com/rs?type=doc&id=556610.1

Required Tasks to Complete After Upgrading Oracle Database

Review and complete these required tasks that are specified for your environment after you complete your upgrade.

You must complete these postupgrade tasks after you upgrade Oracle Database. You must complete these tasks both when you perform the upgrade manually, and when you upgrade by using Database Upgrade Assistant (DBUA).

- Setting Environment Variables on Linux and UNIX Systems After Manual Upgrades
  If you performed a manual upgrade of Oracle Database, then you must ensure that required operating system environment variables point to the directories of the new Oracle Database release.
- Recompiling All Invalid Objects
  Oracle recommends you run the `utlrp.sql` script after you install, patch, or upgrade a database, to identify and recompile invalid objects.
- Recompiling All Invalid Objects on Multitenant Architecture Databases
  On multitenant architecture Oracle Databases, after upgrading. Oracle recommends that you recompile invalid objects using the `catcon` Perl script.
- Track Invalid Object Recompilation Progress
  Use these SQL queries to track the progress of utlrp.sql script recompilation of invalid objects.
- Running OPatch Commands After Upgrading Oracle Database
  After you upgrade Oracle Database, you must run OPatch commands from the new Oracle home.
- Setting oratab and Scripts to Point to the New Oracle Location After Upgrading Oracle Database
  You must set scripts to point to the new Oracle home location.
- Check PL/SQL Packages and Dependent Procedures
  Packages that you installed in the earlier release Oracle Database may not be upgraded automatically in the new release, which may affect applications.
- Upgrading Tables Dependent on Oracle-Maintained Types
  Starting with Oracle Database 12c release 2 (12.2) and later releases, you must manually upgrade user tables that depend on Oracle-Maintained types.
- Enabling the New Extended Data Type Capability
  Enabling a system to take advantage of the new extended data types requires specific upgrade actions.
- Adjusting Minimum and Maximum for Parallel Execution Servers
  You may need to adjust the PARALLEL_MIN_SERVERS default setting, depending on your environment.
- About Recovery Catalog Upgrade After Upgrading Oracle Database
  If you use a version of the recovery catalog schema that is older than that required by the RMAN client, then you must upgrade it.
- Upgrading the Time Zone File Version After Upgrading Oracle Database
  If the Pre-Upgrade Information Tool instructs you to upgrade the time zone files after completing the database upgrade, then use the `DBMS_DST` PL/SQL package to upgrade the time zone file.
- Upgrading Statistics Tables Created by the DBMS_STATS Package After Upgrading Oracle Database
  If you created statistics tables using the `DBMS_STATS.CREATE_STAT_TABLE` procedure, then upgrade these tables by running `DBMS_STATS.UPGRADE_STAT_TABLE`.
- Upgrading Externally Authenticated SSL Users After Upgrading Oracle Database
  If you are upgrading from Oracle9*i* Release 2 (9.2) or Oracle Database 10*g* Release 1 (10.1), and you are using externally authenticated SSL users, then you

must run the SSL external users conversion (`extusrupgrade`) script to upgrade those users.

- Configuring the FTP and HTTP Ports and HTTP Authentication for Oracle XML DB
  Database Configuration Assistant (DBCA) does not configure ports for Oracle XML DB on Oracle Database 12*c* and later release upgrades use digest authentication.
- Install Oracle Text Supplied Knowledge Bases After Upgrading Oracle Database
  Regenerate user extensions to Oracle Text after upgrading.
- Rebuild Oracle Text Indexes Using AUTO_LEXER
  If you are upgrading Oracle Text from releases earlier than Oracle Database 12*c*, then review this topic.
- Update Oracle Application Express Configuration After Upgrading Oracle Database
  Oracle Application Express affects upgrade procedures, depending on the Oracle Application Express release and your database installation type.
- Configure Access Control Lists (ACLs) to External Network Services
  Oracle Database 12*c* and later releases includes fine-grained access control to the `UTL_TCP`, `UTL_SMTP`, `UTL_MAIL`, `UTL_HTTP`, or `UTL_INADDR` packages.
- Enabling Oracle Database Vault After Upgrading Oracle Database
  Depending on your target database release, you can be required to disable Oracle Database Vault to complete an Oracle Database upgrade.
- Check for the SQLNET.ALLOWED_LOGON_VERSION Parameter Behavior
  Connections to Oracle Database from clients earlier than release 10*g* fail with the error `ORA-28040: No matching authentication protocol`.

Setting Environment Variables on Linux and UNIX Systems After Manual Upgrades

If you performed a manual upgrade of Oracle Database, then you must ensure that required operating system environment variables point to the directories of the new Oracle Database release.

If you are upgrading a cluster database, then perform these checks on all nodes on which the cluster database has instances configured.

Confirm that the following environment variables point to the directories of the new Oracle home:

- `ORACLE_HOME`
- `PATH`

> **Note:**
>
> DBUA automatically makes necessary changes to Oracle environment variables.

Recompiling All Invalid Objects

Oracle recommends you run the `utlrp.sql` script after you install, patch, or upgrade a database, to identify and recompile invalid objects.

The `utlrp.sql` script recompiles all invalid objects. Run the script immediately after installation, to ensure that users do not encounter invalid objects.

1. Start SQL*Plus:

   ```
   sqlplus "/ AS SYSDBA"
   ```

2. Run the `utlrp.sql` script, where *`Oracle_home`* is the Oracle home path:

   ```
   SQL> @Oracle_home/rdbms/admin/utlrp.sql
   ```

The `utlrp.sql` script automatically recompiles invalid objects in either serial or parallel recompilation, based on both the number invalid objects, and on the number of CPUs available. CPUs are calculated using the number of CPUs (`cpu_count`) multiplied by the number of threads for each CPU (`parallel_threads_per_cpu`). On Oracle Real Application Clusters (Oracle RAC), this number is added across all Oracle RAC nodes.

Recompiling All Invalid Objects on Multitenant Architecture Databases

On multitenant architecture Oracle Databases, after upgrading. Oracle recommends that you recompile invalid objects using the `catcon` Perl script.

Use the `catcon.pl` utility to run `utlrp.sql` on all containers in your container database (CDB).

The `catcon.pl` script runs utlrp.sql from the `$ORACLE_HOME/rdbms/admin` directory. The script recompiles any remaining stored PL/SQL and Java code.

Example 4-1 Running the utlrp.sql Script On All Containers in the CDB With the CATCON Utility

```
$ORACLE_HOME/perl/bin/perl catcon.pl -n 1 -e -b utlrp -d '''.''' utlrp.sql
```

Note the following conditions of this use case:

- The `-n` parameter is set to 1, so the script runs each PDB recompilation in sequence.
- Expect a time delay for the serial recompilation of PDBs to complete. Depending on the number of PDBs that you are upgrading, the recompilation can extend significantly beyond the time required for the upgrade scripts to complete.

Track Invalid Object Recompilation Progress

Use these SQL queries to track the progress of utlrp.sql script recompilation of invalid objects.

Oracle recommends that you run the `utlrp.sql` script after upgrade to recompile invalid objects. You can run SQL queries to monitor the script.

Example 4-2 Number of Invalid Objects Remaining

Enter this query to return the number of remaining invalid objects. This number decreases over time as the `utlrp.sql` script runs.

```
SELECT COUNT(*) FROM obj$ WHERE status IN (4, 5, 6);
```

Example 4-3 Number of Objects Recompiled

Enter this query to return the number of objects that utlrp.sql has compiled. This number increases over time as the script runs.

```
SELECT COUNT(*) FROM UTL_RECOMP_COMPILED;
```

Example 4-4 Number of Objects Recompiled with Errors

Enter this query to return the number of objects that `utlrp.sql` has compiled with errors.

```
select COUNT(DISTINCT(obj#)) "OBJECTS WITH ERRORS" from utl_recomp_errors;
```

If the number is higher than expected, then examine the error messages reported with each object. If you see errors due to system misconfiguration or resource constraints, then fix the cause of these errors, and run `utlrp.sql` again.

Running OPatch Commands After Upgrading Oracle Database

After you upgrade Oracle Database, you must run OPatch commands from the new Oracle home.

OPatch is a Java-based utility that you install with Oracle Universal Installer. Opatch is platform-independent. It runs on all supported operating systems. Another version of OPatch, called standalone OPatch, is also available. It runs on Oracle homes without Oracle Universal Installer.

Patches are a small collection of files copied over to an existing installation. They are associated with particular versions of Oracle products. When applied to the correct version of an installed product, patches result in an upgraded version of the product.

Run Opatch to Check the Oracle Database Inventory

Log in as the Oracle installation owner, and run the `lsinventory` command from the new Oracle home. The command generates an accurate and complete inventory of the Oracle software installed on the system:

```
opatch lsinventory –patch
```

Refer to My Oracle Support note 756671.1 regularly to obtain current recommendations regarding release updates (RU) and release update revisions (RUR).

Related Topics

- https://support.oracle.com/rs?type=doc&id=756671.1

Setting oratab and Scripts to Point to the New Oracle Location After Upgrading Oracle Database

You must set scripts to point to the new Oracle home location.

After you upgrade Oracle Database to a new release, you must ensure that your `oratab` file and any client scripts that set the value of *`ORACLE_HOME`* point to the new Oracle home that is created for the new Oracle Database release. DBUA automatically points `oratab` to the new Oracle home. However, you must check client scripts regardless of the method you use to upgrade.

If you upgrade your database manually, then you must log in as the Oracle installation owner for the new Oracle Database release, and update the `oratab` file manually. The location of the `oratab` file can vary, depending on your operating system.

Check PL/SQL Packages and Dependent Procedures

Packages that you installed in the earlier release Oracle Database may not be upgraded automatically in the new release, which may affect applications.

After the upgrade, check to ensure that any packages that you have used in your own scripts, or that you call from your scripts, are available in the new release. Testing procedures dependent on packages should be part of your upgrade plan.

Code in database applications can reference objects in the connected database. For example, Oracle Call Interface (OCI) and precompiler applications can submit anonymous PL/SQL blocks. Triggers in Oracle Forms applications can reference a schema object. Such applications are dependent on the schema objects they reference. Dependency management techniques vary, depending on the development environment. Oracle Database does not automatically track application dependencies.

Related Topics

- *Oracle Database Administrator's Guide*

Upgrading Tables Dependent on Oracle-Maintained Types

Starting with Oracle Database 12c release 2 (12.2) and later releases, you must manually upgrade user tables that depend on Oracle-Maintained types.

If your database has user tables that are dependent on Oracle-Maintained types (for example, AQ queue tables), then run the `utluptabdata.sql` command after the upgrade to carry out ALTER TABLE UPGRADE on any user tables affected by changes in Oracle-Maintained types. This change in behavior enables user tables to remain in READ-ONLY state during an upgrade. Users are prevented from logging into applications AS SYSDBA and changing application tables that are dependent on Oracle-Maintained types.

To identify tables that need to be upgraded after the database upgrade, connect AS SYSDBA and run the following query:

```
COLUMN owner FORMAT A30
COLUMN table_name FORMAT A30
SELECT DISTINCT owner, table_name
FROM dba_tab_cols
```

```
WHERE data_upgraded = 'NO'
ORDER BY 1,2;
```

This query lists all tables that are not listed as UPGRADED. However, the `utluptabdata.sql` script only upgrades tables that depend on Oracle-Maintained types. If any tables are listed by the query, then run the `utluptabdata.sql` script to perform ALTER TABLE UPGRADE commands on dependent user tables to upgrade these Oracle-Maintained types to the latest version of the type.

You must run the `utluptabdata.sql` script either with a user account with the privileges to ALTER all of the tables dependent on Oracle-Maintained types, or with a user granted the SYSDBA system privileges that is logged in AS SYSDBA.

When the parameter SERVEROUTPUT is set to `ON`, the `utluptabdata.sql` script displays the names of all upgraded tables, and lists any error encountered during the table upgrade. Run the following command to set the server output to `ON`:

```
SET SERVEROUTPUT ON
@utluptabdata.sql
```

Enabling the New Extended Data Type Capability

Enabling a system to take advantage of the new extended data types requires specific upgrade actions.

Oracle Database 12*c* introduced `MAX_STRING_SIZE` to control the maximum size of `VARCHAR2`, `NVARCHAR2`, and `RAW` data types in SQL. Setting `MAX_STRING_SIZE = EXTENDED` enables the 32767 byte limit introduced in Oracle Database 12*c*.

To be able to set `MAX_STRING_SIZE = EXTENDED`, you must set the `COMPATIBLE` initialization parameter to `12.0.0.0` or higher

In addition, you must run the script `utl32k.sql` script while the database is open in upgrade mode so that you invalidate and recompile objects that are affected by the change in data type sizes. For example:

```
CONNNECT SYS / AS SYSDBA
SHUTDOWN IMMEDIATE;
STARTUP UPGRADE;
ALTER SYSTEM SET max_string_size=extended;
START $ORACLE_HOME/rdbms/admin/utl32k.sql
SHUTDOWN IMMEDIATE;
STARTUP;
```

> **Caution:**
>
> You can change the value of `MAX_STRING_SIZE` from `STANDARD` to `EXTENDED`. However, you cannot change the value of `MAX_STRING_SIZE` from `EXTENDED` to `STANDARD`. By setting `MAX_STRING_SIZE = EXTENDED`, you are taking an explicit action that could introduce application incompatibility in your database.

Adjusting Minimum and Maximum for Parallel Execution Servers

You may need to adjust the PARALLEL_MIN_SERVERS default setting, depending on your environment.

In Oracle Database 12*c* the default for `PARALLEL_MIN_SERVERS` changed from `0` to a value depending on your hardware platform. This change is to provide sufficient minimal support for parallel execution. If the new default setting is too high for your environment, then adjust the setting for your requirements. The default for `PARALLEL_MAX_SERVERS` has not changed. If the default in your old environment is unchanged, then you do not need to take further action.

About Recovery Catalog Upgrade After Upgrading Oracle Database

If you use a version of the recovery catalog schema that is older than that required by the RMAN client, then you must upgrade it.

Upgrading the Time Zone File Version After Upgrading Oracle Database

If the Pre-Upgrade Information Tool instructs you to upgrade the time zone files after completing the database upgrade, then use the `DBMS_DST` PL/SQL package to upgrade the time zone file.

Oracle Database supplies multiple versions of time zone files. There are two types of file associated with each time zone file: a large file, which contains all the time zones defined in the database, and a small file, which contains only the most commonly used time zones. The large versions are designated as `timezlrg_`*`version_number`*`.dat`. The small versions are designated as `timezone_`*`version_number`*`.dat`. The files are located in the `oracore/zoneinfo` subdirectory under the Oracle Database home directory.

Related Topics

- *Oracle Database Globalization Support Guide*
- https://support.oracle.com/rs?type=doc&id=1585343.1

Upgrading Statistics Tables Created by the DBMS_STATS Package After Upgrading Oracle Database

If you created statistics tables using the `DBMS_STATS.CREATE_STAT_TABLE` procedure, then upgrade these tables by running `DBMS_STATS.UPGRADE_STAT_TABLE`.

In the following example, `green` is the owner of the statistics table and `STAT_TABLE` is the name of the statistics table.

```
EXECUTE DBMS_STATS.UPGRADE_STAT_TABLE('green', 'stat_table');
```

Perform this procedure for each statistics table.

Upgrading Externally Authenticated SSL Users After Upgrading Oracle Database

If you are upgrading from Oracle9*i* Release 2 (9.2) or Oracle Database 10*g* Release 1 (10.1), and you are using externally authenticated SSL users, then you must run the SSL external users conversion (`extusrupgrade`) script to upgrade those users.

The `extusrupgrade` script has the following syntax, where *`ORACLE_HOME`* is the Oracle database home, *`hostname`* is the name of the host on which the database is running, *`port_no`* is the listener port number, *`sid`* is the system identifier for the database instance, and *`db_admin`* is the database administrative user with privileges to modify user accounts.

```
ORACLE_HOME/rdbms/bin/extusrupgrade --dbconnectstring
hostname:port_no:sid --dbuser db_admin --dbuserpassword
password -a
```

For example:

```
extusrupgrade --dbconnectstring dlsun88:1521:10gR2 --dbuser system --dbuserpassword
manager -a
```

> **Note:**
>
> If you are upgrading from Oracle Database 10*g* Release 2 (10.2) or later, then you are not required to run the `extusrupgrade` script.

Configuring the FTP and HTTP Ports and HTTP Authentication for Oracle XML DB

Database Configuration Assistant (DBCA) does not configure ports for Oracle XML DB on Oracle Database 12*c* and later release upgrades use digest authentication.

Oracle recommends that when you configure ports, you also configure the authentication for HTTP for accessing Oracle XML DB Repository to take advantage of improved security features.

Starting with Oracle Database 12*c*, Oracle has enhanced database security by supporting digest authentication. Digest authentication is an industry-standard protocol that is commonly used with the HTTP protocol. It is supported by most HTTP clients. Digest authentication ensures that passwords are always transmitted in a secure manner, even when an encrypted (HTTPS) connection is not in use. Support for digest authentication enables organizations to deploy applications that use Oracle XML DB HTTP, without having to worry about passwords being compromised. Digest authentication support in Oracle XML DB also ensures that the Oracle XML DB HTTP server remains compatible with Microsoft Web Folders WebDAV clients.

After installing or upgrading for the new release, you must manually configure the FTP and HTTP ports for Oracle XML DB as follows:

1. Use `DBMS_XDB_CONFIG.setHTTPPort(HTTP_port_number)` to set the HTTP port for Oracle XML DB:

   ```
   SQL> exec DBMS_XDB_CONFIG.setHTTPPort(port_number);
   ```

2. Use `DBMS_XDB_CONFIG.setFTPPort(FTP_port_number)` to set the FTP port for Oracle XML DB:

   ```
   SQL> exec DBMS_XDB_CONFIG.setFTPPort(FTP_port_number);
   ```

   > **Note:**
   >
   > You can query the port numbers to use for FTP and HTTP in the procedure by using `DBMS_XDB_CONFIG.getFTPPort` and `DBMS_XDB_CONFIG.getHTTPPort` respectively.

3. To see all the used port numbers, query `DBMS_XDB_CONFIG.usedport`.

Install Oracle Text Supplied Knowledge Bases After Upgrading Oracle Database

Regenerate user extensions to Oracle Text after upgrading.

After an upgrade, all user extensions to the Oracle Text supplied knowledge bases must be regenerated. These changes affect all databases installed in the given Oracle home.

The Oracle Text-supplied knowledge bases are part of the companion products for the new Oracle Database are not immediately available after an upgrade. Any Oracle Text features dependent on the supplied knowledge bases which were available before the upgrade do not function after the upgrade. To re-enable such features, you must install the Oracle Text supplied knowledge bases from the installation media.

Rebuild Oracle Text Indexes Using AUTO_LEXER

If you are upgrading Oracle Text from releases earlier than Oracle Database 12*c*, then review this topic.

After you complete your upgrade to the new Oracle Database release, if you use Oracle Text indexes created with AUTO_LEXER, then you must rebuild the indexes for your queries to work.

In addition, you must rebuild indexes that have the following INDEX_STEMS types of BASIC_LEXER set:

- ARABIC
- BOKMAL
- CATALAN
- CROATIAN
- CZECH
- DANISH

- ERIVATIONAL_NEW
- DUTCH_NEW
- ENGLISH_NEW
- FINNISH
- FRENCH_NEW
- GERMAN_NEW
- GREEK
- HEBREW
- HUNGARIAN
- ITALIAN_NEW
- NYNORSK
- POLISH
- PORTUGUESE
- ROMANIAN
- RUSSIAN
- SERBIAN
- SLOVAK
- SLOVENIAN
- SPANISH_NEW
- SWEDISH

Update Oracle Application Express Configuration After Upgrading Oracle Database

Oracle Application Express affects upgrade procedures, depending on the Oracle Application Express release and your database installation type.

If the Oracle Database release that you upgrade includes Oracle Application Express release 3.2 or later, then you do not need to carry out additional configuration after upgrading to the new Oracle Database release. However, if Oracle Application Express is in the registry, so that Oracle Application Express is included in the upgrade, then set the `open_cursors` parameter to a minimum of 200.

If the Oracle Database you upgrade is an Oracle Express Edition database, but it contains an earlier release of Oracle Application Express, then the latest release is automatically installed during the upgrade. You must complete a series of postinstallation steps to configure Application Express for use with the new Oracle Database release.

If your database is an Oracle Express Edition database, then it contains an earlier release of Oracle Application Express that is tailored for the Oracle Express Edition environment.

Configure Access Control Lists (ACLs) to External Network Services

Oracle Database 12*c* and later releases includes fine-grained access control to the `UTL_TCP`, `UTL_SMTP`, `UTL_MAIL`, `UTL_HTTP`, or `UTL_INADDR` packages.

If you have applications that use these packages, then after upgrading Oracle Database you must configure network access control lists (ACLs) in the database before the affected packages can work as they did in earlier releases. Without the ACLs, your applications can fail with the error "ORA-24247: network access denied by access control list (ACL)."

Enabling Oracle Database Vault After Upgrading Oracle Database

Depending on your target database release, you can be required to disable Oracle Database Vault to complete an Oracle Database upgrade.

- Upgrading Oracle Database Without Disabling Oracle Database Vault
  If your target Oracle Database release is 12.2 or later, then you can upgrade without disabling Oracle Database Vault.
- Common Upgrade Scenarios with Oracle Database Vault
  The requirements to enable Oracle Database Vault after upgrades change, depending on your source Oracle Database release.

Upgrading Oracle Database Without Disabling Oracle Database Vault

If your target Oracle Database release is 12.2 or later, then you can upgrade without disabling Oracle Database Vault.

If you have Oracle Database Vault enabled in your source Oracle Database release, then you can upgrade Oracle Database to Oracle Database 18c without first disabling Oracle Database Vault. After the upgrade, if your source Oracle Database release is Oracle Database 12*c* release 1 (12.1) or later, then Oracle Database Vault is enabled with the same enforcement settings that you had in place before the upgrade. For example, if your source database is Oracle Database release 12.1, and Oracle Database Vault was disabled in that release, then it remains disabled after you upgrade. If your source Oracle Database release 12.1 database had Oracle Database Vault enabled before the upgrade, then Oracle Database Vault is enabled after the upgrade.

If you manually disable Oracle Database Vault before the upgrade, then you must enable Oracle Database Vault manually after the upgrade.

If you did not have Oracle Database Vault enabled before the upgrade, then you can enable it manually after the upgrade.

Enable Oracle Database Vault in the upgraded database by using the procedure `dvsys.dbms_macadm.enable_dv()`. Run this procedure with a user account that is granted `DV_OWNER`. After you run the procedure, restart the database instance so that the procedure takes effect.

Related Topics

- *Oracle Database Vault Administrator's Guide*

Common Upgrade Scenarios with Oracle Database Vault

The requirements to enable Oracle Database Vault after upgrades change, depending on your source Oracle Database release.

- Upgrades from Oracle Database 11*g* release 2 (11.2) or earlier: After the upgrade, Oracle Database Vault is disabled by default.
- Upgrades from Oracle Database 12*c* release 1 (12.1) or later: After the upgrade, Oracle Database Vault has the same enforcement status that you had in place before the upgrade.

Table 4-1 Common Oracle Database Vault Upgrade Scenarios and Upgrade Preparation Tasks

Source Database Release	Target Database Release	Do you need to disable Database Vault Before Upgrade	What is Database Vault Status After Upgrade
11.2 or earlier	12.1	Yes	Disabled. You need to enable Database Vault manually after the upgrade.
11.2.or earlier	12.2, 18.1 and later	No	Disabled. You need to enable Database Vault manually after the upgrade.
12.1, 12.2, 18.1, and later	12.2, 18.1 and later	No	Database Vault has the same enforcement status that you had in place before the upgrade.

Check for the SQLNET.ALLOWED_LOGON_VERSION Parameter Behavior

Connections to Oracle Database from clients earlier than release 10*g* fail with the error `ORA-28040: No matching authentication protocol`.

Starting with Oracle Database 18c, the default value for the SQLNET.ALLOWED_LOGON_VERSION parameter changes from 11 in Oracle Database 12*c* (12.2) to 12 in Oracle Database 18c. The use of this parameter is deprecated.

SQLNET.ALLOWED_LOGON_VERSION is now replaced with the SQLNET.ALLOWED_LOGON_VERSION_SERVER and SQLNET.ALLOWED_LOGON_VERSION_CLIENT parameters. If you have not explicitly set the SQLNET.ALLOWED_LOGON_VERSION_SERVER parameter in the upgraded database, then connections from clients earlier than release 10*g* fail with the error `ORA-28040: No matching authentication protocol`. For better security, check the password verifiers of your database users, and then configure the database to use the correct password verifier by setting the SQLNET.ALLOWED_LOGON_VERSION_SERVER and SQLNET.ALLOWED_LOGON_VERSION_CLIENT parameters.

If you have password-protected roles (secure roles) in your existing database, and if you upgrade to Oracle Database 18c with the default `SQLNET.ALLOWED_LOGON_VERSION_SERVER` setting of 12, because those secure roles only have release 10*g* verifiers, then the password for each secure role must be reset by the administrator so that the secure roles can remain usable after the upgrade.

Recommended and Best Practices to Complete After Upgrading Oracle Database

Oracle recommends that you complete these good practices guidelines for updating Oracle Database. These practices are recommended for both manual and DBUA upgrades.

- Back Up the Database
  Perform a full backup of the production database.
- Running Postupgrade Fixup Scripts
  Review this procedure to understand how to use the `postupgrade_fixups.sql` scripts for CDB and Non-CDB databases.
- Gathering Dictionary Statistics After Upgrading
  To help to assure good performance, use this procedure to gather dictionary statistics after completing your upgrade.
- Regathering Fixed Objects Statistics with DBMS_STATS
  After an upgrade, or after other database configuration changes, Oracle strongly recommends that you regather fixed object statistics after you have run representative workloads on Oracle Database.
- Reset Passwords to Enforce Case-Sensitivity
  For upgraded databases, improve security by using case-sensitive passwords for default user accounts and user accounts.
- Finding and Resetting User Passwords That Use the 10G Password Version
  For better security, find and reset passwords for user accounts that use the `10G` password version so that they use later, more secure password versions.
- Understand Oracle Grid Infrastructure, Oracle ASM, and Oracle Clusterware
  Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM) are both part of an Oracle Grid Infrastructure installation.
- Oracle Grid Infrastructure Installation and Upgrade and Oracle ASM
  Oracle ASM is installed with Oracle Grid Infrastructure.
- Add New Features as Appropriate
  Review new features as part of your database upgrade plan.
- Develop New Administrative Procedures as Needed
  Plan a review of your scripts and procedures, and change as needed.
- Set Threshold Values for Tablespace Alerts
  After an upgrade, thresholds for Oracle Database 18c Tablespace Alerts are set to null, disabling the alerts.
- Migrating From Rollback Segments To Automatic Undo Mode
  If your database release is earlier than Oracle Database 11*g*, then you must migrate the database that is being upgraded from using rollback segments (manual undo management) to automatic undo management.

- Migrating Tables from the LONG Data Type to the LOB Data Type
  You can use the `ALTER TABLE` statement to change the data type of a `LONG` column to `CLOB` and that of a `LONG RAW` column to `BLOB`.
- Migrate Your Upgraded Oracle Databases to Use Unified Auditing
  To use the full facilities of unified auditing, you must manually migrate to unified auditing.
- Identify Oracle Text Indexes for Rebuilds
  You can run a script that helps you to identify Oracle Text index indexes with token tables that can benefit by being rebuilt after upgrading to the new Oracle Database release..
- Dropping and Recreating DBMS_SCHEDULER Jobs
  If DBMS_SCHEDULER jobs do not function after upgrading from an earlier release, drop and recreate the jobs.
- Transfer Unified Audit Records After the Upgrade
  Review these topics to understand how you can obtain better performance after you upgrade and migrate to unified auditing
- About Testing the Upgraded Production Oracle Database
  Repeat tests on your production database that you carried out on your test database to ensure applications operate as expected.

Back Up the Database

Perform a full backup of the production database.

Although this step is not required, Oracle strongly recommends that you back up your production database.

Running Postupgrade Fixup Scripts

Review this procedure to understand how to use the `postupgrade_fixups.sql` scripts for CDB and Non-CDB databases.

The postupgrade fixup scripts are generated when you run the Pre-Upgrade Information Tool (`preupgrade.jar`). Run the postupgrade scripts any time after completing an upgrade. For both Container Databases (CDBs) with pluggable databases (PDBs), and for Non-CDB databases, the postupgrade fixup scripts provide general warnings, errors, and informational recommendations.

You can run the script either by using the `catcon.pl` utility, or by using SQL*Plus.

The location of the postupgrade SQL scripts and log files depends on how you set output folders, or define the Oracle base environment variable. The postupgrade fixup scripts are placed in the same directory path as the preupgrade fixup scripts.

If you specify an output directory by using the `dir` option with the Pre-Upgrade Information Tool, then the output logs and files are placed under that directory in the file path /`cfgtoollogs`/*`dbunique_name`*/`preupgrade`, where *`dbunique_name`* is the name of your source Oracle Database. If you do not specify an output directory when you run the Pre-Upgrade Information Tool, then the output is directed to one of the following default locations:

- If you do not specify an output directory with `DIR`, but you have set an Oracle base environment variable, then the generated scripts and log files are created in the following file path:

  Oracle-base`/cfgtoollogs/`*dbunique_name*`/preupgrade`

- If you do not specify an output directory, and you have not defined an Oracle base environment variable, then the generated scripts and log files are created in the following file path:

  Oracle-home`/cfgtoollogs/`*dbunique_name*`/preupgrade`

The postupgrade fixup scripts that the Pre-Upgrade Information Tool creates depend on whether your source database is a Non-CDB database, or a CDB database:

- Non-CDB: `postupgrade_fixups.sql`
- CDB: Two different sets of scripts:
  1. `postupgrade_fixups.sql`: A consolidated script for all PDBs
  2. Multiple `postupgrade_fixups_`*pdbname*`.sql` scripts, where*pdbname* is the name of the PDB for which a script is generated: Individual scripts, which you run on specific PDBs.

Example 4-5 Example of Spooling Postupgrade Fixup Results for a Non-CDB Oracle Database

Set the system to spool results to a log file so you can read the output. However, do not spool to the `admin` directory:

```
SQL> SPOOL postupgrade.log
SQL> @postupgrade_fixups.sql
SQL> SPOOL OFF
```

Turn off the spooling of script results to the log file:

```
SQL> SPOOL OFF
```

Example 4-6 Examples of Running Postupgrade Fixups Using catcon.pl On Linux, UNIX and Windows Systems

In the examples in this section, the `catcon` command runs `postupgrade_fixups.sql` in all the containers of a CDB database. Before you run this command, you must ensure that the operating system environment variables ORACLE_HOME and ORACLE_SID are set for UNIX and Linux environments, and that their equivalents are set for Windows environments. In the following examples, `sales1` is the unique name for the target database.

Linux and UNIX environments:

```
$ORACLE_HOME/perl/bin/perl -I$ORACLE_HOME/perl/lib -I$ORACLE_HOME/rdbms/
admin $ORACLE_HOME/rdbms/admin/catcon.pl -l /home/oracle/here/ -b postupg /
cfgtoollogs/sales1/preupgrade/postupgrade_fixups.sql
```

Windows environments:

```
%ORACLE_HOME%\perl\bin\perl –I%ORACLE_HOME%\perl\lib –I%ORACLE_HOME%\rdbms\admin
%ORACLE_HOME%\rdbms\admin\catcon.pl -l c:\tmp\logdir\ -b postupg c:\cfgtoollogs
\sales1\preupgrade\postupgrade_fixups.sql
```

In this Windows example, the command option `-l` creates logs under the file path `c:/tmp/logdir/`, and places the output from the postupgrade scripts into that directory. The option `-b` sets the prefix `postupg` on the output files.

> **Note:**
>
> You must enter the `catcon` parameters in the order that they are shown in these examples.

Gathering Dictionary Statistics After Upgrading

To help to assure good performance, use this procedure to gather dictionary statistics after completing your upgrade.

Oracle recommends that you gather dictionary statistics both before and after upgrading the database, because Data Dictionary tables are modified and created during the upgrade. With Oracle Database 12*c* release 2 (12.2) and later releases, you gather statistics as a manual procedure after the upgrade, when you bring the database up in normal mode.

- Non-CDB Oracle Database: Oracle recommends that you use the `DBMS_STATS.GATHER_DICTIONARY_STATS` procedure to gather these statistics. For example, enter the following SQL statement:

  ```
  SQL> EXEC DBMS_STATS.GATHER_DICTIONARY_STATS;
  ```

- CDB (multitenant architecture) Oracle Database: Oracle recommends that you use `catcon` to gather Data Dictionary statistics across the entire multitenant architecture

  To gather dictionary statistics for all PDBs in a container database, use the following syntax

  ```
  $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -l /tmp -b
  gatherstats -- --x"exec dbms_stats.gather_dictionary_stats"
  ```

  To gather dictionary statistics on a particular PDB, use syntax similar to the following:

  ```
  $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -l /tmp -c
  'SALES1' -b gatherstats -- --x"exec dbms_stats.gather_dictionary_stats"
  ```

  In the preceding example the `-c SALES1` option specifies a PDB inclusion list for the command that you run, specifying the database named `SALES1`. The option `-b gatherstats`specifies the base name for the logs. The option `--x` specifies the SQL command that you want to execute. The SQL command itself is inside the quotation marks.

Related Topics

- *Oracle Database PL/SQL Packages and Types Reference*

Regathering Fixed Objects Statistics with DBMS_STATS

After an upgrade, or after other database configuration changes, Oracle strongly recommends that you regather fixed object statistics after you have run representative workloads on Oracle Database.

Fixed objects are the X$ tables and their indexes. V$ performance views are defined through X$ tables. Gathering fixed object statistics is valuable for database performance because these statistics help the optimizer generate good execution plans, which can improve database performance. Failing to obtain representative statistics may lead to suboptimal execution plans, which may cause significant performance problems.

Gather fixed objects statistics by using the `DBMS_STATS.GATHER_FIXED_OBJECTS_STATS` PL/SQL procedure. `DBMS_STATS.GATHER_FIXED_OBJECTS_STATS` also displays recommendations for removing all hidden or underscore parameters and events from `init.ora/spfile`.

Because of the transient nature of `X$` tables, you must gather fixed objects statistics when there is a representative workload on the system. If you cannot gather fixed objects statistics during peak load, then Oracle recommends that you do it after the system is in a runtime state, and the most important types of fixed object tables are populated.

To gather statistics for fixed objects, run the following PL/SQL procedure:

```
SQL> execute dbms_stats.gather_fixed_objects_stats;
```

Reset Passwords to Enforce Case-Sensitivity

For upgraded databases, improve security by using case-sensitive passwords for default user accounts and user accounts.

For greater security, Oracle recommends that you enable case sensitivity in passwords. Case sensitivity increases the security of passwords by requiring that users enter both the correct password string, and the correct case for each character in that string. For example, the password `hPP5620qr` fails if it is entered as `hpp5620QR` or `hPp5620Qr`.

To secure your database, create passwords in a secure fashion. If you have default passwords in your database, then change these passwords. By default, case sensitivity is enforce when you change passwords. Every password should satisfy the Oracle recommended password requirements, including passwords for predefined user accounts.

For new databases created after the upgrade, there are no additional tasks or management requirements.

Existing Database Requirements and Guidelines for Password Changes

- If the default security settings for Oracle Database 12*c* release 1 (12.1) and later are in place, then passwords must be at least eight characters, and passwords such as `welcome` and `oracle` are not allowed.
- The `IGNORECASE` parameter is deprecated. Do not use this parameter.

- For existing databases, to take advantage of password case-sensitivity, you must reset the passwords of existing users during the database upgrade procedure. Reset the password for each existing database user with an `ALTER USER` statement.
- Query the PASSWORD_VERSIONS column of DBA_USERS to find the USERNAME of accounts that only have the 10G password version, and do not have either the 11G or the 12C password version. Reset the password for any account that has only the 10G password version.

Finding and Resetting User Passwords That Use the 10G Password Version

For better security, find and reset passwords for user accounts that use the `10G` password version so that they use later, more secure password versions.

Finding All Password Versions of Current Users

You can query the `DBA_USERS` data dictionary view to find a list of all the password versions that user accounts have.

For example:

```
SELECT USERNAME,PASSWORD_VERSIONS FROM DBA_USERS;

USERNAME                       PASSWORD_VERSIONS
------------------------------ -----------------
JONES                          10G 11G 12C
ADAMS                          10G 11G
CLARK                          10G 11G
PRESTON                        11G
BLAKE                          10G
```

The `PASSWORD_VERSIONS` column shows the list of password versions that exist for the account. `10G` refers to the earlier case-insensitive Oracle password version, `11G` refers to the SHA-1-based password version, and `12C` refers to the SHA-2-based SHA-512 password version.

- User `jones`: The password for this user was reset in Oracle Database 12*c* release 12.1 when the `SQLNET.ALLOWED_LOGON_VERSION_SERVER` parameter setting was `8`. This enabled all three password versions to be created.
- Users `adams` and `clark`: The passwords for these accounts were originally created in Oracle Database 10*g* and then reset in Oracle Database 11*g*. The Oracle Database 11*g* software was using the default `SQLNET.ALLOWED_LOGON_VERSION` setting of `8` at that time. Because case insensitivity is enabled by default, their passwords are now case sensitive, as is the password for `preston`.
- User `preston`: This account was imported from an Oracle Database 11*g* database that was running in Exclusive Mode (`SQLNET.ALLOWED_LOGON_VERSION = 12`).
- User `blake`: This account still uses the Oracle Database 10*g* password version. At this stage, user `blake` will be prevented from logging in.

