CUSTOMER

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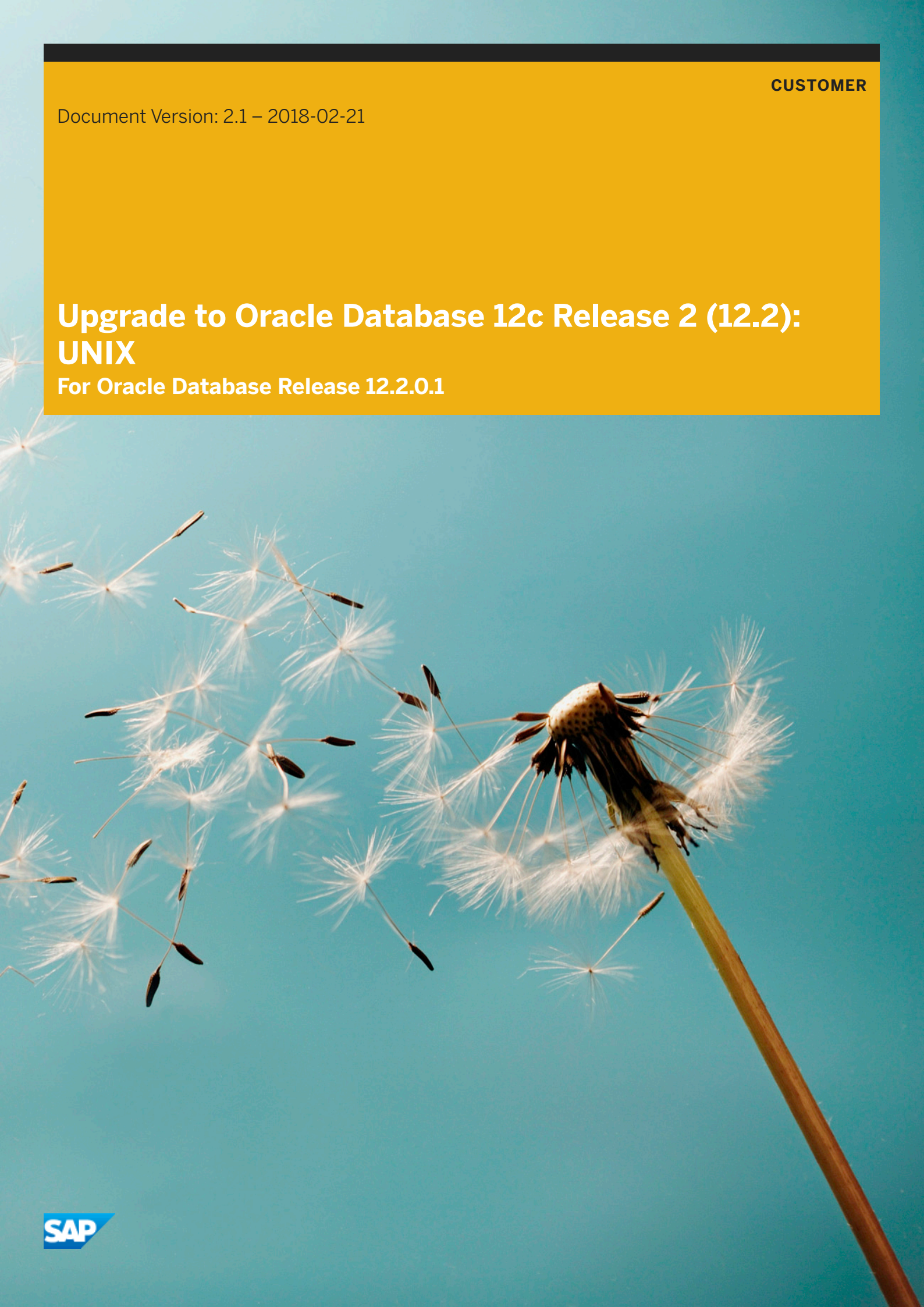
Upgrade to Oracle Database 12c Release 2 (12.2): UNIX

For Oracle Database Release 12.2.0.1



Content

Document History

> **Note**
>
> Before you start the implementation, make sure you have the latest version of this document, which is available at https://help.sap.com/viewer/ora_upgr_unix_12_2.

The following table provides an overview on the most important document changes:

Version	Date	Description
2.1	2018-02-21	Updated version
2.0	2017-12-18	Updated version for Oracle Database 12c Release 2 (12.2)
1.2	2017-02-24	Updated version
1.1	2015-10-22	Updated version
1.0	2015-03-31	Initial version for Oracle Database 12c Release 1

1 Introduction

This documentation describes how to upgrade the Oracle database for the SAP system on the **UNIX** operating system to Oracle Database 12c Release 2 (12.2):

The upgrade path depends on your current Oracle database version:

- If you are currently running 11.2.0.3, 11.2.0.4 or 12.1.0.2, you can upgrade directly to 12.2.0.1.
- If you are running an Oracle database release 11.2.0.2 or earlier, a direct upgrade to 12.2.0.1 is not supported.

Oracle supports the manual database upgrade and the upgrade with the Database Upgrade Assistant (DBUA). In this document only the recommended upgrade procedure with DBUA is described.

> **Note**
>
> This guide does **not** describe upgrades of Oracle RAC and Multitenant databases (container database, pluggable database).

> **Caution**
>
> SAP products running with SAP BASIS 7.00 and above, and SAP kernel release 7.21 EXT and above, are certified for Oracle Database 12c Release 2 (12.2).

Implementation Considerations

- For more information about implementation considerations, including the most important SAP Notes for the upgrade, see Planning [page 9].
- Be sure to read the relevant SAP Notes before beginning the upgrade. These notes contain the most recent information about the upgrade, as well as corrections to the documentation. You can find the most recent version of the SAP Notes at http://support.sap.com/notes
- You use the tools Oracle Universal Installer (OUI), MOPatch, Opatch, Oracle SQL*Plus, and Oracle Database Upgrade Assistant (DBUA) to perform the upgrade.

Naming Conventions

Name	Meaning
<DBSID>	Name of the SAP / Oracle database
<SAPSID>	SAP system name

Name	Meaning
<ora_swc>	Name of the operating system account for the Oracle database software owner. The name of the software owner is either ora<dbsid> or oracle, depending on whether your user concept is SAP Classic or Oracle Standard. For more information, see SAP Note 1915323.
<ora_dba>	Name of the operating system account for the Oracle database administrator. For more information about user concepts, see 1915323.
<New_Oracle_Home>	Name / path of the new Oracle home with the new Oracle database release
<Old_Oracle_Home>	Name / path of the current Oracle home before the database is upgraded to the new release
<IHRDBMS>	Installation Oracle Home e.g. /oracle/<DBSID>/12201
<OHRDBMS>	Runtime Oracle Home e.g. /oracle/<DBSID>/122

1.1 New Features

Use

For the complete list of new features of the Oracle Database 12c Release 2 (12.2), see the *New Features* documentation from Oracle at http://docs.oracle.com/database/122/NEWFT/new-features.htm and SAP Note 2470660.

You can access the complete Oracle documentation at http://docs.oracle.com/database/122/index.html .

