**Practice 12**

# Upgrading Oracle RAC Database

## Practice Overview

In this practice, you will upgrade the Oracle RAC database from release 12.1.0.2 to release 12.2.0.1.

**Note:** In the previous practice you have taken a backup of all the Virtualbox appliance files. If you have not done that, it is recommended to do it now. Shutdown the appliances and exit Oracle Virtualbox then take backup of all the virtual appliance files including the shred disk files.

**Note:** This practice is a long practice. It may take three to implement it all.

**Note:** Do not consider this document as a reference to upgrade a production database. The following should be your references:

- Oracle Grid Infrastructure Installation and Upgrade Guide 12c Release 2 (12.2) for Linux
- Oracle Database Upgrade Guide 12c Release 2 (12.2)
- Doc ID 2189854.1: Complete Checklist for Upgrading to Oracle Database 12c Release 2 (12.2) using DBUA

## Practice Assumptions

- A database backup has been taken on rac database. You have taken this backup in the previous practice.
- You downloaded the following Oracle software products. At the time of this writing, they can be downloaded from this link.
  - Oracle Database 12c R2 Grid Infrastructure (12.2.0.1.0) for Linux x86-64
  - Oracle Database 12c R2 (12.2.0.1.0) for Linux x86-64

## Oracle Release 12.2 Home Locations

- Following are the locations of the upgraded Oracle software products that you will install in this practice:

| Oracle Software Product | Home Location |
|---|---|
| Oracle Grid Infrastructure | /u01/app/12.2.0/grid |
| Oracle Database | /u01/app/oracle/product/12.2.0/db_1 |

## Expanding CRS Disk Group in ASM

Oracle Grid Infrastructure 12.2 has added new features that require plenty of disk space in the CRS disk group. Therefore, you must expand the size of the CRS disk group before you can upgrade Oracle Grid to the new release.

In this section of the practice, you will take the steps to expand the CRS disk group in ASM.

1. Shut down srv1 and srv2.

2. Add a new fixed-size sharable disk to srv1. Give it the name DISK4 and set its size to 40 GB.

   In Oracle VirtualBox, click on srv1 | click on **Settings** | click on **Storage** in the right pane | click on **Controller: SATA** | click on **Add Hardisk** | click on **Add a New Disk** | select **VDI option** | make it **fixed-size** | enter the **full-path filename** of the disk | set **its size to 40 GB**

3. Once the disk is created, make it sharable.

   **File** menu item | **Virtual Media Manager** | select the created disk **DISK4** | click on the **Modify** button | choose the option to make this file **shareable** | press **Ok** | press **Close**

4. Link the new disk to srv2.

   click on srv2 | click on **Settings** | click on **Storage** in the right pane | click on **Controller: SATA** | click on **Add Hardisk** | click on **an Existing Disk** button | navigate to the new disk file and press OK

5. Start srv1 and wait for its OS to load.

6. Start Putty and login to srv1 as root user. Format the added disk.

```
# display all the available disks:
ls -l /dev/sd*

# format the disk:
# answer "n", "p","1", default, default, "w" when prompted
fdisk /dev/sde
```

7. Add the partitioned disk to the ASM recognized disk list.

```
oracleasm listdisks
oracleasm createdisk DISK4 /dev/sde1
oracleasm listdisks
```

8. Start srv2 and wait for its OS to load.

9. Start Putty and login to srv2 as root user.

10. Scan the ASM disks and make sure DISK4 is seen by srv2.

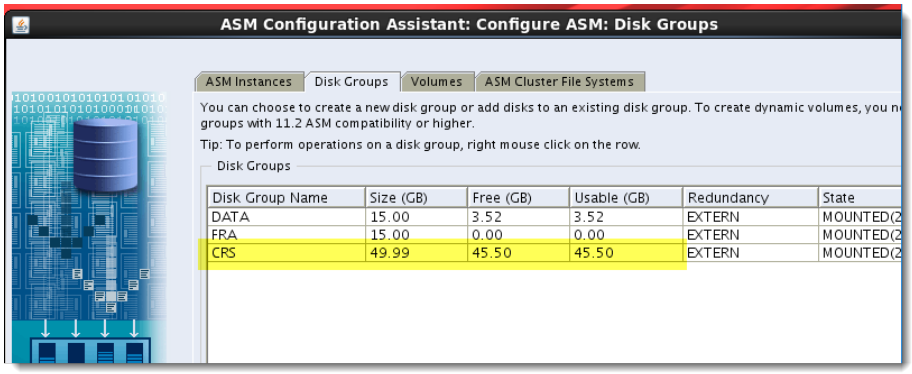
```
oracleasm scandisks
oracleasm listdisks
```