Resetting User Passwords That Use the 10G Password Version

For better security, you should remove the `10G` password version from the accounts of all users. In the following procedure, to reset the passwords of users who have the `10G`

password version, you must temporarily relax the SQLNET.ALLOWED_LOGON_VERSION_SERVER setting, which controls the ability level required of clients before login can be allowed. This will enable these users to log in and change their passwords, and hence generate the newer password versions in addition to the 10G password version. Afterward, you will set the database to use Exclusive Mode and ensure that the clients have the O5L_NP capability. Then the users can reset their passwords again, so that their password versions no longer include 10G but only have the more secure 11G and 12C password versions.

1. Query the DBA_USERS view to find users who only use the 10G password version.

   ```
   SELECT USERNAME FROM DBA_USERS
   WHERE ( PASSWORD_VERSIONS = '10G '
   OR PASSWORD_VERSIONS = '10G HTTP ')
   AND USERNAME <> 'ANONYMOUS';
   ```

2. Configure the database so that it does not run in Exclusive Mode, as follows:

   a. Edit the SQLNET.ALLOWED_LOGON_VERSION_SERVER setting in the sqlnet.ora file so that it is more permissive than the default. For example:

      ```
      SQLNET.ALLOWED_LOGON_VERSION_SERVER=11
      ```

   b. Restart the database.

3. Expire the users that you found when you queried the DBA_USERS view to find users who only use the 10G password version.

   You must expire the users who have only the 10G password version, and do not have one or both of the 11G or 12C password versions.

   For example:

   ```
   ALTER USER username PASSWORD EXPIRE;
   ```

4. Ask the users whose passwords you expired to log in.

   When the users log in, they will be prompted to change their passwords. The database generates the missing 11G and 12C password versions for their account, in addition to the 10G password version. The 10G password version continues to be present, because the database is running in the permissive mode.

5. Ensure that the client software with which the users are connecting has the O5L_NP ability.

   All Oracle Database release 11.2.0.3 and later clients have the O5L_NP ability. If you have an earlier Oracle Database client, then you must install the CPUOct2012 patch.

6. After all clients have the O5L_NP capability, set the security for the server back to Exclusive Mode, as follows:

   a. Remove the SEC_CASE_SENSITIVE_LOGON parameter setting from the instance initialization file, or set SEC_CASE_SENSITIVE_LOGON to TRUE.

      ```
      SEC_CASE_SENSITIVE_LOGON = TRUE
      ```

   b. Remove the SQLNET.ALLOWED_LOGON_VERSION_SERVER parameter from the server sqlnet.ora file, or set the value of SQLNET.ALLOWED_LOGON_VERSION_SERVER in the server sqlnet.ora file back to 12, to set it to an Exclusive Mode.

      ```
      SQLNET.ALLOWED_LOGON_VERSION_SERVER = 12
      ```

   c. Restart the database.

7. Find the accounts that still have the `10G` password version.

```
SELECT USERNAME FROM DBA_USERS
WHERE PASSWORD_VERSIONS LIKE '%10G%'
AND USERNAME <> 'ANONYMOUS';
```

8. Expire the accounts that still have the `10G` password version.

```
ALTER USER username PASSWORD EXPIRE;
```

9. Ask these users to log in to their accounts.

   When the users log in, they are prompted to reset their passwords. The database then generates only the `11G` and `12C` password versions for their accounts. Because the database is running in Exclusive Mode, the `10G` password version is no longer generated.

10. Rerun the following query:

```
SELECT USERNAME FROM DBA_USERS
WHERE PASSWORD_VERSIONS LIKE '%10G%'
AND USERNAME <> 'ANONYMOUS';
```

    If this query does not return any results, then it means that no user accounts have the `10G` password version. Hence, the database is running in a more secure mode than in previous releases.

Understand Oracle Grid Infrastructure, Oracle ASM, and Oracle Clusterware

Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM) are both part of an Oracle Grid Infrastructure installation.

If Oracle Grid Infrastructure is installed for a single server, then it is deployed as an Oracle Restart installation with Oracle ASM. If Oracle Grid Infrastructure is installed for a cluster, then it is deployed as an Oracle Clusterware installation with Oracle ASM.

Oracle Restart enhances the availability of Oracle Database in a single-instance environment. If you install Oracle Restart, and there is a temporary failure of any part of the Oracle Database software stack, including the database, listener, and Oracle ASM instance, Oracle Restart automatically restarts the failed component. In addition, Oracle Restart starts all these components when the database host computer is restarted. The components are started in the proper order, taking into consideration the dependencies among components.

Oracle Clusterware is portable cluster software that enables clustering of single servers so that they cooperate as a single system. Oracle Clusterware also provides the required infrastructure for Oracle RAC. In addition, Oracle Clusterware enables the protection of any Oracle application or any other application within a cluster. In any case Oracle Clusterware is the intelligence in those systems that ensures required cooperation between the cluster nodes.

Oracle Grid Infrastructure Installation and Upgrade and Oracle ASM

Oracle ASM is installed with Oracle Grid Infrastructure.

In earlier releases, Oracle ASM was installed as part of the Oracle Database installation. Starting with Oracle Database release 11.2, Oracle ASM is installed when

you install the Grid Infrastructure components. Oracle ASM shares an Oracle home with Oracle Clusterware.

Add New Features as Appropriate

Review new features as part of your database upgrade plan.

Oracle Database New Features Guide describes many of the new features available in the new Oracle Database release. Determine which of these new features can benefit the database and applications. You can then develop a plan for using these features.

It is not necessary to make any immediate changes to begin using your new Oracle Database software. You can choose to introduce new feature enhancements into your database and applications gradually.

Develop New Administrative Procedures as Needed

Plan a review of your scripts and procedures, and change as needed.

After familiarizing yourself with the features of the new Oracle Database release, review your database administration scripts and procedures to determine whether any changes are necessary.

Coordinate your changes to the database with the changes that are necessary for each application. For example, by enabling integrity constraints in the database, you may be able to remove some data checking from your applications.

Set Threshold Values for Tablespace Alerts

After an upgrade, thresholds for Oracle Database 18c Tablespace Alerts are set to null, disabling the alerts.

You must identify tablespaces in the database that are candidates for monitoring, and you must set the appropriate threshold values for these tablespaces.

In newly-created Oracle Database 18c installations, the following values are used as defaults:

- 85% full warning
- 97% full critical

Migrating From Rollback Segments To Automatic Undo Mode

If your database release is earlier than Oracle Database 11*g*, then you must migrate the database that is being upgraded from using rollback segments (manual undo management) to automatic undo management.

Automatic undo management is the default undo space management mode. The `UNDO_MANAGEMENT` initialization parameter specifies which undo space management mode the system should use:

- If `UNDO_MANAGEMENT` is set to `AUTO` (or if `UNDO_MANAGEMENT` is not set), then the database instance starts in automatic undo management mode.

A null UNDO_MANAGEMENT initialization parameter defaults to automatic undo management mode in Oracle Database 11*g* Release 1 (11.1) and later. In earlier releases it defaults to manual undo management mode. Use caution when upgrading earlier releases.

- If UNDO_MANAGEMENT is set to MANUAL, then undo space is allocated externally as rollback segments.

1. Set the UNDO_MANAGEMENT parameter to UNDO_MANAGEMENT=MANUAL.
2. Start the instance again and run through a standard business cycle to obtain a representative workload. Assess the workload, and compute the size of the undo tablespace that you require for automatic undo management.
3. After the standard business cycle completes, run the following function to collect the undo tablespace size, and to help with the sizing of the undo tablespace. You require SYSDBA privileges to run this function.

```
DECLARE
   utbsiz_in_MB NUMBER;
BEGIN
   utbsiz_in_MB := DBMS_UNDO_ADV.RBU_MIGRATION;
end;
/
```

   This function runs a PL/SQL procedure that provides information on how to size your new undo tablespace based on the configuration and usage of the rollback segments in your system. The function returns the sizing information directly.
4. Create an undo tablespace of the required size and turn on the automatic undo management by setting UNDO_MANAGEMENT=AUTO or by removing the parameter.
5. For Oracle RAC configurations, repeat these steps on all instances.

Migrating Tables from the LONG Data Type to the LOB Data Type

You can use the ALTER TABLE statement to change the data type of a LONG column to CLOB and that of a LONG RAW column to BLOB.

The LOB data types (BFILE, BLOB, CLOB, and NCLOB) can provide many advantages over LONG data types.

In the following example, the LONG column named long_col in table long_tab is changed to data type CLOB:

```
SQL> ALTER TABLE Long_tab MODIFY ( long_col CLOB );
```

After using this method to change LONG columns to LOBs, all the existing constraints and triggers on the table are still usable. However, all the indexes, including Domain indexes and Functional indexes, on all columns of the table become unusable and must be rebuilt using an ALTER INDEX...REBUILD statement. Also, the Domain indexes on the LONG column must be dropped before changing the LONG column to a LOB.

Migrate Your Upgraded Oracle Databases to Use Unified Auditing

To use the full facilities of unified auditing, you must manually migrate to unified auditing.

In unified auditing, all Oracle Database audit trails (`SYS.AUD$` for the database audit trail, `SYS.FGA_LOG$` for fine-grained auditing, `DVYS.AUDIT_TRAIL$` for Database Vault, and so on) are combined into one single audit trail, which you can view by querying the `UNIFIED_AUDIT_TRAIL` data dictionary view for single-instance installations and `GV$UNIFIED_AUDIT_TRAIL` for Oracle Real Application Clusters environments.

- Understanding Unified Auditing Migration Process for Oracle Database
  Decide which audit policies you want to use in the upgraded database.
- Migrating to Unified Auditing for Oracle Database
  Use this procedure for multitenant container (CDB) databases to migrate to unified auditing.
- About Managing Earlier Audit Records After You Migrate to Unified Auditing
  Review, archive, and purge earlier audit trails in preparation for using the unified audit trail.
- Removing the Unified Auditing Functionality
  Use this procedure to remove unified auditing, and to use mixed-mode audit.
- Obtaining Documentation References if You Choose Not to Use Unified Auditing
  You can access documentation listed here to obtain configuration information about how to use non-unified auditing.

> **See Also:**
>
> *Oracle Database Security Guide* for information about how the audit features have changed for this release

Understanding Unified Auditing Migration Process for Oracle Database

Decide which audit policies you want to use in the upgraded database.

By default, unified auditing is not enabled for upgraded databases. If you have upgraded from an earlier release to Oracle Database 12*c*, then your database uses the same auditing functionality that was used in the earlier release. For newly created databases, the mixed-mode method of unified auditing is enabled by default. After you complete the migration to unified auditing, traditional auditing is disabled, and the new audit records write to the unified audit trail.

To enable and configure the audit policies and how they are used, choose one method as follows:

- Use the pure unified audit facility.

  Migrate to unified auditing to use the full unified auditing facility features. After you complete the procedure to migrate to unified auditing, you can create and enable new audit policies and also use the predefined audit policies. The audit records for these policies write to the unified audit trail. The earlier audit trails and their audit records remain, but no new audit records write to the earlier audit trails.

> **Note:**
>
> The audit configuration from the earlier release has no effect in the unified audit system. Only unified audit policies generate audit records inside the unified audit trail.

- Use a mixed-mode audit facility.

  The mixed-mode audit facility enables both traditional and unified auditing facilities to run simultaneously and applies to both new and upgraded databases. The mixed-mode unified auditing facility becomes available if you enable at least one of the unified auditing predefined audit policies. Audit records for these policies write to the unified audit trail. The audit configuration in the earlier release of Oracle Database is also available, and the audit records for this configuration write to the earlier audit trails. If you decide that you prefer using the pure unified audit facility, then you can migrate to it.

> **Note:**
>
> If the database is not writable, then audit records write to new format operating system files in the `$ORACLE_BASE/audit/$ORACLE_SID` directory.

> **See Also:**
>
> – *Oracle Database Security Guide* for information about the predefined audit policies
>
> – *Oracle Database Security Guide* for information about the `ora_SecureConfig` audit policy

Migrating to Unified Auditing for Oracle Database

Use this procedure for multitenant container (CDB) databases to migrate to unified auditing.

In CDB environments, perform the following procedure in the `root`. The procedure migrates both the `root`CDB, and any associated PDBs, to unified auditing.

1. Log in to SQL*Plus as user `SYS` with the `SYSDBA` privilege.

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

   In a Pluggable Databases environment, this login connects you to `root`.

2. Check if your Oracle Database is migrated to unified auditing using this query:

   ```
   SQL> SELECT VALUE FROM V$OPTION WHERE PARAMETER = 'Unified Auditing';
   ```

If the output for the VALUE column is TRUE, then unified auditing is already enabled in your database. You can proceed to Managing Earlier Audit Records. If the output is FALSE, then complete the remaining steps in this procedure.

3. Stop the database. For single-instance environments, enter the following commands from SQL*Plus:

```
SQL> SHUTDOWN IMMEDIATE
SQL> EXIT
```

For Windows systems, stop the Oracle service:

```
net stop OracleService%ORACLE_SID%
```

For Oracle RAC installations, shut down each database instance as follows:

```
srvctl stop database -db db_name
```

4. Stop the listener. (Stopping the listener is not necessary for Oracle RAC and Oracle Grid Infrastructure listeners.)

```
lsnrctl stop listener_name
```

You can find the name of the listener by running the `lsnrctl status` command. The `Alias` setting indicates the name.

5. Go to the directory `$ORACLE_HOME/rdbms/lib`.
6. Enable unified auditing.
   - Linux and UNIX

     ```
     make -f ins_rdbms.mk uniaud_on ioracle ORACLE_HOME=$ORACLE_HOME
     ```

   - Windows

     Rename the file `%ORACLE_HOME%/bin/orauniaud12.dll.dbl` to `%ORACLE_HOME%/bin/orauniaud12.dll`.

> **Note:**
>
> For Oracle RAC databases that have non-shared Oracle homes, you must repeat this step on each cluster member node, so that the binaries are updated inside the local ORACLE_HOME on each cluster node.

7. Restart the listener.

```
lsnrctl start listener_name
```

8. Restart the database.

Log in to SQL*Plus and then enter the STARTUP command:

```
sqlplus sys as sysoper
Enter password: password

SQL> STARTUP
```

For Windows systems, start the Oracle service:

```
net start OracleService%ORACLE_SID%
```

For Oracle RAC installations, start each database instance:

```
srvctl start database -db db_name
```

About Managing Earlier Audit Records After You Migrate to Unified Auditing

Review, archive, and purge earlier audit trails in preparation for using the unified audit trail.

After you complete the procedure to migrate Oracle Database to use unified auditing, any audit records that your database had before remain in their earlier audit trails. You can archive these audit records and then purge their audit trails. With unified auditing in place, any new audit records write to the unified audit trail.

Removing the Unified Auditing Functionality

Use this procedure to remove unified auditing, and to use mixed-mode audit.

After you have enabled your databases to use unified auditing, if you decide that you do not want unified auditing, then you can use this procedure to remove the unified auditing functionality. In this case, your database uses the mixed-mode audit facility.

1. Stop the database.

   ```
   sqlplus sys as sysoper
   Enter password: password

   SQL> SHUTDOWN IMMEDIATE
   SQL> EXIT
   ```

   For Windows systems, stop the Oracle service:

   ```
   net stop OracleService%ORACLE_SID%
   ```

   For Oracle RAC installations, shut down each database instance as follows:

   ```
   srvctl stop database -db db_name
   ```

2. Go to the `$ORACLE_HOME/rdbms/lib` directory.
3. Disable the unified auditing executable.
   - **UNIX:** Run the following command:

     ```
     make -f ins_rdbms.mk uniaud_off ioracle ORACLE_HOME=$ORACLE_HOME
     ```

   - **Windows:** Rename the `%ORACLE_HOME%/bin/orauniaud12.dll` file to `%ORACLE_HOME%/bin/orauniaud12.dll.dbl`.
4. Restart the database.

   ```
   sqlplus sys as sysoper
   Enter password: password

   SQL> STARTUP
   SQL> EXIT
   ```

   For Windows systems, start the Oracle service again.

   ```
   net start OracleService%ORACLE_SID%
   ```

For Oracle RAC installations, start each database instance using the following syntax:

```
srvctl start database -db db_name
```

Obtaining Documentation References if You Choose Not to Use Unified Auditing

You can access documentation listed here to obtain configuration information about how to use non-unified auditing.

After upgrading to the new release Oracle Database, if you choose not to change to unified auditing, then Oracle documentation and Oracle Technology Network provide information about traditional non-unified auditing.

- *Oracle Database Security Guide*: This guide is the main source of information for configuring auditing. You must use the Oracle Database Release 11*g* version of this manual. To access this guide:
  1. Visit Oracle Technology Network at the following URL:

     `http://www.oracle.com/technetwork/index.html`
  2. From the `Downloads` menu, under `Databases`, select `Database 11g`.
  3. In the Downloads page, select the **Documentation** tab.
  4. From the most recent Oracle Database 11*g* Release 2 (11.2) Documentation page, select the **View Library** link to display the home page of the Release 11*g* documentation set.
  5. Under the **Search** field, select the **Master Book List** link.
  6. Search for *Security Guide*.
  7. Select either the **HTML** or the **PDF** link for this guide.
- *Oracle Database SQL Language Reference*: This guide explains how to use the AUDIT and NOAUDIT statements for both unified auditing and non-unified auditing environments.
- *Oracle Database Reference*: This guide explains how to use the initialization parameters and data dictionary views that are associated with a non-unified auditing environment.
- *Oracle Database Vault Administrator's Guide*: This guide explains how to configure auditing in a non-unified auditing environment for Database Vault.
- *Oracle Label Security Administrator's Guide*: This guide explains how to configure auditing in a non-unified auditing environment for Oracle Label Security.

Identify Oracle Text Indexes for Rebuilds

You can run a script that helps you to identify Oracle Text index indexes with token tables that can benefit by being rebuilt after upgrading to the new Oracle Database release..

When you upgrade from Oracle Database 12c release 1 (12.2.0.1) to Oracle Database 18c and later releases, the Oracle Text token tables (`$I`, `$P`, and so on) are expanded from 64 bytes to 255 bytes. However, if you have indexes with existing token tables

using the smaller size range, then the Oracle Text indexes cannot take advantage of this widened token column range. You must rebuild the indexes to use the 255 byte size range. Oracle provides a script that can assist you to identify indexes that can benefit by being rebuilt.

Obtain the script from My Oracle Support:

https://support.oracle.com/rs?type=doc&id=2287094.1

Dropping and Recreating DBMS_SCHEDULER Jobs

If DBMS_SCHEDULER jobs do not function after upgrading from an earlier release, drop and recreate the jobs.

If you find that DBMS_SCHEDULER jobs are not functioning after an upgrade. drop and recreate those jobs. This issue can occur even if the upgrade process does not report issues, and system objects are valid.

Transfer Unified Audit Records After the Upgrade

Review these topics to understand how you can obtain better performance after you upgrade and migrate to unified auditing

- About Transferring Unified Audit Records After an Upgrade
  Transferring the unified audit records from Oracle Database 12*c* release 12.1 to the new relational table under the `AUDSYS` schema for the new Oracle Database release improves the read performance of the unified audit trail.
- Transferring Unified Audit Records After an Upgrade
  You can transfer unified audit records to the new relational table in `AUDSYS` by using the `DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS` PL/SQL procedure.

About Transferring Unified Audit Records After an Upgrade

Transferring the unified audit records from Oracle Database 12*c* release 12.1 to the new relational table under the `AUDSYS` schema for the new Oracle Database release improves the read performance of the unified audit trail.

Starting with Oracle Database 12c Release 2, unified audit records are written directly to a new internal relational table that is located in the `AUDSYS` schema. In Oracle Database 12*c* release 12.1, the unified audit records were written to the common logging infrastructure (CLI) SGA queues. If you migrated to unified auditing in that release, then to obtain better read performance, you can transfer the unified audit records that are from that release to the new Oracle Database release internal table. It is not mandatory that you perform this transfer, but Oracle recommends that you do so to obtain better unified audit trail read performance. This is a one-time operation. All new unified audit records that are generated after the upgrade are written to the new table. The table is a read-only table. Any attempt to modify the metadata or data of this table is mandatorily audited.

After you upgrade to the new Oracle Database release, if you have any unified audit records present in the `UNIFIED_AUDIT_TRAIL` from the earlier release, then consider transferring them to the new internal relational table by using the transfer procedure for better read performance of the unified audit trail.

As with the SYS schema, you cannot query the AUDSYS schema if you have the SELECT ANY TABLE system privilege. In addition, this table is not listed as a schema object in the ALL_TABLES data dictionary view unless you have either the SELECT ANY DICTIONARY system privilege or an explicit SELECT privilege on this internal table. Until the database is open read write, the audit records are written to operating system spillover files (.bin format). However, you can transfer the audit records in these operating system files to the internal relational table after the database opens in the read write mode by using the DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES procedure.

Transferring Unified Audit Records After an Upgrade

You can transfer unified audit records to the new relational table in AUDSYS by using the DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS PL/SQL procedure.

1. Log in to the database instance as a user who has been granted the AUDIT_ADMIN role.

   For example, in a non-multitenant environment:

   ```
   sqlplus sec_admin
   Enter password: password
   ```

   For a multitenant environment, connect to the root:

   ```
   sqlplus c##sec_admin@root
   Enter password: password
   ```

   You can perform this procedure execution in the root as well as in a PDB, because the UNIFIED_AUDIT_TRAIL view is container specific. In addition, the transfer procedure is container specific. That is, performing the transfer from the root does not affect the unified audit records that are present in the unified audit trail for the PDB.

2. For a multitenant environment, query the DBA_PDB_HISTORY view to find the correct GUID that is associated with the CLI table that is specific to the container from which audit records must be transferred.

   For example:

   ```
   SQL> SELECT PDB_NAME, PDB_GUID FROM DBA_PDB_HISTORY;

   PDB_NAME  PDB_GUID
   --------  --------------------------------
   HR_PDB    33D96CA7862D53DFE0534DC0E40A7C9B
   ...
   ```

3. In a multitenant environment, connect to the container for which you want to transfer the audit records.

   You cannot perform the transfer operation on a container that is different from the one in which you are currently connected.

4. Run the DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS procedure.

   For example:

   ```
   SQL> EXEC DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS;

   PL/SQL procedure successfully completed.
   ```

Or, to specify the PDB GUID:

```
SQL> EXEC DBMS_AUDIT_MGMT.TRANSFER_UNIFIED_AUDIT_RECORDS
('33D96CA7862D53DFE0534DC0E40A7C9B');

PL/SQL procedure successfully completed.
```

5. If the database is in open read write mode, then execute the `DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES` procedure.

   Until the database is in open read write mode, audit records are written to operating system (OS) files. The `DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES` procedure moves the unified audit records that are present in the files to database tables. You can find the unified audit records that are present in the OS spillover files by querying the `V$UNIFIED_AUDIT_TRAIL` dynamic view.

   For example, if you want to execute this procedure for audit records in the `HR_PDB` container, then you must connect to that PDB first:

   ```
   SQL> CONNECT sec_admin@HR_PDB
   Enter password: password

   SQL> EXEC DBMS_AUDIT_MGMT.LOAD_UNIFIED_AUDIT_FILES;

   PL/SQL procedure successfully completed.
   ```

6. Query the `UNIFIED_AUDIT_TRAIL` data dictionary view to check if the records transferred correctly.

   Oracle highly recommends that you query `UNIFIED_AUDIT_TRAIL`. After a successful audit record transfer, you should query the `UNIFIED_AUDIT_TRAIL` because querying the `V$UNIFIED_AUDIT_TRAIL` dynamic view will show the audit records that are present only in the OS spillover files.

About Testing the Upgraded Production Oracle Database

Repeat tests on your production database that you carried out on your test database to ensure applications operate as expected.

If you upgraded a test database to the new Oracle Database release and then tested it, then you can now repeat those tests on the production database that you upgraded to the new Oracle Database release. Compare the results, noting anomalies. Repeat the test upgrade as many times as necessary.

Test the newly upgraded production database with existing applications to verify that they operate properly with a new Oracle database. You also might test enhanced functions by adding available Oracle Database features. However, first ensure that the applications operate in the same manner as they did before the upgrade.

Recommended Tasks After Upgrading an Oracle RAC Database

Decide if you want to configure clients to use SCAN or node listeners for connections.

Oracle Real Application Clusters 12*c* uses the Single Client Access Name (SCAN). The SCAN is a single name that resolves to three IP addresses in the public network. When you upgrade a release of an Oracle RAC database earlier than release 11.2, the

Oracle RAC database is registered with SCAN listeners as remote listeners. The Oracle RAC database also continues to register with all node listeners. SCAN listeners offer a variety of benefits. These benefits include enabling you to configure clients one time, and adding or removing nodes from the cluster without needing to change client connection configurations.

You can configure clients to use SCANs, or you can continue to use listeners configured on cluster member nodes. If you migrate all of your client connections to use SCANs, then you can remove the node listeners from the `REMOTE_LISTENERS` parameter. However, you cannot remove the node listeners themselves, because only node listeners can create dedicated servers for the database.

Recommended Tasks After Upgrading Oracle ASM

After you have upgraded Oracle ASM, Oracle recommends that you perform tasks such as resetting the Oracle ASM passwords and configuring disk groups.

- Create A Shared Password File in the ASM Diskgroup
  If you advance the `COMPATIBLE.ASM` disk group attribute, then create a shared password file.
- Reset Oracle ASM Passwords to Enforce Case-Sensitivity
  To take advantage of enforced case-sensitive passwords, you must reset the passwords of existing users during the database upgrade procedure.
- Advancing the Oracle ASM and Oracle Database Disk Group Compatibility
  You can advance the Oracle Database and the Oracle ASM disk group compatibility settings across software versions.
- Set Up Oracle ASM Preferred Read Failure Groups
  Oracle ASM administrators can specify some disks as preferred read disks for read I/O operations.

Related Topics

- Add New Features as Appropriate
  Review new features as part of your database upgrade plan.
- Develop New Administrative Procedures as Needed
  Plan a review of your scripts and procedures, and change as needed.

Create A Shared Password File in the ASM Diskgroup

If you advance the `COMPATIBLE.ASM` disk group attribute, then create a shared password file.

If you advanced the `COMPATIBLE.ASM` disk group attribute to 12.1 or later, then you are required to create a shared password file in the ASM diskgroup.

Reset Oracle ASM Passwords to Enforce Case-Sensitivity

To take advantage of enforced case-sensitive passwords, you must reset the passwords of existing users during the database upgrade procedure.

In releases earlier than Oracle Database 11*g* Release 1 (11.1), passwords are not case sensitive. You can enforce case sensitivity for passwords. For example, the password `hPP5620qr` fails if it is entered as `hpp5620QR` or `hPp5620Qr`.

For new Oracle ASM instances, there are no additional tasks or management requirements. For upgraded Oracle ASM instances, each user password must be reset with an `ALTER USER` statement.

> **Note:**
>
> If the default Oracle Database security settings are in place, then passwords must be at least eight characters, and passwords such as `welcome` and `oracle` are not allowed. See *Oracle Database Security Guide* for more information.

Advancing the Oracle ASM and Oracle Database Disk Group Compatibility

You can advance the Oracle Database and the Oracle ASM disk group compatibility settings across software versions.

> **Caution:**
>
> If you advance the `COMPATIBLE.RDBMS` attribute, then you cannot revert to the previous setting. Before advancing the `COMPATIBLE.RDBMS` attribute, ensure that the values for the `COMPATIBLE` initialization parameter for all of the databases that use the disk group are set to at least the new setting for `COMPATIBLE.RDBMS` before you advance the attribute value.

Advancing compatibility enables new features only available in the new release. However, doing so makes the disk group incompatible with older releases of the software. Advancing the on disk compatibility is an irreversible operation.

Use the `compatible.rdbms` and `compatible.asm` attributes to specify the minimum software release required by the database instance and the Oracle ASM instance, respectively, to access the disk group. For example, the following `ALTER DISKGROUP` statement advances the Oracle ASM compatibility of the disk group `asmdg2`:

```
ALTER DISKGROUP asmdg2 SET ATTRIBUTE 'compatible.asm' = '12.2'
```

In this case, the disk group can be managed only by Oracle ASM software of release 12.2 or later, while any database client of release 11.2 or later can use the disk group.

Set Up Oracle ASM Preferred Read Failure Groups

Oracle ASM administrators can specify some disks as preferred read disks for read I/O operations.

When an ASM administrator defines Oracle ASM preferred read failure groups, Oracle ASM can then read from the extent that is in the nearest preferred read disk, rather than always reading the primary copy.

Recommended Tasks After Upgrading Oracle Database Express Edition

Use DBCA or run manual scripts to install additional components into Oracle Database.

An Oracle Database Express database contains only a subset of the components available in an Oracle Database Standard Edition or Oracle Database Enterprise Edition database. After upgrading to the new Oracle Database release, you can use Database Configuration Assistant (DBCA) or manual scripts to install additional components into your database.

Tasks to Complete Only After Manually Upgrading Oracle Database

After you complete your upgrade, you must perform the tasks described here if you upgrade your database manually instead of using DBUA.

- Changing Passwords for Oracle Supplied Accounts
  Oracle recommends that you carry out these tasks to protect new Oracle user accounts.
- Create or Migrate Your Password File with ORAPWD
  Review if you have `REMOTE_LOGIN_PASSWORDFILE` set.
- Migrating Your Initialization Parameter File to a Server Parameter File
  If you are currently using a traditional initialization parameter file, then use this procedure to migrate to a server parameter file.
- Identifying and Copying Oracle Text Files to a New Oracle Home
  To upgrade Oracle Text, use this procedure to identify and copy required files from your existing Oracle home to the new release Oracle home. Complete this task after you upgrade Oracle Database.
- Upgrading the Oracle Clusterware Configuration
  If you are using Oracle Clusterware, then you must upgrade the Oracle Clusterware keys for the database.
- Adjust the Initialization Parameter File for the New Release
  Review these topics to help you to check your initialization parameters after upgrading.
- Set CLUSTER_DATABASE Initialization Parameter For Oracle RAC After Upgrade
  For manual upgrades of Oracle RAC database instances, you must change the CLUSTER_DATABASE initialization parameter to rejoin the node to the new release cluster.

Changing Passwords for Oracle Supplied Accounts

Oracle recommends that you carry out these tasks to protect new Oracle user accounts.

Depending on the release from which you upgraded, there may be new Oracle user accounts on your database. Oracle recommends that you lock all Oracle supplied accounts except for `SYS` and `SYSTEM`, and expire their passwords, so that new passwords are required when the accounts are unlocked.

> **Note:**
>
> If the default Oracle Database 12*c* security settings are in place, then passwords must be at least eight characters, and passwords such as `welcome` and `oracle` are not allowed.

> **See Also:**
>
> *Oracle Database Security Guide* about password requirements

You can view the status of all accounts by issuing the following SQL statement:

```
SQL> SELECT username, account_status
         FROM dba_users
         ORDER BY username;
```

To lock and expire passwords, issue the following SQL statement:

```
SQL> ALTER USER username PASSWORD EXPIRE ACCOUNT LOCK;
```

Create or Migrate Your Password File with ORAPWD

Review if you have `REMOTE_LOGIN_PASSWORDFILE` set.

If the `REMOTE_LOGIN_PASSWORDFILE` initialization parameter is set to `EXCLUSIVE`, then create or migrate the password file with `ORAPWD`. Oracle Database 12*c* and later releases provide a new option to `ORAPWD` for migrating the password file from your existing database.

With Oracle Database 12*c* release 2 (12.2) and later releases, if `REMOTE_LOGIN_PASSWORDFILE` is set to `SHARED`, then you receive a pre-upgrade check validation warning. You can choose one of the following options to correct this issue:

- Disable the password file-based authentication entirely by setting `REMOTE_LOGIN_PASSWORDFILE = NONE`
- Limit the password file-based authentication by setting `REMOTE_LOGIN_PASSWORD = EXCLUSIVE`

Migrating Your Initialization Parameter File to a Server Parameter File

If you are currently using a traditional initialization parameter file, then use this procedure to migrate to a server parameter file.

1. If the initialization parameter file is located on a client computer, then transfer the file from the client computer to the server computer.
2. Create a server parameter file using the `CREATE SPFILE` statement. This statement reads the initialization parameter file to create a server parameter file. You are not required to start the database to issue a `CREATE SPFILE` statement.
3. Start up the instance using the newly-created server parameter file.

> **Note:**
>
> If you are using Oracle RAC, then you must combine all of your instance-specific initialization parameter files into a single initialization parameter file. Complete the procedures necessary for using a server parameter file with cluster databases.

Identifying and Copying Oracle Text Files to a New Oracle Home

To upgrade Oracle Text, use this procedure to identify and copy required files from your existing Oracle home to the new release Oracle home. Complete this task after you upgrade Oracle Database.

Certain Oracle Text features rely on files under the Oracle home that you have configured. After manually upgrading to a new Oracle Database release, or after any process that changes the Oracle home, you must identify and move these files manually. These files include user filters, mail filter configuration files, and all knowledge base extension files. After you identify the files, copy the files from your existing Oracle home to the new Oracle home.

To identify and copy required files from your existing Oracle home to the new release Oracle home:

1. Log in with the `SYS`, `SYSTEM`, or `CTXSYS` system privileges for the earlier release database.
2. Under the Oracle home of the earlier release database, run the `$ORACLE_HOME/ctx/admin/ctx_oh.sql` SQL script.

   For example:

   ```
   sqlplus / as sysdba
   connected
   SQL> @?/ctx/admin/ctx_oh_files
   ```

3. Review the output of the `ctx_oh_files.sql` command, and copy the files to the new Oracle home.

Related Topics

- *Oracle Text Application Developer's Guide*

Upgrading the Oracle Clusterware Configuration

If you are using Oracle Clusterware, then you must upgrade the Oracle Clusterware keys for the database.

Run `srvctl` for Oracle Database 12*c* to upgrade the database. For example:

```
ORACLE_HOME/bin/srvctl upgrade database -db name -o ORACLE_HOME
```

Related Topics

- *Oracle Real Application Clusters Administration and Deployment Guide*

Adjust the Initialization Parameter File for the New Release

Review these topics to help you to check your initialization parameters after upgrading.

Each release of Oracle Database introduces new initialization parameters, deprecates some initialization parameters, and desupports some initialization parameters. You must adjust the parameter file to account for these changes and to take advantage of new initialization parameters that might be beneficial to your system. Additionally, when you perform a manual upgrade without using DBUA, the `tnsnames.ora` file is not automatically populated with new configuration information and settings. Therefore, you must manually update `tnsnames.ora` and adjust `local_listener` and `remote_listener` parameter references if these must be resolved.

- Setting the COMPATIBLE Initialization Parameter After Upgrade
  After testing, you can set the `COMPATIBLE` initialization parameter to the compatibility level you want for your new database.
- Adjust TNSNAMES.ORA and LISTENER Parameters After Upgrade
  After performing a manual upgrade, if you must resolve `local_listener` and `remote_listener` in `tnsnames.ora`, then you must manually adjust those parameters.

> **See Also:**
>
> - *Oracle Database Reference* “Changes In this Release” section for a list of new initialization parameters, and for information about each parameter

Setting the COMPATIBLE Initialization Parameter After Upgrade

After testing, you can set the `COMPATIBLE` initialization parameter to the compatibility level you want for your new database.

The `COMPATIBLE` initialization parameter controls the compatibility level of your database. Set the `COMPATIBLE` initialization parameter to a higher value only when you are certain that you no longer need the ability to downgrade your database.

1. Perform a backup of your database before you raise the `COMPATIBLE` initialization parameter (optional).

Raising the COMPATIBLE initialization parameter can cause your database to become incompatible with earlier releases of Oracle Database. A backup ensures that you can return to the earlier release if necessary.

2. If you are using a server parameter file, then complete the following steps:
   a. To set or change the value of the COMPATIBLE initialization parameter, update the server parameter file.

      For example, to set the COMPATIBLE initialization parameter to 12.2.0, enter the following statement:

      ```
      SQL> ALTER SYSTEM SET COMPATIBLE = '12.2.0' SCOPE=SPFILE;
      ```

   b. Shut down and restart the instance.
3. If you are using an initialization parameter file, then complete the following steps:
   a. If an instance is running, then shut it down.

      For example:

      ```
      SQL> SHUTDOWN IMMEDIATE
      ```

   b. To set or change the value of the COMPATIBLE initialization parameter, you edit the initialization parameter file.

      For example, to set the COMPATIBLE initialization parameter to for Oracle Database release 12.2, enter the following in the initialization parameter file:

      ```
      COMPATIBLE = 12.2.0
      ```

   c. Start the instance using STARTUP.

> **Note:**
>
> If you are using an ASM disk group, then the disk group compatibility attribute must be equal to or less than the value for the database compatibility parameter in init.ora.

Adjust TNSNAMES.ORA and LISTENER Parameters After Upgrade

After performing a manual upgrade, if you must resolve local_listener and remote_listener in tnsnames.ora, then you must manually adjust those parameters.

DBUA handles changes to network naming and listeners during automatic upgrades. However, during a manual upgrade, neither tnsnames.ora nor the listeners are changed.

Related Topics

- *Oracle Database Net Services Administrator's Guide*
- *Oracle Database Net Services Reference*

Set CLUSTER_DATABASE Initialization Parameter For Oracle RAC After Upgrade

For manual upgrades of Oracle RAC database instances, you must change the CLUSTER_DATABASE initialization parameter to rejoin the node to the new release cluster.