More Information

Configuring the New Features for Oracle Database 12c Release 2 (12.2) [page 43]

1.2 SAP Notes for the Oracle Database Upgrade

Make sure that you read the following SAP Notes:

Number	Title
2470660	Central Technical Note for Oracle Database 12c Release 2 (12.2)
2477382	Oracle Database Upgrade
2470718	Oracle Database Parameters (12.2)
2477472	Oracle Database Upgrade with Grid Infrastructure (12.2)
819829	Oracle Instant Client Installation and Configuration on Unix
839182	Oracle patch installation with OPatch
1027012	MOPatch – Install Multiple Oracle Patches in One Run
2087004	BR*Tools Support for Oracle 12c
1598594	BR*Tools Configuration for Oracle Installation Using User "oracle"
1915301	Oracle Database Software 12c Installation on Unix
1915314	Oracle 12c: Uninstalling Oracle Database Software
1521371	Setting of `ORACLE_BASE` in SAP Environments

1.3 More Support Information

You can find more information as follows:

Description	Internet Address
Oracle Database Upgrade Guide – that is, the guide you are now reading	https://help.sap.com/viewer/ora_upgr_unix_12_2
Oracle database software, including patches - at SAP Support Portal	http://support.sap.com/software/databases.html *Oracle*

Description	Internet Address
SAP Notes - at SAP Support Portal	http://support.sap.com/notes
Resources for SAP systems on the Oracle database - at SAP on Oracle Community	https://www.sap.com/community/topic/oracle.html
SAP Software Distribution Center - at SAP Support Portal	http://support.sap.com/swdc
SAP Database Administration for Oracle Databases - at SAP on Oracle Community	https://www.sap.com/community/topic/oracle.html ▶ *Oracle DBA Overview* ▶ *Getting Started* ▶ *SAP Database Guide: Oracle*

2 Planning

➔ Recommendation

Before the production upgrade, make sure that you perform a test upgrade on your backup system.

1. You identify the supported upgrade path [page 9].
2. You check the original version of your database [page 9].
3. You check the hardware and software requirements [page 10].
4. You use the Oracle upgrade checklist for production use [page 10].

2.1 Identifying the Supported Upgrade Path

To upgrade directly to Oracle Database 12c Release 2, your source release must be Oracle Database 11g Release 2 (11.2.0.3 or 11.2.0.4) or Oracle Database 12c Release 1 (12.1.0.2).

If you are running another Oracle database release, a direct upgrade to 12.2.0.1 is not supported.

For more information, see SAP Note 2477382.

2.2 Checking the Original Version of Your Database

Use

You can check the original version of the database you want to upgrade and, if necessary, obtain more information.

Process

To check the original version of your database, enter these commands from the environment of the source database as the appropriate database user:

```
SQL> select version from v$instance;
```

2.3 Checking Hardware and Software Requirements

Use

You need to check that you meet the hardware and software requirements for running the new Oracle release, including the kernel parameters and shell limits.

Procedure

1. Check the complete list of hardware and software requirements for every platform included in the Oracle documentation, which you can find in chapter *Installation Checklist* in the Oracle Database Installation Guide 12c for your platform, available at http://docs.oracle.com/database/122/nav/install-and-upgrade.htm .
   The hardware and software requirements are also checked in detail during the software installation phase.
   You can access the complete Oracle documentation as a member of the Oracle Technology Network (OTN).
2. Check the Oracle-recommended kernel parameters and shell limits for your operating system with Oracle Database 12c Release 2 (12.2). The kernel parameters and shell limits are also checked in detail during the software installation phase.
   These are only **recommendations** from Oracle for optimizing the system performance in production environments. If the recommended settings are not suitable for your system you must tune the kernel parameters accordingly.
   You can obtain the recommended shell limits and kernel parameters from the relevant Oracle database **installation** guide for your operating system at:
   http://docs.oracle.com/database/122/nav/install-and-upgrade.htm
3. If you are upgrading to Oracle Database 12c with the operating system SUSE Linux Enterprise Server (SLES) 12, see SAP Note 1984787.

2.4 Upgrade Checklist

Use

You need to check the following items before starting the SAP system for production use of your upgraded system.

Prerequisites

As of Oracle Database 12c Release 1, SAP supports the user concepts SAP Classic and Oracle Standard, as described in SAP Note 1915323. You need to decide which user concept you want to deploy.

Procedure

Recommendation

To reduce the complexity of the database upgrade and to reduce database downtime to a minimum, we strongly recommend you to perform the steps below where indicated **before** starting the actual Oracle Database Upgrade [page 24].

1. Specify your user concept and, if necessary, perform user migration (you can perform this step before starting the actual database upgrade):
   - If you decide on user concept Oracle Standard, migrate the Oracle software owner from `ora<dbsid>` to `Oracle` as part of the upgrade preparation, as described in SAP Note 1915317.
   - If you decide to stay with user concept SAP Classic, no user migration is needed. However, you can switch to the user concept Oracle Standard at any time after the upgrade if required.
2. Install the Oracle database software of the new release, including the recommended patches.
   For more information, see Installation of Oracle Database Software [page 14].
3. Install the version of the Oracle instant client that is currently recommended for Oracle 12c, which you can find in SAP Note 819829.
   For more information, see Updating the Oracle Instant Client [page 35].
4. Update BR*Tools to the version recommended for Oracle Database 12c, which is BR*Tools 7.40.
   For more information, see Updating BR*Tools [page 36].
   When upgrading from Oracle 11g to 12c, you can perform this step **before** starting the actual database upgrade.
5. Make sure that you have installed the appropriate SAP kernel and that you have a supported version of your operating system. In addition, make sure that you have installed the required support packages for the SAP kernel supported for Oracle Database 12c. For AS Java or AS ABAP+Java, see also SAP Note 1777021
   For more information, check the SAP requirements for your application or product in the Product Availability Matrix (PAM) at http://support.sap.com/pam.
   SAP products running with SAP BASIS 7.00 and above, and SAP kernel release 7.21 EXT and above, are certified for Oracle Database 12c Release 2 (12.2).
   SAP products running on Oracle Database 12c Release 2 (12.2) must use Oracle clients of version 12.1.0.2 V3 or higher or 12.2.0.1.
6. Configure secure storage in file system (SSFS) for ABAP, otherwise the SAP System cannot start because it cannot connect to the database. In addition, consider the dependencies on the SAP kernel version.
   For more information, see Configuring Secure Storage in File System [page 13].
   When upgrading from Oracle 11g to 12c, you can perform this step **before** starting the actual database upgrade.

3 Preparation

You have to complete the following preparations:

1. You download the software required for the upgrade [page 12].
2. You configure Secure Storage in File System (SSFS) [page 13].
3. You migrate to the Oracle Database Software Owner Oracle [page 13]
4. You extract the Oracle software [page 14].
5. You install the Oracle database software [page 14].
6. You run the pre-upgrade scripts [page 20].
7. You back up the Oracle database [page 23].

3.1 Downloading the Software for the Upgrade

Use

You need to download various software packages to perform the upgrade.

Procedure

1. Download the Oracle Database 12c Release 2 (12.2) software, required patches, and Oracle 12.2 Instant Client software from:
   https://launchpad.support.sap.com/#/softwarecenter/database *Database and Database Patches* *Oracle*.
2. Download the latest version of the DBATOOLS (BR*Tools) to be used immediately after the database upgrade from:
   http://support.sap.com/swdc
   BR*Tools supports Oracle Database 12c Release 2 (12.2), as of release 7.40 (Patch Level 32 or higher). For more information, see SAP Note 2087004.

3.2 Configuring Secure Storage in File System

Use

For an ABAP or dual-stack (ABAP+Java) system running on Oracle 12c, you must configure Secure Storage in File System (SSFS), otherwise the SAP system cannot start. If you are currently running Oracle version 11g, you can configure SSFS in advance to avoid extra effort during or after the database upgrade.

Prerequisites

For SSFS, you require at least SAP kernel 7.20 patch 210 (non-Unicode) or patch 98 and DBSL patch 102 or higher. However, for Oracle 12c, you require a higher minimum SAP kernel, as described in Upgrade Checklist for Production Use [page 10].

Procedure

1. Follow the procedure described in SAP Notes 1639578 and 1622837, which describe the configuration of SSFS in detail.
2. Check that the environment variables from SSFS have been changed in the `.sapenv*` files in the home directory of OS user `<sapsid>adm`.

