

HOW TO PERFORM ORACLE DATABASE 11G VERSION UPDATE TO ORACLE DATABASE 19C

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ABSTRACT

Due to the discontinuity of support for one of the database versions most used by organizations, Oracle Database 11g, it is important that companies that still use this version, pay attention to the next upgrade from Oracle. This work was elaborated by means of exploratory research, using as methods and research techniques the documentary and bibliographic analysis, with the purpose of providing steps with techniques and methods of how to proceed with two oracle projects, one of migration from the Linux operating system Red Hat 4.4.7-3 for Oracle Linux 7.7, and a version upgrade from Oracle Database 11g to Oracle Database 19c, presenting strategies using tools and following Oracle's recommendations. This study was built based on real demands that companies have been facing with this great dilemma, the discontinuity of support for the Oracle database 11g version. The observed results were, official support from Oracle, architectural change in order to be prepared for a supposed intervention with updating and migration of services to the cloud.

Keyword: Oracle 11g; Oracle 19c; Update off Version, Roadmap.

1. INTRODUCTION

With the constant evolution in the technological world, it is common for ORACLE products to undergo updates and improvements, as well as implementations of new features (features), security, architecture changes and even the discontinuity of support for products that were previously released.

Oracle has been innovating with several releases of Oracle Database versions, with the purpose of facilitating the desire of all its customers to standardize, automate and turn their database services into the cloud, which began with Oracle Real Application Clusters (RAC) and Oracle Automatic Storage Management (ASM), now it's time for Oracle Cloud and Standalone Database. With the release of the version of oracle database 12c in 2013, the sgbd oracle started to have the multitenant architecture, without undoing the previous structure, so that its customers had time to update and migrate their applications. With this new architecture, we can now use container databases (CDB), databases can be perfectly pluggable to a database container, and at the same time have multiple databases on the same hardware, they are Several documentations are available on the oracle's official website that can help the professional in the execution of the upgrade and migration processes.

However, companies face great difficulties to renew and update their information technology assets, regarding the oracle database, this is no different, both for financial reasons and the lack of professionals with such skills and technical skills to performing tasks that require knowledge and expertise in administration and maintenance of oracle database. Oracle, in turn, makes available on its official website a series of manuals and technical articles that technically help the dba for such procedures, in order to always leave its customers with updated software and prepared for successive updates that have been appearing all the time, making it inevitable that some previously released version will have its support discontinued, being unable to receive upgrade packages and becoming a stagnant version.

As an example, we have the version of ORACLE DATABASE 11g, originally released in 2007, which was discontinued recently, its support ended in December 2020. This does not mean that all oracle customers have updated software and with proper support, on the contrary, many companies are faced with this dilemma, version not updated and the lack of official support from Oracle, leaving them vulnerable to failures and attacks that can cause a catastrophe, such as a possible loss of data. With all this problem, it becomes important that companies that still use the 11g version, pay attention to the next Oracle upgrade.

Given this context, the purpose of this study is to show steps and techniques on how to proceed with a project to migrate the operating system and update the Oracle database 11g version to the Oracle database 19c version, presenting tools, techniques and strategies following the recommendations contained in the official Oracle documentation.

This study consists of six sections, this introduction, the theoretical foundation, then materials and methods, results and discussions, final considerations and finally bibliographical references.

2. THEORETICAL FOUNDATION.

The methodology applied for the development of this work was through exploratory research, using documentary and bibliographic analysis as research methods and techniques.

In the document analysis, several official Oracle documents were analyzed, such as manuals and technical articles in order to understand the steps and processes of both an operating system migration and an update of the Oracle software database version. According to Gil (2008), Documentary research is very similar to bibliographic research, with only one distinction, which is the source content, that is, bibliographic research is based on the help of different authors in a specific theme, the documentary is based on elements that have not been evaluated and that can still be adjusted and improved.

First, an analysis of official documents and technical articles from Oracle was carried out, then a bibliographical survey on the subject was carried out, in addition to readings of other specific works, which served as a basis for the development of this study.

2.1. ORACLE DATABASE 11G

According to Oracle(2021), “Oracle Database 11g, released in 2007, introduced a number of new features that allow administrators and developers to quickly adapt to changing business requirements. The key to adaptability is simplifying the information infrastructure, consolidating information and using automation wherever possible.” (ORACLE, 2021). According to the author, “Oracle Database 11g delivers industry-leading performance, scalability, security and reliability in a choice of clustered or single servers running Windows, Linux and UNIX. It provides comprehensive capabilities to easily manage the most demanding transaction processing, business intelligence and content management applications.”

2.2. ORACLE DATABASE 19C

According to the author, “Oracle Database 19c delivers industry-leading performance, scalability, reliability and security on-premises and in the cloud. And as the Long Term Version of the Oracle Database 12c family of products, having been released in April 2019 with extended support through April 2027, it provides the highest level of version stability and the longest time to support and corrections.” (ORACLE, 2021). One of Oracle's biggest innovations from version 12c onwards was the architectural change, Multitenant, which allows an Oracle database to function as a multi-tenant container database (CDB). (ORACLE, 2021). A CDB includes zero, one, or many customer-created pluggable databases (PDBs). A PDB is a portable collection of schemas, schema objects, and non-schema objects that appear to an Oracle Net client as a non-CDB. All Oracle databases prior to Oracle Database 12c were not CDBs (ORACLE, 2021).