In upgrades of cluster member nodes, you set the `CLUSTER_DATABASE` initialization parameter to `false` before upgrading a cluster database.

After you complete the upgrade, you must set this parameter to `true`, so that you can rejoin the node to the new release cluster.

> **Note:**
>
> If you carry out your upgrade using Database Upgrade Assistant (DBUA), then DBUA performs this task for you.

5

Upgrading Applications After Upgrading Oracle Database

To take full advantage of new features, you must upgrade applications running in the new release.

Many new features and enhancements are available after upgrading to a new release of Oracle Database. Review these topics for guidance in planning these application upgrades.

Topics:

Overview of Upgrading Applications on a New Oracle Database Release

You are not required to modify existing applications that do not use features available in the new Oracle Database release.

Existing applications running in a new release of Oracle Database function the same as they did in earlier releases and achieve the same, or enhanced, performance.

Many new features and enhancements are available after upgrading to the new Oracle Database release. Some of these features provide added features and functions, while others provide improved performance. Before you upgrade your applications, you should review these new features to decide which ones you want to use.

Compatibility Issues for Applications on Different Releases of Oracle Database

You can encounter compatibility issues between different releases of Oracle Database that may affect your applications.

Compatibility issues can occur due to differences between Oracle Database releases. Also, in each new release of Oracle Database, new Oracle reserved words can be added, or initialization parameters can be changed, or the data dictionary can be changed. Review the relevant topics in this documentation for more information.

When you upgrade your Oracle Database software to a new release, ensure that your applications do not use any Oracle reserved words, that your applications are compatible with the initialization parameters of the database, and that your applications are compatible with the data dictionary of the database.

Also be aware that new releases of Oracle Database may be supported only on particular operating system releases or patch sets. An operating system release and patch set that is supported for use with a previous release of Oracle Database may not be supported for current releases. Check operating system requirements before you begin an upgrade. In addition, some features may require additional patch sets or kernel additions to be able to use.

Software Upgrades and Client and Server Configurations for Oracle Database

Use these topics to understand your options for upgrading precompiler and Oracle Call Interface (OCI) applications, depending on the type of software upgrade that you are performing and your client and server configurations.

- Possible Client and Server Configurations for Oracle Database
  Select a client/server configuration to run your precompiler and OCI applications.
- Types of Software Upgrades for Oracle Database Client and Server Software
  Review to identify if a release is a major release or a maintenance release.

Possible Client and Server Configurations for Oracle Database

Select a client/server configuration to run your precompiler and OCI applications.

Your precompiler and OCI applications run on the client in a client/server environment, where the Oracle Database server is the server. You can use one or more of the following client/server configurations in your environment

Oracle Database Client and Server on Different Computers

The client software and the server software are on different computers, and they are connected through a network. The client and server environments are separate.

Oracle Database Client and Server in Different Oracle Locations on the Same Computer

The client software and the server software are on the same computer, but they are installed in different Oracle home directories. Again, the client and server environments are separate.

Oracle Database Client and Server in the Same Oracle Location

The client software and server software are installed in the same Oracle home on the same computer. In this case, any upgrade of the server software is also an upgrade of the client software.

Types of Software Upgrades for Oracle Database Client and Server Software

Review to identify if a release is a major release or a maintenance release.

Two types of upgrades are possible for Oracle Database client and server software: a major release of Oracle Database, and a maintenance release for Oracle Database.

Oracle Database Major Release Upgrade

In a major release, the upgrade changes the first digit of the release number. For example, upgrading from Oracle Database 11*g* to Oracle Database 12*c* is a major database release upgrade.

Oracle Database Maintenance Release Upgrade

In a maintenance release, the upgrade changes the second digit of the release number. For example, upgrading from Oracle Database 12*c* Release 1 (12.1) to Oracle Database 12*g* release 2 (12.2) is a database maintenance release upgrade. However, Oracle can introduce new features in maintenance releases.

Compatibility Rules for Applications When Upgrading Oracle Database Client or Server Software

Compatibility rules apply when you upgrade Oracle Database client or server software.

Compatibility rules are based on the type of software upgrade you are performing, and the type of client/server configuration.

> **Note:**
>
> This section uses the terms introduced in “Software Upgrades and Client and Server Configurations.” .

- Rules for Upgrading Oracle Database Server Software
  Different rules apply when you upgrade Oracle Database server software depending on your database environment.
- Upgrading the Oracle Database Client Software
  Keeping the server and client software at the same release number ensures the maximum stability for your applications.

Rules for Upgrading Oracle Database Server Software

Different rules apply when you upgrade Oracle Database server software depending on your database environment.

- If You Do Not Change the Client Environment, Then You Are Not Required to Relink
  Review these scenarios to determine if you must relink your applications after upgrading.
- Applications Can Run Against Newer or Older Oracle Database Server Releases
  If you run a precompiler or OCI application against a database server, then Oracle recommends that the release of the database server software is equal to or later than the client software release.

If You Do Not Change the Client Environment, Then You Are Not Required to Relink

Review these scenarios to determine if you must relink your applications after upgrading.

If your client and server are on different computers, or are in different Oracle home directories on the same computer, and you upgrade the Oracle Database server software without changing the client software, then you are not required to precompile, compile, or relink your applications.

In this set of scenarios, client software using Oracle Databases are in separate locations from the server software, and the client software continues to function without direct effects from the upgrade.

However, if your applications are using the same Oracle home as the Oracle Database server, then your server upgrade also upgrades your client software, and you must follow the rules for upgrading Oracle Database client software.

> **Note:**
>
> You can upgrade the Oracle Database server software, but not install the new precompiler or OCI client software, when you are using the same Oracle home for both binaries. In this case, the client software is not upgraded. However, Oracle does not recommend this configuration.

Applications Can Run Against Newer or Older Oracle Database Server Releases

If you run a precompiler or OCI application against a database server, then Oracle recommends that the release of the database server software is equal to or later than the client software release.

This recommendation configuration is not strictly required.

For example: If your client software is Oracle 12*c* release 2 (12.2.0.1), then if you run precompiler applications on the client against, the server, Oracle recommends that your server software is Oracle 12*c* release 2 (12.2) or later.

Upgrading the Oracle Database Client Software

Keeping the server and client software at the same release number ensures the maximum stability for your applications.

Use this information to plan your Oracle Database Client installations. Depending on how your applications are linked, different rules apply when you upgrade the Oracle Database client software.

Oracle recommends that you upgrade your client software to match the current server software. For example, if you upgrade your server to Oracle Database 18c, then Oracle recommends upgrading the client software to Oracle Database 18c as well. The latest Oracle Database client software may provide added features and performance enhancements that are only available with current Oracle Database client releases.

- About Linking Applications with Newer Libraries
  You can link the code generated by precompiler applications and OCI with a release of the client library that equals or is later than the server release.
- Statically Linked Applications Must Always Be Relinked
  Statically-linked code can be incompatible with error messages in the upgraded ORACLE_HOME.
- About Relinking Dynamically Linked Applications
  Dynamically linked OCI applications from Oracle Database 10*g* Release 1 (10.1) and later releases are upward-compatible with the current release.

About Linking Applications with Newer Libraries

You can link the code generated by precompiler applications and OCI with a release of the client library that equals or is later than the server release.

You can link OCI applications with a release of the OCI runtime library that equals or is later than the release of the OCI library with which the application was developed.

Statically Linked Applications Must Always Be Relinked

Statically-linked code can be incompatible with error messages in the upgraded ORACLE_HOME.

You must relink statically-linked OCI applications for both major and minor releases. The statically-linked Oracle client-side library code may be incompatible with the error messages in the upgraded ORACLE_HOME. For example, if an error message is updated with additional parameters, then it becomes incompatible with the statically-linked code.

About Relinking Dynamically Linked Applications

Dynamically linked OCI applications from Oracle Database 10*g* Release 1 (10.1) and later releases are upward-compatible with the current release.

The Oracle client-side dynamic library is upward-compatible with the previous version of the library. Oracle Universal Installer creates a symbolic link for the previous version of the library that resolves to the current version. Therefore, an application that is dynamically linked with the previous version of the Oracle client-side dynamic library does not require relinking to operate with the current version of the Oracle client-side library.

> **Note:**
>
> If the application is linked with a run-time library search path (such as `-rpath` on Linux), then the application may still run with the version of the Oracle client-side library with which it is linked. You must relink the application to run with the current version of the Oracle client-side library.
>
> If the application is linked with the deferred option (for example, statically-linked application), then it must be relinked.
>
> If the application is from a release earlier than Oracle Database 10*g* Release 1 (10.1), then it must be relinked.

About Upgrading Precompiler and OCI Applications in Oracle Database

Review this information if you want to upgrade precompiler and Oracle Call Interface (OCI) applications.

Testing precompiler and Oracle Call Interface upgrades consists of the following steps:

1. Create a test environment before you upgrade your production environment.
2. Include your upgraded application and the new Oracle Database software in your test environment.
3. Ensure that your test environment provides a realistic test of your application.

Related Topics

- Testing the Upgrade Process for Oracle Database

> **See Also:**
>
> - *Pro*C/C++ Programmer's Guide*
> - *Pro*COBOL Programmer's Guide*
> - *Oracle Call Interface Programmer's Guide*

About Upgrading Options for Oracle Precompiler and OCI Applications

Oracle provides several options for upgrading your precompiler and Oracle Call Interface (OCI) applications running on a new release of Oracle Database.

The upgrade options are listed in order of increasing difficulty and increasing potential benefits. That is, Option 1 is the least difficult option, but it offers the least potential benefits, while Option 3 is the most difficult option, but it offers the most potential benefits.

- Option 1: Leave the Application Unchanged
  Leave the application and its environment unchanged.
- Option 2: Precompile or Compile the Application Using the New Software
  Application code must be changed if any APIs are deprecated or changed.
- Option 3: Change the Application Code to Use New Oracle Database Features
  Make code changes to your applications to take advantage of new Oracle Database features.
- Changing Oracle Precompiler and OCI Application Development Environments
  When you have decided on the new features to use, change the code of your application to use these features.

Option 1: Leave the Application Unchanged

Leave the application and its environment unchanged.

Do not relink, precompile, or compile the application, and do not change the application code. The application continues to work against the new Oracle Database 12*c*. This option requires that the Oracle home environment of the application is not upgraded. You can leave the application unchanged, and it continues to work with the Oracle Database 12*c* server. The major advantage to this option is that it is simple and easy. In addition, this option requires the least amount of administration, because you are not required to upgrade any of your client computers. If you have a large number of client computers, then avoiding the administrative costs of upgrading all of them can become very important.

The major disadvantage to this option is that your application cannot use the features that are available in the new release of Oracle Database. In addition, your application cannot leverage all the possible performance benefits of Oracle Database 12*c*.

Option 2: Precompile or Compile the Application Using the New Software

Application code must be changed if any APIs are deprecated or changed.

Precompile or compile and then relink the application using the new release of Oracle Database. When upgrading to the new release of Oracle Database software, you must precompile or compile the application with the new software after making necessary code changes to account for APIs that are deprecated or changed.

This option requires that you install the new Oracle Database client software on each client computer. You are required to precompile or compile, and relink your application only one time, regardless of the number of clients you have.

By recompiling, you perform a syntax check of your application code. Some problems in the application code that were not detected by previous releases of the Oracle software might emerge when you precompile or compile with the new Oracle software. Therefore, precompiling and compiling with the new software often helps you detect and correct problems in the application code that might have gone unnoticed before.

Also, recompiling affords maximum stability for your application, because you are sure that it works with the new Oracle software. Further, your environment is ready for new development using the latest tools and features available. In addition, you might benefit from performance improvements that are available with the new Oracle software only after you recompile and relink.

Option 3: Change the Application Code to Use New Oracle Database Features

Make code changes to your applications to take advantage of new Oracle Database features.

Change the application code to use new features in Oracle Database 12*c*. Then, precompile or compile and then relink the code. This option is the most difficult, but it can provide the most potential benefits. You gain all of the advantages described in Option 2: Precompile or Compile the Application Using the New Software. . In addition, you also benefit from changes to your application that may leverage performance and scalability benefits available with the new release of Oracle Database. Further, you can add new features to your application that are available only with the new release. Consult the Oracle documentation for your development environment so that you understand how to implement the features you want to use.

Changing Oracle Precompiler and OCI Application Development Environments

When you have decided on the new features to use, change the code of your application to use these features.

Follow the appropriate instructions in the following sections based on your development environment.

- Changing Precompiler Applications
  Complete these steps to change precompiler applications to use Oracle Database 18c features.
- Changing OCI Applications
  Complete the steps listed here to change your OCI application to use new Oracle Database release features.

Changing Precompiler Applications

Complete these steps to change precompiler applications to use Oracle Database 18c features.

1. To use new features in Oracle Database 18c, incorporate the code for these new features into existing applications.
2. Precompile each application using the Oracle precompiler.
3. Compile each application.
4. Relink each application with the run-time library of the new Oracle Database 18c, `SQLLIB`, which is included with the precompiler.

Changing OCI Applications

Complete the steps listed here to change your OCI application to use new Oracle Database release features.

1. Incorporate OCI calls of the new Oracle Database release into the existing application.
2. Compile the application.
3. Relink the application with the new Oracle Database release runtime library.

Upgrading SQL*Plus Scripts and PL/SQL after Upgrading Oracle Database

To use features and functions of the new Oracle Database release, you must change existing SQL scripts to use the syntax of the new Oracle Database release.

If existing SQL scripts do not use features and functions of the new Oracle Database release, then they run unchanged on the new Oracle Database release, and require no modification.

Be aware that because of improved error checking in the new Oracle Database release, it may identify errors at compile time rather than at run time.

About Upgrading Oracle Forms or Oracle Developer Applications

Review Oracle Forms and Oracle Developer new features to see if any of your applications can benefit from them.

In Oracle Database 12*c*, *Oracle Database Development Guide* was renamed to *Oracle Database Advanced Application Developer's Guide*. Review that publication and the the new features guide for information about changes to procedures for developing applications, and for new features of this Oracle Database release that affect application development.

6

Downgrading Oracle Database to an Earlier Release

For supported releases of Oracle Database, you can downgrade a database to the release from which you last upgraded.

For example, if you recently upgraded from release 11.2.0.4 to Oracle Database 12*c* release 2 (12.2), and you did not change the compatible initialization parameter to 12.1 or higher, then you can downgrade to release 11.2.0.4. If you upgraded your Oracle Database 12*c* release from 12.1.0.2 to release 12.2.0.1, and you did not change the compatible initialization parameter to 12.2.0.1, then you can downgrade to release 12.1.0.2.

> **See Also:**
>
> *Oracle Database Installation Guide* for your operating system for downgrading information specific to your operating platform

Topics:

- Supported Releases for Downgrading Oracle Database
  You can downgrade both major releases and release update or patchset releases, based on the original Oracle Database release from which the database was upgraded.
- Check for Incompatibilities When Downgrading Oracle Database
  To see if the database has incompatibilities that can prevent you from downgrading, check the compatibility level of your database.
- Perform a Full Backup Before Downgrading Oracle Database
  Oracle strongly recommends that you perform a full backup of your new Oracle Database release before you downgrade to a supported earlier release.
- Performing Required Predowngrade Steps for Oracle Database
  Complete the required preparation steps described here before you downgrade Oracle Database to the earlier release from which you upgraded.
- Downgrading a CDB or Non-CDB Oracle Database
  Run `catdwgrd.sql` to downgrade your Oracle Database 18c database to a supported major release, or a relevant release update.
- About Downgrades and Invalid Objects with Component Status OPTION OFF
  Downgrades from Oracle Database Enterprise Edition to Oracle Database Standard Edition with CDB and PDBS do not downgrade later release components to the earlier release if the component option in the earlier release was set to OPTION OFF.

- Downgrading a Single Pluggable Oracle Database (PDB)
  If you are downgrading the latest release of Oracle Database 12*c*, then you can downgrade one PDB without downgrading the whole CDB.
- Downgrading PDBs That Contain Oracle Application Express
  Use this procedure to avoid INVALID OBJECTS OWNED BY APEX_050000 errors when you downgrade PDBs that contain Oracle Application Express.
- Post-Downgrade Tasks for Oracle Database Downgrades
  Additional tasks may be required after downgrading an Oracle database due to changes that affect compatibility, components, and supported protocols.
- Troubleshooting the Downgrade of Oracle Database
  Use this troubleshooting information to address issues that may occur when downgrading Oracle Database.

Supported Releases for Downgrading Oracle Database

You can downgrade both major releases and release update or patchset releases, based on the original Oracle Database release from which the database was upgraded.

You can downgrade a non-CDB Oracle Database from Oracle Database 18c to Oracle Database 12*c*, and to Oracle Database 11*g* releases 11.2.0.4 and 11.2.0.3.

You can downgrade a PDB or CDB from Oracle Database 18c to Oracle Database 12*c* release 2 (12.2.0.1)

You can downgrade a PDB or CDB to Oracle Database 12*c* release 12.1.0.2, but not to 12.1.0.1

> **Note:**
>
> Starting with Oracle Database 12*c*, release 1 (12.1), non-CDB architecture is deprecated. It can be desupported in a future release.

The following table provides additional information about releases supported for downgrading. When using this table, also read about compatibility in "Checking for Incompatibilities When Downgrading Oracle Database."

Table 6-1 Supported Releases and Editions for Downgrading

Oracle Database Release or Edition	Downgradable (Yes/No)	Notes
12.2.0.1 and 12.1.0.2	Yes	You cannot downgrade a database after you set the compatible initialization parameter to 12.1.0.2. You can downgrade a non-CDB from 18.1 or 12.2 to 12.1.0.2, 12.1.0.1, 11.2.0.4, 11.2.0.3 (all supported upgrade releases). You can downgrade a PDB from 18.1 or 12.2 to 12.1.0.2, but not to 12.1.0.1. You can downgrade a CDB from 18.1 or 12.2 to 12.1.0.2, but not to 12.1.0.1. Install the latest bundle patch or patch set update (BP or PSU) before you downgrade a CDB, or before you unplug and downgrade a PDB. Patches (PSU, BP) are available for download on My Oracle Support. Refer to My Oracle Support note 756671.1 to obtain the latest patch set. You cannot downgrade to releases earlier than the minimum compatibility setting for the new Oracle Database release.
12.1.0.1	Yes for non-CDBs No for CDBs and PDBs	If you unplug an Oracle Database 12*c* release 1 (12.1.0.1) PDB from a 12.1.0.1 database, and then plug this PDB into a 12.1.0.2 database for upgrade, then you cannot downgrade this PDB if the compatible initialization parameter in the 12.1.0.2 database is higher than '12.1.0.1.0'. You cannot downgrade a PDB from 12.2 to 12.1.0.1. You cannot downgrade a CDB from 12.2 to 12.1.0.1.
Oracle Enterprise Manager	No	If you downgrade to an earlier supported release, then you must reconfigure Oracle Enterprise Manager controls. Before you start your upgrade, you must use the `emdwgrd` utility to save DB Control files and data, so that you can restore Oracle Enterprise Manager Database Control (DB Control) after a downgrade.
Oracle Database Express Edition	No	You cannot downgrade a database that is upgraded from Oracle Database Express Edition.

The following recommendations for earlier supported releases affect downgrading for Oracle Database:

- This release includes multitenant architecture, which provides architecture features for a multitenant container database (CDB), and pluggable databases (PDBs). Because of these architecture changes, you cannot downgrade if you set the compatible initialization parameter to the highest level after upgrading to this release.
- This release contains a new object privilege, `READ`, in addition to `SELECT`. After you downgrade, note the following implications of this object privilege:

  - If you have the SELECT and READ object privileges, then the READ privilege is removed.
  - If you previously only had the READ object privilege, then the READ object privilege is transformed into the SELECT object privilege.

  Refer to Oracle Database Security Guide for more information about the READ and SELECT object privileges.

- If Oracle XML DB is not installed in the database that you upgrade, then during a downgrade, Oracle XML DB is uninstalled. For example, if you did not install Oracle XML DB with Oracle Database 11*g* Release 2 (11.2), then Oracle XML DB is installed with Oracle Database 12*c*. If you downgrade the database, then Oracle XML DB is uninstalled as part of the downgrade. Oracle XML DB is included by default with Oracle Database 12*c* release 1 (12.1), and later releases.
- During upgrade to Oracle Database 12*c*, the Database (DB) Control repository is removed. If you downgrade to an earlier release, then you must reconfigure the Database (DB) Control to use it after the downgrade.
- Downgrade is not supported for Oracle Enterprise Manager. If you downgrade to an earlier supported release, then you must reconfigure Oracle Enterprise Manager controls.

> **Caution:**
>
> Before you start an upgrade, you must understand the following information regarding compatibility to be able to downgrade:
>
> - You cannot downgrade a database after you set the compatible initialization parameter to 12.1.0.2.
> - You can only downgrade a pluggable database (PDB) if you set the compatibility to 12.1.0.1.
> - If you unplug a release 12.1.0.1 PDB from a 12.1.0.1 database, and then plug this PDB into a release 12.1.0.2 database, then you cannot downgrade this PDB.
> - Install the latest bundle patch or patch set update (BP or PSU) before you try to downgrade a CDB or unplug and downgrade a PDB. See My Oracle Support Note 756671.1 to obtain the latest patch set.

Related Topics

- https://support.oracle.com/rs?type=doc&id=756671.1
- *Oracle Database Security Guide*

Check for Incompatibilities When Downgrading Oracle Database

To see if the database has incompatibilities that can prevent you from downgrading, check the compatibility level of your database.

If the compatibility level of your Oracle Database 12*c* database is `12.1.0`, then you are not able to downgrade.

If you are downgrading to Oracle Database 11*g* release 2, then set the `COMPATIBLE` initialization parameter to `11.2.0` or lower.

> **Note:**
>
> For Oracle ASM disk groups, if you change disk group compatibility to 12.1.0.0.0 when you upgrade your database, then when you downgrade to the earlier release, you cannot mount your Oracle ASM disk groups.
>
> You must manually restore compatibility of Oracle ASM disk groups before downgrade. Otherwise, the instance cannot mount the disk groups after downgrade.

Perform a Full Backup Before Downgrading Oracle Database

Oracle strongly recommends that you perform a full backup of your new Oracle Database release before you downgrade to a supported earlier release.

Performing Required Predowngrade Steps for Oracle Database

Complete the required preparation steps described here before you downgrade Oracle Database to the earlier release from which you upgraded.

Before you start a downgrade, you must resolve incompatibilities between database releases. For example, determine if you must disable components in the database before you start the downgrade.

1. If you are downgrading a CDB or unplugging and downgrading a PDB in Oracle Database, then you must first apply the latest quarterly release update (RU), release update revision (RUR), bundle patch or patch set update (BP or PSU) available. Apply any required set of additional fixes on My Oracle Support Note 756671.1:

   https://support.oracle.com/rs?type=doc&id=756671.1

2. If you have enabled Oracle Database Vault on your database, then disable Oracle Database Vault before downgrading the database.

   Use DBA_DV_STATUS to find out if Oracle Database Vault is enabled:

   ```
   SQL> SELECT * FROM DBA_DV_STATUS;
   ```

   If the output is TRUE, then Oracle Database Vault is enabled, so you must disable it.

On multitenant architecture Oracle Database systems, use CDB_DV_STATUS on CDB$ROOT to find out the Oracle Database Vault status on all PDBs plugged in to the CDB:

```
SQL> SELECT * FROM CDB_DV_STATUS;
```

3. If your database uses Oracle Label Security, and you are downgrading to release 11.2, then run the Oracle Label Security (OLS) preprocess downgrade `olspredowngrade.sql` script in the new Oracle Database 12*c* Oracle home.

> **Caution:**
>
> Run `olspredowngrade.sql` before you downgrade from Oracle Database 12*c* to database release 11.2 for databases that use Oracle Label Security and Oracle Database Vault.

   a. Query the `V$OPTION` dynamic view. Determine if Oracle Label Security is enabled. For example:

      ```
      SQL> SELECT VALUE FROM V$OPTION WHERE PARAMETER = 'Oracle Label Security';
      ```

   b. Run the `olspredowngrade.sql` script:

      ```
      SQL> @ORACLE_HOME/rdbms/admin/olspredowngrade.sql
      ```

4. If you have enabled Unified Auditing, then you can choose to back up and purge the unified audit trail:

   a. Find if unified audit records exist.

      ```
      SQL> SELECT COUNT(*) FROM UNIFIED_AUDIT_TRAIL;
      ```

   b. Back up the existing audit data to a table. For example:

      ```
      SQL> CREATE TABLE UA_DATA AS (SELECT * FROM UNIFIED_AUDIT_TRAIL);
      ```

   c. Clean up the audit trail.

      ```
      EXEC DBMS_AUDIT_MGMT.CLEAN_AUDIT_TRAIL(audit_trail_type =>
      DBMS_AUDIT_MGMT.AUDIT_TRAIL_UNIFIED, use_last_arch_timestamp => FALSE);
      ```

5. Before downgrade, ensure that the target Oracle Home for the downgraded database contains the version of the time zone file that your database is using.

   To find which time zone file version your database is currently using, query `V$TIMEZONE_FILE` using the following command:

   ```
   SQL> select * from  V$TIMEZONE_FILE;
   ```

   For example:

   If the query returns `timezlrg_18.dat` in the column `V$TIMEZONE_FILE.FILENAME`, then check if the file is present in the target Oracle Home:

   Linux and UNIX

   ```
   $ORACLE_HOME/oracore/zoneinfo/timezlrg_18.dat
   ```

   Windows

   ```
   %ORACLE_HOME%\oracore\zoneinfo\timezlrg_18.dat
   ```

If the required time zone file is missing from the target Oracle Home, then do one of the following:

- If you installed the current version of the time zone file as a patch, and you still know the patch number, then use the same patch number to download the corresponding time zone file for the target release from the My Oracle Support website.
- Locate the correct patch by using the My Oracle Support website patch search function. Enter the following search criteria: "Product is 'Oracle Database'", "Release is '*target release*'", and "Description contains 'DST'".
- If you cannot locate the patch on the My Oracle Support website, then log a service request with Oracle Support.

After you find and download the required patch, install it in the target Oracle Home.

6. If you created objects based on fixed objects, then drop these objects to avoid possible `ORA-00600` errors. You can re-create these objects after the downgrade.
7. If you have Oracle Enterprise Manager configured in your database, then drop the Enterprise Manager user:

```
DROP USER sysman CASCADE;
```

> **Note:**
>
> After you drop the Enterprise Manager user, you can find that `MGMT*` synonyms are invalid. You must reconfigure Oracle Enterprise Manager to use any Oracle Enterprise Manager controls in the downgraded database.

8. If you are downgrading to Oracle Database 12*c* release 1 (12.1.0.2) that has the JSON bundled patch applied, and that uses Simple Oracle Document Access (SODA), then ensure that you apply the JSON bundle patch (JSON Patch Bundle 1 or JSON Patch Bundle 2) to the Oracle Database 12.1.0.2 binary. For more information, review the following My Oracle Support note:

   https://support.oracle.com/rs?type=doc&id=1992767.1

9. Obtain the appropriate ARUs for your server operating system from the PSE listed for your release. Download and install all the patches listed for your earlier release before you start the downgrade:

   a. Log in to My Oracle Support:

      https://support.oracle.com

   b. Select **Patches & Updates**. In the Patch Search frame, provide the bug number listed for your release, and provide the platform for your server.

   c. Download and install the patch

   d. Repeat until you have installed all required patches for your server.

   Obtain the patches for your release:

   Downgrade from 12.2.0.1.0 to 12.1.0.2.0 with CDB and PDB

   - 20594149: DATABASE BUNDLE PATCH 12.1.0.2.7, or the latest 12.1.0.2 bundle patch set update

- 20898997: XMLTYPESUP: QCTOXSNLB SHOULD NOT CHECK AGAINST SNAPSHOT SIZE
- 20348910: ALTER TYPE REPLACE IN PRVTAQJI.SQL TO BE REPLACE WITH CREATE OR REPLACE TYPE
- 20958816: INVALID OBJECTS AFTER DOWNGRADE FROM 12.2.0.1 TO 12.1.0.2

Downgrade from 12.2.0.1.0 to 12.1.0.2.0 non-CDB

- 20594149: DATABASE BUNDLE PATCH 12.1.0.2.7, or the latest 12.1.0.2 bundle patch set update
- 21856522: UPGRADE OF 12.1 TO 12.2 CAUSE XOQ COMPONENT TO BE INVALID
- 20898997: XMLTYPESUP: QCTOXSNLB SHOULD NOT CHECK AGAINST SNAPSHOT SIZE
- 20348910: ALTER TYPE REPLACE IN PRVTAQJI.SQL TO BE REPLACE WITH CREATE OR REPLACE TYPE
- 20958816: INVALID OBJECTS AFTER DOWNGRADE FROM 12.2.0.1 TO 12.1.0.2

Downgrade from 12.2.0.1.0 to 12.1.0.1.0 non-CDB

- 23054354: DATABASE PATCH SET UPDATE 12.1.0.1
- 20898997: XMLTYPESUP: QCTOXSNLB SHOULD NOT CHECK AGAINST SNAPSHOT SIZE
- 20348910: ALTER TYPE REPLACE IN PRVTAQJI.SQL TO BE REPLACE WITH CREATE OR REPLACE TYPE

Downgrade from 12.2.0.1.0 to 11.2.0.4.0

- 23054359: DATABASE PATCH SET UPDATE 11.2.0.4
- 20898997: XMLTYPESUP: QCTOXSNLB SHOULD NOT CHECK AGAINST SNAPSHOT SIZE
- 20348910: ALTER TYPE REPLACE IN PRVTAQJI.SQL TO BE REPLACE WITH CREATE OR REPLACE TYPE

Downgrade from 12.2.0.1.0 to 11.2.0.3.0

- 20299017: DATABASE PATCH SET UPDATE 11.2.0.3.14 (INCLUDES CPUAPR2015)
- 20898997: XMLTYPESUP: QCTOXSNLB SHOULD NOT CHECK AGAINST SNAPSHOT SIZE
- 20348910: ALTER TYPE REPLACE IN PRVTAQJI.SQL TO BE REPLACE WITH CREATE OR REPLACE TYPE

Related Topics

- *Oracle Label Security Administrator's Guide*
- *Oracle Database Globalization Support Guide*

Downgrading a CDB or Non-CDB Oracle Database

Run `catdwgrd.sql` to downgrade your Oracle Database 18c database to a supported major release, or a relevant release update.

> **Note:**
>
> Starting with Oracle Database 12*c* release 1 (12.1), non-CDB architecture is deprecated. It can be desupported in a future release.

If you are downgrading from Oracle Database 18c to release 12.2 or 12.1, then you can downgrade all databases in a multitenant container database (CDB) or one pluggable database (PDB) within a CDB. Oracle Database releases earlier than Oracle Database 12*c* did not use multitenant architecture.

1. Log in to the system as the owner of the Oracle Database Oracle home directory.
2. At a system prompt, change to the directory *`ORACLE_HOME`*`/rdbms/admin`, where *`ORACLE_HOME`* is the Oracle home on your system.

   > **Note:**
   >
   > If you are downgrading a cluster database, then shut down the database completely, and change the value for the initialization parameter `CLUSTER_DATABASE` to `FALSE`. After the downgrade, set this parameter back to `TRUE`.

3. Using SQL*Plus, connect to the database instance as a user with `SYSDBA` privileges:

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

4. Log in to the system as the Oracle user (owner) of the new Oracle Database release Oracle home .
5. Change directory to *`ORACLE_HOME`*`/rdbms/admin`, and start SQL*Plus.
6. Connect to the database that you want to upgrade using an account with DBA privileges:

   ```
   CONNECT / AS SYSDBA
   ```

7. Start the instance in downgrade mode by issuing the following SQL*Plus command for your Oracle Database instance type. You can be required to use the `PFILE` option to specify the location of your initialization parameter file.

   Non-CDB instances:

   ```
   SQL> startup downgrade pfile=pfile_name
   ```

   CDB instances:

   ```
   SQL> startup downgrade pfile=pfile_name
   ```

```
SQL> alter pluggable database all open downgrade;
```

Specify the location of your initialization parameter file `PFILE`.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for information about specifying initialization parameters at startup and the initialization parameter file

8. (Optional) If you are downgrading a non-CDB, then you can set the system to spool results to a log file so you can track the changes and issues.

   If you are downgrading a CDB, then you do not need to perform this step. CDBs automatically spool output to the `catcon_logs`.

   On a non-CDB, enter the following command to spool results to a log file, where `downgrade.log` is the name of the log file:

   ```
   SQL> SPOOL downgrade.log
   ```

9. Use the following command to start the downgrade, depending on your configuration:

   Non-CDB:

   ```
   SQL> @catdwgrd.sql
   ```

   CDB:

   ```
   $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -d $ORACLE_HOME/
   rdbms/admin -e -b catdwgrd -l output directory -r catdwgrd.sql
   ```

   In the CDB example, `catdwgrd.sql` is run on containers using `catcon.pl`. To run commands with the `catcon.pl` utility, you first start Perl. The `-d` parameter tells `catcon.pl` where to find `catdwgrd`. The `-l` parameter specifies the output directory for log files (instead of writing to the `rdbms/admin` directory). Specifying the `-r` parameter causes `catdwgrd` to run first on the PDBs, and second on CDB_ROOT.

   Run `catdwgrd` using the `-r` parameter when you downgrade a CDB. The `-r` parameter changes the default order that scripts are run, so that scripts run in all PDBs, and then in CDB_ROOT.

> **Note:**
>
> - Use the version of the `catdwgrd.sql` script included with Oracle Database 12*c*.
> - You must run `catdwgrd` using the `-r` parameter when downgrading a CDB.
> - Run `catdwgrd.sql` in the Oracle Database 12*c* environment.
> - The `catdwgrd.sql` script downgrades all Oracle Database components in the database to the release from which you upgraded. The downgrade is either to the supported major release from which you upgraded, or to the patch release from which you upgraded.

If you are downgrading a multitenant environment database, and the `catdwgrd.sql` command encounters a failure, then review the error message. Check to see what issues are present in the CDB$ROOT or PDBs before proceeding. Check the section "Troubleshooting the Downgrade of Oracle Database." Fix the issues as stated in the errors. After you resolve the errors, rerun `catdgwrd.sq` with the `catcon.pl` utility, using the syntax `catcon.pl -c 'cdb,pdb' -r`.

> **Caution:**
>
> If the downgrade for a component fails, then an `ORA-39709` error is displayed. The SQL*Plus session terminates without downgrading the Oracle Database data dictionary. All components must be successfully downgraded before the Oracle Database data dictionary is downgraded. Identify and fix the problem before rerunning the `catdwgrd.sql` script.

10. For Non-CDB only, if you turned the spool on, then turn off the spooling of script results to the log file:

```
SQL> SPOOL OFF
```

Next, check the spool file, and verify that no errors occurred during the downgrade. You named the spool file in Step 8, and the suggested name was `downgrade.log`. Correct any problems that you find in this file. If necessary, rerun the downgrade script.

> **Note:**
>
> You can save the results from the first time you ran the downgrade script. Before you rerun the downgrade script, rename the file `downgrade.log` to a different name, so that it is not overwritten when you rerun the script.

11. Shut down the instance:

```
SQL> SHUTDOWN IMMEDIATE
```

12. Exit SQL*Plus.
13. If your operating system is Linux or UNIX, then change the following environment variables to point to the directories of the release to which you are downgrading:
    - `ORACLE_HOME`
    - `PATH`

    Also check that your `oratab` file, and any client scripts that set the value of `ORACLE_HOME`, point to the downgraded Oracle home.

> **See Also:**
>
> *Oracle Database Installation Guide* for your operating system for information about setting other important environment variables on your operating system

14. If your operating system is Windows, then complete the following steps:
    a. Stop all Oracle services, including the `OracleService`*`SID`* Oracle service of the Oracle Database 12*c* database, where *`SID`* is the instance name.

       For example, if your *SID* is `ORCL`, then enter the following at a command prompt:

       ```
       C:\> NET STOP OracleServiceORCL
       ```

> **See Also:**
>
> *Oracle Database Platform Guide for Microsoft Windows* for more information about stopping Oracle services on Windows

    b. Delete the Oracle service at a command prompt by issuing the command `ORADIM`.

       For example, if your *SID* is `ORCL`, then enter the following command:

       ```
       C:\> ORADIM -DELETE -SID ORCL
       ```

    c. Create the Oracle service of the database that you are downgrading at a command prompt using the command `ORADIM`:

       ```
       C:\> ORADIM -NEW -SID SID -INTPWD PASSWORD -MAXUSERS USERS
       -STARTMODE MANUAL -PFILE ORACLE_HOME\DATABASE\INITSID.ORA
       ```

       The syntax for `ORADIM` includes the following variables:

Variable	Description
SID	Same system identifier (SID) name as the SID of the database being downgraded.

Variable	Description
PASSWORD	Password for the database instance. This password is the password for the user connected with `SYSDBA` privileges. The `-INTPWD` option is not required. If you are prompted for a password, then use the password for the standard user account for this Windows platform.
USERS	Maximum number of users that can be granted `SYSDBA` and `SYSOPER` privileges.
ORACLE_HOME	Oracle home directory of the database to which you are downgrading. Ensure that you specify the full path name with the option `-PFILE`, including the drive letter where the Oracle home directory is mounted. See *Oracle Database Administrator's Guide* for information about specifying initialization parameters at startup, and for information about the initialization parameter file.