3.3 Migrating to the Oracle Database Software Owner Oracle

Use

As of Oracle Database 12c Release 1, SAP supports the user concepts SAP Classic and Oracle Standard, as described in SAP Note 1915323:

- If you decide on Oracle Standard, migrate the Oracle software owner from `ora<dbsid>` to `oracle` as part of the upgrade preparation, as described in SAP Note 1915317.
- If you decide to stay with SAP Classic, no user migration is needed.

For more information, see SAP Notes 1915323 and 1915317.

Procedure

1. Migrate the Oracle database software owner following the description in SAP Note 1915317, using the tools attached to the note.

3.4 Extracting Oracle Software

Use

You need to verify the availability and correctness of the following Oracle directories:

- Oracle software `stage` directory
- Oracle inventory directory

Procedure

1. For the extraction of the software for Oracle Database 12c Release 2 (12.2.0.1), create the staging directory:
   ```
   mkdir -p /oracle/stage/122
   chmod 755 /oracle/stage/122
   ```
2. Ensure that the stage directories contain enough freespace for the extracted SAR files.
3. Use the SAP tool SAPCAR to extract all the RDBMS media to `/oracle/stage/122`.

   Example

   For example, the following commands extract the database software:

   ```
   cd /oracle/stage/122
   SAPCAR -xvf <RDBMS_Media>/OR112264.SAR
   ```

   To upgrade a single instance database on the file system, you only need to extract the database software that is contained in the SAR file `OR112264.SAR`.

3.5 Installation of Oracle Database Software

As part of the preparations, you install the Oracle Database 12c software.

Note

You can install the Oracle 12.2.0.1 database software into a new Oracle Home while the SAP system and the database are still running from the current Oracle home.

Process Flow

1. You back up the central Oracle inventory [page 15].
2. You update the SAP RUNINSTALLER installation scripts [page 15].
3. You check the prerequisites for the Oracle Universal Installer [page 16].
4. You install the new Oracle database 12c software [page 17].
5. You install the current SAP bundle patch [page 20].

3.5.1 Backing Up the Central Oracle Inventory

Use

Before you install the new Oracle database patch set software, we recommend that you back up the central Oracle inventory.

Procedure

1. If the Oracle inventory exists, check its location by looking at the entry in one of the following files:
   - For example, AIX, HP-UX, Solaris SPARC: `/var/opt/oracle/oraInst.loc`
   - For example, Linux: `/etc/oraInst.loc`

   The location is shown as follows:
   `inventory_loc=<Path_to_Oracle_Inventory>`
2. Make a backup of your existing Oracle inventory by entering the following commands:
   ```
   cd <Path_to_Oracle_Inventory>
   cd ..
   cp -r oraInventory oraInventory.<date>.SAVE
   ```
   Alternatively, you can enter the following command:
   ```
   zip -r oraInventory.zip oraInventory
   ```

3.5.2 Updating the RUNINSTALLER Scripts

You need to update the installation scripts before you start the installation as such.

Context

The SAP-specific installation scripts `RUNINSTALLER` and `12cinstall.sh` are located in directory `SAP` in the Oracle database software stage (that is, `/oracle/stage/122/database/SAP`).

You need to check the patch level of the RUNINSTALLER and check in SAP Note 1915301 whether a higher version is available. If a higher version is available, we recommend that you update the Oracle installation scripts, which are attached to SAP Note 1915301. From there you can download the relevant package for your release. After you have extracted the Oracle software to the staging area, you need to update the installation scripts.

Procedure

1. Check the current version of RUNINSTALLER as the database software owner <ora_swo>:

   ```
   cd /oracle/stage/122/database/SAP
   ./RUNINSTALLER -version
   ```

2. If a higher patch level is available, download the newer version in SAP Note 1915301, following the instructions there.

3.5.3 Checking the Prerequisites for the Oracle Universal Installer

Use

You must check the prerequisites – releases, patches, kernel parameters – for the Oracle software installation.

Prerequisites

If you are performing RUNINSTALLER in dialog mode, make sure that the DISPLAY environment variable is set correctly.

Procedure

1. Log on as the Oracle database software owner <ora_swo>.
2. For RUNINSTALLER, you need to set the following environment variables:
   - DISPLAY – only for dialog mode, that is, when – silent is **not** used
   - DB_SID
3. Perform the following commands in dialog or silent mode to check the RUNINSTALLER version:
   - Dialog mode:
     ```
     cd /oracle/stage/122/database/SAP
     ./RUNINSTALLER -check
     ```
   - Silent mode:
     ```
     cd /oracle/stage/122/database/SAP
     ```

```
./RUNINSTALLER -check -silent
```

4. Apply missing OS patches and OS packages and set OS kernel parameters as recommended by the OUI.
   On the verification results page, note which checks failed. You can fix some of these failed checks by running a fix script generated by the OUI when you click *Fix & Check again*.
5. Only valid for 'Platform': AIX
   On AIX, call the script `rootpre.sh` as user `root`:
   ```
   /oracle/stage/122/database/rootpre.sh
   ```
   End of 'Platform': AIX

3.5.4 Installing the New Oracle Database 12c Software

Proceed as follows to install the Oracle 12c database software.

Prerequisites

A graphical user interface (GUI), for example `X11`, is required for the Oracle database software installation with `runInstaller`. For more information, see the documentation of your operating system.

Context

For more information about the current patch set, see SAP Note 1915313.

For more information about how to install Oracle Database 12c software, see SAP Note 1915301.

During the software installation of Oracle 12c use the new recommended `ORACLE_BASE/oracle/<DBSID>`.

Procedure

1. Log on as the Oracle database software owner `<ora_swo>`.
2. Change to the `stage` directory:
   ```
   cd /oracle/stage/122/database/SAP
   ```
3. Make sure that the `DISPLAY` (for dialog mode) is set in the environment.
4. Set environment variable DB_SID to <DBSID>.
5. Start the OUI with the Oracle database software owner, user `<ora_swo>` , as follows:

   ```
   ./RUNINSTALLER
   ```

   For silent operation, enter this command:

   ```
   ./RUNINSTALLER -oracle_base /oracle/<DBSID> -silent -nocheck
   ```

   For more information on further options, see SAP Note 1915301.

6. Respond to the OUI as follows:

Prompt or Condition	Action
Configure Security Updates	Do **not** select the checkbox. The run Installer issues a warning. Choose *Next* and then *Yes*.
Installation Option	Confirm the pre-selected default *Install database software only* by choosing *Next*.
Database Installation Options	Confirm the default selection *Single Instance database installation* and then choose *Next*.
Database Edition	Confirm the default option *Enterprise Edition* and then choose *Next*.

Installation Location	This screen displays the value of `ORACLE_HOME` that should be:
	`/oracle/<DBSID>/<Release>`, and
	`ORACLE_BASE` that should be:
	`/oracle/<DBSID>`
	For more information on setting `ORACLE_BASE` for your configuration, see SAP Note 1521371.
	Choose *Next*.
	If you see the following error message from the OUI, you can safely ignore it and continue with the installation:
	`[INS-32008] Oracle base location can't be same as user home directory`

Operating System Groups	This screen displays the operating system groups: ○ `OSDBA:dba` ○ `OSOPER:oper` ○ `OSBACKUPDBA:oper` ○ `OSDGDBA:dba` ○ `OSKMDBA:dba` ○ `OSRACDBA:dba` Leave the default and continue with *Next*.

Prompt or Condition	Action
Prerequisite Checks	This screen checks if all the required system prerequisites for installation of the database software have been met. If some of the checks are displayed as *Failed*, you can fix these problems by choosing *Fix & Check Again*. **➔ Recommendation** We strongly recommend you to make sure that there are no failed checks before starting the software installation. If not all prerequisites are met and you decide to ignore the warnings about failed checks, you later see the OUI warning `[INS-13016]`.
Summary	Review the information displayed on this screen and choose *Install* to start the installation.
Install Product	Here you can now monitor the installation progress.
Install Product Finish	Here you can now monitor the installation progress. Finish at the end of the software installation execute the Root Scripts as indicated as the root user from another session. If `root.sh` prompts you that a file (`dbhome`, `oraenv`, `coraenv`) already exists, allow `root.sh` to overwrite it so that the new version is copied.
Finish	On the *Finish* screen you should see `The installation of Oracle Database was successful.` Click *Close* to exit from OUI.