2.3. UPDATE AND MIGRATION DEFINITION

For Oracle (2021), with regard to any change in the database, upgrade and migration are different terms. In an upgrade, be it version upgrades or patch applications, there is no user data change, what changes is only the data dictionary, transforming the existing database landscape into a new environment. In migration, data moves from one database to another database, another process that we can characterize as a migration, is when we need to move a database environment to a new hardware or operating system platform.(ORACLE, 2021). On the official website, there are several guides available with upgrade and migration steps with specific documentation for each version of the Oracle database.

In this study, we will demonstrate the steps of two projects, migration and upgrade, considering that the upgrade from oracle database 11g to oracle database 19c requires some operating system prerequisites and migration and upgrade patch from your oracle database.

Assuming that a certain company uses the DBMS ORACLE 11g with the following source scenario, Linux Red Hat 4.4.7-3 and Oracle Database 11g Release 11.2.0.4.0 - 64bit with a single instance (Single instance) Already the scenario ideal target is Oracle Linux 7.7 and Oracle Database 19c (Single instance).

3. MATERIAL AND METHODS.

In order to carry out the operating system migration and version upgrade projects from oracle database 11g to oracle database 19c, we had to start with a complete backup of the database with a full backup, in order to safeguard the information already contained in the source version, the oracle database 11g with the Linux operating system: Red Hat 4.4.7-3, so that, after the installation and configuration of the new scenario, the operating system oracle linux 7.7 together with the oracle database 11g , it was possible to restore the backup previously performed.

3.1 THE FULL BACKUP OF THE ORACLE DATABASE 11G DATABASE WITH

RMAN.RMAN (Recovery Manager), is an integrated tool that comes with the oracle database. According to Oracle (2021), this application is an oracle database client that performs copy and recovery tasks on your databases and automates the administration of your backup strategies, mainly scheduling, monitoring and several other processes .

With this powerful backup tool (RMAN) in hand, we will start the process of backing up our database with the physical backup strategy with the command "BACKUP PLUS ARCHIVELOG", this is a feature that makes the physical copy of all the necessary files, that is, it is a full backup that copies all datafiles, all control files, spfile and all archive logs, thus enabling a very secure restoration, however, it is worth remembering that this type of backup is only allowed if the database has archivelog mode enabled.

The oracle database allows you to save populated groups of redo log files to one or more offline destinations, known collectively as an archived redo log or, more simply, an archive log. The process of turning redo log files into archived redo log files is called archiving. This process is only possible if the database is running in ARCHIVELOG mode. You can choose automatic or manual archiving (ORACLE, 2021).

To find out if the database has archivelog mode enabled, you can access SQL*PLUS and type the sql statement "select log_mode from v\$database" as shown (Figure 01).

Figure 01 - SQL statement that checks if the database is archived.

```
SQL> select log_mode from v$database;

LOG_MODE
-----
NOARCHIVELOG

SQL>
```

Source: Author, 2021.

It is observed that in figure 01, the database does not have the archivelog mode enabled, to enable this option, just type the sequence of commands as shown in (Figure 02)

Figure 02- Commands that enable the database to archivelog mode.

```
SQL>
SQL>
SQL> shutdown immediate;
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup mount;
ORACLE instance started.

Total System Global Area 725611352 bytes
Fixed Size                 9139032 bytes
Variable Size             494927872 bytes
Database Buffers          218103808 bytes
Redo Buffers               3440640 bytes
Database mounted.
SQL> alter database archivelog;

Database altered.

SQL> _
```

Source: Own authorship, 2021.

The series of commands in figure 02 performs the following procedure, downloads the instance, then starts the mounted database and then enables archivelog mode.

After that, just type again the sql sentence “select log_mode from v\$database” to find out if there was a change in the database log_mode, as shown in (Figure 03).

Figure 03 - Archivelog mode enabled.

```
SQL> select log_mode from v$database;

LOG_MODE
-----
ARCHIVELOG

SQL>
```

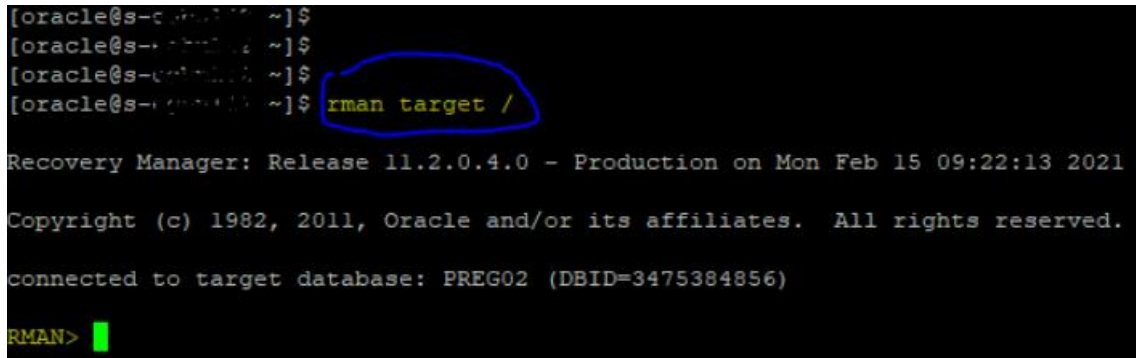
Source: Author, 2021.