For example, if your *SID* is `ORCL`, your *PASSWORD* is `TWxy5791`, the maximum number of *USERS* is `10`, and the *ORACLE_HOME* directory is `C:\ORANT`, then enter the following command:

```
C:\> ORADIM -NEW -SID ORCL -INTPWD TWxy5791 -MAXUSERS 10
     -STARTMODE AUTO -PFILE C:\ORANT\DATABASE\INITORCL.ORA
```

> **Note:**
>
> The `ORADIM` command prompts you for the password for the Oracle home user account. You can specify other options using `ORADIM`.
>
> You are not required to change any Windows Registry settings when downgrading a database. The `ORADIM` utility makes all necessary changes automatically.

> **See Also:**
>
> *Oracle Database Platform Guide for Microsoft Windows* for information about administering an Oracle Database instance using `ORADIM`

15. Restore the configuration files (for example, parameter files, password files, and so on) of the release to which you are downgrading.

    If the database is an Oracle RAC database, then run the following command to return the database to single instance mode:

    ```
    SET CLUSTER_DATABASE=FALSE
    ```

> **Note:**
>
> If you are downgrading a cluster database, then perform this step on all nodes on which this cluster database has instances configured. Set the value for the initialization parameter `CLUSTER_DATABASE` to `FALSE`. After the downgrade, set this initialization parameter back to `TRUE`.

> **See Also:**
>
> *Oracle Real Application Clusters Administration and Deployment Guide* for information about initialization parameter use in Oracle RAC

16. At a system prompt, change to the `admin` directory in the Oracle home directory of the earlier release to which you are downgrading. (*`ORACLE_HOME`*`/rdbms/admin`, where *`ORACLE_HOME`* is the path to the earlier release Oracle home.)
17. Start SQL*Plus, and connect to the database instance as a user with SYSDBA privileges.

    For a non-CDB:

    ```
    SQL> CONNECT / AS SYSDBA
    SQL> STARTUP UPGRADE
    ```

    For a CDB:

    ```
    connect / as sysdba
    startup upgrade;
    alter pluggable database all open upgrade;
    ```

18. (Optional) For a non-CDB, set the system to spool results to a log file to track changes and issues. This step is not needed for a CDB.

    ```
    SQL> SPOOL reload.log
    ```

19. Run `catrelod.sql` on non-CDB databases, or use `catcon.pl` to run `utlrp.sql` on CDB databases.

    For a non-CDB:

    ```
    SQL> $ORACLE_HOME/rdbms/admin/catrelod.sql
    ```

    For a CDB:

    ```
     $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -n 1 -e -b
    catrelod -d $ORACLE_HOME/rdbms/admin catrelod.sql
    ```

    reloads the appropriate version for each of the database components in the downgraded database.

20. If you turned on spooling for a non-CDB, then turn off the spooling of script results to the log file:

    ```
    SQL> SPOOL OFF
    ```

    Check the spool file, and verify that the packages and procedures compiled successfully. Correct any problems that you find in this log file, and rerun the appropriate script, if necessary.

21. Shut down and restart the instance for normal operation:

```
SQL> SHUTDOWN IMMEDIATE
SQL> STARTUP
```

You can be required to use the option`PFILE` to specify the location of your initialization parameter file.

> **See Also:**
>
> *Oracle Database Administrator's Guide* for information about specifying initialization parameters at startup, and in the initialization parameter file

22. If you configured your database to use Oracle Label Security, then complete this step. If you did not configure your database to use Oracle Label Security, then proceed to the next step.
    a. Copy the script `olstrig.sql` from the Oracle home under Oracle Database 12*c* to the Oracle home of the release number to which you are downgrading the database.
    b. From the Oracle home of the downgrade release, run `olstrig.sql` to recreate DML triggers on tables with Oracle Label Security policies:

```
SQL> @olstrig.sql
```

23. (Optional) For a non-CDB, set the system to spool results to a log file to track changes and issues. This step is not needed for a CDB. Example:

```
SQL> SPOOL utlrp.log
```

24. Run the `utlrp.sql` script to recompile any remaining stored PL/SQL and Java code. Use the procedure for your configuration:

non-CDB:

```
SQL> $ORACLE_HOME/rdbms/admin/utlrp.sql
```

CDB:

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -n 1 -e -b utlrp -
d $ORACLE_HOME/rdbms/admin utlrp.sql
```

The `utlrp.sql` script recompiles all existing PL/SQL modules previously in `INVALID` state, such as packages, procedures, types, and so on. The log file `utlrp0.log` is generated. That log file lists the recompilation results.

25. If you turn on spooling for a non-CDB when you run `utlrp.sql`, then turn off the spooling of script results to the log file:

```
SQL> SPOOL OFF
```

Check the spool file, and verify that the packages and procedures compiled successfully. Correct any problems that you find in this log file. If necessary, rerun the appropriate script.

26. Exit SQL*Plus.
27. If you are downgrading a cluster database, then you must run the following command to downgrade the Oracle Clusterware database configuration. :

```
$ srvctl downgrade database -d db-unique-name -o oraclehome -t to_version
```

Replace the variables in this syntax example with the values for your system:

- *db-unique-name* is the database name (not the instance name).
- *oraclehome* is the location of the old Oracle home for the downgraded database.
- *to_version* is the database release to which the database is downgraded. (For example: 12.1.0.2.0.)

> **Note:**
>
> Run this command from the current Oracle Database 12*c* Oracle home, not from the Oracle home to which the database is being downgraded.

At the completion of this procedure, your database is downgraded.

Related Topics

- Troubleshooting the Downgrade of Oracle Database
- *Oracle Database Administrator's Guide*

About Downgrades and Invalid Objects with Component Status OPTION OFF

Downgrades from Oracle Database Enterprise Edition to Oracle Database Standard Edition with CDB and PDBS do not downgrade later release components to the earlier release if the component option in the earlier release was set to OPTION OFF.

It is expected behavior to find later release invalid objects in the downgraded database, where the components were set to FALSE in the earlier release database.

For example:

During a downgrade from Oracle Database 18*c* Enterprise Edition release 18.1 to Oracle Database Standard Edition 2 12*c* release 2 (12.2.0.1), you have OLAP and Spatial components. After the downgrade, the OLAP and Spatial components are downgraded, but they are not downgraded and reloaded into the 12.2.0.1 release. You then see this result in the dba registry:

```
OLAP Analytic Workspace            OPTION OFF   18.1.0
Oracle OLAP API                    OPTION OFF   18.1.0
```

This result is expected behavior in downgrades from Oracle Database 18c and earlier releases, where you are downgrading from Oracle Database Enterprise Edition to Oracle Database Standard Edition. The reason that this behavior is expected is because the option setting for these options in Standard Edition databases is FALSE. Downgrading back to Standard Edition leaves many OLAP and Spatial objects at their later release versions. During the run of `catrelod.sql`, the reload scripts do not run to replace these objects with the earlier release versions.

Downgrading a Single Pluggable Oracle Database (PDB)

If you are downgrading the latest release of Oracle Database 12*c*, then you can downgrade one PDB without downgrading the whole CDB.

For example, you can unplug a PDB from a release 12.2.0.1 CDB, downgrade it, and then plug it in to a release 12.1.0.2 CDB, or you can convert the database to a standalone database.

Downgrade the PDB

In this procedure, you downgrade the PDB to release 12.1.0.2:

1. Start up the release 12.2.0.1 PDB in DOWNGRADE mode. The CDB can be in normal mode when you do this.

   ```
   SQL> alter pluggable database CDB1_PDB1 open downgrade;
   ```

2. Downgrade the PDB by running `catdwgrd`, which in this example is `PDB1`.

   Run `catdwgrd` as follows:

   ```
   $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -d
    $ORACLE_HOME/rdbms/admin -n 1 -l <output directory> -e -b catdwgrd -c 'PDB1'
    catdwgrd.sql
   ```

   In the example, `catdwgrd` is run with `catcon.pl`. The `-d` parameter tells `catcon.pl` where to find `catdwgrd`. The `-l` parameter specifies the output directory for log files, instead of writing to the `rdbms/admin` directory). You must use the `-r` parameter to run the two scripts together at the same time.

3. Close the PDB.

Unplug the PDB from the CDB

In this step you unplug the downgraded PDB from the release 12.2.0.1 CDB:

1. Connect to the 12.2.0.1 CDB.
2. Close the PDB that you want to unplug.

   ```
   SQL> alter pluggable database PDB1 close;
   ```

3. Unplug the downgraded 12.1.0.2 PDB, replacing the variable *`path`* with the path on your system:

   ```
   SQL> alter pluggable database PDB1 unplug into 'path/pdb1.xml';
   ```

   You receive the following response when the unplug is completed:

   ```
   Pluggable database altered
   ```

Plug in the Downgraded 12.1.0.2 PDB

In this step you plug the downgraded 12.1.0.2 PDB into the 12.1.0.2 CDB. To do this, you must create the PDB in this CDB. The following example shows how to create a pluggable database called PDB1:

1. Connect to the 12.1.0.2 CDB.
2. Plug in the 12.1.0.2 PDB.

```
SQL> create pluggable database PDB1 using 'path/pdb1.xml';
```

You will see `Pluggable database created.`

3. Open the PDB in upgrade mode:

```
SQL> alter pluggable database PDB1 open upgrade;
```

4. Connect to the PDB:

```
SQL> alter session set container=PDB1;
```

5. Run `catrelod` in the PDB:

```
SQL> @$ORACLE_HOME/rdbms/admin/catrelod.sql
```

The `catrelod.sql` script reloads the appropriate version for each of the database components in the downgraded database.

6. Run `utlrp` in the PDB:

```
SQL> @$ORACLE_HOME/rdbms/admin/utlrp.sql
```

The `utlrp.sql` script recompiles all existing PL/SQL modules that were previously in an `INVALID` state, such as packages, procedures, types, and so on.

Downgrading PDBs That Contain Oracle Application Express

Use this procedure to avoid INVALID OBJECTS OWNED BY APEX_050000 errors when you downgrade PDBs that contain Oracle Application Express.

After you downgrade the PDB to an earlier release, enter a SQL statement similar to the following to drop the Oracle Application Express user:

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -b drop_apex5
-c 'PDB1' -- --x'drop user apex_050000 cascade'
```

In this example, the PDB name is `'PDB1'`.

Post-Downgrade Tasks for Oracle Database Downgrades

Additional tasks may be required after downgrading an Oracle database due to changes that affect compatibility, components, and supported protocols.

- Oracle XML DB Authentication Recommendations for an Oracle Database Downgrade
  Upgrades from releases earlier than 12.1 result in digest authentication being disabled.
- Reapply Release Update and Other Patches After Downgrade
  After the downgrade is run, and `catrelod.sql` completes successfully, if you installed new patches in your original Oracle home after the upgrade, but before the downgrade, then ensure that you apply any patches that you installed.
- Re-enabling Oracle Database Vault after Downgrading Oracle Database
  You must do this if you are instructed during the downgrade to disable Oracle Database Vault.

- Restoring the Configuration for Oracle Clusterware
  To restore the configuration, you must restore the release from which you were upgrading.
- Restoring Oracle Enterprise Manager after Downgrading Oracle Database
  The restore task described in this section is required only if you are performing a downgrade, and Oracle Enterprise Manager is configured on the host.
- Restoring Oracle Application Express to the Earlier Release
  After a downgrade, if you upgraded Oracle Application Express at the same time as you upgraded Oracle Database, then you must complete steps to revert to the earlier Oracle Application Express release.
- Gathering Dictionary Statistics After Downgrading
  To help to assure good performance after you downgrade, use this procedure to gather dictionary statistics.
- Regathering Fixed Object Statistics After Downgrading
  After the downgrade, run representative workloads on Oracle Database, and regather fixed object statistics.
- Regathering Stale CBO Statistics After Downgrade
  Oracle recommends that you regather Oracle Cost-Based Optimizer (CBO) statistics after completing an Oracle Database downgrade.

Oracle XML DB Authentication Recommendations for an Oracle Database Downgrade

Upgrades from releases earlier than 12.1 result in digest authentication being disabled.

If you downgrade to a release that is earlier than Oracle Database 12*c*, in which digest authentication is not supported, digest authentication is disabled and made unavailable as an authentication choice. This affects HTTP authentication for Oracle XML DB Repository. If you did not take advantage of digest authentication and instead used the default configuration, then no further actions are necessary.

Reapply Release Update and Other Patches After Downgrade

After the downgrade is run, and `catrelod.sql` completes successfully, if you installed new patches in your original Oracle home after the upgrade, but before the downgrade, then ensure that you apply any patches that you installed.

If you installed new patches, then run the datapatch tool to apply those patches to the downgraded database. If you did not change the binaries and files in your Oracle Home after the upgrade, then there is no need to run datapatch after running `catrelod.sql`.

Re-enabling Oracle Database Vault after Downgrading Oracle Database

You must do this if you are instructed during the downgrade to disable Oracle Database Vault.

If you use Oracle Database Vault, then you may have been instructed to disable it before downgrading your database. To use Oracle Database Vault after downgrading, you must re-enable it.

Restoring the Configuration for Oracle Clusterware

To restore the configuration, you must restore the release from which you were upgrading.

You can restore the Oracle Clusterware configuration to the state it was in before the Oracle Clusterware 12*c* Release 2 (12.2) upgrade. Any configuration changes that you have performed during or after the Oracle Database 12*c* upgrade process are removed and cannot be recovered.

Restoring Oracle Enterprise Manager after Downgrading Oracle Database

The restore task described in this section is required only if you are performing a downgrade, and Oracle Enterprise Manager is configured on the host.

To restore Oracle Enterprise Manager, you first run Oracle Enterprise Manager configuration assistant (EMCA), and then you run the `emdwgrd` utility.

- Requirements for Restoring Oracle Enterprise Manager After Downgrading
  You must complete these requirements before you upgrade to be able to restore Oracle Enterprise Manager after a downgrade to a release earlier than 12.1
- Running EMCA to Restore Oracle Enterprise Manager After Downgrading
  Review these topics and select your restoration scenario to restore Oracle Enterprise Manager after a downgrade.
- Running the emdwgrd utility to restore Enterprise Manager Database Control
  You can restore the Oracle Enterprise Manager Database Control and data by using the `emdwgrd` utility after you run `emca -restore`.

Requirements for Restoring Oracle Enterprise Manager After Downgrading

You must complete these requirements before you upgrade to be able to restore Oracle Enterprise Manager after a downgrade to a release earlier than 12.1

The following must be true to use `emca -restore` to restore Oracle Enterprise Manager to its previous state:

- Before the upgrade, you saved a backup of your Oracle Enterprise Manager configuration files and data
- You run the `emca` binary located in the Oracle Database 12*c* Oracle home for this procedure

On Oracle Clusterware systems, to restore Oracle Enterprise Manager on an Oracle RAC database, you must have the database registered using `srvctl` before you run `emca -restore`. You must run `emca -restore` from the *`ORACLE_HOME`*`/bin` directory of the earlier Oracle Database release to which the database is being downgraded.

Run the `emca -restore` command with the appropriate options to restore Oracle Enterprise Manager Database Control or Grid Control to the old Oracle home.

Specify different emca options, depending on whether the database you want to downgrade is a single-instance database, an Oracle RAC database, or an Oracle ASM database.

Related Topics

- *Oracle Clusterware Administration and Deployment Guide*

Running EMCA to Restore Oracle Enterprise Manager After Downgrading

Review these topics and select your restoration scenario to restore Oracle Enterprise Manager after a downgrade.

- Running emca on a Single-Instance Oracle Database Without Oracle ASM
  Use Enterprise Manager Configuration Assistant (emca) to manage your database.
- Running EMCA on an Oracle RAC Database Without Oracle ASM
  Use Enterprise Manager Configuration Assistant (emca) to manage your database:
- Running EMCA on a Single-Instance Oracle ASM Instance
  Use Enterprise Manager Configuration Assistant (emca) to manage your database and storage.
- Running emca on an Oracle ASM on Oracle RAC Instance
  Use Enterprise Manager Configuration Assistant (emca) to manage your database and storage.
- Running emca on a Single-Instance Oracle Database With Oracle ASM
  Use Enterprise Manager Configuration Assistant (emca) to manage your database and storage.
- Running emca on an Oracle RAC Database and Oracle ASM Instance
  Use Enterprise Manager Configuration Assistant (emca) to manage your database and storage.

Running emca on a Single-Instance Oracle Database Without Oracle ASM

Use Enterprise Manager Configuration Assistant (emca) to manage your database.

Use this command to run Enterprise Manager Configuration Assistant.

```
ORACLE_HOME/bin/emca -restore db
```

You are prompted to enter the following information:

- Oracle home for the database that you want to restore
- Database SID
- Listener port number

Running EMCA on an Oracle RAC Database Without Oracle ASM

Use Enterprise Manager Configuration Assistant (emca) to manage your database:

Use this procedure to run Enterprise Manager Configuration Assistant:

```
ORACLE_HOME/bin/emca -restore db -cluster
```

You are prompted to enter the following information:

- Oracle home for the database that you want to restore
- Database unique name
- Listener port number

Running EMCA on a Single-Instance Oracle ASM Instance

Use Enterprise Manager Configuration Assistant (`emca`) to manage your database and storage.

Use this command to run Enterprise Manager Configuration Assistant.

```
ORACLE_HOME/bin/emca -restore asm
```

You are prompted to enter the following information:

- Oracle home for the database that you want to restore
- Oracle ASM port
- Oracle ASM SID

Running emca on an Oracle ASM on Oracle RAC Instance

Use Enterprise Manager Configuration Assistant (`emca`) to manage your database and storage.

Use this command to run Enterprise Manager Configuration Assistant.

```
ORACLE_HOME/bin/emca -restore asm -cluster
```

You are prompted to enter the following information:

- Oracle home for the database that you want to restore
- Oracle ASM port

Running emca on a Single-Instance Oracle Database With Oracle ASM

Use Enterprise Manager Configuration Assistant (`emca`) to manage your database and storage.

Use this command to run Enterprise Manager Configuration Assistant.

```
ORACLE_HOME/bin/emca -restore db_asm
```

You are prompted to enter the following information:

- Oracle home for the Oracle Database that you want to restore
- Database SID
- Listener port number
- Oracle ASM port
- Oracle ASM home
- Oracle ASM SID [+ASM]

Running emca on an Oracle RAC Database and Oracle ASM Instance

Use Enterprise Manager Configuration Assistant (emca) to manage your database and storage.

Use this command to run Enterprise Manager Configuration Assistant:

```
ORACLE_HOME/bin/emca -restore db_asm -cluster
```

You are prompted to enter the following information:

- Oracle home for the database that you want to restore
- Database unique name
- Listener port number
- Oracle ASM port
- Oracle ASM Oracle home
- Oracle ASM SID [+ASM]

The output of emca varies according to the options that you specify and the values that you enter at the prompts. In Oracle RAC environments, you must repeat this step on all Oracle RAC cluster member nodes.

You must now run the emdwgrd utility to restore Oracle Enterprise Manager Database Control and data.

Running the emdwgrd utility to restore Enterprise Manager Database Control

You can restore the Oracle Enterprise Manager Database Control and data by using the emdwgrd utility after you run emca -restore.

To use emdwgrd, you must do the following:

- Set *ORACLE_HOME* and other environment variables to point to the Oracle home from which the upgrade originally took place.
- Run the emdwgrd utility from the Oracle Database 12*c* home

The following procedure is for Linux and UNIX. To run it on Windows, substitute emdwgrd.bat for emdwgrd.

1. Set *ORACLE_HOME* to the Oracle home from which the database upgrade originally took place.
2. Set *ORACLE_SID* to the SID of the database that was upgraded and then downgraded.
3. Set *PATH*, *LD_LIBRARY_PATH* and *SHLIB_PATH* to point to the Oracle home from which the database upgrade originally took place.
4. Go to the Oracle Database 12*c* Oracle home:

   ```
   cd $ORACLE_HOME/bin
   ```

5. Run emdwgrd using one of the following procedures:
   a. For a single-instance database, run the following command, where *SID* is the SID of the database that was upgraded and then downgraded and

save_directory is the path to the storage location you chose when saving your database control files and data:

```
emdwgrd -restore -sid SID -path save_directory -tempTablespace TEMP
```

b. For an Oracle RAC database, remote copy is required across the cluster nodes. Define an environment variable to indicate which remote copy is configured. For example:

```
setenv EM_REMCP /usr/bin/scp
```

Then, run `emdwgrd –restore` with the following options:

```
emdwgrd -restore -tempTablespace TEMP -cluster -sid SID_OldHome -path
save_directory
```

If the Oracle home is on a shared device, then add `-shared` to the `emdwgrd` command options.

6. Enter the SYS and SYSMAN passwords when prompted by `emdwgrd`.
7. When `emdwgrd` completes, Oracle Enterprise Manager Database Control is downgraded to the old Oracle home.

Restoring Oracle Application Express to the Earlier Release

After a downgrade, if you upgraded Oracle Application Express at the same time as you upgraded Oracle Database, then you must complete steps to revert to the earlier Oracle Application Express release.

To complete the downgrade of Oracle Application Express after a database downgrade, complete all the steps listed in *Oracle Application Express Installation Guide* to revert your Oracle Application Express release to the earlier release. The steps to revert are different, depending on whether your architecture is a Non-CDB or a multitenant architecture (CDB) Oracle Database.

> **Note:**
>
> You only need to complete these steps if you upgraded Oracle Application Express at the same time that you upgraded the database.

Related Topics

- *Oracle Application Express Installation Guide*

Gathering Dictionary Statistics After Downgrading

To help to assure good performance after you downgrade, use this procedure to gather dictionary statistics.

Oracle recommends that you gather dictionary statistics after downgrading the database, so that the statistics are collected for the downgraded release Data Dictionary tables.

- Non-CDB Oracle Database: Oracle recommends that you use the `DBMS_STATS.GATHER_DICTIONARY_STATS` procedure to gather these statistics. For example, enter the following SQL statement:

  ```
  SQL> EXEC DBMS_STATS.GATHER_DICTIONARY_STATS;
  ```

- CDB (multitenant architecture) Oracle Database: Oracle recommends that you use `catcon` to gather Data Dictionary statistics across the entire multitenant architecture.

  To gather dictionary statistics for all PDBs in a container database, use the following syntax:

  ```
  $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -l /tmp -b
  gatherstats -- --x"exec dbms_stats.gather_dictionary_stats"
  ```

  To gather dictionary statistics on a particular PDB, use syntax similar to the following:

  ```
  $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -l /tmp -c
  'SALES1' -b gatherstats -- --x"exec dbms_stats.gather_dictionary_stats"
  ```

  In the preceding example the `-c SALES1` option specifies a PDB inclusion list for the command that you run, specifying the database named `SALES1`. The option `-b gatherstats`specifies the base name for the logs. The option `--x` specifies the SQL command that you want to execute. The SQL command itself is inside the quotation marks.

Related Topics

- *Oracle Database PL/SQL Packages and Types Reference*

Regathering Fixed Object Statistics After Downgrading

After the downgrade, run representative workloads on Oracle Database, and regather fixed object statistics.

Fixed objects are the X$ tables and their indexes. V$ performance views are defined through X$ tables. After you downgrade, regather fixed object statistics to ensure that the optimizer for the restored database can generate good execution plans. These execution plans can improve database performance. Failing to obtain representative statistics can lead to suboptimal execution plans, which can cause performance problems

Gather fixed objects statistics by using the `DBMS_STATS.GATHER_FIXED_OBJECTS_STATS` PL/SQL procedure. `DBMS_STATS.GATHER_FIXED_OBJECTS_STATS` also displays recommendations for removing all hidden or underscore parameters and events from `init.ora` and `SPFILE`.

To gather statistics for fixed objects, run the following PL/SQL procedure:

```
SQL> execute dbms_stats.gather_fixed_objects_stats;
```

> **See Also:**
>
> *Oracle Database PL/SQL Packages and Types Reference* for more information about using the `GATHER_FIXED_OBJECTS_STATS` procedure

Regathering Stale CBO Statistics After Downgrade

Oracle recommends that you regather Oracle Cost-Based Optimizer (CBO) statistics after completing an Oracle Database downgrade.

When you upgrade Oracle Database and gather new CBO statistics, the upgraded database has new database statistics. The upgraded database also can include new histogram types. For this reason, when you downgrade the database, the statistics that you collected for the new release can be different from the previous release. This issue is applicable both to data dictionary tables, and to regular user tables.

Regather stale statistics either by using GATHER_DATABASE_STATS, or by using gather commands that you typically use to update stale statistics in the dictionary and application schemas.

For example:

- Non-CDB Oracle Database: To regather statistics, Oracle recommends that you use the `GATHER_DATABASE_STATS` procedure, with the option `'GATHER STALE'`. For example:

  ```
  SQL> execute dbms_stats.gather_database_stats(options=>'GATHER STALE');
  ```

- CDB (multitenant architecture) Oracle Database: to regather Data Dictionary statistics across the entire multitenant architecture, Oracle recommends that you use `catcon`.

  To regather stale dictionary statistics for all PDBs in a container database, use the following syntax:

  ```
  $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -l /tmp -b
  gatherstats -- --x"exec dbms_stats.gather_database_stats(options=>'GATHER
  STALE')"
  ```

  To gather dictionary statistics on a particular PDB, use syntax similar to the following:

  ```
  $ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -l /tmp -c
  'SALES1' -b gatherstats -- --x"exec
  dbms_stats.gather_database_stats(options=>'GATHER STALE')"
  ```

  In the preceding example, the `-c SALES1` option specifies a PDB inclusion list for the command that you run, specifying the database named `SALES1`. The option `-b gatherstats`specifies the base name for the logs. The option `--x` specifies the SQL command that you want to execute. The SQL command itself is inside the quotation marks.

Related Topics

- *Oracle Database PL/SQL Packages and Types Reference*

Troubleshooting the Downgrade of Oracle Database

Use this troubleshooting information to address issues that may occur when downgrading Oracle Database.

This section contains known errors that may occur during downgrades, and workarounds to address those errors.

- Errors Downgrading Oracle Database Components with catdwgrd.sql Script
  Use this section to troubleshoot errors when you run the `catdwgrd.sql` script during a downgrade, such as `ORA-20001`: Downgrade cannot proceed.
- Oracle Multimedia Downgrade and imrelod.sql Script Error
  Review if you encounter ORA-20000: Oracle ORDIM component in registry is status: DOWNGRADED.
- Oracle Database Vault and dvrelod.sql Script Error
  Review if you encounter ORA-31011: XML parsing failed.
- Downgrading Oracle Grid Infrastructure (Oracle Restart) After Successful or Failed Upgrade
  To downgrade Oracle Restart, you must deconfigure and then reinstall Oracle Grid Infrastructure. You can then add back the databases and services.
- Oracle ACFS and Oracle Grid Infrastructure Downgrades to 11g Release 2 (11.2)
  You must run `acfsroot install` before you attempt to start the software stack.
- Database Links Passwords After Downgrading Oracle Database 11g Release 1 (11.1)
  Reset the passwords for any database links that were created in releases 11.2 or 12.1.

Errors Downgrading Oracle Database Components with catdwgrd.sql Script

Use this section to troubleshoot errors when you run the `catdwgrd.sql` script during a downgrade, such as `ORA-20001`: Downgrade cannot proceed.

The `catdwgrd.sql` script downgrades all Oracle Database components in the database to the major release from which you originally upgraded. This script must run before the Data Dictionary can be downgraded. If you encounter any problems when you run the script, then correct the causes of the problems, and rerun the script.

Errors you can see include `ORA-39709`: incomplete component downgrade; string downgrade aborted, and `ORA-06512`. When these errors occur, downgrades cannot proceed.

- **Cause**: One or more components that must be downgraded before proceeding with the Data Dictionary downgrade did not downgrade.
- **Action**: Review the log files to determine what errors occurred before the catdwgrd.sql script halted, and the downgrade was stopped.

Review these examples to understand how to correct this issue.

Example 6-1 ORA-20001 Error Due To ORA-06512

Your downgrade stops. When you review the log files, you find that `catdwgrd.sql` terminates on this error:

```
DECLARE * ERROR at line 1: ORA-20001: Downgrade cannot proceed -
Unified Audit Trail data exists. Please clean up the data first
using DBMS_AUDIT_MGMT.CLEAN_AUDIT_TRAIL. ORA-06512: at line 65
ORA-06512: at line 42
```

Errors typically describe what you must do to fix the issue that is preventing the downgrade to complete. Follow the instructions in the error message. After you have fixed the cause of the error, rerun the `catdwgrd.sql` script.

If the CDB downgrade fails during the downgrade of CDB$ROOT due to a check, then follow the instructions in the error message to fix the condition error. After you fix the error, rerun `catdwgrd.sql` with `catcon.pl`. Use the `-c` option to run the command with the inclusion list `'CDB$ROOT PDB1'`. Use the `-r` option to run the command first on the PDB, and then on CDB$ROOT. For example:

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -d $ORACLE_HOME/rdbms/
admin -e -b catdwgrd -l /scratch/rac/downgradeLogs -c 'CDB$ROOT' -r catdwgrd.sql
```

Oracle Multimedia Downgrade and imrelod.sql Script Error

Review if you encounter ORA-20000: Oracle ORDIM component in registry is status: DOWNGRADED.

When downgrading Oracle Database from release 12.1 to release 11.2.0.2, an error may be raised from the `imrelod.sql` script, which is included with release 11.2.0.2.

```
ORA-20000: Oracle ORDIM component in registry is status: DOWNGRADED. Oracle ORDIM
must be installed and valid prior to Oracle Multimedia upgrade, downgrade, or
patch.
```

- **Cause** The `imrelod.sql` script raises this error because it does not know the status of ORDIM.
- **Action** No action. You can ignore this error.

Oracle Database Vault and dvrelod.sql Script Error

Review if you encounter ORA-31011: XML parsing failed.

When downgrading Oracle Database from release 12.1 to release 11.2.0.3, databases that use Oracle Database Vault may encounter the following error, which is a result of the `dvrelod.sql` script that is included with release 11.2.0.3:

```
ORA-31011: XML parsing failed; Oracle Database Vault downgrade to release 11.2.0.3
```

- **Cause** The `dvrelod.sql` script does not know the status of XML parsing.

  Action No action. You can ignore this message.

Downgrading Oracle Grid Infrastructure (Oracle Restart) After Successful or Failed Upgrade

To downgrade Oracle Restart, you must deconfigure and then reinstall Oracle Grid Infrastructure. You can then add back the databases and services.

Related Topics

- https://support.oracle.com/rs?type=doc&id=1364412.1
- *Oracle Grid Infrastructure Installation and Upgrade Guide*

Oracle ACFS and Oracle Grid Infrastructure Downgrades to 11*g* Release 2 (11.2)

You must run `acfsroot install` before you attempt to start the software stack.

If you use Oracle ASM Cluster File System (Oracle ACFS), and you upgrade to Oracle Grid Infrastructure 12*c*, either for a cluster or for an Oracle Restart standalone server, and you choose to downgrade to Oracle Grid Infrastructure 11*g* Release 2 (11.2), then before you attempt to start the release 11.2 software stack, you must run the command `acfsroot install` from the release 11.2 Oracle Grid Infrastructure Oracle home (Grid home).

Database Links Passwords After Downgrading Oracle Database 11*g* Release 1 (11.1)

Reset the passwords for any database links that were created in releases 11.2 or 12.1.

After downgrading to Oracle Database release 11.1, you are required to reset the passwords for any database links that were created in releases 11.2 or 12.1.

- ORA-00600 Errors with Database Links Passwords After Downgrading to Oracle Database 11.1 Release 1
  This error can occur if you do not reset the database link password.
- Using Oracle Data Pump Export to Create a Dump File Containing All Existing Database Links
  Before performing the downgrade, use this Oracle Data Pump export procedure to create a dump file that contains all the existing database links.

ORA-00600 Errors with Database Links Passwords After Downgrading to Oracle Database 11.1 Release 1

This error can occur if you do not reset the database link password.

If you do not reset the database link password, then an internal error is displayed when anyone attempts to make use of the database link. For reference, this is the internal error that is reported in the Oracle trace file when the Oracle server fails to retrieve the password of the database link:

```
ORA-00600: [kzdlk_zt2 err], [18446744073709551601]
```

To reset the password for the database link after downgrading to release 11.1, use the `ALTER DATABASE LINK` command to change the password back to the original password by specifying the original password in the IDENTIFIED BY clause.

To create new database links while running Oracle Database release 11.2 or 12.1 that do not have this password issue, contact Oracle support for information about how to use the IDENTIFIED BY VALUES clause of the `CREATE DATABASE LINK` command.

Using Oracle Data Pump Export to Create a Dump File Containing All Existing Database Links

Before performing the downgrade, use this Oracle Data Pump export procedure to create a dump file that contains all the existing database links.

The dump file you create includes any newly-created database links. The procedure uses the `FULL=Y` and `INCLUDE=DB_LINK` parameters with the `expdp` command.

1. Log in to SQL*Plus.

   For example:

   ```
   sqlplus system/manager
   ```

2. Drop the dump directory in case one exists.

   For example:

   ```
   SQL> DROP DIRECTORY dpump_dir;
   SQL> CREATE DIRECTORY dpump_dir AS '/location_to_write_datapump_dump_file';
   ```

3. Export the database links.

   For example:

   ```
   $ expdp system/manager FULL=Y directory=dpump_dir
     dumpfile=saved_dblinks.dmp INCLUDE=DB_LINK;
   ```

4. After the downgrade, if any of the downgraded database links are not working properly, then drop these links, and import them from the dump file:

   ```
   $ impdp system/manager directory=dpump_dir dumpfile=saved_dblinks.dmp;
   ```

   For example, if you find that links are showing the internal error ORA-00600, then dropping and importing the links from the dump file should cause those links to work as intended.

7

Migrating Data Using Oracle Data Pump

Use the Export and Import utilities in Oracle Data Pump to migrate data from one database to another.

Oracle Data Pump provides high performance Export (`expdp`) and Import (`impdp`) utilities. These utilities facilitate upgrading to Oracle Database.

> **See Also:**
>
> *Oracle Database Utilities* for detailed information about Data Pump and the Export and Import utilities

Topics:

Overview of Data Pump and Export/Import For Migrating Data

Oracle provides Data Pump Export and Import to migrate (move) data from one Oracle database to another.

Migrating data by using Oracle Data Pump offers the following benefits:

- Supports filtering the metadata that is exported and imported based upon objects and object types, using `INCLUDE` and `EXCLUDE` parameters.
- Supports different modes for unloading/loading portions of the database including: full database mode, schema mode, table mode, tablespace mode, and transportable tablespace mode.
- Enables you to specify how partitioned tables should be handled during import operations, using the `PARTITION_OPTIONS` parameter.

- Provides support for the full range of data types.

Related Topics

- The Export/Import Method for Migrating Data When Upgrading Oracle Database

> **See Also:**
>
> *Oracle Database Utilities* for an overview of Data Pump Export and Import

Migrating Data With Oracle Data Pump Before Upgrades

Use this Oracle Data Pump procedure to export data from the source database before you install the new Oracle Database software. Then import the data into the target upgraded database.

1. Install the new Oracle Database software, and ensure that it is patched to the latest Oracle bundle patch or patch set update (BP or PSU). Installation steps for Oracle Database are covered in your operating system-specific Oracle documentation.
2. Export data from the current database using the Export utility shipped with the current database.

   The current database must not be available for updates during and after the export. If the current database is available to users for updates after the export, then before making the current database available, you must put procedures in place to copy the changes made in the current database to the new database after the import is complete.

   To obtain a consistent point from which you can update the exported database, use one of the following options:

   - Set `FLASHBACK_TIME=SYSTIMESTAMP` in your parameter file, so that the image you obtain of the data in the tables that you export represents the committed state of the table data at the same single point-in-time for all the tables that you are exporting.
   - Use `FLASHBACK_SCN` to select a specific system change number (SCN) that the Export can use to enable the Flashback Query utility.

   Using a flashback option increases UNDO usage and retention.
3. Create the new database. If the new database is on the same server, and it has the same name as the current database, then shut down the current database before creating the new database.

   (Option) You can change the storage parameters from the source database. You can pre-create tablespaces, users, and tables in the new database to improve space usage by changing storage parameters. When you pre-create tables using SQL*Plus, either run the database in the original database compatibility mode or make allowances for the specific data definition conversions that occur during import.
4. Start SQL*Plus in the new Oracle Database environment, and start an Oracle Database instance.

For example:

```
$ SQLPLUS / AS SYSDBA
SQL> STARTUP
```

5. If you have pre-created items, then specify the `TABLE_EXISTS_ACTION=APPEND` option for Data Pump Import.

> **Note:**
>
> If the new database is created on the same server as the source database, and you do not want to overwrite the source database data files, then you must pre-create the tablespaces and set the following parameter values for the Data pump import:
>
> - `REUSE_DATAFILES=N` for Data Pump Import
>
> (Option) You can use the `REMAP_DATAFILE, REMAP_TABLESPACE` and `REMAP_TABLE` options to remap references to export database names in the dump file set to new, non-colliding names in the importing database.
>
> - `DESTROY=N` for original Import.

6. Import the objects exported from the current database by using the new database Import utility. To save the informational messages and error messages from the import session to a file, use the following parameters:
   - The `LOGFILE` parameter for Data Pump Import
   - The `LOG` parameter for original Import
7. After the import, check the import log file for information about the imports of specific objects that completed successfully. If there were failures, check for information about any objects that failed.
8. Use further Import scenarios, or use SQL scripts that create the database objects to clean up incomplete imports (or possibly to start an entirely new import).

> **Note:**
>
> If a Data Pump Export or Import job encounters an unrecoverable error, then the job can be restarted after the condition inducing the failure is corrected. The job continues automatically from the point of failure.

9. If changes are made to the current database after the export, then make sure that those changes are propagated to the new database before making it available to users. Refer to step 1 in this procedure.
10. Complete required post-upgrade tasks for your upgrade as described in Chapter 4, “Post-Upgrade Tasks for Oracle Database.”

Related Topics

- *Oracle Database Utilities*

Importing a Full Oracle Database Using a Network Link

This database export/import method is an alternative to Oracle Data Pump migrations that is helpful when you are migrating to a different storage system.

Set up a database link and use the Data Pump Import utility (`impdp`) to perform a full database import from a source database to a destination database. Using this method to migrate data means that dump files are not written, so you do not have to copy over dump files. This method is of particular benefit when you use different storage systems. However, you must work within the limits imposed by the earlier release Oracle Data Pump software during the Oracle Database export.

> **Note:**
>
> To avoid interoperability errors, ensure that you have applied appropriate patchsets to the database you want to upgrade before you start the upgrade.

1. Ensure that the exporting user at the source database has the `DATAPUMP_EXP_FULL_DATABASE` role.

   You must specify this exporting user when you create the database link.
2. Ensure that the importing user at the destination database has the `DATAPUMP_IMP_FULL_DATABASE` role.
3. Create and test a database link between the source and destination databases.
4. Use the following command syntax to start a Data Pump export, where *`import_user`* is the username for the importing user, and *`db_link`* is the name of the database link owned by the exporting user:

   ```
   impdp import_user NETWORK_LINK=db_link FULL=Y NOLOGFILE=Y;
   ```

   > **Note:**
   >
   > Running this command on the importing database implicitly triggers a Data Pump export operation (`expdp`) on the exporting Oracle Database.

5. A log file for the import operation writes to the `DATA_PUMP_DIR` directory. You can discover the location of this directory by running the following command:

   ```
   SQL> select * from dba_directories where DIRECTORY_NAME like 'DATA_PUMP_DIR';
   ```

   In carrying out this command, be aware that the XDB repository is not moved in a full database export and import operation. LONG columns and NESTED columns are also not moved. However, user-created XML schemas are moved.

> **Note:**
>
> The import operation recreates users on the new destination server. The creation date for users in the `dba_users` table shows the actual import date. The expiration date is updated to the value of the `creation_date` plus the `password_life_time` columns. The creation dates in the `dba_users` table in the destination database are different from the values for the `dba_users` table in the source database.

Related Topics

- Migrating Data With Oracle Data Pump Before Upgrades
  Use this Oracle Data Pump procedure to export data from the source database before you install the new Oracle Database software. Then import the data into the target upgraded database.

> **See Also:**
>
> `http://support.oracle.com` to obtain the latest patchsets

Data Pump Requirements When Downgrading Oracle Database

You can obtain a downward-compatible dump file using Data Pump.

When you use Oracle Data Pump with the downgrade process, the Oracle Database release to which you downgrade must be no more than one release earlier than the release from which you are downgrading.

Use one of the following Data Pump Export methods to obtain a downward-compatible dump file:

- Use the Data Pump Export utility included in the current release Oracle Database home, and set the `VERSION` parameter to the release of the earlier target to which you are downgrading.

  Data Pump Import cannot read dump file sets created by the version of Oracle Data Pump that is later than the current Oracle Database release, unless you created these dump file sets with the `VERSION` parameter set to the release number of the target database. For this reason, the best way to perform a downgrade is to use Data Pump Export with the `VERSION` parameter set to the release number of the target database to which you are downgrading.

- Use the Data Pump Export utility with DOWNGRADE using the NETWORK_LINK parameter with the VERSION parameter.

  If the compatibility level of the database to which you want to downgrade is earlier than the version of the export dump file sets you created, then you can still transfer data over a database link if the compatibility level of the Oracle Database from which you want to export is within two major release numbers. For example, if one

database is Oracle Database 18c, then the other database must be 12*c* release 1 (12.1), or 12*c* release 2 (12.2). You can use Data Pump Export this way to recover from having the VERSION set to an incompatible value during a previous dump file export.

Note:

If you raise the compatibility level after you install the new release of Oracle Database, so that it uses features from the new release, then objects that use those new features cannot be downgraded. For example, if you use the long identifiers available with Oracle Database 18c, then objects with those long identifiers cannot be downgraded. After the downgrade, when you try to import those objects, and the Data Pump Import utility attempts to recreate objects that use long identifiers, you receive an error.

See Also:

Oracle Database Utilities for more information about using the `VERSION` parameter

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Behavior Changes, Deprecated and Desupported Features for Oracle Database 18c

Review for information about Oracle Database 18c changes, deprecations, and desupports.

- About Deprecated and Desupported Status
  In addition to new features, Oracle Database release can modify, deprecate or desupport features, and introduce upgrade behavior changes for your database
- Simplified Image-Based Oracle Database Installation
  Starting with Oracle Database 18c, installation and configuration of Oracle Database software is simplified with image-based installation.
- Initialization Parameter Changes in Oracle Database 18c
  Review to see the list of new, deprecated, and desupported initialization parameters in this release.
- Deprecated Features in Oracle Database 18c
  Review the deprecated features listed in this section to prepare to use alternatives after you upgrade.
- Desupported Features in Oracle Database 18c
  Review this list of desupported features as part of your upgrade planning.
- Terminal Release of Oracle Streams
  Oracle Database 18c is the terminal release for support of the Oracle Streams feature. Oracle Streams will be desupported from Oracle Database 19 onwards.
- Feature Changes for Oracle Database 18c Upgrade Planning
  Use these feature changes to help prepare for changes that you include as part of your planning for Oracle Database 18c upgrades.

About Deprecated and Desupported Status

In addition to new features, Oracle Database release can modify, deprecate or desupport features, and introduce upgrade behavior changes for your database

Be aware of the implications of deprecated and desupported:

- *Deprecated* features are features that are no longer being enhanced, but are still supported for the full life of this release of Oracle Database.
- *Desupported* features are features that are no longer supported by fixing bugs related to that feature. Oracle can choose to remove the code required to use the feature. Where indicated, a deprecated feature can be desupported in a future major release.

Simplified Image-Based Oracle Database Installation

Starting with Oracle Database 18c, installation and configuration of Oracle Database software is simplified with image-based installation.

Starting with Oracle Database 18c, the Oracle Database software is available as an image file for download and installation. You must extract the image software into the directory where you want your Oracle home to be located, and then run the `runInstaller` script to start the Oracle Database installation. For details, refer to your operating system platform *Oracle Database Installation Guide*.

> **Note:**
>
> You must extract the image software (`db_home.zip`) into the directory where you want your Oracle Database home to be located, and then run the `runInstaller` script to start the Oracle Database installation and configuration. Oracle recommends that the Oracle home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations.

Related Topics

- *Oracle Database Installation Guide*

Initialization Parameter Changes in Oracle Database 18c

Review to see the list of new, deprecated, and desupported initialization parameters in this release.

- STANDBY_ARCHIVE_DEST is Desupported
  Support for the initialization parameter `STANDBY_ARCHIVE_DEST` is removed in Oracle Database 18c.
- UNIFORM_LOG_TIMESTAMP_FORMAT Changes in INIT.ORA
  By default, the format of timestamps is different in Oracle Database 12*c* release 2 (12.2) and later releases. To view alert logs, use the Oracle Database utility Automatic Diagnostic Repository Command Interpreter (ADRCI) utility.
- Desupport of UTL_FILE_DIR Initialization Parameter
  Starting in Oracle Database 18c, the UTL_FILE_DIR parameter is no longer supported. Instead, specify the name of a directory object.

STANDBY_ARCHIVE_DEST is Desupported

Support for the initialization parameter `STANDBY_ARCHIVE_DEST` is removed in Oracle Database 18c.

Oracle Database 11*g* Release 2 (11.2) included an increase to 31 of the parameters `LOCAL` and `REMOTE` archiving `LOG_ARCHIVE_DEST_`*n*. This increase, and the `ALTERNATE` attribute enhancements to provide high availability for local and remote archiving, provides you with more control over the results after an archiving destination fails.

Because of these enhancements, STANDBY_ARCHIVE_DEST is not required or practical to use.

UNIFORM_LOG_TIMESTAMP_FORMAT Changes in INIT.ORA

By default, the format of timestamps is different in Oracle Database 12*c* release 2 (12.2) and later releases. To view alert logs, use the Oracle Database utility Automatic Diagnostic Repository Command Interpreter (ADRCI) utility.

If you use scripts to parse the alert log for timestamp dates, then be aware that the default value for timestamp formats is set by the init.ora parameter UNIFORM_LOG_TIMESTAMP_FORMAT. The default value for this parameter is TRUE. When TRUE, the timestamp format changes from a day-month-year-time format to a year-month-day-time format. For example: 2017-05-17T10:00:54.799968+00:00.

You can change to the timestamp format used in previous releases by changing the value of UNIFORM_LOG_TIMESTAMP_FORMAT to FALSE. You can also use scripts to parse log.xml instead of the alert log.

Oracle provides a dedicated command-line utility to find and analyze Oracle errors and tracefiles, called Automatic Diagnostic Repository Command Interpreter (ADRCI) Oracle recommends that you use the ADRCI utility for error management.

For example, you can use the ADRCI command show alert to view the alert log:

```
$ oracle@user> adrci
adrci> show alert -tail -f
```

ADRCI also enables you to use the show log command to pass predicates for a query. For example:

```
adrci> show log -p "message_text like '%tablespace%'"
```

Refer to *Oracle Database Utilities* for more information about how to use the ADRCI utility.

Related Topics

- *Oracle Database Utilities*

Desupport of UTL_FILE_DIR Initialization Parameter

Starting in Oracle Database 18c, the UTL_FILE_DIR parameter is no longer supported. Instead, specify the name of a directory object.

The UTL_FILE_DIR initialization parameter is no longer listed in V$SYSTEM_PARAMETER and related views. If you attempt to set this parameter, then the attempt fails. If you attempt to specify an operating system file directly by using the LOCATION parameter of UTL_FILE.FOPEN, or by using the LOCATION parameter of FOPEN_NCHAR, then those attempts also fail. Specify the name of a directory object instead.

The security model for the use of a directory object for UTL_FILE and other Oracle Database subsystems is secure, because there is a clear privilege model. However, the use of an explicit operating system directory is insecure, because there is no associated privilege model. The notice of deprecation for the UTL_FILE_DIR initialization parameter was given in version 12.2. Now the parameter is desupported.

UTL_FILE Package Symbolic Link in Directory Paths Not Supported

Using the `UTL_FILE` package to access a symbolic link fails in the new Oracle Database release. To avoid the issue, you must change the directory object and the file name, so that neither contains a symbolic link.

Deprecated Features in Oracle Database 18c

Review the deprecated features listed in this section to prepare to use alternatives after you upgrade.

- Data Guard MAX_CONNECTIONS Attribute is Deprecated
  The MAX_CONNECTIONS attribute of the LOG_ARCHIVE_DEST_*n* parameter for Data Guard redo transport is deprecated in Oracle Database 18c.
- Extended Datatype Support (EDS) is Deprecated
  Extended Datatype Support (EDS) is deprecated in Oracle Database 18c .
- Deprecation of Oracle Multimedia
  Starting in Oracle Database 18c, Oracle Multimedia is deprecated. This is the terminal release for Oracle Multimedia.
- GET_* Functions Deprecated in the DBMS_DATA_MINING Package
  Starting in Oracle Database 18c, the GET_* functions in DBMS_DATA_MINING are deprecated. Use the Oracle Data Mining (ODM) Model Details views instead.
- Package DBMS_XMLQUERY is deprecated
  The PL/SQL package DBMS_XMLQUERY is deprecated in Oracle Database 18c. Use DBMS_XMLGEN instead.
- Package DBMS_XMLSAVE is Deprecated
  The PL/SQL package DBMS_XMLSAVE is deprecated in Oracle Database 18c. Use DBMS_XMLSTORE instead.
- Deprecated Columns in Oracle Label Security Views
  Starting in Oracle Database 18c, The LABELS column is deprecated in the ALL_SA_USER_LABELS and DBA_SA_USER_LABELS views.
- Returning JSON True or False Values using NUMBER is Deprecated
  Starting with Oracle Database 18c , the option to specify a SQL NUMBER value (1 or 0) as the return value of a JSON value of true or false is deprecated.
- Deprecation of MAIL_FILTER in Oracle Text
  Starting with Oracle Database 18c, the use of `MAIL_FILTER` in Oracle Text is deprecated. Before adding email to the database, filter emails to indexable plain text, or to HTML.
- Deprecation of asmcmd showversion Option
  Starting with Oracle Database 18c, the command options for `asmcmd showversion` are replaced with new `asmcmd` options.
- Deprecation of NEWS_SECTION_GROUP in Oracle Text
  Starting with Oracle Database 18c, use of `NEWS_SECTION_GROUP` is deprecated in Oracle Text. Use external processing instead.
- Oracle Net Services Support for SDP is Deprecated
  Starting with Oracle Database 18c, the Oracle Net Services support for Sockets Direct Protocol (SDP) is deprecated.

Data Guard MAX_CONNECTIONS Attribute is Deprecated

The MAX_CONNECTIONS attribute of the LOG_ARCHIVE_DEST_*n* parameter for Data Guard redo transport is deprecated in Oracle Database 18c.

Oracle Database 11*g* Release 1 (11.1) introduced the new streaming asynchronous model for redo transport. Using the MAX_CONNECTIONS attribute setting no longer provides any benefit when Oracle Data Guard is resolving gaps in the archive log files.

Extended Datatype Support (EDS) is Deprecated

Extended Datatype Support (EDS) is deprecated in Oracle Database 18c .

The Extended Datatype Support (EDS) feature provides a mechanism for logical standbys to support certain Oracle data types that lack native redo-based support. For example, EDS was used to replicate tables with SDO_GEOMETRY column. However, starting with Oracle Database 12*c* release 2 (12.2), there are no EDS-supported Oracle data types that are not supported natively by Logical data or GoldenGate. This feature is now obsolete.

Deprecation of Oracle Multimedia

Starting in Oracle Database 18c, Oracle Multimedia is deprecated. This is the terminal release for Oracle Multimedia.

Oracle Multimedia is unavailable with Oracle Database 19c. Oracle recommends that you store multimedia content in SecureFiles LOBs, and use open source or third-party products for image processing and conversion.

GET_* Functions Deprecated in the DBMS_DATA_MINING Package

Starting in Oracle Database 18c, the GET_* functions in DBMS_DATA_MINING are deprecated. Use the Oracle Data Mining (ODM) Model Details views instead.

In Oracle Database 12*c* release 1, and earlier releases, the DBMS_DATA_MINING package supports a separate GET_MODEL_DETAILS function for each data mining algorithm. Global details are also available for Generalized Linear Models, Expectation Maximization, Singular Value Decomposition, and Association Rules. There are many DBMS_DATA_MINING `Get_*` functions. For example:

- `GET_MODEL_DETAILS`
- `DBMS_DATA_MINING.GET_MODEL_TRANSFORMATIONS`

For example, the Model detail view for Decision Tree describes the split information view, node statistics view, node description view, and the cost matrix view.

Starting with Oracle Database 18c, Oracle recommends that you replace the GET_MODEL_DETAILS_XML functions with the Oracle Data Mining Model Details views. The split information view `DM$VP`*`model_name`* describes the decision tree hierarchy, in which you append the name of the Oracle Data Mining model to the view prefix.

Related Topics

- *Oracle Data Mining User's Guide*

Package DBMS_XMLQUERY is deprecated

The PL/SQL package DBMS_XMLQUERY is deprecated in Oracle Database 18c. Use DBMS_XMLGEN instead.

DBMS_XMLQUERY provides database-to-XMLType functionality. Oracle recommends that you replace calls to DBMS_XMLQUERY with DBMS_XMLGEN. DBMS_XMLGEN is written in C and compiled into the kernel, so it provides higher performance.

Package DBMS_XMLSAVE is Deprecated

The PL/SQL package DBMS_XMLSAVE is deprecated in Oracle Database 18c. Use DBMS_XMLSTORE instead.

The DBMS_XMLSAVE package is part of the Oracle XML SQL Utility. It is used to insert, update, and delete data from XML documents in object-relational tables. Oracle recommends that you replace DBMS_XMLSAVE calls with DBMS_XMLSTORE. DBMS_XMLSTORE is written in C and compiled into the kernel, so it provides higher performance.

For example: to replace DBMS_XMLSAVE, you can create a wrapper function or procedure that you used to call DBMS_XMLSAVE on an earlier release Oracle Database, and change the call to DBMS_XMLSTORE. Or you can create a synonym:

For example: to replace DBMS_XMLSAVE, you can create a wrapper function or procedure that you used to call DBMS_XMLSAVE on an earlier release Oracle Database, and change the call to DBMS_XMLSTORE. Or you can create a synonym:

```
CREATE OR REPLACE PUBLIC SYNONYM DBMS_XMLSAVE FOR DBMS_XMLSTORE;
GRANT EXECUTE ON DBMS_XMLSAVE TO PUBLIC;
```

Deprecated Columns in Oracle Label Security Views

Starting in Oracle Database 18c, The LABELS column is deprecated in the ALL_SA_USER_LABELS and DBA_SA_USER_LABELS views.

Table 8-1 Deprecated columns in Oracle Label Security Views

Data Dictionary View	Deprecated Column
ALL_SA_USER_LABELS	LABELS
ALL_SA_USERS	USER_LABELS
DBA_SA_USER_LABELS	LABELS
DBA_SA_USERS	USER_LABELS

The information in the LABELS and USER_LABELS columns is redundant. This information is displayed in other columns in these data dictionary views.

Returning JSON True or False Values using NUMBER is Deprecated

Starting with Oracle Database 18c , the option to specify a SQL NUMBER value (1 or 0) as the return value of a JSON value of true or false is deprecated.

Oracle Database 12*c* release 1 (12.1) provided support for JSON data, including the function of specifying NUMBER as the type of a column that is returned. The option to specify NUMBER is deprecated. Instead of specifying NUMBER as the output for JSON data for true/false queries, you can use the default SQL value returned for a JSON Boolean value, and specify the string as 'true' or 'false'. If you have an application that requires a numeric value, then you can return the Boolean JSON value as a SQL VARCHAR2 value, and then test that value and return a SQL NUMBER value as the result of that test.

Deprecation of MAIL_FILTER in Oracle Text

Starting with Oracle Database 18c, the use of `MAIL_FILTER` in Oracle Text is deprecated. Before adding email to the database, filter emails to indexable plain text, or to HTML.

`MAIL_FILTER` is based on an obsolete email protocol, RFC-822. Modern email systems do not support RFC-822. There is no replacement.

Deprecation of asmcmd showversion Option

Starting with Oracle Database 18c, the command options for `asmcmd showversion` are replaced with new `asmcmd` options.

In place of the command `asmcmd showversion --softwarepatch`, use the new option `asmcmd showpatches -l`. In place of the command `asmcmd showversion --releasepatch`, use the new option `asmcmd showversion --active`.

Deprecation of NEWS_SECTION_GROUP in Oracle Text

Starting with Oracle Database 18c, use of `NEWS_SECTION_GROUP` is deprecated in Oracle Text. Use external processing instead.

If you want to index USENET posts, then preprocess the posts to use `BASIC_SECTION_GROUP` or `HTML_SECTION_GROUP` within Oracle Text. USENET is rarely used commercially.

USENET currently is rarely used for serious purpose. Performing index processing using this section group type is obsolete.

Oracle Net Services Support for SDP is Deprecated

Starting with Oracle Database 18c, the Oracle Net Services support for Sockets Direct Protocol (SDP) is deprecated.

Oracle recommends that you use TCP as an alternative.

Desupported Features in Oracle Database 18c

Review this list of desupported features as part of your upgrade planning.

- Oracle Administration Assistant for Windows is Desupported
  The Oracle Administration Assistant tool for Windows is desupported in Oracle Database 18c.

- Oracle Multimedia DICOM Desupported Features
  Several Oracle Multimedia DICOM features are desupported in Oracle Database 18c.. Replace DICOM with Oracle SecureFiles and third-party DICOM products.
- Oracle Multimedia Java Client Classes Desupported
  Oracle Multimedia proxy classes and Oracle Multimedia servlet and JSP classes are desupported.
- Oracle XML DB Desupported Features
  Starting withOracle Database 18c, schema subprograms in `DBMS_XMLSCHEMA`, many `DBMS_XDB` subprograms, and many other Oracle XML DB schema features are desupported.
- ODP.NET, Managed Driver - Distributed Transaction DLL Desupported
  Oracle is desupporting the `Oracle.ManagedDataAccessDTC.dll` file in Oracle Database 18c.
- Data Guard Broker DGMGRL ALTER Syntax is Desupported
  Starting with Oracle Database 18c, the Oracle Data Guard Broker ALTER command in DGMGRL is desupported.

Oracle Administration Assistant for Windows is Desupported

The Oracle Administration Assistant tool for Windows is desupported in Oracle Database 18c.

Oracle Administration Assistant for Windows is desupported in the current database release. Oracle Administration Assistant for Windows was a tool for creating database administrators, operators, users, and roles in Windows. Oracle Administration Assistant also enabled database services, startup and shutdown configurations, and Windows Registry parameter management. There is no replacement.

Oracle Multimedia DICOM Desupported Features

Several Oracle Multimedia DICOM features are desupported in Oracle Database 18c.. Replace DICOM with Oracle SecureFiles and third-party DICOM products.

Digital Imaging and Communications in Medicine (DICOM) is a medical imaging technology that supports the connectivity of radiological devices. Oracle's native DICOM feature is deprecated, and parts of it are desupported in this release. The desupport of Oracle Multimedia DICOM includes the following features:

- Oracle Multimedia DICOM protocol
- Oracle Multimedia DICOM mid-tier support
- Oracle Multimedia Oracle DICOM Component for WebCenter integration (DICOM/UCM)

The following Oracle Multimedia DICOM features continue to be deprecated:

- DICOM support in Oracle Multimedia ORDImage object
- Oracle Multimedia DICOM objects and packages

There is no replacement for Oracle Multimedia DICOM. Oracle recommends that you replace Oracle Multimedia DICOM by using Oracle SecureFiles with third-party products for DICOM functionality. For example: Use third-party DICOM features to carry out metadata management, DICOM image conversion, and so on.

Oracle Multimedia Java Client Classes Desupported

Oracle Multimedia proxy classes and Oracle Multimedia servlet and JSP classes are desupported.

Oracle Multimedia Java client is desupported in Oracle Database 18c for the following classes:

- Oracle Multimedia proxy classes, including DICOM proxy classes
- Oracle Multimedia servlet/jsp classes

To develop Java applications that manage multimedia content within Oracle Databases, Oracle recommends that you embed PL/SQL blocks in Java.

Oracle XML DB Desupported Features

Starting withOracle Database 18c, schema subprograms in `DBMS_XMLSCHEMA`, many `DBMS_XDB` subprograms, and many other Oracle XML DB schema features are desupported.

In Oracle Database 12*c* release 1 (12.1), the PL/SQL package `DBMS_XDB_CONFIG` was introduced. At the same time, all Oracle XML DB configuration functions, procedures, and constants that were moved from package `DBMS_XDB` to `DBMS_XDB_CONFIG`. were deprecated, and a series of other `DBMS_XMLSCHEMA`, `DBMS_XDB` subprograms, and other schema features were deprecated. These components are now desupported.

Desupported PL/SQL subprograms in package DBMS_XMLSCHEMA

The following PL/SQL subprograms in package DBMS_XMLSCHEMA are desupported:

- `generateSchema`
- `generateSchemas`

There are no replacements for these constructs. There is no workaround for this change.

Desupported Oracle XML DB Configuration Functions, Procedures, and Constants

All Oracle XML DB configuration functions, procedures, and constants that were moved from package `DBMS_XDB` to `DBMS_XDB_CONFIG` are desupported. Use `DBMS_XDB_CONFIG`.

The following list of subprograms are desupported in package DBMS_XDB:

- `ADDHTTPEXPIREMAPPING`
- `ADDMIMEMAPPING`
- `ADDSCHEMALOCMAPPING`
- `ADDSERVLET`
- `ADDSERVLETMAPPING`
- `ADDSERVLETSECROLE`
- `ADDXMLEXTENSION`

- CFG_GET
- CFG_REFRESH
- CFG_UPDATE
- DELETEHTTPEXPIREMAPPING
- DELETEMIMEMAPPING
- DELETESCHEMALOCMAPPING
- DELETESERVLET
- DELETESERVLETMAPPING
- DELETESERVLETSECROLE
- DELETEXMLEXTENSION
- GETFTPPORT
- GETHTTPPORT
- GETLISTENERENDPOINT
- SETFTPPORT
- SETHTTPPORT
- SETLISTENERENDPOINT
- SETLISTENERLOCALACCESS

The following constants are desupported in package DBMS_XDB:

- XDB_ENDPOINT_HTTP
- XDB_ENDPOINT_HTTP2
- XDB_PROTOCOL_TCP
- XDB_PROTOCOL_TCPS

Desupported Oracle XQuery Functions

The following Oracle XQuery functions are desupported. Use the corresponding standard XQuery functions instead. Corresponding functions are the functions that have the same names, but that use the namespace prefix fn.

- ora:matches . Use fn:matches instead
- ora:replace. Use fn:replace instead

ODP.NET, Managed Driver - Distributed Transaction DLL Desupported

Oracle is desupporting the Oracle.ManagedDataAccessDTC.dll file in Oracle Database 18c.

Oracle provided a native managed distributed transaction support for Oracle Data Provider for .NET (ODP.NET), Managed Driver using Oracle.ManagedDataAccessDTC.dll. In .NET Framework 4.5.2, Microsoft introduced its own native managed distributed transaction implementation, which managed ODP.NET could use. The new .NET Framework made the

`Oracle.ManagedDataAccessDTC.dll` unnecessary. Moreover, Microsoft has desupported all .NET Framework 4 versions earlier than 4.5.2. In accordance with Microsoft policy, Oracle is desupporting the `Oracle.ManagedDataAccessDTC.dll` file.

The desupport includes removing the `UseManagedDTC .NET` configuration file parameter, and `Oracle.ManagedDataAccessDTC.dll`.

Data Guard Broker DGMGRL ALTER Syntax is Desupported

Starting with Oracle Database 18c, the Oracle Data Guard Broker ALTER command in DGMGRL is desupported.

The ALTER command syntax in the Data Guard Broker DGMGRL command-line interface was deprecated in Oracle Database 10g Release 1 and replaced with the EDIT CONFIGURATION, EDIT DATABASE, and EDIT INSTANCE syntax.

Terminal Release of Oracle Streams

Oracle Database 18c is the terminal release for support of the Oracle Streams feature. Oracle Streams will be desupported from Oracle Database 19 onwards.

Oracle Streams was deprecated in Oracle Database 12*c* (12.1). It does not support features introduced in Database version 12.1 and later releases, including the multitenant architecture, the LONG VARCHAR data type, long identifiers, and other features. Oracle GoldenGate is the replication solution for Oracle Database.

Feature Changes for Oracle Database 18c Upgrade Planning

Use these feature changes to help prepare for changes that you include as part of your planning for Oracle Database 18c upgrades.

Topics:

- Support Indexing of JSON Key Names Longer Than 64 Characters
  If you use JSON keys, then you can take advantage of increased efficiency of searching JSON documents generated from HASH MAP-like structures by using longer key names.
- Upgrading Existing Databases is Replaced With Image Installations
  Starting with Oracle Database 18c, existing services are no longer migrated by the installation. Use Database Upgrade Assistant (DBUA) to migrate services.
- RPM-Based Oracle Database Installation
  On Linux systems, you can install Oracle Database 18c with an RPM image installation.
- Token Limitations for Oracle Text Indexes
  Starting with Oracle Database Release 18c, the indexed token maximum size is increased to 255 characters for single-byte character sets.
- Changes to /ALL/USER/DBA User View and PL/SQL External Libraries
  Starting in Oracle Database 18c, there are changes to the `/USER/ALL/DBA_ARGUMENTS` and `/USER/ALL/DBA_IDENTIFIERS` views, and to `LIBRARY` object creation in PDBs.

- Symbolic Links and UTL_FILE
  You cannot use UTL_FILE. with symbolic links. Use directory objects instead.
- Deprecation of Direct Registration of Listeners with DBCA
  Using Database Configuration Assistant (DBCA) to register Oracle Database to Oracle Internet Directory (OID) is deprecated in Oracle Database 18c.

Support Indexing of JSON Key Names Longer Than 64 Characters

If you use JSON keys, then you can take advantage of increased efficiency of searching JSON documents generated from HASH MAP-like structures by using longer key names.

The upper limit is increased for JSON key names that can be indexed by the JSON Search index. The JSON key name upper limit in Oracle Database 12c Release 2 (12.2.0.2) is 255 bytes. In previous releases, JSON search indexes that were created did not index key names greater than 64 bytes.

Upgrading Existing Databases is Replaced With Image Installations

Starting with Oracle Database 18c, existing services are no longer migrated by the installation. Use Database Upgrade Assistant (DBUA) to migrate services.

If you have an existing Oracle Database with services that you want to migrate, then to migrate those services, you must install the new release Oracle Database software in the Oracle home, and then start DBUA.

On Windows, to migrate the Microsoft Transaction Service to the new Oracle home, you must also run the command `%ORACLE_HOME%\bin\oramtsctl.exe -new`

RPM-Based Oracle Database Installation

On Linux systems, you can install Oracle Database 18c with an RPM image installation.

Starting with Oracle Database 18c, you can use the Oracle Preinstallation RPM and the `rpm -ivh` command to perform an RPM-based Oracle Database installation. RPM-based installation is supported for single-instance Oracle Database on Oracle Linux systems only.

Token Limitations for Oracle Text Indexes

Starting with Oracle Database Release 18c, the indexed token maximum size is increased to 255 characters for single-byte character sets.

Before Oracle Database Release 18c, all Oracle Text index types except `SDATA` sections stored tokens in a table column of type `VARCHAR2` (64 BYTE). Starting with Oracle Database Release 18c, all Oracle Text index types except `CTXCAT` and `CTXRULE` indexes store tokens in `VARCHAR2` (255 BYTE) table column types. This change is an increase for the maximum size of an indexed token to 255 characters for single-byte character sets. The size increase is less with multibyte or variable-length character sets. Tokens longer than 255 bytes are truncated. Truncated tokens do not prevent searches on the whole token string. However, the system cannot distinguish between two tokens that have the same first 255 bytes.

> **Note:**
>
> Before Oracle Database Release 18c, tokens that were greater than 64 bytes were truncated to 64 bytes. After upgrading to Oracle Database Release 18c, the token tables are increased to 255 bytes from 64 bytes. Searches with more than 64 bytes in the search token (that is, any single word in search string) cannot find any tokens which were truncated to 64 bytes. To avoid this problem, rebuild the index. If you never use search tokens longer than 64 bytes, it is not necessary to rebuild the index.

`SDATA` sections store tokens in a table column of type `VARCHAR2` (249 BYTE). `CTXCAT` and `CTXRULE` indexes store tokens in a table column of type `VARCHAR2` (64 BYTE).

Changes to /ALL/USER/DBA User View and PL/SQL External Libraries

Starting in Oracle Database 18c, there are changes to the `/USER/ALL/DBA_ARGUMENTS` and `/USER/ALL/DBA_IDENTIFIERS` views, and to `LIBRARY` object creation in PDBs.

Review the changes that can affect your work.

ALL/USER/DBA_ARGUMENTS User Views Changes

`ARGUMENTS` views contain fewer rows. In particular, only top-level (`DATA_LEVEL=0`) items are stored in the `ARGUMENTS` views.

In earlier Oracle Database releases, the PL/SQL compiler collected metadata for all nested types in a PL/SQL datatype. `DATA_LEVEL` represented the nesting level of the type. Starting in Oracle Database 18c, only top-level type metadata (`DATA_LEVEL=0`) is stored in the `ARGUMENTS` views.

For instance: Note the changes in the create-or-replace package `NestedTypesExample`:

```
Type Level2Record is RECORD (Field1 NUMBER);
Type Level1Collection is TABLE of Level2Record index by binary_integer;
Type Level0Record is RECORD (Field1 Level1Collection);
Procedure NestedTypesProc (Param1 Level0Record);
```

In previous Oracle Database releases, the top-level type of the `NestedTypeProc` procedure, `parameter Param1, Level0Record`, is returned, and also an expanded description of all the nested types within `Level0Record`. For example:

```
SQL> select argument_name,type_subname,position,sequence,data_level from
user_arguments where object_name='NESTEDTYPESPROC';
ARGUMENT_NAME   TYPE_SUBNAME      POSITION   SEQUENCE  DATA_LEVEL
--------------- ----------------- ---------- ---------- ---------
PARAM1          LEVEL0RECORD             1          1          0
FIELD1          LEVEL1COLLECTION         1          2          1
                LEVEL2RECORD             1          3          2
FIELD1                                   1          4          3
```

In contrast, the same query in an 18.1 database returns the following:

```
ARGUMENT_NAME   TYPE_SUBNAME      POSITION   SEQUENCE  DATA_LEVEL
--------------- ----------------- ---------- ---------- ---------
PARAM1          LEVEL0RECORD             1          1           0
```

In releases earlier than Oracle Database 12c (12.1), PL/SQL package type descriptive metadata was not accessible in the way that metadata is accessible for top-level object types. With Top-level object types and collections, you can query `ALL_TYPES` and the associated user views, `ALL_TYPE_ATTRS`, and `ALL_COLL_TYPES`, to obtain type metadata. However, before Oracle Database 12.1, there was no way to obtain type metadata for PL/SQL package types, such as records and packaged collections. Function or procedure parameters that referenced those PL/SQL package types resulted in publishing all metadata about these types in the ARGUMENTS views, including any nested types.

The problem with this approach is that deeply nested types can consume extensive memory in the SYS tablespace. Also, because there is no way to share the type metadata in the ARGUMENTS views, each parameter with deeply nested types required its own redundant copy of the type metadata. The amount of metadata in the `ARGUMENTS` views and `SYS` tablespace, can lead to various issues, including PL/SQL compiler performance degradation. The degradation is caused because of the time it takes PL/SQL to update rows in the underlying dictionary tables.

In the Oracle Database 12.1 release, PL/SQL introduced enhanced support for package types, including the new user views, `ALL_PLSQL_TYPES`, `ALL_PLSQL_TYPE_ATTRS`, and `ALL_PLSQL_COLL_TYPES`. As the names imply, these views are similar to the `ALL_TYPES` view family. However, you can use the enhanced PL/SQL type views to query metadata about PL/SQL package types, instead of top-level object and collection types.

Because of the package types added with Oracle Database 12.1, there is no longer a need to insert large amounts of descriptive metadata into the ARGUMENTS views. A single row of metadata that includes the type name is all that is required in the ARGUMENTS views for each parameter type. You can obtain a full description of the type name in a query against the PL/SQL type views, and any nested types.

`OCIDescribeAny()` is based on the same metadata used by the `ARGUMENTS` views. `OCIDescribeAny()` also returns a single row for each parameter type, instead of the multiple rows commonly returned before the change in Oracle Database 12.1.

`ALL/DBA/USER_ARGUMENTS` contains a new column type, `TYPE_OBJECT_TYPE`. To determine the type of the type described by `TYPE_OWNER`, `TYPE_NAME` and `TYPE_SUBNAME`, you use the `TYPE_OBJECT_TYPE` column. The possible values include `TABLE`, `VIEW`, `PACKAGE`, and `TYPE`.

If you prefer to continue to collect the `ALL_TYPES` and the associated user views, `ALL_TYPE_ATTRS` and ALL_COLL_TYPES in ARGUMENTS views, then you can set events to `events='10946, level 65536'`. Setting this event reverts the `ARGUMENTS` views back to the behavior in Oracle Database releases earlier than 12.1, in which DATA_LEVEL can be greater than `0`, and descriptive metadata for the type and any nested types is included in the view. If you make this change, then you must recompile affected packages after you set the event. When you recompile the affected packages, the compiler recollects the additional metadata. This event also reverts `OCIDescribeAny()` to the behavior in Oracle Database releases earlier than 12.1.

Starting in Oracle Database 12*c* release 1 (12.1.0.2), if you enter a procedure with no arguments, then the `ARGUMENTS` views do not have any rows. This change is an additional change that is separate from the row reduction change to `ARGUMENTS` views. Before Oracle Database 12.1.0.2, a procedure with no arguments was presented as a single row in the `ARGUMENTS` views.

USER/ALL/DBA_IDENTIFIERS User View Changes

Starting with Oracle Database 18c, PL/Scope is enhanced to capture additional information about user identifiers in PL/SQL code. The additional information includes constraints placed on the identifiers, and an indicator that notes when a function is a SQL builtin in PL/SQL.

The following columns are new in the USER/ALL/DBA_IDENTIFIERS views in Oracle Database 18c:

- `CHARACTER_SET`: This column contains the value of the character set clause, when the column is used in a variable identifier declaration. The possible values are `CHAR_CS`, `NCHAR_CS`, and `IDENTIFIER`, when the character set is derived from another variable identifier.
- `ATTRIBUTE`: This column contains the attribute value when *`%attribute`* is used in a variable declaration. The possible values are `ROWTYPE`, `TYPE`, and `CHARSET`.
- `CHAR_USED`: This column contains the type of the length constraint when a constraint is used in a string length constraint declaration. The possible values are `CHAR` and `BYTE`.
- `LENGTH`: This column contains the numeric length constraint value for a string length constraint declaration.
- `PRECISION`: This column contains the numeric precision when it is used in a variable declaration.
- `PRECISION2`: This column contains the numeric second precision value (for instance, interval types) used in a variable declaration.
- `SCALE`: This column contains the numeric scale value used in a variable declaration.
- `LOWER_RANGE`: This column contains the numeric lower range value used by a variable declaration with a range constraint.
- `UPPER_RANGE`: This column contains the numeric upper range value used by a variable declaration with a range constraint.
- `NULL_CONSTRAINT`: When a `NULL` constraint is used by a variable declaration, this column is set. The possible values are `NULL`, or `NOT NULL`.
- `SQL_BUILTIN`: When an identifier is a SQL builtin used in a SQL statement issued from PL/SQL, this column is set to `YES`. If the identifier is not a SQL builtin, then the column is set to `NO`.

PL/SQL EXTERNAL LIBRARY Changes

Starting with Oracle Database 18c, the methods change for how to create LIBRARY objects in an Oracle Database 18c PDB with a pre-defined `PATH_PREFIX`.

- When you create a new `LIBRARY` object in a PDB that has a predefined `PATH_PREFIX`, the `LIBRARY` must use a `DIRECTORY` object. The `DIRECTORY` object enforces the rules of `PATH_PREFIX` for the `LIBRARY` object. Failure to use a `DIRECTORY` object in the `LIBRARY` object results in a `PLS-1919` compile-time error.
- If a database is plugged into a CDB as a PDB with a predefined `PATH_PREFIX`, then attempts to use a `LIBRARY` object that does not use a DIRECTORY object result in an `ORA-65394` runtime error. The `LIBRARY` object is not invalidated. However, to

make the LIBRARY useful (as opposed to always issuing a runtime error), you must recreate the LIBRARY object so that it uses a DIRECTORY object.

These changes enhance the security and manageability of LIBRARY objects in a PDB by accounting for the value of the PATH_PREFIX, which describes where the LIBRARY dynamic link library (DLL) can appear in the file system. The use of a DIRECTORY object also allows administrators to determine which users can access the DLL directory.

Symbolic Links and UTL_FILE

You cannot use UTL_FILE. with symbolic links. Use directory objects instead.

After an upgrade if applications address the database using symbolic links through, UTL_FILE, then these links fail. Oracle recommends that you use directory objects. If necessary, you can create real files that are the targets of file names in UTL_FILE..

Example 8-1 Example of Error Messages with UTL_FILE And Symbolic Links

Applications that use symbolic links that address UTL_FILE encounter an error. For example. suppose you attempt to create a symbolic link, where Ia.c is a symbolic link file:

```
create or replace directory TEMP as '/home/PLSQL/TEMP';

declare
f utl_file.file_type;
begin
f := utl_file.fopen('TEMP','la.c','r');
end;
/
```

This command fails with the following errors:

```
ERROR at line 1:
ORA-29283: invalid file operation
ORA-06512: at "SYS.UTL_FILE", line 536
ORA-29283: invalid file operation
ORA-06512: at line 4
```

Deprecation of Direct Registration of Listeners with DBCA

Using Database Configuration Assistant (DBCA) to register Oracle Database to Oracle Internet Directory (OID) is deprecated in Oracle Database 18c.

Instead of using DBCA to migrate or register listeners to a database home during an upgrade, use Net Configuration Assistant or Net Manager to create a LISTENER.ORA file for the new release Oracle home, and then start this listener. You can also use DBCA to de-register and register listeners again to OID.

A

Changes for Earlier Releases of Oracle Database

Review changes in behavior between Oracle Database 11*g* release 2 (11.2) or Oracle Database 12*c* release 1 (12.1).

Behavior changes typically require you to make informed decisions to minimize risks that Oracle Database changes can create for in an upgraded Oracle Database. This appendix does not describe all changed behavior and new features in each release of Oracle Database.

> **See Also:**
>
> - *Oracle Database New Features Guide* for a complete list of all new features introduced in this release
> - *Oracle Database Reference* “Changes in this Release” section for a list of new initialization parameters, new static data dictionary views, and new dynamic performance views
> - *Oracle Database Installation Guide* for your operating system for more information about operating system parameter changes
> - Your operating system-specific Oracle documentation for more information about these initialization parameters.

Topics:

- Behavior Changes in Oracle Database 12c Release 2 (12.2.0.1)
  Review for descriptions of Oracle Database 12c release 1 (12.1) changes.
- Behavior Changes in Oracle Database 12c Release 1 (12.1)
  Review for descriptions of Oracle Database 12*c* release 1 (12.1) changes.

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

Review for descriptions of Oracle Database 12c release 1 (12.1) changes.

Topics:

- Initialization Parameter Changes in Oracle Database 12c Release 2 (12.2)
  Review to see the list of new, deprecated, and desupported initialization parameters in this release.

- Deprecated Features in Oracle Database 12c Release 2 (12.2)
  Review the deprecated features listed in this section to prepare to use alternatives after you upgrade.
- Desupported Features in Oracle Database 12c Release 2 (12.2)
  Review this list of desupported features as part of your upgrade planning.
- Database Upgrade Assistant (DBUA) Enhancements and Changes
  Oracle Database 12*c* release 2 (12.2) includes several enhancements to DBUA, and some features have been removed or modified.
- Enhancements to Oracle Data Guard Broker and Rolling Upgrades
  Starting with Oracle Database 12*c* release 2 (12.2), Oracle Data Guard Broker has more features to assist rolling upgrades.
- About Changes in Default SGA Permissions for Oracle Database
  Starting with Oracle Database 12*c* Release 2 (12.2.0.1), by default, permissions to read and write to the System Global Area (SGA) are limited to the Oracle software installation owner.
- Network Access Control Lists and Upgrade to Oracle Database 12c
  Network access control lists (ACLs) are implemented as Real Application Security ACLs in 12*c*, and existing ACLs are migrated from XML DB ACLs and renamed during upgrade.
- Parallel Upgrade Utility Batch Scripts
  In Oracle Database 12*c* release 2, you can run the Parallel Upgrade Utility using command-line batch scripts.`catupgrd.sql` is no longer distributed.
- Unified Auditing AUDIT_ADMIN and AUDIT_VIEWER Roles Changes
  You may need to rename or drop `AUDIT_ADMIN` and `AUDIT_VIEWER` roles before upgrading.
- Oracle Update Batching Batch Size Settings Disabled
  Oracle update batching settings are disabled in Oracle Database 12c release 2 (12.2). Use JDBC batching instead.
- About Upgrading Tables Dependent on Oracle-Maintained Types
  Starting with Oracle Database 12*c* release 2 (12.2), you can run the Parallel Upgrade Utility with the `-T` option to set tables to READ ONLY.
- Case-Insensitive Passwords and ORA-1017 Invalid Username or Password
  The Oracle Database 12*c* release 2 (12.2) default authentication protocol is `12` (Exclusive Mode). This protocol requires case-sensitive passwords for authentication. Review your options if you have earlier release password versions.
- About Deploying Oracle Grid Infrastructure Using Rapid Home Provisioning and Maintenance
  Rapid Home Provisioning and Maintenance (RHP) is a software lifecycle management method for provisioning and maintaining Oracle homes. RHP enables mass deployment and maintenance of standard operating environments for databases, clusters, and user-defined software types.
- Restrictions Using Zero Data Loss Recovery Appliance Release 12.1 Backups
  Zero Data Loss Recovery Appliance release 12.1 does not support backups from protected database clients using Oracle Database 12*c* release 2 (12.2).

Initialization Parameter Changes in Oracle Database 12c Release 2 (12.2)

Review to see the list of new, deprecated, and desupported initialization parameters in this release.

- Deprecated Initialization Parameters in Oracle Database 12c Release 2 (12.2)
  To understand changes and replacements in parameter settings, review the parameters deprecated in the 12.2 release. These parameters can be removed in a later release.
- Desupported Initialization Parameters in Oracle Database 12c Release 2 (12.2)
  Review this list of desupported initialization parameters for changes and replacements in parameter settings in this release.
- Initialization Parameter Default Changes in Oracle Database 12c Release 2 (12.2)
  Review this list of initialization parameter default setting changes for Oracle Database 12*c* release 2 (12.2).

Deprecated Initialization Parameters in Oracle Database 12*c* Release 2 (12.2)

To understand changes and replacements in parameter settings, review the parameters deprecated in the 12.2 release. These parameters can be removed in a later release.

O7_DICTIONARY_ACCESSIBILITY Initialization parameter

The initialization parameter O7_DICTIONARY_ACCESSIBILITY controls restrictions on SYSTEM privileges. If the parameter is set to TRUE, then access to objects in the SYS schema is allowed. The default setting is FALSE. This default setting prevents system privileges that allow access to objects in any schema from allowing access to objects in the SYS schema. The O7_DICTIONARY_ACCESSIBILITY parameter is deprecated.

ASM_PREFERRED_READ_FAILURE_GROUPS Initialization Parameter

The ASM_PREFERRED_READ_FAILURE_GROUPS initialization parameter is deprecated in Oracle Automatic Storage Management 12*c* release 2 (12.2.0.1). Starting with Oracle Automatic Storage Management (Oracle ASM) 12*c* release 2 (12.2.0.1), specifying the preferred read failure groups is done automatically, so the use of the ASM_PREFERRED_READ_FAILURE_GROUPS initialization parameter is no longer required. Use the PREFERRED_READ.ENABLED disk group attribute to control the preferred read functionality.

PARALLEL_ADAPTIVE_MULTI_USER Initialization Parameter

The initialization parameter PARALLEL_ADAPTIVE_MULTI_USER specifies if you want to use an adaptive algorithm to improve performance in multi-user environments that use parallel execution. This parameter is deprecated, and the default value is now FALSE. There is no replacement for this parameter. Oracle recommends that you use the Oracle Database feature Parallel Statement Queuing to obtain parallel execution performance gains.

UTL_FILE_DIR Initialization Parameter

The initialization parameter UTL_FILE_DIR specifies accessible directories for PL/SQL file I/O. This parameter is deprecated, and Oracle recommends that you do not provide UTL_FILE_DIR access. Oracle recommends that you instead use the directory object feature, which replaces UTL_FILE_DIR. Directory objects provide the following benefits:

- They offer more flexibility and granular control to the UTL_FILE application administrator
- They can be maintained dynamically, without shutting down the database
- They are consistent with other Oracle tools.

Related Topics

- *Oracle Database Reference*

Desupported Initialization Parameters in Oracle Database 12*c* Release 2 (12.2)

Review this list of desupported initialization parameters for changes and replacements in parameter settings in this release.

GLOBAL_CONTEXT_POOL_SIZE Initialization Parameter

The GLOBAL_CONTEXT_POOL_SIZE initialization parameter is removed and desupported in this release.

GLOBAL_CONTEXT_POOL_SIZE specified the amount of memory to allocate in the SGA for storing and managing global application context. The default value of this parameter was null. The parameter was deprecated in Oracle Database 10*g* release 2 (10.2).

MAX_ENABLED_ROLES Initialization Parameter

The MAX_ENABLED_ROLES initialization parameter is removed and desupported in this release.

There is no replacement for this parameter. Oracle Database has not used this parameter since Oracle Database 10*g* release 2 (10.2).

OPTIMIZER_ADAPTIVE_FEATURES Initialization Parameter

The OPTIMIZER_ADAPTIVE_FEATURES initialization parameter is removed and desupported in this release.

The functions of this parameter are replaced by two new parameters. The default value for OPTIMIZER_ADAPTIVE_PLANS is TRUE. When set to TRUE, this parameter determines alternate execution plans that are based on statistics collected as a query executes. OPTIMIZER_ADAPTIVE_STATISTICS is set by default to FALSE. When set to TRUE, the optimizer augments the statistics gathered in the database with adaptive statistics gathered at SQL statement parse time to improve the quality of SQL execution plans.

PARALLEL_AUTOMATIC_TUNING Initialization Parameter

The PARALLEL_AUTOMATIC_TUNING initialization parameter is removed and desupported in this release.

The PARALLEL_AUTOMATIC_TUNING initialization parameter determined the default values for parameters that controlled parallel processing. It was deprecated in Oracle Database 10*g* release 2 (10.2).

PARALLEL_IO_CAP_ENABLED Initialization Parameter

The PARALLEL_IO_CAP_ENABLED initialization parameter determined if Oracle Database set a limit to the default degree of parallelism to a level no greater than the I/O system supported. This parameter was deprecated in Oracle Database release 11.2. The function of this parameter was replaced by the PARALLEL_DEGREE_LIMIT parameter, when that parameter is set to IO.

PARALLEL_SERVER Initialization Parameter

The PARALLEL_SERVER initialization parameter is removed and desupported in this release.

The PARALLEL_SERVER initialization parameter was used to start a database in Oracle Parallel Server mode. This parameter was deprecated in Oracle Database release 9.0.1. Oracle Parallel Server was replaced with Oracle Real Application Clusters, which uses the CLUSTER_DATABASE initialization parameter.

PARALLEL_SERVER_INSTANCES Initialization Parameter

The PARALLEL_SERVER_INSTANCES initialization parameter is removed and desupported in this release.

The PARALLEL_SERVER_INSTANCES initialization parameter specified the number of configured instances in Oracle Parallel Server mode. This parameter was deprecated in Oracle Database release 9.0.1. Oracle Parallel Server was replaced with Oracle Real Application Clusters, which uses the CLUSTER_DATABASE_INSTANCES initialization parameter.

USE_INDIRECT_DATA_BUFFERS Initialization Parameter

The initialization parameter USE_INDIRECT_DATA_BUFFERS is removed and desupported in this release.

The parameter was used to enable the Very Large Memory feature for 32-bit platforms. These platforms are no longer supported.

Related Topics

- *Oracle Database Reference*

Initialization Parameter Default Changes in Oracle Database 12c Release 2 (12.2)

Review this list of initialization parameter default setting changes for Oracle Database 12*c* release 2 (12.2).

OPTIMIZER_ADAPTIVE_PLANS and OPTIMIZER_ADAPTIVE_STATISTICS

OPTIMIZER_ADAPTIVE_FEATURE functions are replaced by two new parameters: OPTIMIZER_ADAPTIVE_PLANS, and OPTIMIZER_ADAPTIVE_STATISTICS.

OPTIMIZER_ADAPTIVE_PLANS controls adaptive plans. It is set by default to TRUE. When set to TRUE, this parameter determines alternate execution plans built with alternative choices that are based on statistics collected as a query executes.

OPTIMIZER_ADAPTIVE_STATISTICS controls adaptive statistics. It is set by default to FALSE. When set to TRUE, the optimizer augments the statistics gathered in the database with adaptive statistics gathered at SQL statement parse time to improve the quality of SQL execution plans. Some query shapes are too complex to rely upon base table statistics alone. The optimizer augments them with adaptive statistics to determine more accurately the best SQL execution plan.

SQL92_SECURITY Initialization Parameter Default is TRUE

The SQL standard specifies that security administrators should be able to require that users have SELECT privilege on a table when running an UPDATE or DELETE statement that references table column values in a WHERE or SET clause. SQL92_SECURITY specifies whether users must have been granted the SELECT object privilege in order to execute such UPDATE or DELETE statements.

Starting in Oracle Database 12*c* release 2 (12.2), the default setting for this parameter changes from FALSE to TRUE.

When this parameter is set to TRUE, users must have SELECT privilege on the object being deleted or updated.

Related Topics

- *Oracle Database Reference*

Deprecated Features in Oracle Database 12*c* Release 2 (12.2)

Review the deprecated features listed in this section to prepare to use alternatives after you upgrade.

- Deprecation of ALTER TYPE REPLACE
  Starting with Oracle Database 12*c* release 2 (12.2.0.1), the REPLACE clause of ALTER TYPE is deprecated.
- Deprecation of configToolAllCommands Script
  The postinstallation check script configToolAllCommands is deprecated in Oracle Database 12c release 1 (12.1).
- Deprecation of DBMS_DEBUG Package
  The DBMS_DEBUG package is deprecated in Oracle Database 12*c* release 2 (12.2). Oracle recommends that you use DBMS_DEBUG_JDWP.
- Deprecation of DBMS_JOB Package
  The DBMS_JOB package is deprecated, and may be desupported in a future release.
- Deprecation of Intelligent Data Placement (IDC)
  Intelligent Data Placement is deprecated in Oracle Database 12*c* release 2 (12.2).
- Deprecation of CONTINUOUS_MINE Option
  Starting with Oracle Database 12*c* Release 2 (12.2.0.1), the LogMiner CONTINUOUS_MINE option is deprecated.

- Deprecation of Non-CDB Architecture
  The non-CDB architecture was deprecated in Oracle Database 12*c*. It can be desupported and unavailable in a release after Oracle Database 19*c* .
- Deprecation of Oracle Administration Assistant for Windows
  Oracle Administration Assistant for Windows is deprecated in Oracle Database 12*c* release 2 (12.2).
- Deprecation of Oracle Data Provider for .NET PromotableTransaction Setting
  The Oracle Data Provider for .NET `PromotableTransaction` setting is deprecated, because it is no longer necessary.
- Deprecation of oracle.jdbc.OracleConnection.unwrap()
  Starting in Oracle Database 12*c* release 2 (12.2), the Java package `oracle.jdbc.OracleConnection.unwrap()` is deprecated.
- Deprecation of oracle.jdbc.rowset Package
  Starting in Oracle Database 12*c* release 2 (12.2), the Java `oracle.jdbc.rowset` package is deprecated
- Deprecation of oracle.sql.DatumWithConnection Classes
  `oracle.sql` classes that extend `oracle.sql.DatumWithConnection` are deprecated in Oracle Database 12*c* release 2 (12.2), in favor of `oracle.jdbc` extension types.
- Deprecation of Oracle Multimedia Java APIs
  The Oracle Multimedia Java APIs are deprecated in Oracle Database 12*c* release 2.
- Deprecation of Oracle Multimedia Support for DICOM
  Starting in Oracle Database 12*c* release 2 (12.2), the Oracle Multimedia DICOM feature is deprecated.
- Deprecation of Multimedia SQL/MM Still Image Standard Support
  Starting in Oracle Database 12*c* release 2 (12.2), Oracle Multimedia SQL/MM Still Image standard support is deprecated.
- Deprecation of Unicode Collation Algorithm (UCA) 6.1 Collations
  Starting in Oracle Database 12*c* release 2, the Unicode Collation Algorithm (UCA) 6.1 collations are deprecated.
- Deprecation of UNIFIED_AUDIT_SGA_QUEUE_SIZE
  Starting in Oracle Database 12*c* release 2, the initialization parameter UNIFIED_AUDIT_SGA_QUEUE_SIZE is deprecated.
- Deprecation of VERIFY_FUNCTION and VERIFY_FUNCTION_11G
  The `VERIFY_FUNCTION` and `VERIFY_FUNCTION_11G` password verify functions are deprecated in this release, because they enforce the weaker password restrictions from earlier releases.
- Deprecation of V$MANAGED_STANDBY
  The V$MANAGED_STANDBY view is deprecated in Oracle Database 12*c* release 2 (12.2.0.1). Oracle recommends that you use the new view V$DATAGUARD_PROCESS.
- Deprecation of Some XML DB Functions
  Starting with Oracle Database 12*c* release 2 (12.2) the options listed in this topic are deprecated.

Deprecation of ALTER TYPE REPLACE

Starting with Oracle Database 12*c* release 2 (12.2.0.1), the REPLACE clause of ALTER TYPE is deprecated.

As an alternative, Oracle recommends that you use the ALTER TYPE methods ADD and DROP, or use ALTER TYPE *`method`* ADD .

Related Topics

- *Oracle Database PL/SQL Language Reference*

Deprecation of configToolAllCommands Script

The postinstallation check script configToolAllCommands is deprecated in Oracle Database 12c release 1 (12.1).

The script `configToolAllCommands` runs in the response file mode to configure Oracle products after installation. It uses a separate password response file. Starting with Oracle Database 12*c* release 2 (12.2), `configToolAllCommands` is deprecated. It may be desupported in a future release.

You can now obtain postinstallation checks as part of the installation process. Oracle recommends that you run the Oracle Database or Oracle Grid Infrastructure installer with the option `-executeConfigTools`. You can use the same response file created during installation to complete postinstallation configuration.

Deprecation of DBMS_DEBUG Package

The DBMS_DEBUG package is deprecated in Oracle Database 12*c* release 2 (12.2). Oracle recommends that you use DBMS_DEBUG_JDWP.

In earlier releases, PL/SQL included the DBMS_DEBUG package to enable internal and third-party tools to debug PL/SQL programs. The DBMS_DEBUG package provides APIs to set breakpoints, obtain values of variables, and so on. This functionality has been provided by the DBMS_DEBUG_JDWP package for several releases. DBMS_DEBUG_JDWP provides the equivalent PL/SQL debugging capabilities, and it enables seamless debugging of PL/SQL routines when it calls into or is called from server-side Java (OJVM) with Java stored procedures.

Related Topics

- *Oracle Database PL/SQL Packages and Types Reference*

Deprecation of DBMS_JOB Package

The DBMS_JOB package is deprecated, and may be desupported in a future release.

Oracle recommends that developers move to DBMS_SCHEDULER, which provides a richer set of features and capabilities.

Related Topics

- *Oracle Database Administrator's Guide*

Deprecation of Intelligent Data Placement (IDC)

Intelligent Data Placement is deprecated in Oracle Database 12*c* release 2 (12.2).

Intelligent Data Placement enables you to specify disk regions on Oracle ASM disks for best performance. Using the disk region settings, you can ensure that frequently accessed data is placed on the outermost (hot) tracks which have greater speed and higher bandwidth. In addition, files with similar access patterns are located physically close, reducing latency. Intelligent Data Placement also enables the placement of primary and mirror extents into different hot or cold regions

This feature is deprecated in Oracle Database 12c release 2 (12.2).

Related Topics

- *Oracle Automatic Storage Management Administrator's Guide*

Deprecation of CONTINUOUS_MINE Option

Starting with Oracle Database 12*c* Release 2 (12.2.0.1), the LogMiner CONTINUOUS_MINE option is deprecated.

The LogMiner CONTINUOUS_MINE option is still supported for backward compatibility reasons. However, Oracle recommends that you discontinue using it. There is no replacement functionality.

Deprecation of Non-CDB Architecture

The non-CDB architecture was deprecated in Oracle Database 12*c*. It can be desupported and unavailable in a release after Oracle Database 19*c* .

Oracle recommends use of the CDB architecture.

Deprecation of Oracle Administration Assistant for Windows

Oracle Administration Assistant for Windows is deprecated in Oracle Database 12*c* release 2 (12.2).

Oracle Administration Assistant for Windows is a tool for creating database administrators, operators, users, and roles in Windows. It also allows database service, startup and shutdown configuration, and Windows Registry parameter management.

Instead of using Oracle Administration Assistant for Windows, use native Windows administration tools.

Deprecation of Oracle Data Provider for .NET PromotableTransaction Setting

The Oracle Data Provider for .NET `PromotableTransaction` setting is deprecated, because it is no longer necessary.

Promotable transactions themselves are not being deprecated. Only this specific setting is deprecated.

The Oracle Data Provider for .NET registry setting `PromotableTransaction` indicates whether the application must keep transactions as local, or if it can begin all single

connection transactions as local, and then promote the transaction to distributed when a second connection enlists. This is the concept of promotable transactions.

The Promotable Transaction setting is deprecated in Oracle Database 12*c* release 2 (12.2). There is no reason not to use promotable transactions. Oracle recommends you accept the default value `promotable`.

Deprecation of oracle.jdbc.OracleConnection.unwrap()

Starting in Oracle Database 12*c* release 2 (12.2), the Java package `oracle.jdbc.OracleConnection.unwrap()` is deprecated.

The Java package `oracle.jdbc.OracleConnection.unwrap()` is deprecated in Oracle Database 12*c* release 2, and later releases. There is no replacement for this package.

Oracle recommends that you replace this JDBC method in your applications with standard Java methods.

Related Topics

- https://support.oracle.com/rs?type=doc&id=2024500.1

Deprecation of oracle.jdbc.rowset Package

Starting in Oracle Database 12*c* release 2 (12.2), the Java `oracle.jdbc.rowset` package is deprecated

Oracle recommends that you use the Standard JDBC RowSet package to replace this feature.

Related Topics

- *Oracle Database JDBC Developer's Guide*
- https://support.oracle.com/rs?type=doc&id=2024500.1

Deprecation of oracle.sql.DatumWithConnection Classes

`oracle.sql` classes that extend `oracle.sql.DatumWithConnection` are deprecated in Oracle Database 12*c* release 2 (12.2), in favor of `oracle.jdbc` extension types.

In previous releases, Oracle Database included Oracle JDBC drivers that provided specific type extensions and performance extensions in both `oracle.sql` and `oracle.jdbc` Java packages. Starting with Oracle Database 12*c* release 2 (12.2), the `oracle.sql` classes that extend `oracle.sql.DatumWithConnection` are deprecated. The `oracle.jdbc` extensions continue to be supported.

For example, here is a partial list of deprecated `oracle.sql` classes:

- ARRAY
- BFILE
- BLOB
- CLOB
- OPAQUE
- REF
- STRUCT

Oracle recommends that you replace `oracle.sql` classes that extend `oracle.sql.DatumWithConnection` in your applications with standard Java types, or with `oracle.jdbc` extensions.

Deprecation of Oracle Multimedia Java APIs

The Oracle Multimedia Java APIs are deprecated in Oracle Database 12*c* release 2.

The following Java APIs are deprecated in Oracle Database 12*c* Release 2 (12.2), and may be desupported in a future release:

- Oracle Multimedia Java API
- Oracle Multimedia Servlets and JSP Java API
- Oracle Multimedia DICOM Java API
- Oracle Multimedia Mid-Tier Java API

Related Topics

- *Oracle Multimedia Reference*
- *Oracle Multimedia DICOM Developer's Guide*

Deprecation of Oracle Multimedia Support for DICOM

Starting in Oracle Database 12*c* release 2 (12.2), the Oracle Multimedia DICOM feature is deprecated.

There is no replacement for DICOM support in Oracle Database.

Related Topics

- *Oracle Multimedia DICOM Developer's Guide*

Deprecation of Multimedia SQL/MM Still Image Standard Support

Starting in Oracle Database 12*c* release 2 (12.2), Oracle Multimedia SQL/MM Still Image standard support is deprecated.

For image processing operations, Oracle Multimedia developers can call the new ORD_IMAGE PL/SQL package, or call the ORDImage methods.

For image matching, Oracle Database developers can use open source packages, such as OpenCV.

Related Topics

- *Oracle Multimedia Reference*
- *Oracle Multimedia User's Guide*

Deprecation of Unicode Collation Algorithm (UCA) 6.1 Collations

Starting in Oracle Database 12*c* release 2, the Unicode Collation Algorithm (UCA) 6.1 collations are deprecated.

The Unicode Collation Algorithm (UCA) 6.1 collations (UCA0610_*) are deprecated. They can be desupported and unavailable in a future release. Oracle recommends

that you use the latest supported version of UCA collations for sorting multilingual data.

Related Topics

- *Oracle Database Globalization Support Guide*

Deprecation of UNIFIED_AUDIT_SGA_QUEUE_SIZE

Starting in Oracle Database 12*c* release 2, the initialization parameter UNIFIED_AUDIT_SGA_QUEUE_SIZE is deprecated.

The UNIFIED_AUDIT_SGA_QUEUE_SIZE parameter is deprecated, and the value for this parameter is no longer honored. However, the parameter is currently retained for backward compatibility.

See *Oracle Database Security Guide* for additional information about Unified Audit records.

Related Topics

- *Oracle Database Security Guide*

Deprecation of VERIFY_FUNCTION and VERIFY_FUNCTION_11G

The `VERIFY_FUNCTION` and `VERIFY_FUNCTION_11G` password verify functions are deprecated in this release, because they enforce the weaker password restrictions from earlier releases.

Oracle recommends that you use the functions `ORA12C_VERIFY_FUNCTION` and `ORA12C_STRONG_VERIFY_FUNCTION`. These functions enforce stronger, more up-to-date password verification restrictions.

Deprecation of V$MANAGED_STANDBY

The V$MANAGED_STANDBY view is deprecated in Oracle Database 12*c* release 2 (12.2.0.1). Oracle recommends that you use the new view V$DATAGUARD_PROCESS.

The V$DATAGUARD_PROCESS view includes much more information about processes used by Oracle Data Guard.

Related Topics

- *Oracle Database Reference*

Deprecation of Some XML DB Functions

Starting with Oracle Database 12*c* release 2 (12.2) the options listed in this topic are deprecated.

The following options are deprecated:

- Oracle XQuery function `ora:contains`. Use XQuery Full Text instead.
- Oracle SQL function XMLRoot. Use SQL/XML function `XMLSerialize()` with a version number instead.

- Nested tables stored as index-ordered tables (IOTs). This includes both the use of option `DBMS_XMLSCHEMA.REGISTER_NT_AS_IOT`, and the use of clause `NESTED TABLE N STORE AS ... (ORGANIZATION INDEX)` when creating a table with nested-table column `N`. Instead, store nested-table columns using heap storage (the default behavior for PL/SQL procedure `DBMS_XMLSCHEMA.registerSchema`).
- PL/SQL procedure `DBMS_XSLPROCESSOR.CLOB2FILE`. Use `DBMS_LOB.CLOB2FILE` instead.
- PL/SQL function `DBMS_XSLPROCESSOR.READ2CLOB`. Use `DBMS_LOB.LOADCLOBFROMFILE` instead.
- Use of XLink with Oracle XML DB.
- Oracle XML DB Content Connector.

For more information, refer to *Oracle XML DB Developer's Guide*.

Related Topics

- *Oracle XML DB Developer's Guide*

Desupported Features in Oracle Database 12*c* Release 2 (12.2)

Review this list of desupported features as part of your upgrade planning.

- Desupport of Advanced Replication
  Starting in Oracle Database 12*c* release 2 (12.2), the Advanced Replication feature of Oracle Database is desupported.
- Desupport of Direct File System Placement for OCR and Voting Files
  Placing OCR and Voting Disk files on shared file systems is desupported in favor of placing the files on Oracle ASM.
- Desupport of JPublisher
  All Oracle JPublisher features are desupported and unavailable in Oracle Database 12*c* Release 2 (12.2.0.1).
- Desupport of preupgrd.sql and utluppkg.sql
  The `preupgrd.sql` and `utluppkg.sql` scripts are replaced by the Preupgrade Information Tool (`preupgrade.jar`).
- Desupported Oracle Data Provider for .NET APIs for Transaction Guard
  Application programming interfaces (APIs) for Transaction Guard listed here are desupported in Oracle Database 12*c* release 2 (12.2).
- Desupported Views in Oracle Database 12c Release 2 (12.2)
  The views listed in this topic are desupported in Oracle Database 12*c* release 2 (12.2).
- SQLJ Support Inside Oracle Database
  Starting with Oracle Database 12*c* release 2 (12.2), Oracle does not support running server-side SQLJ code.
- Desupport of Some XML DB Features
  Starting in Oracle Database 12*c* release 2 (12.2), the XML DB features listed here are desupported.

Desupport of Advanced Replication

Starting in Oracle Database 12*c* release 2 (12.2), the Advanced Replication feature of Oracle Database is desupported.

The Oracle Database Advanced Replication feature is desupported in its entirety. The desupport of this feature includes all functionality associated with this feature: multimaster replication, updateable materialized views, hierarchical materialized views, and deployment templates. Read-only materialized views are still supported with basic replication.

Oracle recommends that you replace your use of Advanced Replication with Oracle GoldenGate.

Desupport of Direct File System Placement for OCR and Voting Files

Placing OCR and Voting Disk files on shared file systems is desupported in favor of placing the files on Oracle ASM.

Starting with Oracle Grid Infrastructure 12c Release 2 (12.2), the placement of Oracle Clusterware files: the Oracle Cluster Registry (OCR), and the Voting Files, directly on a shared file system is desupported in favor of having Oracle Clusterware files managed by Oracle Automatic Storage Management (Oracle ASM). You cannot place Oracle Clusterware files directly on a shared file system. If you need to use a supported shared file system, either a Network File System, or a shared cluster file system instead of native disks devices, then you must create Oracle ASM disks on supported network file systems that you plan to use for hosting Oracle Clusterware files before installing Oracle Grid Infrastructure. You can then use the Oracle ASM disks in an Oracle ASM disk group to manage Oracle Clusterware files.

If your Oracle Database files are stored on a shared file system, then you can continue to use the same for database files, instead of moving them to Oracle ASM storage.

Desupport of JPublisher

All Oracle JPublisher features are desupported and unavailable in Oracle Database 12*c* Release 2 (12.2.0.1).

Oracle recommends that you use the following alternatives:

- To continue to use Web service callouts, Oracle recommends that you use the Oracle JVM Web Services Callout utility, which is a replacement for the Web Services Callout utility.
- To replace other JPublisher automation capabilities, including mapping user-defined SQL types or SQL types, wrapping PL/SQL packages and similar capabilities, Oracle recommends that developers use explicit steps, such as precompiling code with SQLJ precompiler, building Java STRUCT classes, or using other prestructured options.

Related Topics

- https://support.oracle.com/rs?type=doc&id=1937939.1

> **See Also:**
>
> My Oracle Support Note 1937939.1 for more information about JDeveloper deprecation and desupport

Desupport of preupgrd.sql and utluppkg.sql

The `preupgrd.sql` and `utluppkg.sql` scripts are replaced by the Preupgrade Information Tool (`preupgrade.jar`).

Beginning with Oracle Database 12*c* release 2 (12.2), the Pre-Upgrade Information Tool scripts `preupgrd.sql` and `utluppkg.sql` are no longer supplied as part of the Oracle Database release. The Pre-Upgrade Information Tool `preupgrade.jar` replaces both of these files.

The `preupgrade.jar` Pre-Upgrade Information Tool is supplied with Oracle Database 12*c* release 2 (12.2). This script has the same capabilities as the scripts it replaces. It can run using the Java Development Kits (JDKs) installed with Oracle Database releases supported for direct upgrade to Oracle Database 12*c* release 2 (12.2).

Desupported Oracle Data Provider for .NET APIs for Transaction Guard

Application programming interfaces (APIs) for Transaction Guard listed here are desupported in Oracle Database 12*c* release 2 (12.2).

The following Oracle Data Provider for .NET application programming interfaces for Transaction Guard are desupported in Oracle Database 12*c* Release 2 (12.2):

- `OracleLogicalTransactionStatus` class
- `OracleConnection.GetLogicalTransactionStatus` method
- `OracleConnection.LogicalTransactionId` property
- `OracleConnection.OracleLogicalTransaction` property
- `OracleLogicalTransaction.DataSource` property
- `OracleLogicalTransaction.GetOutcome()` method
- `OracleLogicalTransaction.GetOutcome(string, string, string)` method
- `OracleLogicalTransaction.UserId` property

Desupported Views in Oracle Database 12c Release 2 (12.2)

The views listed in this topic are desupported in Oracle Database 12*c* release 2 (12.2).

Revise any of your SQL statements that use these views.

DBA_REGISTERED_MVIEW_GROUPS View

V$REPLPROP View

V$REPLQUEUE View

SQLJ Support Inside Oracle Database

Starting with Oracle Database 12*c* release 2 (12.2), Oracle does not support running server-side SQLJ code.

Oracle supports using client-side SQLJ. However, Oracle does not support the use of server-side SQLJ, including running stored procedures, functions, and triggers in the database environment.

Desupport of Some XML DB Features

Starting in Oracle Database 12*c* release 2 (12.2), the XML DB features listed here are desupported.

The following features are desupported:

- Java classes in package `oracle.xdb.dom`
- Oracle XPath function `ora:instanceof`. Use XQuery operator `instance of` instead.
- Oracle XPath function `ora:instanceof-only`. Use XML Schema attribute `xsi:type` instead.
- Function-based indexes on XMLType. Use XMLIndex with a structured component instead.
- Oracle XQuery function `ora:view`. Use XQuery functions `fn:collection` instead.
- PL/SQL procedure `DBMS_XDB_ADMIN.CreateRepositoryXMLIndex`
- PL/SQL procedure `DBMS_XDB_ADMIN.XMLIndexAddPath`
- PL/SQL procedure `DBMS_XDB_ADMIN.XMLIndexRemovePath`
- PL/SQL procedure `DBMS_XDB_ADMIN.DropRepositoryXMLIndex`
- XML schema annotation (attribute) `csx:encodingType`
- XMLIndex index on CLOB portions of hybrid XMLType storage (index on CLOB data that is embedded within object-relational storage)

Database Upgrade Assistant (DBUA) Enhancements and Changes

Oracle Database 12*c* release 2 (12.2) includes several enhancements to DBUA, and some features have been removed or modified.

In response to customer requests, and to improve functionality, Database Upgrade Assistant (DBUA) includes new features and code enhancements. Also, some features in previous releases have been removed.

DBUA New Features

DBUA includes the following new features for Oracle Database 12*c* release 2 (12.2):

- Selective PDB Plug-In Upgrades: You can plug in a PDB created in a previous release into a release 12.2 multitenant architecture CDB environment, and upgrade the PDB using DBUA started from the release 12.2 CDB home

  You can unplug PDBs from a CDB, upgrade the CDB and any PDBs plugged in to the CDB, and then plug in earlier release PDBs and upgrade them using DBCA.
- Priority-Based PDB Upgrades: You can set priority for PDB upgrades, so that higher priority PDBs are upgraded first.
- Retry and Ignore Functionality: You can fix errors and retry upgrades, or select to ignore certain errors and continue upgrades.

- Pause and Continue Functionality: You can stop the upgrade, and continue the upgrade at a later time.
- Standalone Prerequisite Checks: You can run DBUA with the new `-executePrereqs` option to check prerequisites for upgrades at any time.
- Listener Configuration During Database Moves: You can configure the database with a new listener during a database move operation.
- Improved Logging Mechanism: DBUA now has time-stamped logs.
- Performance Enhancements: DBUA includes code enhancements that reduce the number of instance restarts during the upgrade process.
- Enhanced Error Reporting: All DBUA errors are reported using the error code prefix `DBT`, and all errors are reported as a list on a progress page, instead of being presented in message windows.

DBUA Removed Features

The following DBUA features available in previous releases are removed in Oracle Database 12*c* release 2 (12.2):

- Data Files Move: Data files can no longer be moved during upgrades.
- Database Renames During Upgrades: It is no longer supported to rename Oracle Database names during the upgrade.
- Degree of Parallelism Selection Removed from DBUA: The default parallelism is calculated depending on the use case.
  - Upgrade: The default parallelism using DBUA is the same value used by the Parallel Upgrade Utility for manual upgrades. However, in an upgrade operation, you can override the default by specifying the number of cores that you want to use.
  - Recompile: The default parallelism for object recompilation is determined by the `utlrp` script used in manual upgrade.
- Recompile parallelism is the same value as the upgrade parallelism by default.
- Changing Diagnostic and Audit Dest No Longer Available: You can only change the Diagnostic and Audit destination by using the DBUA command-line option `-initParam`.
- Remote DBUA Desupported: In previous releases, DBUA had an option on Windows platforms for supporting Oracle Database remote upgrades. This feature is desupported.

Enhancements to Oracle Data Guard Broker and Rolling Upgrades

Starting with Oracle Database 12*c* release 2 (12.2), Oracle Data Guard Broker has more features to assist rolling upgrades.

Oracle Data Guard Broker now supports Oracle Active Data Guard rolling upgrade. Oracle Active Data Guard rolling upgrade was introduced in Oracle Database 12*c* release 1 (12.1). It simplifies the execution of the transient logical database rolling upgrade process by automating many manual steps in a simple PL/SQL package (DBMS_ROLLING). In addition to making database rolling upgrades simpler, the automated process is much more reliable. Oracle Data Guard broker can now direct Oracle Active Data Guard rolling upgrades from the DGMGRL command-line interface.

Broker support also adds substantial simplification to the rolling upgrade process by transparently handling redo transport destination settings and other tasks.

In Oracle Database 12*c* release 2 (12.2) and later releases, when you perform a rolling upgrade using the DBMS_ROLLING PL/SQL package, you no longer have to disable the broker. In addition, the broker now reports when a rolling upgrade is in place, and tracks its status. The status information is displayed in the output of the DGMGRL commands SHOW CONFIGURATION and SHOW DATABASE.

Using Oracle Data Guard Broker to manage database rolling upgrades can simplify the upgrade process by minimizing your downtime and risk when introducing change to production environments.

Related Topics

- *Oracle Data Guard Broker*

About Changes in Default SGA Permissions for Oracle Database

Starting with Oracle Database 12*c* Release 2 (12.2.0.1), by default, permissions to read and write to the System Global Area (SGA) are limited to the Oracle software installation owner.

In previous releases, both the Oracle installation owner account and members of the OSDBA group had access to shared memory. The change in Oracle Database 12*c* Release 2 (12.2) and later releases to restrict access by default to the Oracle installation owner account provides greater security than previous configurations. However, this change may prevent DBAs who do not have access to the Oracle installation owner account from administering the database.

The Oracle Database initialization parameter `ALLOW_GROUP_ACCESS_TO_SGA` determines if the Oracle Database installation owner account (`oracle` in Oracle documentation examples) is the only user that can read and write to the database System Global Area (SGA), or if members of the OSDBA group can read the SGA. In Oracle Database 12*c* Release 2 (12.2) and later releases, the default value for this parameter is FALSE, so that only the Oracle Database installation owner has read and write permissions to the SGA. Group access to the SGA is removed by default. This change affects all Linux and UNIX platforms.

If members of the OSDBA group require read access to the SGA, then you can change the initialization parameter `ALLOW_GROUP_ACCESS_TO_SGA` setting from FALSE to TRUE. Oracle strongly recommends that you accept the default permissions that limit access to the SGA to the oracle user account.

Related Topics

- *Oracle Database Reference*

Network Access Control Lists and Upgrade to Oracle Database 12*c*

Network access control lists (ACLs) are implemented as Real Application Security ACLs in 12*c*, and existing ACLs are migrated from XML DB ACLs and renamed during upgrade.

During Oracle Database upgrades to 12*c* release 1 (12.1) and later releases, network access control in Oracle Database is implemented using Real Application Security access control lists (ACLs). Existing ACLs in XDB are migrated during upgrade. Existing APIs in the `DBMS_NETWORK_ACL_ADMIN` PL/SQL package and catalog views are

deprecated. These deprecated views are replaced with new equivalents in Oracle Database 12*c*.

Starting with Oracle Database 12*c* release 1 (12.1), you can grant network privileges by appending an access control entry (ACE) to a host ACL using `DBMS_NETWORK_ACL_ADMIN.APPEND_HOST_ACE`. If you append an ACE to a host that has no existing host ACL, then a new host ACL is created implicitly. If the host ACL exists, then the ACEs are appended to the existing ACL.

How Changing to Real Application Security ACLS Affects You

During upgrades, the following changes are made:

- Existing network ACLs are migrated from Oracle Database 11*g* XML DB to Oracle Database 12*c* Real Application Security. All privileges of the existing ACLs are preserved during this migration.
- Existing ACLs are renamed.

What You Need To Do Before Upgrades

- Check for existing Network ACLs before the upgrade.
- Preserve existing network ACLs and privileges (`DBA_NETWORK_ACLS` and `DBA_NETWORK_ACL_PRIVILEGES`) in an intermediate staging table. Preserving the existing privileges in a table enables you to restore them if the automatic migration fails, or if you want to roll back an upgrade.

Related Topics

- *Oracle Database Security Guide*
- *Oracle Database Reference*

Parallel Upgrade Utility Batch Scripts

In Oracle Database 12*c* release 2, you can run the Parallel Upgrade Utility using command-line batch scripts.`catupgrd.sql` is no longer distributed.

Starting in Oracle Database 12*c* release 2 (12.2), you can run the Parallel Upgrade Utility (`catctl.pl`) from the command line by entering the shell commands `dbupgrade` for Linux and UNIX, and `dbupgrade.com` for Windows. These shell scripts call the `catctl.pl` script from the upgrade binary home. You can either run these scripts with default values, or you can run them with the same input parameters that you use to run `catctl.pl` from the Perl prompt.

Related Topics

- About the Parallel Upgrade Utility for Oracle Database (CATCTL.PL and DBUPGRADE)

Unified Auditing AUDIT_ADMIN and AUDIT_VIEWER Roles Changes

You may need to rename or drop `AUDIT_ADMIN` and `AUDIT_VIEWER` roles before upgrading.

In Oracle Database 12*c*, if you use Unified Auditing, then two AUDSYS roles may exist in your Oracle Database 11*g* release 2 (11.2.0.4) and earlier releases that affect upgrading: `AUDIT_ADMIN` and `AUDIT_VIEWER`. Because of changes in these roles, you must

drop these earlier release users or user roles before you can upgrade to Oracle Database 12*c* release 1 (12.1) or later.

If you have created `AUDIT_ADMIN` and `AUDIT_VIEWER` users or roles with Oracle Database 12*c* release 1 (12.1), then you do not need to drop these users or roles.

Only drop the AUDSYS schema and the AUDIT_ADMIN and AUDIT_VIEWER roles if both of the following conditions are true:

- The version from which you are upgrading is earlier than Oracle Database 12*c* release 1 (12.1)
- You have created a custom schema with the name AUDSYS

If you are affected by this requirement, and you cannot drop these AUDSYS roles, then select the `UNIFIED_AUDIT_TRAIL` view, create your own table, using similar definitions, and use this table to take a backup of the Unified Audit data. Oracle recommends that you carry out this procedure also if you may want to downgrade to your earlier release database.

The Pre-Upgrade Information Tool and DBUA perform a pre-upgrade check to make sure these users or roles do not exist in the database. Oracle recommends that you do not use these names in your databases. If these users or roles exist, then you should rename or drop them as appropriate before upgrading to Oracle Database 12*c*.

Oracle Update Batching Batch Size Settings Disabled

Oracle update batching settings are disabled in Oracle Database 12c release 2 (12.2). Use JDBC batching instead.

Oracle update batching was deprecated in Oracle Database 12*c* Release 1 (12.1). Starting in Oracle Database 12*c* Release 2 (12.2), Oracle update batching is a no operation code (no-op). This means that if you implement Oracle update batching in your application using the Oracle Database 12*c* Release 2 (12.2) JDBC driver, then the specified batch size is not set, and results in a batch size of 1. With this batch setting, your application processes one row at a time. Oracle strongly recommends that you use the standard JDBC batching if you are using the Oracle Database 12*c* Release 2 (12.2) JDBC driver.

About Upgrading Tables Dependent on Oracle-Maintained Types

Starting with Oracle Database 12*c* release 2 (12.2), you can run the Parallel Upgrade Utility with the `-T` option to set tables to READ ONLY.

When you run the Parallel Upgrade Utility with the `-T` option, any tablespaces that do not contain Oracle Maintained objects are set to READ ONLY. Setting these tables to READ ONLY can reduce the amount of data that you need to back up before upgrading the database.

If your database has user tables that depend on Oracle Maintained types (for example, AQ queue tables), then you must upgrade these tables manually after upgrade.

After the upgrade is complete, to upgrade tables dependent on Oracle-Maintained types, run the script `utluptabdata.sql` to carry out ALTER TABLE UPGRADE commands on tables in tablespaces set to READ ONLY during the upgrade.

Starting with Oracle Database 12*c* release 2, the ALTER TYPE statement behavior is also changed. If a dependent table is in an accessible tablespace, then it is automatically upgraded to the new version of the type. If the dependent table is in a READ ONLY tablespace, then it is not automatically upgraded. Run the `utluptabdata.sql` script to upgrade those tables set to READ ONLY tablespace states during the upgrade. You only need to run the `utluptabdata.sql` script when you run the Parallel Upgrade Utility with the `-T` option to run the upgrade.

> **Note:**
>
> When tablespaces are set to `READ ONLY`, this setting prevents updates on all tables in the tablespace, regardless of a user's update privilege level. For example, users connecting as SYSDBA are prevented from changing their application data.

Related Topics

- Upgrading Tables Dependent on Oracle-Maintained Types
- Running Upgrades with Read-Only and Offline Tablespaces

Case-Insensitive Passwords and ORA-1017 Invalid Username or Password

The Oracle Database 12*c* release 2 (12.2) default authentication protocol is `12` (Exclusive Mode). This protocol requires case-sensitive passwords for authentication. Review your options if you have earlier release password versions.

Starting with Oracle Database 12*c* release 2 (12.2), the default value for the SQLNET.ORA parameter ALLOWED_LOGON_VERSION_SERVER is changed to `12`. This parameter refers to the logon authentication protocol used for the server, not the Oracle Database release.

By default, Oracle no longer supports case-insensitive password-based authentication; only the new password versions (`11G` and `12C`) are allowed. The case-insensitive `10G` password version is no longer generated.

If the following conditions are true, then you may have accounts that are prevented from logging into the database after upgrading to 12.2:

- You are upgrading a server that has user accounts created in an earlier Oracle Database release.
- User accounts created in the earlier release use a case-insensitive password version from an earlier release authentication protocol, such as the `10G` password version.
- Earlier release user accounts have not reset passwords.
- The server has been configured with SEC_CASE_SENSITIVE_LOGON set to FALSE, so that it can only authenticate users who have a `10G` case-insensitive password version.

If you have accounts that require `10G` password versions, then to prevent accounts using that password version from being locked out of the database, you can change from an Exclusive Mode to a more permissive authentication protocol.

> **Note:**
>
> Oracle does not support case-insensitive password-based authentication while running in an Exclusive Mode. The default authentication protocol in Oracle Database 12*c* release 2 (12.2) is an Exclusive Mode. Oracle only supports case-insensitive authentication with the following conditions:
>
> - The server is running in a mode other than an Exclusive Mode
> - The `10G` password version is present

Option for Servers with Accounts Using Only 10G Password Version

After you upgrade to Oracle Database 12*c* release 2 (12.2), complete the following procedure to enable accounts using the `10G` password version:

1. Log in as an administrator.
2. Edit the SQLNET.ORA file to change the SQLNET.ALLOWED_LOGON_VERSION_SERVER setting from the default, `12`, to `11` or lower. For example:

   ```
   SQLNET.ALLOWED_LOGON_VERSION_SERVER=11
   ```

After you change to a more permissive SQLNET.ALLOWED_LOGON_VERSION_SERVER setting, expire users' passwords to require them to change their passwords. For detailed information, refer to *Oracle Database Security Guide*.

Related Topics

- *Oracle Database Security Guide*
- *Oracle Database Net Services Reference*

About Deploying Oracle Grid Infrastructure Using Rapid Home Provisioning and Maintenance

Rapid Home Provisioning and Maintenance (RHP) is a software lifecycle management method for provisioning and maintaining Oracle homes. RHP enables mass deployment and maintenance of standard operating environments for databases, clusters, and user-defined software types.

Rapid Home Provisioning and Maintenance enables you to install clusters, and provision, patch, scale, and upgrade Oracle Grid Infrastructure, Oracle Restart, and Oracle Database homes. The supported versions are 11.2, 12.1, 12.2, and 18c. You can also provision applications and middleware using Rapid Home Provisioning.

Rapid Home Provisioning and Maintenance is a service in Oracle Grid Infrastructure that you can use in either of the following modes:

- Central Rapid Home Provisioning Server

The Rapid Home Provisioning Server stores and manages standardized images, called gold images. Gold images can be deployed to any number of nodes across the data center. You can create new clusters and databases on the deployed homes and can use them to patch, upgrade, and scale existing installations.

The Rapid Home Provisioning Server can manage the following types of installations:

- Software homes on the cluster hosting the Rapid Home Provisioning Server itself.
- Rapid Home Provisioning Clients running Oracle Grid Infrastructure 12*c* Release 2 (12.2) and 18c.
- Installations running Oracle Grid Infrastructure 11*g* Release 2 (11.2) and 12*c* Release 1 (12.1).
- Installations running without Oracle Grid Infrastructure.

The Rapid Home Provisioning Server can provision new installations and can manage existing installations without requiring any changes to the existing installations. The Rapid Home Provisioning Server can automatically share gold images among peer servers to support enterprises with geographically distributed data centers.

- Rapid Home Provisioning Client

  The Rapid Home Provisioning Client can be managed from the Rapid Home Provisioning Server, or directly by executing commands on the client itself. The Rapid Home Provisioning Client is a service built into the Oracle Grid Infrastructure and is available in Oracle Grid Infrastructure 12*c* Release 2 (12.2) and later releases. The Rapid Home Provisioning Client can retrieve gold images from the Rapid Home Provisioning Server, upload new images based on the policy, and apply maintenance operations to itself.

Rapid Home Provisioning and Maintenance

Deploying Oracle software using Rapid Home Provisioning has the following advantages:

- Ensures standardization and enables high degrees of automation with gold images and managed lineage of deployed software.
- Minimizes downtime by deploying new homes as images (called gold images) out-of-place, without disrupting active databases or clusters.
- Simplifies maintenance by providing automatons which are invoked with a simple, consistent API across database versions and deployment models.
- Reduces maintenance risk with built-in validations and a “dry run” mode to test the operations.
- Enables you to resume or restart the commands in the event of an unforeseen issue, reducing the risk of maintenance operations.
- Minimizes and often eliminates the impact of patching and upgrades, with features that include:
  - Zero-downtime database upgrade with fully automated upgrade, executed entirely within the deployment without requiring any extra nodes or external storage.

  - Adaptive management of database sessions and OJVM during rolling patching.
  - Options for management of consolidated deployments.
- The deployment and maintenance operations enable customizations to include environment-specific actions into the automated workflow.

Restrictions Using Zero Data Loss Recovery Appliance Release 12.1 Backups

Zero Data Loss Recovery Appliance release 12.1 does not support backups from protected database clients using Oracle Database 12*c* release 2 (12.2).

Zero Data Loss Recovery Appliance release 12.2 (Recovery Appliance) does support backups from protected release 12.2 database clients.

If you back up your database to Recovery Appliance, then Oracle recommends that you do not not upgrade your database to release 12.2 until your Recovery Appliance is upgraded to release 12.2.

Behavior Changes in Oracle Database 12*c* Release 1 (12.1)

Review for descriptions of Oracle Database 12*c* release 1 (12.1) changes.

Review these sections to find out about behavior changes in Oracle Database 12*c* release 1 (12.1), and to obtain information about actions that you can take to prevent problems resulting from these changes.

- Oracle Database Changes
  Review these topics to understand changes introduced in Oracle Database 12*c* release 1 (12.1) that affect Oracle Database operations.
- Oracle Database Security Changes
  Oracle Database 12*c* includes changes to security features in Oracle Database Vault and Oracle Data Guard and other areas.
- Oracle Globalization Support Deprecated or Desupported Features
  Oracle Database 12*c* provides changes to how Oracle supports globalization.
- Oracle Multimedia Deprecated or Desupported Features
  In Oracle Database 12*c*, ORDImage support for Oracle Multimedia DICOM is deprecated.
- Oracle Net Services Deprecated or Desupported Features
  Oracle Net Services has deprecated or no longer supports the features, parameters, and commands listed here.
- Oracle Text Deprecated and Desupported Features
  Three text indexes are desupported for Oracle Text starting with Oracle Database 12*c*.
- Oracle XML Database Changes
  Oracle XML Database is now installed with Oracle Database. It also has changed features in Oracle Database 12*c*.

Oracle Database Changes

Review these topics to understand changes introduced in Oracle Database 12*c* release 1 (12.1) that affect Oracle Database operations.

- Deprecation of Non-CDB Architecture
  The non-CDB architecture is deprecated in Oracle Database 12*c*, and may be desupported and unavailable in a release after Oracle Database 12*c* Release 2.
- Deprecation of catupgrd.sql Script and Introduction of Parallel Upgrade Utility
  In Oracle Database 12c release 1 (12.1), Oracle recommends that you use the Parallel Upgrade Utility (`catctl.pl`instead of `catupgrd.sql` to enable parallel upgrades.
- Error Associated with catupgrd.sql Run Without PARALLEL=NO
  If you choose to run the `catupgrd.sql` script instead of running `catctl.pl`), then you now must provide information for an additional input parameter, PARALLEL.
- Desupport of Oracle Enterprise Manager Database Control
  Starting with Oracle Database 12*c*, Oracle Enterprise Manager Database Control is desupported and is no longer available.
- Changes for Deinstallation and Cleanup of Oracle Base
  Review these topics to understand deinstallation and Oracle Base cleanup script changes.
- Identifying and Dropping Deprecated and Desupported Parameters
  To locate deprecated parameters, you can use the `SELECT NAME FROM V$PARAMETER` query, and then drop those parameters with `ALTER SYSTEM RESET`.
- Deprecated Oracle Database Roles
  The following Oracle Database roles are deprecated in Oracle Database 12*c*:
- Deprecated Views
  Views listed here are deprecated in Oracle Database 12*c*.
- Deprecation of Oracle Streams
  Oracle Streams is deprecated in Oracle Database 12*c* and may be desupported and unavailable in a later Oracle Database release.
- Deprecation of Advanced Replication
  Oracle Database Advanced Replication is deprecated in Oracle Database 12*c*.
- Deprecation of Single-Character SRVCTL CLI Options
  Starting with Oracle Database 12*c*, single-character options are deprecated and may be desupported in a later release.
- Desupported Features on Microsoft Windows Platforms
  Review these topics to learn which features are deprecated or desupported with Oracle Database 12*c* for Microsoft Windows.
- Desupport of Oracle Cluster File System (OCFS) on Windows
  Starting with Oracle Database 12*c*, Oracle Cluster File System (OCFS) is desupported on Windows. Support and distribution of OCFS on Linux (OCFS and OCFS2) remains unaffected by this desupport notice.
- Desupport for Raw Storage Devices
  Starting with Oracle Database 12*c* release 1 (12.1), block file storage on raw devices is not supported.

- About Upgrading Oracle Database Release 10.2 or 11.1 and OCFS and RAW Devices
  If you are upgrading an Oracle Database release 10.2.0.5 or release 11.1.0.7 environment that stores Oracle Clusterware files on OCFS on Windows or RAW devices, then you cannot directly upgrade to Oracle Database 12*c* release 1 (12.1).
- Desupport of cluvfy comp cfs for OCFS
  The `cluvfy comp cfs` component verification command option is removed from Oracle Database 12c release 1 (12.1).
- Deprecation of Stored List of Administrative Users for Cluster Administration
  Cluster administration is managed differently starting with Oracle Database 12*c*.
- Deprecation of -checkpasswd for QOSCTL Quality of Service (QoS) Command
  The syntax `qosctl -checkpasswd username password` is deprecated.
- Change to VARCHAR2, NVARCHAR2, and RAW Datatypes
  You can increase the MAX_STRING_SIZE value for these datatypes to 32767 bytes in Oracle Database 12*c* release 1 (12.1) and later releases.
- Oracle JDBC and SQLJ Deprecated and Desupported Features
  This is a list of features for JDBC, UCP, SQLJ, JPublisher, and Java in the Database (Oracle JVM) that are deprecated or desupported with Oracle Database 12*c*. The JDBC Javadoc also contains a page for all the deprecated APIs.
- Deprecated Features for Oracle Call Interface
  Oracle Call Interface (OCI) features listed here are deprecated in Oracle Database 12*c*, and may be desupported in a future release
- Changed Default for RESOURCE_LIMIT Parameter
  RESOURCE_LIMIT is set to TRUE by default.

Deprecation of Non-CDB Architecture

The non-CDB architecture is deprecated in Oracle Database 12*c*, and may be desupported and unavailable in a release after Oracle Database 12*c* Release 2.

Oracle recommends use of the CDB architecture.

> **Note:**
>
> There remain a small number of features that do not work with the CDB architecture (see README, section 2.2.1 "Features Restricted or Not Available for a Multitenant Container Database"). If you need these features, then continue to use the non-CDB architecture until your required feature works with the CDB architecture.

Deprecation of catupgrd.sql Script and Introduction of Parallel Upgrade Utility

In Oracle Database 12c release 1 (12.1), Oracle recommends that you use the Parallel Upgrade Utility (`catctl.pl`instead of `catupgrd.sql` to enable parallel upgrades.

Oracle Database 12*c* release 1 (12.1) introduces the new Parallel Upgrade Utility, `catctl.pl`. This utility replaces the `catupgrd.sql` script that was used in earlier releases. Although you can still use the `catupgrd.sql` script, it is deprecated starting

with Oracle Database 12*c*. It will be removed in future releases. Oracle recommends that you perform database upgrades by using the new Parallel Upgrade Utility.

Error Associated with catupgrd.sql Run Without PARALLEL=NO

If you choose to run the `catupgrd.sql` script instead of running `catctl.pl`), then you now must provide information for an additional input parameter, PARALLEL.

For example:

```
SQL> catupgrd.sql PARALLEL=NO
```

If you run `catupgrd.sql` without the parameter, then Oracle displays the following error message:

```
NOTE

The catupgrd.sql script is being deprecated in the 12.1 release of
Oracle Database. Customers are encouraged to use catctl.pl as
the replacement for catupgrd.sql when upgrading the database dictionary.

                cd $ORACLE_HOME/rdbms/admin
                $ORACLE_HOME/perl/bin/perl catctl.pl -n 4 catupgrd.sql

Refer to the Oracle Database Upgrade Guide for more information.

This database upgrade procedure must be called with the following
argument when invoking from the SQL prompt:

                @catupgrd.sql PARALLEL=NO
```

Desupport of Oracle Enterprise Manager Database Control

Starting with Oracle Database 12*c*, Oracle Enterprise Manager Database Control is desupported and is no longer available.

Oracle introduces Oracle Enterprise Manager Database Express (Oracle EM Express) as a replacement. Oracle EM Express is installed when you upgrade to Oracle Database 12*c*.

You can carry out a manual configuration of the HTTP port for Oracle EM Express:

1. Look in the `init.ora/spfile` (default setting) for the following string:

   ```
   dispatchers=(PROTOCOL=TCP)(SERVICE=sample XDB)
   ```

   Check the Oracle EM Express port configuration:

   ```
   SQL> select DBMS_XDB_CONFIG.getHTTPport() from dual;
   SQL> select DBMS_XDB_CONFIG.getHTTPSport() from dual;
   ```

2. Set new ports. For example:

   ```
   SQL> exec DBMS_XDB_CONFIG.setHTTPport(5500);
   SQL> exec DBMS_XDB_CONFIG.setHTTPSport(8080);
   ```

3. Access the Oracle EM Express home page in the browser. For example, using the settings you have provided, check the following path, where *`database`* is your SID, *`hostname`* is your fully qualified domain name, and *`port`* is the port you assigned:

   `http://database-hostname:port/em`

For example:

```
http://localhost:5500/em
```

4. Repeat this configuration step for the CDB, and for every PDB, using different port numbers.

Changes for Deinstallation and Cleanup of Oracle Base

Review these topics to understand deinstallation and Oracle Base cleanup script changes.

- Change for Standalone Deinstallation Tool
  Starting with Oracle Database 12*c*, the deinstallation standalone utility is replaced with a deinstall option using Oracle Universal Installer (OUI).
- Desupport of CLEANUP_ORACLE_BASE Property
  In Oracle Database 12*c*, the `CLEANUP_ORACLE_BASE` property is removed for response file (silent) deinstalls.
- Deprecation of -cleanupOBase
  The `-cleanupOBase` flag of the deinstallation tool is deprecated in Oracle Database 12c Release 1 (12.1).

Change for Standalone Deinstallation Tool

Starting with Oracle Database 12*c*, the deinstallation standalone utility is replaced with a deinstall option using Oracle Universal Installer (OUI).

You can also run the deinstallation tool from the base directory of the installation media for Oracle Database, Oracle Database Client, or Oracle Grid Infrastructure.

Run the deinstallation tool by using the `runInstaller` command on Linux and UNIX, or `setup.exe` on Windows, with the `-deinstall` and `-home` options.

Desupport of CLEANUP_ORACLE_BASE Property

In Oracle Database 12*c*, the `CLEANUP_ORACLE_BASE` property is removed for response file (silent) deinstalls.

It is no longer supported to use CLEANUP_ORACLE_BASE to remove an Oracle base during silent or response file mode deinstalls.

Deprecation of -cleanupOBase

The `-cleanupOBase` flag of the deinstallation tool is deprecated in Oracle Database 12c Release 1 (12.1).

Identifying and Dropping Deprecated and Desupported Parameters

To locate deprecated parameters, you can use the `SELECT NAME FROM V$PARAMETER` query, and then drop those parameters with `ALTER SYSTEM RESET`.

Parameters can be deprecated or desupported after Oracle Database upgrades. Obsolete parameters generate ORA-32004 errors.

You can use the `ALTER SYSTEM RESET` command to drop the setting of any initialization parameter in the SPFILE that was used to start the instance. The `SCOPE = SPFILE` clause is not required, but you can include it.

Identifying Deprecated Parameters

To obtain a current list of deprecated parameters, run the following query in SQL*Plus:

```
SQL> SELECT name from v$parameter
         WHERE isdeprecated = 'TRUE' ORDER BY name;
```

The query returns a list of the deprecated parameters as of the date and time that you run it.

Dropping Deprecated Parameters Example

This SQL*Plus command drops the deprecated parameter `O7_DICTIONARY_ACCESSIBILITY` from all instances on a server with an SPFILE on the next system startup:

```
SQL> ALTER SYSTEM RESET O7_DICTIONARY_ACCESSIBILITY SCOPE=SPFILE SID='*'
```

- SEC_CASE_SENSITIVE_LOGON Initialization Parameter Deprecated
  The `SEC_CASE_SENSITIVE_LOGON` initialization parameter is deprecated in Oracle Database 12*c* release 1 (12.1).
- FILE_MAPPING Initialization Parameter Deprecated
  The `FILE_MAPPING` initialization parameter is deprecated. It is still supported for backward compatibility.
- RDBMS_SERVER_DN Initialization Parameter Deprecated
  The initialization parameter `RDBMS_SERVER_DN` is deprecated in Oracle Database release 12.1.0.2.

Related Topics

- *Oracle Database SQL Language Reference*1

SEC_CASE_SENSITIVE_LOGON Initialization Parameter Deprecated

The `SEC_CASE_SENSITIVE_LOGON` initialization parameter is deprecated in Oracle Database 12*c* release 1 (12.1).

FILE_MAPPING Initialization Parameter Deprecated

The `FILE_MAPPING` initialization parameter is deprecated. It is still supported for backward compatibility.

RDBMS_SERVER_DN Initialization Parameter Deprecated

The initialization parameter `RDBMS_SERVER_DN` is deprecated in Oracle Database release 12.1.0.2.

Use `LDAP_DIRECTORY_ACCESS` instead of `RDBMS_SERVER_DN`.

Deprecated Oracle Database Roles

The following Oracle Database roles are deprecated in Oracle Database 12*c*:

- DELETE_CATALOG_ROLE Deprecated
  The `DELETE_CATALOG_ROLE` database role is deprecated in Oracle Database 12*c*.

DELETE_CATALOG_ROLE Deprecated

The `DELETE_CATALOG_ROLE` database role is deprecated in Oracle Database 12*c*.

Deprecated Views

Views listed here are deprecated in Oracle Database 12*c*.

The following views are deprecated:

- `ALL_SCHEDULER_CREDENTIALS` view. See *Oracle Database Reference* for more information.
- `DBA_NETWORK_ACL_PRIVILEGES` view. See *Oracle Database Reference* for more information.
- `DBA_NETWORK_ACLS` view. See *Oracle Database Reference* for more information.
- `DBA_SCHEDULER_CREDENTIALS` view. See *Oracle Database Reference* for more information.
- `USER_NETWORK_ACL_PRIVILEGES` view. See *Oracle Database Reference* for more information.
- `USER_SCHEDULER_CREDENTIALS` view. See *Oracle Database Reference* for more information.
- `V$OBJECT_USAGE` view. Use the `USER_OBJECT_USAGE` view instead. See *Oracle Database Reference* for more information.

Deprecation of Oracle Streams

Oracle Streams is deprecated in Oracle Database 12*c* and may be desupported and unavailable in a later Oracle Database release.

Use Oracle GoldenGate to replace all replication features of Oracle Streams.

> **Note:**
>
> Oracle Database Advanced Queuing is independent of Oracle Streams, and continues to be enhanced.

Deprecation of Advanced Replication

Oracle Database Advanced Replication is deprecated in Oracle Database 12*c*.

Read-only materialized views are still supported with basic replication.

Use Oracle GoldenGate to replace all features of Advanced Replication. This guidance includes multimaster replication, updateable materialized views, hierarchical materialized views, and deployment templates.

Deprecation of Single-Character SRVCTL CLI Options

Starting with Oracle Database 12*c*, single-character options are deprecated and may be desupported in a later release.

The Server Control Utility (SRVCTL) command line interface (CLI) supports long GNU-style options in addition to short CLI options used in earlier releases.

Desupported Features on Microsoft Windows Platforms

Review these topics to learn which features are deprecated or desupported with Oracle Database 12*c* for Microsoft Windows.

- Desupport of Oracle COM Automation on Windows
  Oracle Database 12*c* does not contain Oracle COM Automation.
- Desupport of Oracle Objects for OLE
  Oracle Database 12*c* does not contain Oracle Objects for OLE.
- Desupport of Oracle Counters for Windows Performance Monitor
  Oracle Database 12*c* does not contain Oracle Counters for Windows Performance Monitor.
- Programming Interface Deprecations for Oracle Data Provider for .NET
  Oracle Data Provider for .NET application programming interfaces for Transaction Guard listed here are deprecated in Oracle Database 12*c* (12.1.0.2), and may be desupported in a future release.

Desupport of Oracle COM Automation on Windows

Oracle Database 12*c* does not contain Oracle COM Automation.

This feature was deprecated in Oracle Database 11*g*, which is the last database release that contains the database component Oracle COM Automation. Oracle recommends that you migrate your Oracle COM applications to current technology, such as the .NET Framework.

Desupport of Oracle Objects for OLE

Oracle Database 12*c* does not contain Oracle Objects for OLE.

Oracle Objects for OLE is deprecated in Oracle Database 11*g*. You can migrate your code to the OLE DB data access standard and ActiveX Data Objects (ADO), or you can migrate your applications to .NET (or Java or another application architecture) and use another driver.

Desupport of Oracle Counters for Windows Performance Monitor

Oracle Database 12*c* does not contain Oracle Counters for Windows Performance Monitor.

Oracle Counters for Windows Performance Monitor was deprecated in Oracle Database 11*g*. The counters are not installed by default in earlier releases, and the counters only work on Windows. For monitoring, Oracle recommends that you use Oracle Enterprise Manager Cloud Control.

Programming Interface Deprecations for Oracle Data Provider for .NET

Oracle Data Provider for .NET application programming interfaces for Transaction Guard listed here are deprecated in Oracle Database 12*c* (12.1.0.2), and may be desupported in a future release.

- `OracleLogicalTransactionStatus` class
- `OracleConnection.LogicalTransactionId` property
- `OracleConnection.GetLogicalTransactionStatus` method

Desupport of Oracle Cluster File System (OCFS) on Windows

Starting with Oracle Database 12*c*, Oracle Cluster File System (OCFS) is desupported on Windows. Support and distribution of OCFS on Linux (OCFS and OCFS2) remains unaffected by this desupport notice.

Databases currently using OCFS on Windows to host either the Oracle cluster files (Oracle Cluster Registry and voting files) or database files or both need to have these files migrated off OCFS *before* upgrading to Oracle Database 12*c*.

Desupport for Raw Storage Devices

Starting with Oracle Database 12*c* release 1 (12.1), block file storage on raw devices is not supported.

You must migrate any data files stored on raw devices to Oracle ASM, to a cluster file system, or to a Network File System (NFS).

This desupport guideline also applies to OCR and voting disk files for Oracle Clusterware. You cannot store OCR or voting disk files on raw devices. Before you start the upgrade, you must move Oracle Clusterware files from raw devices to a supported storage option.

About Upgrading Oracle Database Release 10.2 or 11.1 and OCFS and RAW Devices

If you are upgrading an Oracle Database release 10.2.0.5 or release 11.1.0.7 environment that stores Oracle Clusterware files on OCFS on Windows or RAW devices, then you cannot directly upgrade to Oracle Database 12*c* release 1 (12.1).

You must first perform an interim upgrade to Oracle Database release 11.2, and then migrate Oracle Clusterware files to Oracle Automatic Storage Management (Oracle

ASM). Then you can upgrade from release 11.2 to Oracle Database 12*c* release 1 (12.1).

Desupport of cluvfy comp cfs for OCFS

The `cluvfy comp cfs` component verification command option is removed from Oracle Database 12c release 1 (12.1).

The Cluster Verification Utility (`cluvfy`) option `comp cfs` is removed in Oracle Database 12.1, because Oracle Cluster File System (OCFS) is no longer supported.

Deprecation of Stored List of Administrative Users for Cluster Administration

Cluster administration is managed differently starting with Oracle Database 12*c*.

Starting with Oracle Database 12*c*, the method of cluster administration using a stored list of administrative users is being replaced with more comprehensive management of administrative user roles by configuring the access control list of the policy set.

Deprecation of -checkpasswd for QOSCTL Quality of Service (QoS) Command

The syntax `qosctl -checkpasswd username password` is deprecated.

Change to VARCHAR2, NVARCHAR2, and RAW Datatypes

You can increase the MAX_STRING_SIZE value for these datatypes to `32767` bytes in Oracle Database 12*c* release 1 (12.1) and later releases.

Starting with Oracle Database 12*c* release 1 (12.1), you can increase the maximum size of the VARCHAR2, NVARCHAR2, and RAW datatypes to `32767` bytes. This size increase is possible if you set the `COMPATIBLE` initialization parameter to `12.0` or higher, and you set the `MAX_STRING_SIZE` initialization parameter to `EXTENDED`. This size increase is available for non-CDB Oracle Database instances, and for PDBs in multitenant architecture.

If you want to make this change, then you must run the `utl32k.sql` script in `UPGRADE` mode. After you run the script, you can set `MAX_STRING_SIZE` to `EXTENDED`.

> **Caution:**
>
> When you increase the COMPATIBLE initialization to 12.0 or higher, you cannot reverse this change.

Oracle JDBC and SQLJ Deprecated and Desupported Features

This is a list of features for JDBC, UCP, SQLJ, JPublisher, and Java in the Database (Oracle JVM) that are deprecated or desupported with Oracle Database 12*c*. The JDBC Javadoc also contains a page for all the deprecated APIs.

- Deprecation of SQLJ Inside the Server
  SQLJ usage inside the database server is deprecated in this release.
- Deprecated Oracle Update Batching
  Oracle Update Batching APIs are deprecated in Oracle Database 12*c*.
- Deprecated EndToEndMetrics-related APIs
  `EndToEndMetrics` -related APIs are deprecated in Oracle Database 12*c*. Use Universal Connection Pool instead.
- Deprecated Stored Outlines
  Stored outlines are deprecated in Oracle Database 12*c*.
- Deprecated Concrete Classes in oracle.sql Package
  The concrete classes in the `oracle.sql` package are deprecated in Oracle Database 12*c*.
- Deprecated defineColumnType Method
  The JDBC method `defineColumnType` is deprecated in Oracle Database 12*c* Release 1.
- Deprecated CONNECTION_PROPERTY_STREAM_CHUNK_SIZE Property
  The JDBC property CONNECTION_PROPERTY_STREAM_CHUNK_SIZE is deprecated in this release.
- Desupported Implicit Connection Caching
  Implicit Connection Caching is desupported in Oracle Database 12*c*.

Deprecation of SQLJ Inside the Server

SQLJ usage inside the database server is deprecated in this release.

The capability of translating and running SQLJ applications inside the database will not be available in later releases. SQLJ can only be used as a client tool to translate the applications that can connect to Oracle Database and run as a client. SQLJ cannot be used inside stored procedures, functions, or triggers.

Deprecated Oracle Update Batching

Oracle Update Batching APIs are deprecated in Oracle Database 12*c*.

The following APIs are deprecated and marked deprecated in the JDBC Javadoc:

- OraclePreparedStatement.setExecuteBatch()
- OraclePreparedStatement.getExecuteBatch()
- OracleCallableStatement.setExecuteBatch()

Use Standard Update Batching instead.

Deprecated EndToEndMetrics-related APIs

`EndToEndMetrics` -related APIs are deprecated in Oracle Database 12*c*. Use Universal Connection Pool instead.

The following APIs are deprecated and marked deprecated in the JDBC Javadoc:

- `getEndToEndMetrics`
- `getEndToEndECIDSequenceNumber`

- `setEndToEndMetrics`
- `setApplicationContext`
- `clearAllApplicationContext`

Deprecated Stored Outlines

Stored outlines are deprecated in Oracle Database 12*c*.

Use plan baselines instead.

Deprecated Concrete Classes in oracle.sql Package

The concrete classes in the `oracle.sql` package are deprecated in Oracle Database 12*c*.

These classes are replaced with new interfaces in the `oracle.jdbc` package.

Deprecated defineColumnType Method

The JDBC method `defineColumnType` is deprecated in Oracle Database 12*c* Release 1.

Deprecated CONNECTION_PROPERTY_STREAM_CHUNK_SIZE Property

The JDBC property CONNECTION_PROPERTY_STREAM_CHUNK_SIZE is deprecated in this release.

Desupported Implicit Connection Caching

Implicit Connection Caching is desupported in Oracle Database 12*c*.

Use Universal Connection Pool instead.

Deprecated Features for Oracle Call Interface

Oracle Call Interface (OCI) features listed here are deprecated in Oracle Database 12*c*, and may be desupported in a future release

- OCI deployment parameters in sqlnet.ora are deprecated. These include the following parameters:
  - OCI client result cache parameters: `OCI_RESULT_CACHE_MAX_SIZE`, `OCI_RESULT_CACHE_MAX_RSET_SIZE`, and `OCI_RESULT_CACHE_MAX_RSET_ROWS`

Changed Default for RESOURCE_LIMIT Parameter

RESOURCE_LIMIT is set to TRUE by default.

The Oracle Database `RESOURCE_LIMIT` parameter determines if resource limits are enforced in database profiles. In this release, the `RESOURCE_LIMIT` parameter is set to `TRUE` by default. If Oracle resource limits are disabled, then any defined profile limits are ignored. This behavior does not apply to password resources.

Check the resource_limit parameter setting by entering the following SQL*Plus command:

```
SQL> select value from v$parameter where name = 'resource_limit';
```

Oracle Database Security Changes

Oracle Database 12*c* includes changes to security features in Oracle Database Vault and Oracle Data Guard and other areas.

- Oracle Business Intelligence and Data Warehousing Changes
  Review this list of changes to business intelligence and data warehousing applications and features for Oracle Database 12*c*.
- Changes to Security Auditing Features
  The full set of auditing features are available automatically in Oracle Database 12*c* release 1 (12.1) and later releases.
- Deprecated Functions and Parameters in Oracle Label Security
  Nine Oracle Label Security features are deprecated in Oracle Database 12*c* release 1.
- Deprecated DBMS_NETWORK_ACL_ADMIN PL/SQL package Procedures
  `DBMS_NETWORK_ACL_ADMIN` PL/SQL package procedures listed here are deprecated in Oracle Database 12*c*.
- Deprecation of IGNORECASE and SEC_CASE_SENSITIVE_LOGON
  The `IGNORECASE` argument of `ORAPWD` and the `SEC_CASE_SENSITIVE_LOGON` system parameter are deprecated in Oracle Database 12*c*.
- Deprecation of SQLNET.ALLOWED_LOGON_VERSION Parameter
  The `SQLNET.ALLOWED_LOGON_VERSION` parameter is deprecated in Oracle Database 12*c*.
- Upgrading a System that Did Not Have SQLNET.ALLOWED_LOGON_VERSION Parameter Setting
  Review the parameter setting for `SQLNET.ALLOWED_LOGON_VERSION_SERVER` to determine its implications for security and client connections to the upgraded database.
- Deprecation of Windows NTS Authentication Using the NTLM Protocol
  Because of security vulnerabilities, NTLM is deprecated as of Oracle Database 12*c*.
- Deprecation of Public Key Infrastructure for Transparent Data Encryption
  Public Key Infrastructure (PKI) is deprecated for Transparent Data Encryption (TDE) in Oracle Database 12*c*.
- Desupported Cipher Suites for Secure Sockets Layer (SSL)
  Review this list of desupported cipher suites if you use Oracle Advanced Security.
- Desupport of Database Rules Manager (RUL) and Expression Filter (EXF)
  Starting with Oracle Database 12*c* release 1, the Expression Filter (EXF) and Database Rules Manager (RUL) features are desupported.
- Oracle Data Guard Broker Deprecated or Desupported Features
  Review these deprecations if you use Oracle Data Guard Broker.
- Oracle Data Pump Export Utility Deprecated or Desupported Features
  The `XML_CLOBS` option of the Oracle Data Pump Export `DATA_OPTIONS` parameter is deprecated.

- Oracle Database Vault Deprecated or Desupported Features
  Starting with Oracle Database 12*c*, the Oracle Database Vault features and rule sets listed here are deprecated or desupported.
- Oracle Database Semantic Technologies Deprecated or Desupported Features
  Features listed here are deprecated for Oracle Database Semantic Technologies in Oracle Database 12*c* (12.1):

Oracle Business Intelligence and Data Warehousing Changes

Review this list of changes to business intelligence and data warehousing applications and features for Oracle Database 12*c*.

- Oracle Warehouse Builder (OWB) Not Installed with Oracle Database
  Oracle Warehouse Builder must be installed separately.
- Desupport of Change Data Capture
  Oracle Change Data Capture is not included in Oracle Database 12*c* and is replaced with Oracle GoldenGate.
- Desupported Features in Oracle Data Mining
  These Oracle Data Mining features are desupported in Oracle Database 12*c*.
- Desupport of ABN Models for Oracle Data Mining Upgrades
  Starting with Oracle Database 12*c*, Oracle is desupporting the Data Mining Java API and the Adaptive Bayes Network (ABN) algorithm.
- Desupport of OLAP Catalog (AMD)
  Starting with Oracle Database 12*c*, the Common Warehouse Metamodel (CWM) standard is desupported for the OLAP catalog (AMD).

Oracle Warehouse Builder (OWB) Not Installed with Oracle Database

Oracle Warehouse Builder must be installed separately.

Starting with Oracle Database 12*c*, Oracle Warehouse Builder (OWB) is not installed as part of the software for Oracle Database. An installer for Oracle Warehouse Builder is available on Oracle Technology Network. OWB components that may exist from earlier releases are not upgraded as part of the Oracle Database upgrade process.

Desupport of Change Data Capture

Oracle Change Data Capture is not included in Oracle Database 12*c* and is replaced with Oracle GoldenGate.

Desupported Features in Oracle Data Mining

These Oracle Data Mining features are desupported in Oracle Database 12*c*.

- The Oracle Data Mining Java API is no longer available. The programmatic interfaces to Oracle Data Mining 12*c* consist of two PL/SQL packages, `DBMS_DATA_MINING` and `DBMS_DATA_MINING_TRANSFORM`, and a family of SQL language functions for scoring data.

> **See Also:**
>
> *Oracle Data Mining User's Guide* for information about the Data Mining PL/SQL packages

- The Adaptive Bayes Network (ABN) algorithm is no longer available. The Decision Tree algorithm replaces ABN in Oracle Data Mining 12*c*.

> **See Also:**
>
> *Oracle Data Mining Concepts* for information about the Decision Tree algorithm

Desupport of ABN Models for Oracle Data Mining Upgrades

Starting with Oracle Database 12*c*, Oracle is desupporting the Data Mining Java API and the Adaptive Bayes Network (ABN) algorithm.

Because Oracle is desupporting these features, you cannot upgrade models created by the Oracle Data Mining Java API from Oracle Database release 11*g* to Oracle Database 12*c*. All other models and metadata are upgraded automatically during the upgrade from Oracle Database 11*g* to Oracle Database 12*c*. ABN models can be upgraded, but you cannot use them in an Oracle Database 12*c* database. You must drop ABN models either before the upgrade or afterward. You can replace ABN models by building new classification models in the Oracle Database 12*c* database.

Desupport of OLAP Catalog (AMD)

Starting with Oracle Database 12*c*, the Common Warehouse Metamodel (CWM) standard is desupported for the OLAP catalog (AMD).

CWM standard support was deprecated in Oracle Database 11*g* Release 2 (11.2). If your existing database has CWM metadata in the OLAP catalog, and you upgrade to Oracle Database 12*c*, then the upgraded database has the AMD component. If the database you upgrade does not have the AMD component, then the upgraded Oracle Database 12*c* database also does not have the AMD component, because new installations for Oracle Database 12*c* do not include AMD. If your database has the AMD component, and you want to remove it, then run the `catnoamd.sql` script that is located in the path*`ORACLE_HOME`*`/olap/admin/catnoamd.sql`. You may run this script either before or after you complete your upgrade.

> **Note:**
>
> If the OLAP catalog exists in the database you are upgrading, you may see `AMD OLAP Catalog OPTION OFF` and invalid CWM OLAP objects. You can safely ignore the invalid OLAP objects as they are not needed.

Changes to Security Auditing Features

The full set of auditing features are available automatically in Oracle Database 12*c* release 1 (12.1) and later releases.

The auditing functionality is redesigned in Oracle Database 12*c*. When you create a new database with Oracle Database 12*c*, the full set of auditing enhancement features are automatically available. If you upgrade from an earlier release, then you are given the option of using some of the new audit features and the audit functionality from the release from which you upgraded. Oracle strongly recommends that you migrate to the full set of the latest audit features.

Deprecated Functions and Parameters in Oracle Label Security

Nine Oracle Label Security features are deprecated in Oracle Database 12*c* release 1.

The Oracle Label Security features listed here are deprecated in Oracle Database 12*c* release 1. They can be desupported in a future release. Oracle recommends that you use the alternative features listed here.

- LEAST_UBOUND. Use OLS_GREATEST_LBOUND instead.
- LUBD. Use OLS_GLBD instead.
- DOMINATES. Use OLS_DOMINATES instead.
- DOM. Use OLS_STRICTLY_DOMINATES instead.
- STRICTLY_DOMINATES. Use OLS_STRICTLY_DOMINATES instead.
- S_DOM. Use OLS_STRICTLY_DOMINATES instead.
- DOMINATED_BY. Use OLS_DOMINATED_BY instead.
- DOM_BY. Use OLS_DOMINATED_BY instead.
- STRICTLY_DOMINATED_BY. Use OLS_STRICTLY_DOMINATED_BY instead.
- S_DOM_BY. Use OLS_STRICTLY_DOMINATED_BY instead.

Deprecated DBMS_NETWORK_ACL_ADMIN PL/SQL package Procedures

`DBMS_NETWORK_ACL_ADMIN` PL/SQL package procedures listed here are deprecated in Oracle Database 12*c*.

- `CREATE_ACL`
- `ADD_PRIVILEGE`
- `DELETE_PRIVILEGE`
- `ASSIGN_ACL`
- `UNASSIGN_ACL`
- `DROP_ACL`
- `ASSIGN_WALLET_ACL`
- `UNASSIGN_WALLET_ACL`
- `CHECK_PRIVILEGE`

- `CHECK_PRIVILEGE_ACLID`

Deprecation of IGNORECASE and SEC_CASE_SENSITIVE_LOGON

The `IGNORECASE` argument of `ORAPWD` and the `SEC_CASE_SENSITIVE_LOGON` system parameter are deprecated in Oracle Database 12*c*.

By default, passwords in Oracle Database 12*c* are case-sensitive.

Deprecation of SQLNET.ALLOWED_LOGON_VERSION Parameter

The `SQLNET.ALLOWED_LOGON_VERSION` parameter is deprecated in Oracle Database 12*c*.

`SQLNET.ALLOWED_LOGON_VERSION` is replaced with two new Oracle Net Services parameters:

- `SQLNET.ALLOWED_LOGON_VERSION_SERVER`
- `SQLNET.ALLOWED_LOGON_VERSION_CLIENT`

Related Topics

- Upgrading a System that Did Not Have SQLNET.ALLOWED_LOGON_VERSION Parameter Setting
  Review the parameter setting for `SQLNET.ALLOWED_LOGON_VERSION_SERVER` to determine its implications for security and client connections to the upgraded database.
- Check for the SQLNET.ALLOWED_LOGON_VERSION Parameter Behavior
  Connections to Oracle Database from clients earlier than release 10*g* fail with the error `ORA-28040: No matching authentication protocol`.

> **See Also:**
>
> *Oracle Database Net Services Reference* for information about `SQLNET.ALLOWED_LOGON_VERSION_SERVER`
>
> *Oracle Database Net Services Reference* for information about `SQLNET.ALLOWED_LOGON_VERSION_CLIENT`
>
> *Oracle Database Security Guide* for information about this deprecation

Upgrading a System that Did Not Have SQLNET.ALLOWED_LOGON_VERSION Parameter Setting

Review the parameter setting for `SQLNET.ALLOWED_LOGON_VERSION_SERVER` to determine its implications for security and client connections to the upgraded database.

If you are upgrading a system that did not have a `SQLNET.ALLOWED_LOGON_VERSION` parameter setting (that is, it was using the default SQLNet setting `8`), then the new default value for the login verifier is set to `11`,

which sets the 11g password verifier (`11G`) in Oracle Database 18c. This value permits Oracle Database 10*g*, 11*g*, and 12*c* clients to connect to the database, as well as Oracle Database 18c clients.

If you do not provide a parameter setting for `SQLNET.ALLOWED_LOGON_VERSION_SERVER` (or the deprecated `SQLNET.ALLOWED_LOGON_VERSION`) in the upgraded Oracle Database 18c server, then the new Oracle Database 18c default is `11`. This value enables connections from clients using releases earlier than Oracle Database release 11.2.0.3 that have not applied critical patch update CPU Oct 2012, or later patches, and that must use the 10*g* verifier (`10G`) to connect.

The higher the setting, the more restrictive the use of verifiers. A setting of `8` permits the most verifiers. For example, the `10G`, `11G`, and `12C` verifiers are all permitted with this setting. A setting of `12a` only permits the 12C verifier. For greater security, consider setting `SQLNET.ALLOWED_LOGON_VERSION_SERVER` to 12a. A setting of 12 permits both the 11G and 12C verifier to be used for authentication.

Deprecation of Windows NTS Authentication Using the NTLM Protocol

Because of security vulnerabilities, NTLM is deprecated as of Oracle Database 12*c*.

Windows users can no longer authenticate using the NTS adaptor on Windows clients and servers that require the NT Lan Manager (NTLM) protocol. Windows users can still use Kerberos. NTLM is still used for local user authentication, and in cases in which the database service runs as a local user.

A new client side `sqlnet.ora` boolean parameter NO_NTLM (defaulting to false) allows you to control when NTLM is used in NTS authentication. When you set NO_NTLM to true, this parameter value prevents NTLM from being used in Windows NTS authentication.

Deprecation of Public Key Infrastructure for Transparent Data Encryption

Public Key Infrastructure (PKI) is deprecated for Transparent Data Encryption (TDE) in Oracle Database 12*c*.

To configure TDE, use the ADMINISTER KEY MANAGEMENT SQL statement. Other implementations of PKI are not affected.

Desupported Cipher Suites for Secure Sockets Layer (SSL)

Review this list of desupported cipher suites if you use Oracle Advanced Security.

Oracle Advanced Security has desupported the following cipher suites in Oracle Database 12*c*:

- `SSL_DH_anon_WITH_DES_CBC_SHA`
- `SSL_RSA_EXPORT_WITH_DES40_CBC_SHA`
- `SSL_RSA_EXPORT_WITH_RC4_40_MD5`
- `SSL_RSA_WITH_DES_CBC_SHA`

Desupport of Database Rules Manager (RUL) and Expression Filter (EXF)

Starting with Oracle Database 12*c* release 1, the Expression Filter (EXF) and Database Rules Manager (RUL) features are desupported.

If you are using Rules Manager, then Oracle recommends that you migrate to Oracle Business Rules, which is a component of Oracle Fusion Middleware. The Continuous Query Notification feature of Oracle Database replaces Expression Filter.

This script is executed by the upgrade process. To remove these components before upgrading, run the `catnoexf.sql` script before the upgrade. The `catnoexf.sql` script is located under *`ORACLE_HOME`*`/rdbms/admin/`.

Oracle Data Guard Broker Deprecated or Desupported Features

Review these deprecations if you use Oracle Data Guard Broker.

As part of Oracle Data Guard Broker's support for Separation of Duty features, the following broker properties are deprecated in Oracle Database 12*c* :

- `LsbyASkipCfgPr`
- `LsbyASkipErrorCfgPr`
- `LsbyASkipTxnCfgPr`
- `LsbyDSkipCfgPr`
- `LsbyDSkipErrorCfgPr`
- `LsbyDSkipTxnCfgPr`
- `LsbySkipTable`
- `LsbySkipTxnTable`

There are no replacements.

Oracle Data Pump Export Utility Deprecated or Desupported Features

The `XML_CLOBS` option of the Oracle Data Pump Export `DATA_OPTIONS` parameter is deprecated.

Oracle Database Vault Deprecated or Desupported Features

Starting with Oracle Database 12*c*, the Oracle Database Vault features and rule sets listed here are deprecated or desupported.

Starting with Oracle Database 12*c*, the Database Vault Configuration Assistant (DVCA) and Database Vault Administrator (DVA) are being deprecated. Use Oracle Enterprise Manager Cloud Control for Oracle Database Vault configuration and administration.

- Deprecated Default Rule Sets for Oracle Database Vault
  Rule sets listed here are deprecated with Oracle Database 12*c* Release 1.

- Deprecated Default Realms for Oracle Database Vault
  The Oracle Data Dictionary realm and Oracle Enterprise Manager realm are deprecated in this release.
- Deprecated API for Oracle Database Vault
  The `DVSYS.DBMS_MACADM.SYNC_RULES` procedure is deprecated, because its functionality is built into the rule creation functionality.

Deprecated Default Rule Sets for Oracle Database Vault

Rule sets listed here are deprecated with Oracle Database 12*c* Release 1.

The following rule sets are deprecated in this release:

- Allow Oracle Data Pump Operation rule set
- Allow Scheduler Job rule set

Deprecated Default Realms for Oracle Database Vault

The Oracle Data Dictionary realm and Oracle Enterprise Manager realm are deprecated in this release.

The objects formerly protected by the Oracle Data Dictionary realm have been migrated to new realms.

Deprecated API for Oracle Database Vault

The `DVSYS.DBMS_MACADM.SYNC_RULES` procedure is deprecated, because its functionality is built into the rule creation functionality.

Oracle Database Semantic Technologies Deprecated or Desupported Features

Features listed here are deprecated for Oracle Database Semantic Technologies in Oracle Database 12*c* (12.1):

- VPD Support in Oracle Database Semantic Technologies
  Transition existing Semantic Technologies applications that depend on Virtual Private Database (VPD) to use Oracle Label Security (OLS) instead.
- Version-Enabled Models Support In Oracle Database Semantic Technologies
  The specific alternative to using Workspace Manager with semantic data depends on the purpose of the application.

VPD Support in Oracle Database Semantic Technologies

Transition existing Semantic Technologies applications that depend on Virtual Private Database (VPD) to use Oracle Label Security (OLS) instead.

Version-Enabled Models Support In Oracle Database Semantic Technologies

The specific alternative to using Workspace Manager with semantic data depends on the purpose of the application.

Oracle Globalization Support Deprecated or Desupported Features

Oracle Database 12*c* provides changes to how Oracle supports globalization.

- Desupport of CSSCAN and CSALTER for Oracle Globalization
  Oracle Database 12*c* includes Oracle Database Migration Assistant for Unicode (DMU), and Oracle is desupporting the legacy database tools CSSCAN and CSALTER.

Desupport of CSSCAN and CSALTER for Oracle Globalization

Oracle Database 12*c* includes Oracle Database Migration Assistant for Unicode (DMU), and Oracle is desupporting the legacy database tools CSSCAN and CSALTER.

DMU provides a complete end-to-end Unicode migration solution for database administrators. Starting with Oracle Database 12*c*, DMU is included with Oracle Database. The CSSCAN and CSALTER tools are no longer included or supported.

Oracle Multimedia Deprecated or Desupported Features

In Oracle Database 12*c*, ORDImage support for Oracle Multimedia DICOM is deprecated.

Oracle Net Services Deprecated or Desupported Features

Oracle Net Services has deprecated or no longer supports the features, parameters, and commands listed here.

- Desupport of Oracle Net Connection Pooling
  In Oracle Database 12*c*, Oracle Net connection pooling is no longer supported.
- Desupport of Oracle Names
  Oracle Names was desupported as a naming method in Oracle Database 11*g*. You must migrate to directory naming.
- Desupport of Oracle Net Listener Password
  In Oracle Database 12*c*, the Oracle Net Listener password feature is no longer supported.
- Desupport of SQLNET.KERBEROS5_CONF_MIT Parameter for Oracle Net Services
  The `SQLNET.KERBEROS5_CONF_MIT` networking parameter is no longer needed and is not supported in `sqlnet.ora`.
- Desupport of Oracle Names Control Utility for Oracle Net Services
  The Oracle Names Control Utility is desupported. Starting with Oracle Database 10*g*, it is not available.
- Deprecated NT LAN Manager (NTLM) Protocol for Oracle Net Services
  The NT LAN Manager (NTLM) protocol for domain authentication is deprecated in the Oracle Windows adapter.

Desupport of Oracle Net Connection Pooling

In Oracle Database 12*c*, Oracle Net connection pooling is no longer supported.

Oracle Net connection pooling was deprecated in Oracle Database 11*g*. This deprecation included the `DISPATCHERS` attributes `TICKS`, `SESSIONS`, and `CONNECTIONS`.

Desupport of Oracle Names

Oracle Names was desupported as a naming method in Oracle Database 11*g*. You must migrate to directory naming.

Desupport of Oracle Net Listener Password

In Oracle Database 12*c*, the Oracle Net Listener password feature is no longer supported.

This change does not cause a loss of security, because Oracle Database enforces authentication through local operating system authentication.

Desupport of SQLNET.KERBEROS5_CONF_MIT Parameter for Oracle Net Services

The `SQLNET.KERBEROS5_CONF_MIT` networking parameter is no longer needed and is not supported in `sqlnet.ora`.

By default, the value of `SQLNET.KERBEROS5_CONF_MIT` is set to `FALSE`. This parameter setting has no affect on the Kerberos configuration. In previous releases, when `SQLNET.KERBEROS5_CONF_MIT` is set to `TRUE`, the parameter set parsing in a format as specified by `MIT Kerberos 5`. However, this parameter setting is no longer required. Starting with Oracle Database 12*c*, only `MIT Kerberos 5` configuration is supported.

Desupport of Oracle Names Control Utility for Oracle Net Services

The Oracle Names Control Utility is desupported. Starting with Oracle Database 10*g*, it is not available.

Desupport of the Oracle Names Control Utility includes desupporting all the related control utility commands. Oracle Database clients cannot use a Names Server to resolve connect strings. Migrate your applications to Oracle Internet Directory with LDAP directory naming.

Deprecated NT LAN Manager (NTLM) Protocol for Oracle Net Services

The NT LAN Manager (NTLM) protocol for domain authentication is deprecated in the Oracle Windows adapter.

Only Kerberos authentication is used for the NTS adapter.

Oracle Text Deprecated and Desupported Features

Three text indexes are desupported for Oracle Text starting with Oracle Database 12*c*.

- Desupport of CTXXPATH in Oracle Text and Oracle XML DB
  The CTXSYS.CTXXPATH index is desupported, starting with Oracle Database 12*c* release 1 (12.1).
- Desupport of ALTER INDEX OPTIMIZE for Text Indexes
  The ALTER INDEX OPTIMIZE `[token index_token | fast | full [maxtime (time | unlimited)]` operation is not supported for Oracle Database 12*c*.
- Desupport of SYNC [MEMORY memsize] for Text Indexes
  The `SYNC [MEMORY memsize]` operation is not supported for Oracle Database 12*c*

Desupport of CTXXPATH in Oracle Text and Oracle XML DB

The CTXSYS.CTXXPATH index is desupported, starting with Oracle Database 12*c* release 1 (12.1).

The desupport of CTXSYS.CTXXPATH does not affect CTXCAT. Use `XMLIndex` indexes instead.

Desupport of ALTER INDEX OPTIMIZE for Text Indexes

The ALTER INDEX OPTIMIZE `[token index_token | fast | full [maxtime (time | unlimited)]` operation is not supported for Oracle Database 12*c*.

To optimize your index, use CTX_DDL.OPTIMIZE_INDEX.

Desupport of SYNC [MEMORY memsize] for Text Indexes

The `SYNC [MEMORY memsize]` operation is not supported for Oracle Database 12*c*

. To synchronize your index, use `CTX_DDL.SYNC_INDEX`.

Oracle XML Database Changes

Oracle XML Database is now installed with Oracle Database. It also has changed features in Oracle Database 12*c*.

- Oracle XML DB is Mandatory and Cannot Be Uninstalled
  Starting with Oracle Database 12*c*, Oracle XML DB is a mandatory component of Oracle Database.
- Deprecated Features for Oracle XML Database
  These features are deprecated in Oracle Database 12*c* Release 1, and may be desupported in a future release.

Oracle XML DB is Mandatory and Cannot Be Uninstalled

Starting with Oracle Database 12*c*, Oracle XML DB is a mandatory component of Oracle Database.

You cannot uninstall Oracle XML DB, and there is no option to exclude it when you create an Oracle Database. Oracle XML DB is automatically installed or upgraded when you upgrade an existing Oracle Database to Oracle Database 12*c*.

Deprecated Features for Oracle XML Database

These features are deprecated in Oracle Database 12*c* Release 1, and may be desupported in a future release.

- `CLOB` storage of `XMLType`, also known as unstructured storage, is deprecated. Use binary XML storage of `XMLType` instead.

  To preserve whitespace in an XML file, store two copies of your original XML document. Use one file as an `XMLType` instance for database use and XML processing, and use the other file as a `CLOB` instance to provide document fidelity.
- Creating an `XMLIndex` index over an XML fragment stored as a `CLOB` instance embedded in object-relational `XMLType` data is deprecated. If you must index the data in such a fragment, then store the document using binary XML storage, instead of object-relational storage.
- The following PL/SQL subprograms in package `DBMS_XMLSCHEMA` are deprecated:
  - `generateSchema`
  - `generateSchemas`

  There are no replacements for these constructs, and there is no workaround for this change.
- PL/SQL package `DBMS_XDB_CONFIG` is new. All Oracle XML((nbsp))DB configuration functions, procedures, and constants are moved from package `DBMS_XDB` to `DBMS_XDB_CONFIG`. These functions, procedures and constants are now deprecated for package `DBMS_XDB`. Use them in package `DBMS_XDB_CONFIG` instead.

  The following is a list of subprograms deprecated in package `DBMS_XDB`:
  - `ADDHTTPEXPIREMAPPING`
  - `ADDMIMEMAPPING`
  - `ADDSCHEMALOCMAPPING`
  - `ADDSERVLET`
  - `ADDSERVLETMAPPING`
  - `ADDSERVLETSECROLE`
  - `ADDXMLEXTENSION`
  - `CFG_GET`
  - `CFG_REFRESH`
  - `CFG_UPDATE`

  - DELETEHTTPEXPIREMAPPING
  - DELETEMIMEMAPPING
  - DELETESCHEMALOCMAPPING
  - DELETESERVLET
  - DELETESERVLETMAPPING
  - DELETESERVLETSECROLE
  - DELETEXMLEXTENSION
  - GETFTPPORT
  - GETHTTPPORT
  - GETLISTENERENDPOINT
  - SETFTPPORT
  - SETHTTPPORT
  - SETLISTENERENDPOINT
  - SETLISTENERLOCALACCESS

  The following is a list of constants that are deprecated in package DBMS_XDB:

  - XDB_ENDPOINT_HTTP
  - XDB_ENDPOINT_HTTP2
  - XDB_PROTOCOL_TCP
  - XDB_PROTOCOL_TCPS

  > **See Also:**
  >
  > *Oracle Database PL/SQL Packages and Types Reference*, Chapter "DBMS_XDB_CONFIG"

- All Oracle SQL functions for updating XML data are deprecated. Use XQuery Update instead for these functions . The following is a list of deprecated XML updating functions:
  - updateXML
  - insertChildXML
  - insertChildXMLbefore
  - insertChildXMLafter
  - insertXMLbefore
  - insertXMLafter
  - appendChildXML
  - deleteXML

> **See Also:**
>
> *Oracle XML DB Developer's Guide* for the appendix that describes Oracle SQL functions for updating XML data that are deprecated and recommendations for replacements

- Oracle SQL function `sys_xmlgen` is deprecated. Use the SQL/XML generation functions instead.

> **See Also:**
>
> *Oracle XML DB Developer's Guide* for information about SQL functions that you can use to construct XML data

- The following Oracle XQuery functions are deprecated. Use the corresponding standard XQuery functions instead, that is, the functions with the same names but with namespace prefix `fn`.
  - `ora:matches` – use `fn:matches` instead
  - `ora:replace` – use `fn:replace` instead
- The following Oracle constructs that provide support for XML translations are deprecated.
  - PL/SQL package `DBMS_XMLTRANSLATIONS`
  - Oracle XPath function `ora:translate`
  - XML Schema annotations `xdb:maxOccurs`, `xdb:srclang`, and `xdb:translate`

  There are no replacements for these constructs, and there is no workaround for this change.

> **See Also:**
>
> *Oracle XML DB Developer's Guide* for more information

- The following XML Schema annotations are deprecated:
  - `xdb:defaultTableSchema`
  - `xdb:maintainOrder`
  - `xdb:mapUnboundedStringToLob`
  - `xdb:maxOccurs`
  - `xdb:SQLCollSchema`
  - `xdb:SQLSchema`
  - `xdb:srclang`
  - `xdb:storeVarrayAsTable`
  - `xdb:translate`

There are no replacements for these constructs, and there is no workaround for this change.

- The value `xml_clobs` for export parameter `data_options` is deprecated starting with Oracle Database 12*c*.

> **See Also:**
>
> *Oracle XML DB Developer's Guide* for information about exporting and importing XMLType Tables

B

Oracle Database Upgrade Utilities

Oracle Upgrade utility scripts help to carry out Oracle Database upgrades.

- Scripts for Upgrading Oracle Database
  Oracle provides a set of tools and scripts for upgrades that you run before, during, and after upgrading.

Scripts for Upgrading Oracle Database

Oracle provides a set of tools and scripts for upgrades that you run before, during, and after upgrading.

> **Note:**
>
> Some of the scripts Oracle provides cannot be run in UPGRADE mode.

The following table lists the various scripts and tools with a description for each.

Table B-1 Upgrade, Post-Upgrade, and Downgrade Scripts

Script	Description
`catcon.pl`	Must be run in UPGRADE mode. This script is used when upgrading a CDB.
`catctl.pl`	Parallel Upgrade Utility (`catctl.pl`, and the shell script `dbupgrade`). You must run these scripts in UPGRADE mode. In Oracle Database 12*c* and later releases, the Parallel Upgrade Utility replaces the SQL Upgrade Utility `catupgrd.sql`. With Parallel Upgrade Utility, you can run upgrade scripts and processes in parallel. This capability takes full advantage of your server CPU capacity, and can shorten upgrade time. DBUA uses this tool.
`dbupgrade`, `dbupgrade.cmd`	Shell scripts that call the `catctl.pl` script. These shell scripts are available with Oracle Database 12*c* release 2 (12.2) and later releases. The scripts enable you to enter the `dbupgrade` command at the shell command prompt. You can either run these scripts with default values, or you can run them with the same input parameters that you use to run `catctl.pl` from the Perl prompt. Use `dbupgrade` for Linux and UNIX systems, and `dbupgrade.cmd` for Windows systems.
`catdwgrd.sql`	This is the downgrade script, which is used in the procedure to downgrade to the earlier release from which you upgraded.

Table B-1 (Cont.) Upgrade, Post-Upgrade, and Downgrade Scripts

Script	Description
`catnoamd.sql`	Do not run in UPGRADE mode. Run this script only after upgrading. The `catnoamd.sql` script drops the OLAP catalog component, also referred to as AMD.
`catnoexf.sql`	The upgrade process runs this script for you; however, you can run the `catnoexf.sql` script before the upgrade. Do not run this script in UPGRADE mode. The `catnoexf.sql` script removes the Expression Filter (EXF) and Database Rules Manager (RUL) components, which are desupported in this release.
`catuppst.sql`	You must run this script, either through DBUA or manually, if you perform a manual upgrade. DBUA automatically runs `catuppst.sql`. You only must run this script separately for manual upgrades. Do not run this in UPGRADE mode. Run `catuppst.sql`, located in the *`ORACLE_HOME`*`/rdbms/admin` directory, to perform remaining upgrade actions that do not require the database to be in `UPGRADE` mode. If an Oracle bundle patch or patch set update (PSU or BP) is installed in the Oracle home, then this script automatically applies that patch set update to the database. **Caution:** If you perform a manual upgrade, and you do not run `catuppst.sql`,, then your database suffers performance degradation over time.
`catuptabdata.sql`	The `catuptabdata.sql` script is run automatically by `catuppst.sql` to run ALTER TABLE UPGRADE on any Oracle-Maintained tables that are affected by changes to Oracle-Maintained types during the upgrade. You can run the `catuptabdata.sql` script manually to upgrade any Oracle-Maintained tables that require upgrading because of changes to any Oracle-Maintained types. You must run the command with a user account that is granted the SYSDBA system privileges, and that is connected AS SYSDBA.
`emdwgrd`	Do not run this script in UPGRADE mode. The `emdwgrd` utility saves Oracle Enterprise Manager Database Control (DB Control) configuration files and data for your release 11*g* database. If it is possible that you want to downgrade Oracle Database 18c to Oracle Database 11*g* (11.2), and you want to restore Oracle DB Control, then you must run `emdwgrd` before you upgrade. **See Also:** Oracle Support document ID 1484775.1.

Table B-1 (Cont.) Upgrade, Post-Upgrade, and Downgrade Scripts

Script	Description
`emremove.sql`	The `emremove.sql` script drops the Oracle Enterprise Manager-related schemas and objects. Use this script to manually remove DB Control. Running `emremove.sql` before starting the upgrade process minimizes downtime. This is an optional pre-upgrade step because the Parallel Upgrade Utility and DBUA automatically run this script. **Caution**: If you want to preserve the DB Control configuration and data to have the option of downgrading and restoring DB Control, then you must first follow the procedure for using `emdwgrd` .
`olspreupgrade.sql`	Do not run this script in UPGRADE mode. The `olspreupgrade.sql` script is a preprocessing script required for upgrading a database earlier than Oracle Database release 12.1 that uses Oracle Label Security (OLS) and Oracle Database Vault.
`postupgrade_fixups.sql`	The `postupgrade_fixups.sql` script is supplied with Oracle Database. Run `postupgrade_fixups.sql` after upgrading. DBUA runs this script automatically; however, you can run it any time after upgrading.
`preupgrd.sql`	(Obsolete in 12.2 and later releases) The `preupgrd.sql` Pre-Upgrade Information Tool is supplied with Oracle Database 12c release 1 (12.1). Run `preupgrd.sql` any time before upgrading to analyze your database. The Pre-Upgrade Information Tool provides a preview of the items that DBUA checks and generates scripts, called Fixup scripts, that you can run to resolve issues that are flagged in the source database. In release 12.1, `preupgrd.sql` script replaces the `utlu121i.sql` script.) In release 12.2, `preupgrade.jar` replaces `preupgrd.sql`.
`preupgrade.jar`	The `preupgrade.jar` Pre-Upgrade Information Tool is supplied with Oracle Database 12*c* release 2 (12.2). The `preupgrade.jar` has the same capabilities as `preupgrd.sql`, which `preupgrade.jar` replaces.
`utlrp.sql`	Use `utlrp.sql` to recompile stored PL/SQL and Java code. DBUA runs this script automatically. When you upgrade manually, you must run this script.
`utlu122s.sql`	The `utlu122s.sql` Post-Upgrade Status Tool is supplied with Oracle Database and displays the version and elapsed upgrade time for each component in `DBA_REGISTRY`. The Post-Upgrade Status Tool can be run any time after upgrading the database.

Table B-1 (Cont.) Upgrade, Post-Upgrade, and Downgrade Scripts

Script	Description
`utluptabdata.sql`	Run the `utluptabdata.sql` script after upgrades to perform an ALTER TABLE UPGRADE command on any user tables that depend on Oracle-Maintained types that changed during the upgrade. You must run the `utluptabdata.sql` script either with a user account that is assigned the ALTER TABLE system privilege for all of the tables that you want to upgrade, or by a user account with SYSDBA system privileges that is connected AS SYSDBA). User tables are not automatically upgraded to new versions of types during the database upgrade, so that you can run the upgrade with user tablespaces set to READ ONLY.

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