11. Login to the VirtualBox window of srv1 as grid.

**12.** Start asmca utility and add DISK4 to the CRS disk group.

Right-click on the **CRS disk group** | select **Add Disks** | select **DISK4** then click on **OK** button

You should see the CRS disk group size increased to nearly 50GB, as shown in the following screenshot:




**13.** Exit from the asmca utility.

## Preparing Upgrade Installation files

In this section of the practice, you will prepare the Oracle RAC database stack installation files.

14. **Copy** the Oracle 12.2 Grid Infrastructure installation file locally in the shared folder in your hosting machine.

    We mean by the shared folder, the folder that is shared by the Oracle Virtualbox machines and which you used to install Oracle 12.1 and apply PSU on it.

15. **Extract** the Oracle 12.2 database installation zip file locally into the shared folder.

## Upgrade Oracle Grid Infrastructure

In this section of the practice, you will upgrade Oracle Grid Infrastructure. Oracle Grid Infrastructure supports rolling upgrade. When nodes are being upgraded in a batch, the nodes in the other batches remain in operation.

**Note:** In real life scenario, it is recommended to perform RAC check Upgrade Readiness Assessment. This involves downloading an automated upgrade-specific health check for upgrades to Oracle Grid Infrastructure from Oracle Support (Doc ID 1457357.1). Because upgrading Grid Infrastructure on the practice environment has already be tested and for the sake of minimizing the practice time, I have skipped this step from this practice document.

**Note:** Oracle Grid Infrastructure upgrade required patch number 21255373. This patch was already included in the PSU that you applied in the previous lecture.

**16.** Make sure you have Putty sessions connected to `srv1` and `srv2` as `root`.

**17.** Create the directory of the new Oracle Grid home. Make `grid` the owner of the home directory.

```
mkdir -p /u01/app/12.2.0/grid
chown grid:oinstall /u01/app/12.2.0/grid
```

**18.** Create the same directory in `srv2`.

```
ssh srv2
mkdir -p /u01/app/12.2.0/grid
chown grid:oinstall /u01/app/12.2.0/grid
exit
```

**19.** In the VirtualBox window of `srv1`, login as `grid` user.

**20.** Open a terminal window and change the current directory to the directory where the Oracle Grid Infrastructure installation file was copied.

```
cd /media/sf_staging/12.2/grid/

[grid@srv1 grid]$ ls
linuxx64_12201_grid_home.zip
```

**21.** Unzip the `linuxx64_12201_grid_home.zip` file to the new Grid home directory.

```
unzip linuxx64_12201_grid_home.zip -d /u01/app/12.2.0/grid
```

**22.** Install the new Oracle Grid Infrastructure software. The procedure that you follow will upgrade the running Oracle Grid instance.

a) In the terminal windows, change the current directory to the new Oracle Grid directory.

```
cd /u01/app/12.2.0/grid
```

b) Set the `ORACLE_HOME` variable to the new Oracle Grid home directory then run `gridSetup.sh`

```
export ORACLE_HOME=/u01/app/12.2.0/grid
./gridSetup.sh
```

c) Follow the installer windows to install and upgrade the Oracle Grid software. Make your responses to the installer windows are as follows:

| Installer Window | Response |
|---|---|
| **Configuration Option** | Select the radio button "Upgrade Oracle Grid Infrastructure…" |
| **Node Selection** | Click on **SSH Connectivity** button<br>Enter the OS `grid` user password.<br>Click on **Test** button. If it reports that the SSH connectivity is not configured, click on **Setup** button.<br><br>**Note**: If the installer reports the following error even after SSH Connectivity is successfully set up:<br>`INS-06006 Passwordless SSH connectivity not set up…`<br>Try the following steps:<br>- exit from the installer<br>- In the command line, issue the following command: `ssh srv2 date`<br>- If the command above returns the following error: `Agent Admitted Failure To Sign Using The Key`<br>- ,issue the following command:<br>`ssh-add`<br>- Then try the "`ssh srv2 date`" command again. It should work with no error.<br>- Issue the installer again.<br>If the procedure above does not work in your case, try referring to Doc ID 1323714.1 |
| **Management Options** | click on **Next** button |
| **Operating System Groups** | Make sure `asmadmin` and `asmdba` are selected. |
| **Installation Location** | Make sure `/u01/app/grid` is selected. |
| **Root Script execution** | Mark the check box "**Automatically run configuration scripts**"<br>Enter the **root password** |
| **Batch Selection** | Set the upgrade on **srv2** to **Batch 2**.<br>If you keep it in Batch 1, the system will not be available while the upgrade is going on. |

| | |
|---|---|
| **Prerequisites Checks** | If you receive error: "cvuqdisk-1.0.10-1" being unavailable on the system, click on "**Fix and Check Again**" button.<br>The following warning can be ignored (for a production system they must be addressed):<br>- Memory is less than 8 GB<br>- resolv.conf Integrity<br>- (Linux)resolv.conf Integrity<br>Select **Ignore All** check box then click on **Next** button<br>**Note:** You could have run the Cluster Verification Utility (CVU) before running the installer. Running it from within the installer gives the same results. |
| **Summary** | click on **Install** button<br>When prompted to execute configuration scripts, click on **Yes** button. |
| **Batch execution confirmation** | When prompted to execute the next batch, click on "**Execute Now**" button. |
| **Oracle Cluster Verification Utility failed** | Just click on **OK**, **Next** and **Close** buttons. |

**23.** In the Putty window, verify the upgrade has been successfully concluded:

```
/u01/app/12.2.0/grid/bin/crsctl check cluster -all
/u01/app/12.2.0/grid/bin/crsctl query crs activeversion
```

**24.** Sign out from srv1 VirtualBox window.

## Installing Oracle Database 12.2 Software

In this section of the practice, you will install Oracle Database 12.2 software. You will **not** upgrade the RAC database yet at this stage.

**25.** In the VirtualBox window of `srv1`, login as `oracle` user.

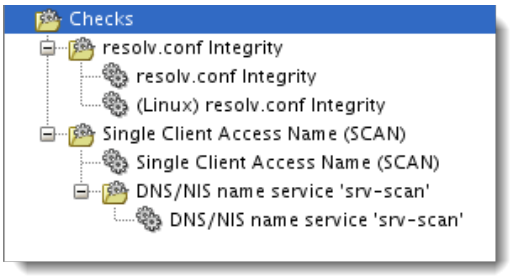
**26.** Open a terminal window and change the current directory to the directory where the Oracle Database installation files were extracted.

```
cd /media/sf_staging/12.2/database/
```

**27.** Set the `ORACLE_HOME` variable to the new Oracle Database home directory then invoke the OUI utility.

```
export ORACLE_HOME=/u01/app/oracle/product/12.2.0/db_1
./runInstaller
```

**28.** Follow the installer windows to install the Oracle Database software only. Make your responses to the installer windows as follows:

| Installer Window | Response |
|---|---|
| **Configuration Security Updates** | Unmark the checkbox " I wish to receive security… " |
| **Installation Option** | Install Database Software only |
| **Database Installation Options** | select the option "**Oracle Real Application Clusters …**" |
| **Node Selection** | Make sure all nodes selected<br>Click on **SSH Connectivity** button<br>Enter the OS `oracle` user password.<br>Click on **Test** button. |
| **Database Edition** | Make sure "Enterprise Edition" selected |
| **Installation Location** | Make sure Oracle home is set to /u01/app/oracle/product/**12.2.0**/db_1 |
| **Operating System Groups** | Make sure dba is selected as the group for all the mandatory options |
| **Prerequisites Checks** | The following warnings can be ignored:<br>  <br>Mark **Ignore All** checkbox and click on **Next** button |

| | |
|---|---|
| **Summary** | click on **Install** button |
| **Execute Configuration Scripts** | Run the configuration scripts as `root` in `srv1` then on `srv2`. |
| **Finish** | click on **Close** button |