7. To exit the OUI, choose *Close* and confirm the dialog box that appears.
   In the event of error during the software installation, see the troubleshooting information in SAP Note 1915299 .

Results

The Oracle Database 12c software is now installed. The installation location is referred to – for example, in SAP Notes – as Installation Oracle Home `<IHRDBMS>`. Also the link 122 -> 12201 under `/oracle/<DBSID>` is created.

Example

```
/oracle/<DBSID>/12201
```

3.5.5 Installing the Current SAP Bundle Patch

After the installation of the Oracle Database software, you need to install the current (that is, the latest) SAP bundle patch (SBP) into the new Oracle home.

Prerequisites

Check SAP Note 2470660 to find a cross-reference to the current SAP Note with the list of required patches to be installed. You must install the SBP using the Oracle tool MOPatch. For more information about MOPatch, see SAP Note 1027012.

Context

The SBP also delivers a set of upgrade scripts that later automate most of the pre-upgrade and post-upgrade tasks.

Procedure

1. Download the required patches.
2. Log on as the Oracle database software owner `<ora_swo>`.
3. Install the SBP into the new Oracle home according to the instructions in the SBP README file.

> **Note**
>
> The installation of the SBP consists of these steps:
>
> 1. The installation of the SBP software into the Oracle home.
>   This step must be completed before the database is upgraded.
> 2. The change of the database structure and database properties (dictionary, parameter, and properties)
>   This step must be done immediately after the database has been upgraded. For more information, see *Performing SAP Bundle Patch Post-Installation Steps*.

3.6 Running the Pre-Upgrade Scripts

Use

You run the Oracle pre-upgrade scripts, which automatically perform various tasks and checks on your database. For more information, see SAP Note 2477382.

The scripts do the following on your pre-upgrade database:

- Provide information on the database
- Suggest any changes that you need to make to the database before you start the upgrade
- Perform some of the pre-upgrade tasks on the database

You can run the pre-upgrade scripts as often as necessary.

> **Note**
>
> You always execute these pre-upgrade scripts as the Oracle database administrator `<ora_dba>`. We recommend to use `ora<dbsid>` or `sapsid<adm>` since the Oracle environment is already set for these users.
>
> If you use Oracle software owner oracle for this task, you must first set the environment. For more information, see SAP Note 2477382.

Prerequisites

- The directory where the upgrade scripts are installed is called `ora_upgrade`.
- The scripts are installed as part of the SAP bundle patch into the following directory of the new Oracle Home: `<New_Oracle_Home>/sap/ora_upgrade`
- The database is running (in the pre-upgrade Oracle environment).

Procedure

1. Log on as the Oracle database administrator `<ora_dba>`or `<ora_swo>` in the environment of the Old Oracle Home.
2. Run the Pre-Upgrade Information tool
   `$ORACLE_HOME/jdk/bin/java -jar <NEW_ORACLE_HOME>/sap/ora_upgrade/pre_upgrade_utility/preupgrade.jar TERMINAL`
   The result is shown on the terminal. For more information, see SAP Note 2477382.
   The Pre-Upgrade Information tool gives you a first overview of the upgrade readiness of your database.
   The default location for output files and scripts is:
   `$ORACLE_BASE/cfgtoollogs/<DBSID>/preupgrade`
   If you have no write permissions for this directory, you get the following error message:
   `ERROR - Unable to create directory <Dir> for preupgrade workfiles`
   In this case, you must use the *'DIR `<Dir>`'* option and specify another output directory (see SAP Note 2477382) as follows:
   Example:
   ```
   mkdir -p /tmp/ora_pre_upgrade
   chmod 777 /tmp/ora_pre_upgrade
   $ORACLE_HOME/jdk/bin/java -jar <NEW_ORACLE_HOME>/sap/ora_upgrade/
   pre_upgrade_utitlity/preupgrade.jar DIR /tmp/ora_pre_upgrade
   ```

> **Note**
>
> When you run the preupgrade.jar utitility you might get the following recommendation to manually remove hidden and underscore parameters:
>
> Check Name Status Further DBA Action
>
> ---------- ------ ------------------
>
> hidden_params Failed Manual fixup recommended.
>
> underscore_events Failed Manual fixup recommended.
>
> You should ignore these warnings. SAP systems have always hidden parameters and events set in the database. Do not remove any parameter (hidden, event, fix_control) from the database configuration before the upgrade.
>
> After the upgrade, the parameters will be checked and configured for the new database release.

3. Change to the correct directory:
   ```
   cd /oracle/<DBSID>/12201/sap/ora_upgrade/pre_upgrade
   ```
4. Execute the following commands to perform pre-upgrade tasks, which can improve the performance of the upgrade process:
   ```
   sqlplus / as sysdba
   SQL> spool pre_upgrade_tasks.log
   SQL>@pre_upgrade_tasks.sql
   SQL> spool off
   ```
5. Execute the following commands to check the pre-upgrade status of your database:
   ```
   sqlplus / as sysdba
   SQL> spool pre_upgrade_checks.log
   SQL> @pre_upgrade_checks.sql
   SQL> spool off
   ```
6. Run the Oracle database object ID check script. If this script does not return 'OK', refer to SAP Note 2137109 for further actions.
   ```
   sqlplus / as sysdba
   SQL> spool objidchk.log
   SQL> @objidchk.sql
   SQL> spool off
   ```
7. For additional preparation steps before the database upgrade, see SAP Note 2477382.
8. Verify that the *PUBLIC* role was not modified. For more information, see SAP Note 2553347.

Result

Follow the recommendations and instructions. However, you can safely ignore warnings about the setting of database parameter `remote_os_authent=TRUE`.

3.7 Backing Up the Oracle Database

Use

You **must** have a **complete and usable** database backup otherwise you might lose data if the upgrade fails.

Procedure

1. Create a complete database backup.
2. Check that the backup is usable. If for any reason, you have problems during the upgrade you must be able to restore the database from this backup.

4 Oracle Database Upgrade

This section describes how to upgrade the Oracle database.

1. You shut down the SAP system [page 24].
2. You upgrade the database [page 25].

> **Note**
>
> If you have problems during the upgrade, see SAP Note 2086029.

4.1 Shutting Down the SAP System

Use

You need to shut down the SAP system.

Procedure

Stop the SAP application instances by entering the following command as user `<sapsid>adm`:

```
stopsap r3
```

You can also stop the SAP application server with the `sapcontrol` tool:

```
sapcontrol -nr <SAP_Instance_Number> -function Stop
```

> **Note**
>
> Make sure that processes that log on to the database, such as CRON jobs, are not active during the upgrade. Make sure that you reschedule these processes when the upgrade has finished.

4.2 Upgrading the Database with the Database Upgrade Assistant

Use

To upgrade the database to the new release, you need to start the Oracle Database Upgrade Assistant (DBUA). The DBUA is a graphical tool that leads you step-by-step through the upgrade.

Prerequisites

- You have installed the database software [page 14].
- Make sure that the software owner `<ora_swo>` has write permissions (664) on the `oratab` file, which is either `/etc/oratab` or `/var/opt/oracle/oratab`, depending on your operating system.
- Make sure that `oratab` contains the entry `<DBSID>:<OHRDBMS>:N`

  > **Example**
  >
  > Oracle Database 11g: `OQ1:/oracle/OQ1/112_64:N`

- Make sure that the database and the Oracle Listener are both running.
- When you migrate the listener with DBUA from the `<Old_Oracle_Home>` to the `<New_Oracle_Home>` ensure that (1) the listener is running from `<Old_Oracle_Home>` and (2) that the listener was started by the Oracle software owner.
- Explanation: DBUA runs as software owner. If the listener was not started by the software owner, then DBUA will not be able to stop the listener and you will get the following error:
  `SEVERE: Failed to stop listener.TNS-01190: The user is not authorized to execute the requested listener command`

Procedure

1. Log on as Oracle software owner `<ora_swo>`:
   - With user concept Oracle Standard, the software owner is oracle.
   - With user concept SAP Classic, the software owner is `ora<dbsid>`.
2. Make a backup of directory `<Oracle_Home>/network/admin` as follows:
   `cp -r <Old_Oracle_Home>/network/admin <Old_Oracle_Home>/network/admin.SAVE`
3. Start the DBUA.
   `dbua.sap.sh` is a wrapper script to automate most of the upgrade and post-upgrade tasks.
   To run the upgrade with this script, you have to set the environment variables `ORACLE_HOME_SRC`, `ORACLE_HOME_TGT`, and `DB_SID`.
   1. Set `ORACLE_HOME_SRC` and `ORACLE_HOME_TGT` and `DB_SID`.

Example

- Enter these commands to upgrade from 11.2.0.x to 12.2.0.1:
  ```
  export ORACLE_HOME_SRC=/oracle/<DBSID>/112_64
  export ORACLE_HOME_TGT=/oracle/<DBSID>/12201
  export DB_SID=<DBSID>
  ```
- Enter these commands to upgrade from 12.1.0.2 to 12.2.0.1:
  ```
  export ORACLE_HOME_SRC=/oracle/<DBSID>/121
  export ORACLE_HOME_TGT=/oracle/<DBSID>/12201
  export DB_SID=<DBSID>
  ```

2. Change to the correct directory:
   ```
   cd $ORACLE_HOME_TGT/sap/ora_upgrade/post_upgrade
   ```
3. Run this script in query mode initially to verify that the environment for the upgrade is correct:
   ```
   ./dbua.sap.sh -q
   ```
4. Run this script as follows to perform the upgrade:
   - For interactive mode, enter the following command:
     ```
     ./dbua.sap.sh
     ```

     ### Note

     Due to Oracle bug 19897084, you must make sure that the `oratab` contains the corresponding entry for the database you want to upgrade, `<DBSID>:<Oracle_home>:N`. This is especially necessary if you run DBUA in non-silent mode.

     This is an example of such an entry:

     ```
     OQ1:/oracle/OQ1/112_64:N
     ```

     ```
     OQ1:/oracle/OQ1/121:N
     ```

   - For silent mode, enter the following command:
     ```
     ./dbua.sap.sh -silent
     ```

   For more information on how to use `dbua.sap.sh`, see SAP Note 2477382 or run `dbua.sap.sh -help`.

4. Respond appropriately to the DBUA dialogs (unless DBUA is started in silent mode):
   1. On the *Select Database* screen, select your database to upgrade and *Next*.
      If you use the wrapper script `dbua.sap.sh`, the database is already pre-selected.
      The DBUA now retrieves all information from the database that is required for the upgrade. Then DBUA runs the upgrade prerequisite checks.

Recommendation

If the DBUA warns you of issues that need to be fixed before the upgrade, you need to analyze and act on these warnings. The most common messages are as follows:

Warning Message	Explanation or Solution
Warning message: *Database contains schemas with stale optimizer statistics*	Solution: Run the following command: `brconnect -u / -c -f stats -t oradict_stats`
Warning message: *Database contains INVALID objects prior to upgrade*	Solution: To recompile any invalid objects, use SQL*Plus to execute the script `$ORACLE_HOME/rdbms/admin/utlrp.sql`. Any invalid SYS/SYSTEM objects found before upgrading the database are stored in table `registry$sys_inv_objs` Any invalid non-SYS/SYSTEM objects found before upgrading the database are stored in table `registry$nonsys_inv_objs`. After the upgrade, run `ORACLE_HOME/rdbms/admin/utluiobj.sql` to identify any new invalid objects due to the upgrade.

2. On the *Prerequisite Checks* screen fix pre-upgrade failures.
   The following "Pre-Upgrade Recommendations" are for information purpose only:
   - Remove hidden parameters before database upgrade"
     Old hidden (underscore) parameters will be removed after the upgrade.
     New hidden (underscore) parameter will be set after the upgrade.
   - "There are events that should be removed before the upgrade"
     Parameter 'EVENT' will be set for the new release after the upgrade.

   The following "Post-Upgrade Recommendations" are for information purpose only:
   - "Dictionary statistics provide essential information to the Oracle optimizer."
     After the upgrade new dictionary statistics will be gathered using 'brconnect'.
   - "Fixed object statistics provide essential information to the Oracle optimizer."
     After the upgrade new fixed object statistics will be gathered using 'brconnect'.
3. On the *Upgrade Options* screen, select the following fields:
   - *Enable Parallel Upgrade*
   - *Recompile Invalid Objects*
   - *Upgrade Timezone Data*

   The option *Gather Statistics Before Upgrade* should not be selected because database statistics were already gathered during the pre-upgrade phase. Gathering them again would result in a longer downtime. If you have a backup and restore concept for this option, then you can select the following option: *Set User Tablespaces to Read Only During the Upgrade*

> **Note**
>
> Do not change the database directories Diagnostic Destination and Audit File Destination unless they do not contain the recommended values according to the parameter SAP Note.

The customer SQL Scripts page lists all SAP-specific SQL scripts that are run as part of the post-upgrade steps (set_compatible.sql, post_upgrade_tasks.sql) .

4. On the *Recovery Options* screen, you can tell the DBUA how to recover in the event of an upgrade error. For SAP databases, we suggest that you select the recommendation is 'Use Flashback with GRP' or ' I have my own backup and restore strategy' as you should already have your own backup strategy. Choose *Next*.
   If you decide to choose 'Use RMAN Backup' / Create New Full Offline RMAN backup, you might see `"ORA-32004 : obsolete or deprecated parameters specified for RDBMS instance" (because of parameter setting remote_os_authent=TRUE`). You can ignore this error and continue, given this is the only error observed during the RMAN backup.
5. On the *Configure Network* screen, you can decide whether you migrate the database listener to the new Oracle Home. By default, the database listener is migrated using the same name and same port to the new Oracle Home. As part of this migration, `tnsnames.ora`, `sqlnet.ora`, and `listener.ora` are automatically copied and configured.
6. On the *Management Options* screen, you can select whether you want to register the database with EM Cloud Control or EM Database Express. If EM Database Express is selected, de-select it.
7. On the *Summary* screen, review the *Database Upgrade Summary*. If you are satisfied with the summary, click *Finish* to start the upgrade.
8. On the *Progress* screen, you can follow the upgrade progress of the DBUA. You can optionally open the*Alert Log* or *Activity Log* window. You can drill down into the upgrade steps to check their progress by clicking the arrows.
   You might get the warning `ORA-32006: REMOTE_OS_AUTHENT initialization parameter has been deprecated`. You can ignore this warning.
   When the progress bar shows `100%`, the upgrade is complete.
9. On the *Results* screen, after reviewing the upgrade results, click *Close* to close the DBUA.
10. Optionally, delete the environment variables `ORACLE_HOME_SRC` and `ORACLE_HOME_TGT`.

5 Post-Upgrade Steps

After the Oracle database upgrade, you need to perform the steps described here.