**29.** In the Putty session, switch the current user to `oracle` then run the Pre-Upgrade Information Tool (`preupgrade.jar`) by issuing the following command. This is a single-line command. Make sure you copy it all before you paste it in the Putty window.

```
/u01/app/oracle/product/12.1.0/db_1/jdk/bin/java -jar
/u01/app/oracle/product/12.2.0/db_1/rdbms/admin/preupgrade.jar FILE TEXT DIR
/home/oracle/scripts
```

The command should give the following output:

```
Preupgrade generated files:
    /home/oracle/scripts/preupgrade.log
    /home/oracle/scripts/preupgrade_fixups.sql
    /home/oracle/scripts/postupgrade_fixups.sql
```

**30.** Examine the contents of the generated log file. It included recommendations on the steps to perform before you start upgrading the database.

**31.** As sysdba, run the `preupgrade_fixups.sql` script.

```
sqlplus / as sysdba
@/home/oracle/scripts/preupgrade_fixups.sql

# to obtain list of invalid objects:
# compile invalid views
SELECT  OWNER, OBJECT_NAME FROM DBA_OBJECTS WHERE STATUS='INVALID';

# to obtain list of the materialized views:
SELECT OWNER, OBJECT_NAME FROM DBA_OBJECTS WHERE OBJECT_TYPE LIKE '%MATERIA%'
```

**32.** Gather the optimizer statistics on the dictionary objects. Run the following command as sys user.

This is recommended action to reduce the upgrade time.

```
EXEC DBMS_STATS.GATHER_DICTIONARY_STATS;
```

**33.** Purge the Recycle Bin

```
PURGE DBA_RECYCLEBIN;
```

**34.** Make sure that the parameter `SEC_CASE_SENSITIVE_LOGON` is set to `TRUE`.

```
SHOW PARAMETER SEC_CASE_SENSITIVE_LOGON
```

## Upgrading Oracle RAC Database

In this section of the practice, you will use the DBUA to upgrade rac database to release 12.2.

**35.** In the VirtualBox window of srv1, make sure you are logged in as oracle user and that you have a terminal window opened.

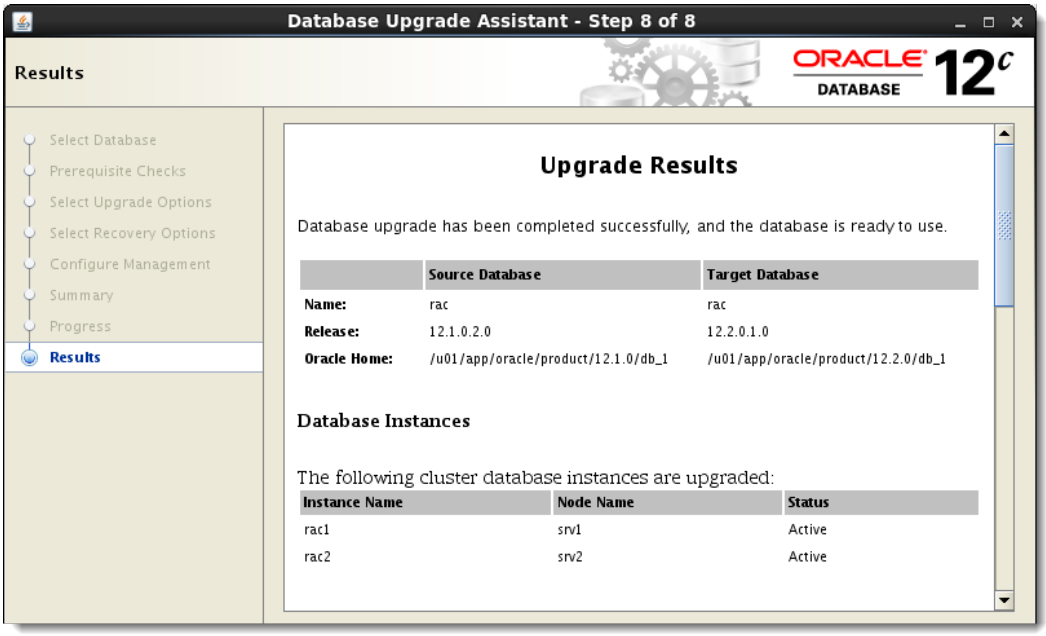
**36.** Start the dbua utility by issuing the following commands:

```
export ORACLE_HOME=$ORACLE_BASE/product/12.2.0/db_1
export PATH=$ORACLE_HOME/bin:$PATH
cd $ORACLE_HOME/bin
./dbua
```