1. You update oratab [page 30].
2. You check the symbolic link for the runtime Oracle home [page 30].
3. You adapt the environment of the <sapsid>adm user [page 30].
4. You update the SQL*Net configuration files [page 31].
5. You start the database listener [page 32].
6. You start the database instance [page 33].
7. You perform the post-installation steps for the SAP bundle patch [page 34].
8. You perform post-upgrade tasks [page 39].
9. You check the database parameters [page 35].
10. You update the Oracle Instant Client [page 35].
11. You update BR*Tools executables [page 36].
12. You Upgrading Database Statistics [page 39].
13. You back up the database [page 40].
14. If required and not yet done, update the SAP executables [page 40].
15. If not yet done, configure the Secure Storage in the File System (SSFS) [page 13].
16. For systems with Java components – AS Java or AS ABAP+Java – update the JDBC driver references [page 41].
17. You restart the SAP system [page 42].
18. You configure the new features for Oracle Database 12c Release 2 (12.2) [page 43].
19. If not already done, you migrate from software owner `ora<dbsid>` to software owner `Oracle`, as described in Migrating to the Oracle Database Software Owner Oracle [page 13].
20. You deinstall the old Oracle Home [page 43].
21. You follow the instructions in SAP Note 2157904. Otherwise you might run into Oracle error ORA-39726 (Unsupported add / drop column operation on compressed tables) when adding additional fields to a table. This might occur when you import Support Packages or when you manually add fields in transaction SE11.
22. You make sure that you have installed the required support packages for the SAP kernel supported for Oracle 12c. For AS Java or AS ABAP+Java, see also SAP Note 1777021.

> **Note**
>
> Make sure that you have installed the required SAP Bundle Patch. For more information, see Installing the Required SAP Bundle Patch [page 20].

5.1 Updating oratab

1. After the database upgrade, change the entry `<DBSID>:/oracle/<DBSID>/12201:N` in `/etc/oratab` or `/var/opt/oracle/oratab` so that it now looks as follows:
   `<DBSID>:/oracle/<DBSID>/122:N`
   For more information, see SAP Note 2477382.

5.2 Checking the Symbolic Link for Runtime Oracle Home

Use

By default, when you install the Oracle database software with `RUNINSTALLER`, the symbolic link `/oracle/<DBSID>/122` is created by `RUNINSTALLER`.

Procedure

1. Change to the required directory:
   `cd /oracle/<DBSID>`
2. Check that the following symbolic link exists:
   `ls -l /oracle/<DBSID>/122`
3. If this link does not exist, create a symbolic link to the relative path of the new Oracle home:
   `cd /oracle/<DBSID>`
   `ln -s 12201 122`

5.3 Adapting the Environment of the <sapsid>adm user and ora<dbsid> user

Use

You have to change the environment of user `<sapsid>adm` for SAP application servers that are installed on the Oracle database server. You need to make sure that the changes you made to the Oracle user environment are permanently stored in the profiles `.dbenv_hostname.csh`, `.dbenv_hostname.sh`,`.dbenv.csh`, and `.dbenv.sh`.

Procedure

1. Log on as user <sapsid>adm and adapt the variables listed below in the .dbenv* files.
2. Change the ORACLE_HOME values from <Old_Oracle_Home> to <New_Oracle_Home>.
3. Set ORACLE_BASE to the new Oracle base /oracle/<DBSID>.
4. Adapt the PATH variable so that it no longer contains references to the old Oracle home.
5. After you have made these changes login as <sapsid> adm and check the environment with:
   $ env | grep ORACLE_HOME
   $ env | grep ORACLE_BASE
   $ env | grep PATH (this should no longer contain a reference to e.g. 112_64 or 121)

   > **Note**
   >
   > Make sure that the environment does not contain any variables that still refer to the old database release.
6. Repeat the steps 1 to 5 for ora<sid>.

5.4 Updating the SQL*Net Configuration Files

Use

You need to adapt the SQL*Net files that are located in the directory <Oracle_Home>/network/admin and in the directory (server) pointed to by the environment variable TNS_ADMIN (client), for example, under /usr/sap/<SID>/SYS/profile/oracle.

> **Note**
>
> DBUA modifies the SQLNET profiles in the directory <Oracle_Home>/network/admin.

Procedure

1. Check and, if necessary, add the following entries in the tnsnames.ora file located at <Oracle_Home>/network/admin and $TNS_ADMIN:
   LISTENER_<DBSID>.WORLD = (ADDRESS = (COMMUNITY = SAP.WORLD)(PROTOCOL = TCP)(HOST = <Hostname>)(PORT = <Listener_Port>))
   LISTENER_<DBSID> = (ADDRESS = (COMMUNITY = SAP.WORLD)(PROTOCOL = TCP)(HOST = <Hostname>)(PORT = <Listener_Port>))
   The easiest method to do this is to just copy the complete LISTENER_<DBSID> entry from the file <Old_Oracle_Home>/network/admin/tnsnames.ora and add this entry unchanged to the file in <Oracle_Home>/network/admin and $TNS_ADMIN/tnsnames.ora on the SAP side
   When the database instance is started, this entry is used to resolve the parameter local_listener. For recommendations on setting local_listener, see SAP Note 2470718.

> **Note**
>
> Although this entry is only needed on the database server or on central systems where the `startdb` or `stopdb` scripts are used, it is recommended to repeat the change described above on all application servers. Without this entry, the `startdb` or `stopdb` script fails with the following error message:
>
> `ORA-00119: invalid specification for system parameter LOCAL_LISTENER`

2. Check that the following parameters are configured in `listener.ora`:
   - `SID_LIST_<Listener_Name>`
   - `ADR_BASE_<Listener_Name>`

   If they are missing, copy them from the `listener.ora` from the source Oracle home `<Old_Oracle_Home>` and check thato Oracle home in `listener.ora` is set to `<New_Oracle_Home>`.

   > **Example**
   >
   > ```
   > ADR_BASE_<Listener_Name>=/oracle/<DBSID>/saptrace
   > SID_LIST_<Listener_Name> =
   > (SID_LIST =
   > (SID_DESC =
   > (SID_NAME = <DBSID>)
   > (ORACLE_HOME = /oracle/<DBSID>/122)
   > )
   > )
   > ```
   >
   > When the database instance is started, this entry is used to resolve the parameter `local_listener`. For recommendations on setting `local_listener`, see SAP Note 2470718.

3. Only valid for SAP systems running the SAP Java stack:
   When upgrading an SAP 7.0X system with AS Java or dual-stack (ABAP+Java), add the parameter `SQLNET.ALLOWED_LOGON_VERSION_SERVER = 8` to `sqlnet.ora` on the database server in directory `<Oracle_Home>/network/admin` and on the SAP application server(s) in the directory `$TNS_ADMIN`.
   Without the entry in `sqlnet.ora`, the following error occurs:
   `ORA-28040: No Matching authentication`

5.5 Starting the Database Listener

Use

You need to restart the Oracle database listener. After the upgrade with DBUA the migrated listener is running from the new Oracle Home, but with `<IHRDBMS>` instead of `<OHRDBMS>`.

Procedure

1. Log on as follows:
   - User concept SAP Classic
     Log on as `ora<dbsid>`.
   - User concept Oracle Standard
     Log on as `ora<dbsid>` or as `oracle`.
     For more information, see SAP Note 1915317.
2. Restart the listener with the following commands from the new environment:
   ```
   lsnrctl stop <Listener Name>
   lsnrctl start <Listener Name>
   ```

5.6 Starting the Database Instance

Use

You need to restart the Oracle database instance as it is running from new `Oracle Home /oracle/<DBSID>/12201` (installation `Oracle Home IHRDBMS`) instead of `/oracle/<DBSID>/122` (runtime `Oracle Home OHRDBMS`).

Procedure

1. Log on as the Oracle database administrator `<ora_dba>`.
2. Stop the database from `<IHRDBMS>`:
   ```
   setenv ORACLE_HOME /oracle/<DBSID>/12201
   sqlplus / as sysdba
   SQL> shutdown immediate
   SQL> quit
   ```
3. Logon as `<ora_dba>` and check that `ORACLE_HOME` is set to `/oracle/<DBSID>/122`
4. Start the database by entering the following commands:
   ```
   sqlplus / as sysdba
   SQL> startup
   ```
   Verify from which `<ORACLE_HOME>` the database was started with
   `$grep "ORACLE_HOME:" <alert.log>`

5.7 Performing SAP Bundle Patch Post-Installation Steps

Use

You have installed an SAP bundle patch (SBP) before you upgraded to the new Oracle Release. Now you need to run the SBP post-installation steps.

Procedure

1. Run the SBP post-installation instructions as described in the README of the SBP that is installed in the new Oracle home.

5.8 Performing Post-Upgrade Checks

Use

You run the SAP-specific database post-upgrade check scripts.

> **Note**
>
> You always execute these post-upgrade scripts as Oracle database administrator `<ora_dba>`. We recommend to use `ora<dbsid>` or `<sapsid>adm` as for these users the Oracle environment is already set. If you use Oracle software owner `oracle` for this task, you must first set the environment, as described in SAP Note 2477382.

Procedure

1. Log on as the current Oracle database administrator `<ora_dba>`.
2. Open a command prompt and change to the directory `<New_Oracle_Home>/sap/ora_upgrade/post_ugprade`.
3. From the same directory, start `sqlplus` and enter the following commands to run the post-upgrade scripts, referring to SAP Note 2477382:
   ```
   sqlplus / as sysdba
   SQL> @?/rdbms/admin/utlu122s.sql
   ```
   This provides an overview of the status of the upgraded database.
   ```
   SQL>spool post_upgrade_tasks.log
   SQL> @post_upgrade_tasks.sql
   ```
   (if you have not already executed this with DBUA)
   ```
   SQL> spool off
   SQL> spool post_upgrade_checks.log
   ```

```
SQL> @post_upgrade_checks.sql
SQL> spool off
```
If required recompile invalid objects with
```
SQL>@?/rdbms/admin/utlrp.sql
```
Check the compatible parameter with
```
SQL> show parameter compatible
```

5.9 Checking the Database Parameters

After the database upgrade, you need to check and set the database parameters, as described in SAP Note 2470718. You might need to change the settings of existing parameters, delete parameters, or add new parameters. Check SAP Note 1171650 to see whether an automated script for Oracle 12c is already available. This helps you check whether your SAP system complies with the database parameter recommendations at any given point in time.

5.10 Updating the Oracle Instant Client

Use

After the upgrade, you need to check whether you must install a newer version of the Oracle instant client.

For more information on the recommended versions, see the Product Availability Matrix (PAM) at http://support.sap.com/pam and SAP Note 819829. A mixture of different Oracle instant client versions on different SAP application servers running in the same SAP system is not supported.

Procedure

1. As user `<sapsid>adm`, update the Oracle instant client for UNIX according to the recommendations in SAP Note 819829:

   > **Note**
   >
   > For more information, see SAP Note 819829.

   Installation of Oracle Database 12c Release 2 Client

   1. Create the new client directory and install the client software:
      ```
      mkdir -p /oracle/client/122
      cd /oracle/client/122
      SAPCAR -xvf <Oracle_Client_Media>/OCL_<your OS>/OCL12264.SAR
      cd /oracle/client/122
      ```

```
ln -s instantclient_12201 instantclient
```

2. Create the symbolic link for BR*Tools 7.40:
   1. `cd /oracle/client`
   2. If the link or directory 11x_64 already exists and 11x_64 client is no longer used, rename it, as in this example and create the symbolic link. If the 11x_64 client is installed and used on the system do not create the link.
      ```
      mv 11x_64 11x_64_save
      ```
   3. `ln -s /oracle/client/122 /oracle/client/11x_64`

Installation of Oracle Database 12c Release 1 Client

1. Create the new client directory and install the client software:
   ```
   mkdir -p /oracle/client/12x
   cd /oracle/client/12x
   SAPCAR -xvf <Oracle_Client_Media>/OCL<Your OS>/OCL12164.SAR
   cd /oracle/client/12x
   ln -s instantclient_12102 instantclient
   ```
2. Create the symbolic link for BR*Tools 7.40:
   1. `cd /oracle/client`
      If the link or directory 11x_64 already exists and 11x_64 client is no longer used, rename it, as in this example and create the symbolic link. If the 11x_64 client is installed and used on the system do not create the link.
   2. If the link or directory `11x_64` already exists, rename it, as in this example:
      ```
      mv 11x_64 11x_64_save
      ```
   3. `ln -s /oracle/client/12x /oracle/client/11x_64`

2. Adapt the environment of user `<sapsid>adm` and `ora<sid>` to make sure that the change to the new Oracle client directory environment variable `LD_LIBRARY_PATH`, `SHLIB_PATH` or `LIBPATH` is permanently stored in the profiles such as `.dbenv_<hostname>.csh`, `.dbenv_<hostname>.sh`, `.dbenv.csh`, or `dbenv.sh`. This means that you need to replace e.g. `/oracle/client/11x_64` with `/oracle/ client/12x...` in the `.dbenv*` files.
   Log out and log on again as the `<sapsid>adm` or `ora<dbsid>` user.

5.11 Updating BR*Tools Executables

Use

You update BR*Tools to the latest release, with the latest patch level. For more information, see SAP Notes 2087004, 12741, and 1598594.

> **Note**
>
> You can also update BR*Tools as described here during the preparation phase.

Prerequisites

As of Oracle Database 12c Release 1, the configuration of BR*Tools has changed in comparison to earlier Oracle versions. The BR*Tools profile is now located in the `$SAPDATA_HOME/sapprof` directory.

For more information, see SAP Notes 2087004 and 2470660.

You should therefore configure the BR*Tools according to the new BR*Tools configuration default.

The new `sapprof` directory in `$SAPDATA_HOME` contains the following files:

- `init<DBSID>.sap`: BR*Tools profile
- `init<DBSID>.utl`: backup utility parameter file (backint profile, if it exists)
- `init<DBSID>.ora`: transparent copy of Oracle database profile

Procedure

1. Download the most current version of BR*Tools from http://support.sap.com/swdc *Software Downloads* *Support Packages and Patches* *Browse Download Catalog* *Additional Components* *SAP Kernel* *SAP KERNEL* `<Platform>` *SAP KERNEL* `<Version>` `<Platform>` *ORACLE* *DBATLxxxx.SAR*, following the descriptions in SAP Notes 2087004 and 12741 and adapt the permissions as described in SAP Note 1598594.
2. Create the `sapprof` directory in `$SAPDATA_HOME`:
   ```
   $ mkdir -p $SAPDATA_HOME/sapprof
   ```
3. Copy the files `init<DBSID>.sap` and if it exists `init<DBSID>.utl`(from `<OLD_ORACLE_HOME>`), and `init<DBSID>.ora` (from `<NEW_ORACLE_HOME>`) to the sapprof directory.
4. Replace the file `init<DBSID>.ora` in the `$ORACLE_HOME/dbs` directory with a profile that contains only the `spfile` parameter.

   Example

   ```
   spfile = $ORACLE_HOME/dbs/spfile<DBSID>.ora
   ```
5. Delete the files `init<DBSID>.sap` and `init<DBSID>.utl` (if they exist) from directory `$ORACLE_HOME/dbs`.
6. Update the parameters `util_par_file` / `util_par_file_arch` in `init<DBSID>.sap`, if necessary (that is, if they refer to path `$ORACLE_HOME/dbs`).

   Example

   Replace `util_par_file = $ORACLE_HOME/dbs/init<DBSID>.utl` with

   `util_par_file = $SAPDATA_HOME/sapprof/init<DBSID>.utl` .

   For non-ASM installations, the spfile `spfile<DBSID>.ora` remains in the directory `$ORACLE_HOME/dbs` by default whereas in ASM installations, it is located on an ASM disk.

Caution

If `$ORACLE_HOME/dbs` already contains an `init<DBSID>.ora` that contains only the parameter `spfile`, create an empty `init<DBSID>.ora` in the `sapprof` directory with the relevant authorizations. This file is automatically updated by an upcoming operation with an SAP BR*Tools program.