**37.** Respond to the utility windows as follows:

| DBUA Window | Response |
|---|---|
| **Select Database** | Enter the **sys** username and **password** |
| **Prerequisites Checks** | click on **Next** button |
| **Select Upgrade Options** | click on **Next** button |
| **Select Recovery Options** | select "**I have my own backup and restore strategy**" |
| **Configure Management** | Make sure "Configure Enterprise.." is selected |
| **Summary** | Click on **Finish** button |

When the upgrade finishes (it took one hour in my case), it should display a message like the following screenshot:



## Post-upgrade Tasks

In this section of the practice, you will perform tasks that should be performed after the upgrade is finished.

**38.** In the Putty window, switch current user to `oracle` and fix the `ORACLE_HOME` variable setting in `.bash_profile`.

```
vi .bash_profile
```

```
...
ORACLE_HOME=$ORACLE_BASE/product/12.2.0/db_1; export ORACLE_HOME
...
```

**39.** Source the `bash_profile` file.

```
source .bash_profile
```

**40.** Test connecting to `rac` database using the SQL*Plus in the upgraded Oracle home

```
sqlplus / as sysdba
```

**41.** Copy the `tnsnames.ora` file from the old Oracle home directory to the upgraded Oracle home directory.

```
cp /u01/app/oracle/product/12.1.0/db_1/network/admin/*.ora
/u01/app/oracle/product/12.2.0/db_1/network/admin
```

**42.** Perform the same steps in `srv2`.

```
ssh srv2
# fix the ORACLE_HOME variable setting
vi .bash_profile

# copy the network configuration files:
cp /u01/app/oracle/product/12.1.0/db_1/network/admin/*.ora
/u01/app/oracle/product/12.2.0/db_1/network/admin

exit
```

**43.** In srv1 and srv2, switch to grid user and fix the ORACLE_HOME variable settings and copy the network configuration files.

```
su – grid

# fix the value set to the variable ORACLE_HOME
vi .bash_profile

# source the bash profile file
source .bash_profile

# copy the network files:
cp /u01/app/12.1.0/grid/network/admin/*.ora $ORACLE_HOME/network/admin

ssh srv2
# perform the same steps.
```

**44.** Run rman and delete the archivelog files (just to save the disk space). Plenty of archive logs must have been generated by the upgrade process.

```
rman target /
delete archivelog all;
```

**45.** Make sure the current user in the Putty session is oracle then start SQL*Plus and execute the postupgrade_fixups.sql script:

```
sqlplus / as sysdba
@/home/oracle/scripts/postupgrade_fixups.sql
```

**46.** While srv1 is still in operation, restart srv2. You will restart the instances just to make sure everything goes well after upgrade even after restarting the nodes.

**47.** Wait until srv2 is fully restarted and allow a few minutes for its instance to startup.

**48.** Make sure the database is running in both instances.

```
srvctl status database -d rac
```

**49.** Restart srv1.

**50.** Wait until srv1 is fully restarted and allow a few minutes for its instance to startup.

**51.** Make sure the database is running in both instances.

```
srvctl status database -d rac
```

**52.** Delete the existing database rac backupset files and take a new database backup.

```
# delete existing backup sets (just to avoid running out of free disk space)
rman target /
DELETE BACKUPSET;

# fix ORACLE_HOME value in the backup script:
vi /home/oracle/scripts/rman_script.sh


# perform backup:
/home/oracle/scripts/rman_script.sh

# Verify the backup was successfully made
tail -n 80 ~/scripts/rman.log

# verify that backupset files have been put in their place:
rman target /
list backup of database;
```

## Summary

- Upgrading an Oracle RAC environment includes upgrading first Oracle Grid Infrastructure and then upgrading Oracle database.