Example

The resulting permissions are as follows:

- File permissions for software owner `oracle` (Oracle Standard user concept):

```
drwxrwxr-x 2 oracle oinstall 4096 May 31 17:30 sapprof
-rw-rw-r-- 1 oracle oinstall 1274 May 31 17:30 init<DBSID>.ora
-rw-rw-r-- 1 oracle oinstall 26534 May 31 17:30 init<DBSID>.sap
```

- File permissions for software owner `ora<dbsid>` (SAP Classic user concept)

```
drwxrwxr-x 2 or<dbsid> dba 4096 May 31 17:30 sapprof
-rw-rw-r-- 1 ora<dbsid> dba 1274 May 31 17:30 init<DBSID>.ora
-rw-rw-r-- 1 ora<dbsid> dba 26534 May 31 17:30 init<DBSID>.sap
```

7. Only valid for 'Platform': AIX

For AIX 6.1 or higher, enter the settings for all BR executables for AIX RBAC (Role-Based Access Control), as described in SAP Note 1598594.

Enter the settings for the following paths:

- `/usr/sap/<SID>/SYS/exe/run`
- `/sapmnt/<SID>/exe`
- `/sapmnt/<SID>/exe/uc|nuc/platform`

Example

```
setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /usr/sap/QO1/SYS/exe/run/brarchive

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /usr/sap/QO1/SYS/exe/run/brbackup

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /usr/sap/QO1/SYS/exe/run/brconnect

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /usr/sap/QO1/SYS/exe/run/brrecover

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /usr/sap/QO1/SYS/exe/run/brrestore

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /usr/sap/QO1/SYS/exe/run/brspace

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /sapmnt/QO1/exe/uc/rs6000_64/brarchive

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /sapmnt/QO1/exe/uc/rs6000_64/brbackup
```

```
setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /sapmnt/QO1/exe/uc/rs6000_64/brconnect

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /sapmnt/QO1/exe/uc/rs6000_64/brrecover

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /sapmnt/QO1/exe/uc/rs6000_64/brrestore

setsecattr -c accessauths=ALLOW_OWNER,ALLOW_GROUP innateprivs=PV_DAC_UID
secflags=FSF_EPS /sapmnt/QO1/exe/uc/rs6000_64/brspace

setkst
```

End of 'Platform': AIX

5.12 Upgrading Database Statistics

Use

You need to perform this task as <sapsid>adm.

Procedure

> **Note**
>
> When you use SecureStore for the BR*Tools, replace the **-u /** in the brconnect commands below with **-u //**.
>
> For example, use **brconnect -u // -c -f stats -t system_stats** instead of **brconnect -u / -c -f stats -t system_stats**

1. Gather Oracle optimizer statistics by executing the following commands as the administration user <sapsid>adm:
   ```
   brconnect -u / -c -f stats -t system_stats
   brconnect -u / -c -f stats -t oradict_stats
   ```

   > **Note**
   >
   > You can perform this step later if required.

2. Update the Oracle database statistics with BRCONNECT as follows:
   ```
   brconnect -u / -c -f stats -t all -f collect -p 4
   ```
   For more information about update statistics, see the documentation *SAP Database Guide: Oracle* at:
   http://scn.sap.com/community/oracle *SAP ON ORACLE KNOWLEDGE CENTER* > *SAP Documentation*

> **Note**
>
> You can perform this step later if required.

5.13 Backing Up the Database

Use

After the upgrade, you need to back up your Oracle database.

> **Caution**
>
> You risk losing data if you do not back up your database.

Procedure

Perform a full database backup.

> **Example**
>
> You can enter a command like the following to perform a full database backup:
>
> ```
> brbackup -u / -type offline -mode all -device disk -compress yes -language E
> ```

5.14 Updating the SAP Executables

Use

If you are not running a SAP kernel supported for Oracle 12c yet, you need to update the SAP executables to the latest SAP kernel supported for Oracle 12c. This is a task for the `<sapsid>adm`.

Procedure

For supported SAP kernels 7.21EXT, see the procedure in SAP Note 1716826. For supported SAP 7.41 downward-compatible kernels (DCK), see the procedure in SAP Note 1994690.

> ⚠ Caution
>
> In an MCOD system, you have to update the executables of **all** SAP systems connecting to the database.

5.15 Updating the JDBC Driver References

This topic is only valid for 'Technology': Dual Stack (ABAP+Java), Java

Use

If you have an SAP system with Java components, you have to change the JDBC driver references after you have upgraded the database client software. Otherwise, the J2EE Engine cannot start because the driver references still point to the old Oracle client software home.

> ℹ Note
>
> You only need to perform this procedure if the major version of your Oracle client software has changed.

If your SAP software is version 7.0 or below, follow SAP Note 867976 to change the JDBC driver references in the J2EE engine. For Oracle 12c, `DB_URL` has not changed

If your SAP software is version 7.1 or higher, change the reference to the JDBC driver in the instance profile as described below.

Prerequisites

- Secure storage in file system (SSFS) is enabled and configured
- SAP can connect to the database through the SSFS connect mechanism

Procedure

1. Change to the correct directory containing the file `<SAPSID>_J<Instance_Number>_<Host>`.
2. Open the file with your text editor and search for property `j2ee/dbdriver`.
3. Replace the old driver **location** with the new one:
   `/oracle/client/<Oracle_Client_Major_Version>x/instantclient/<Java_Class_Archive>.jar`
   where `<Oracle_Client_Major_Version>` is the major version of the Oracle client that you are using after this upgrade. So for example, if you are now using Oracle Client 12.1, set the new driver location to `/oracle/`

`client/12x/instantclient/<Java_Class_Archive>.jar`. For Oracle client 12.2, make sure the new driver location is set to `/oracle/client/122/instantclient/<Java_Class_Archive>.jar`.

> **Caution**
>
> Do **not** change the file `<Java_Class_Archive>.jar`, which is one of the following:
>
> - `ojdbc14.jar`
> - `ojdbc6.jar`
> - `ojdbc7.jar`

End of 'Technology': Dual Stack (ABAP+Java), Java

5.16 Starting the SAP System

Use

You need to restart the SAP system.

Prerequisites

- The supported SAP kernel for Oracle 12c is installed.
- Secure storage in file system (SSFS) is configured.
- The switch to user `oracle` has been made (not necessary for user concept 'SAP Classic').
- The latest BR*Tools 7.40 are installed and configured.
- The recommended Oracle client software is installed.
- The environment has been adapted for the Oracle administration users such as `<sapsid>adm`.

Procedure

1. Log on as `<sid>adm`.
2. For SAP installations with an ABAP application server, enter this command to check whether R3trans can connect to the database:
   ```
   R3trans -d
   ```

   > **Note**
   >
   > Connecting to the database with `R3trans -d` only works successfully if SSFS is already configured. For more information, see SAP Notes 1639578 and 1622837.

3. Start the SAP system:
   ```
   startsap
   ```

You can also use `sapcontrol`.

4. Check the new Oracle version using SAP transaction ST04.
   For Java systems check it with `http://<Hostname>:5<nr>` *System Information* > *logon as Administrator* > *Database* .

5.17 Configuring the New Features for Oracle Database 12c Release 2 (12.2)

Use

You can configure the new Oracle Database 12c Release 2 (12.2) features.

Procedure

For more information about new features with Oracle Database 12c Release 2 (12.2), see SAP Note 2470660. This note provides links to other SAP notes that describe how to configure or activate each new feature.

5.18 Deinstalling the Old Oracle Home

Use

Once the database is running correctly, it is recommended to deinstall the old Oracle Home to prevent accidental usage of the old binaries.

To delete the old Oracle Home, see SAP Note 1915314 and http://docs.oracle.com/database/122/LADBI/removing-oracle-database-software.htm .

Procedure

Follow the procedure in the above SAP Note to deinstall the old Oracle Home directory.

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