Access to RMAN can be done with the following command, "rman target /", connecting with the target operator, the distinct database is indicated, and with this user you have sufficient privileges for backup and recovery operations, according to (Figure 04).

Figure 04 - RMAN tool.

Source: Author, 2021.

Now, the next step is to perform the full backup, as the command "BACKUP PLUS



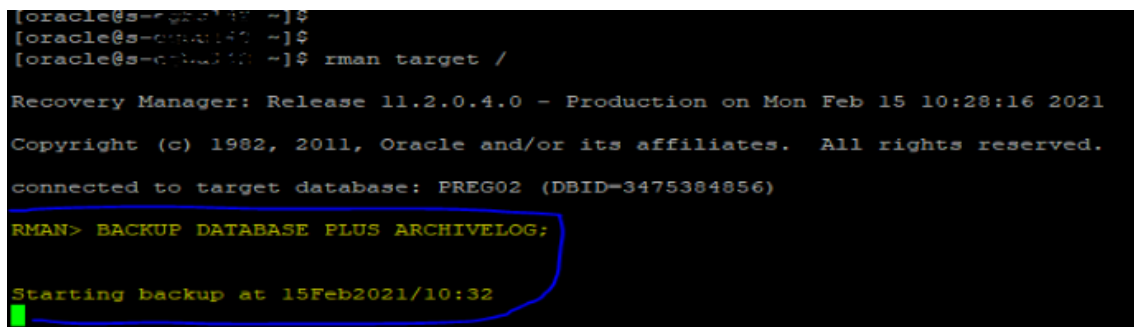
```
[oracle@server ~]$
[oracle@server ~]$
[oracle@server ~]$
[oracle@server ~]$ rman target /

Recovery Manager: Release 11.2.0.4.0 - Production on Mon Feb 15 09:22:13 2021
Copyright (c) 1982, 2011, Oracle and/or its affiliates. All rights reserved.
connected to target database: PREG02 (DBID=3475384856)

RMAN>
```

ARCHIVELOG;”, according to (Figure 05).

Figure 05 - RMAN tool - starting the backup.



```
[oracle@server ~]$
[oracle@server ~]$
[oracle@server ~]$ rman target /

Recovery Manager: Release 11.2.0.4.0 - Production on Mon Feb 15 10:28:16 2021
Copyright (c) 1982, 2011, Oracle and/or its affiliates. All rights reserved.
connected to target database: PREG02 (DBID=3475384856)

RMAN> BACKUP DATABASE PLUS ARCHIVELOG:

Starting backup at 15Feb2021/10:32
```

Source: Author, 2021.

Após a finalização do backup full, pode iniciar o processo de mudança do sistema operacional Linux Red Hat 4.4.7-3 para o Oracle Database 11g Release 11.2.0.4.0 - 64bit.

3.2 INSTALLING ORACLE LINUX 7.7.

Oracle Linux is an operating system compiled from the Red Hat Enterprise Linux distribution, encapsulated and distributed by Oracle. In this work, the change of operating system is necessary due to the fact that Linux: Red Hat 4.4.7-3 does not support oracle database 19c.

With an open and complete operating environment, Oracle Linux provides native virtualization, management and cloud computing tools, along with the Linux operating system, in a single support offering. Oracle Linux is 100% application binary compatible with Red Hat Enterprise Linux. (ORACLE, 2021).

First, the Oracle Linux ISO version 7.7 was downloaded from the Oracle download site at the following email address: <https://edelivery.oracle.com/osdc/faces/SoftwareDelivery>, then this file was copied onto the server, to run on the next server boot and start installing Oracle Linux 7.7, as shown in (Figure 06).

Figure 06 - Initial screen for installing oracle linux 7.7



Fonte: Oracle, 2021.

After the installation and configuration of oracle linux 7.7, we started the installation of oracle database 11g.

3.3 A INSTALAÇÃO DO ORACLE SOFTWARE DATABASE 11G.

The ISO of Oracle Database 11g release 2.0.4 was downloaded from the Oracle download site at the following address: <https://edelivery.oracle.com/osdc/faces/SoftwareDelivery>, then the installer was run with the command “./runinstaller”, as shown in (Figure 07).

Figura 07- Tela inicial da instalação do oracle database 11g.



Fonte: Oracle, 2021.

After installing oracle database 11g, the full backup was restored.

3.4 RESTORING ORACLE DATABASE 11G WITH RMAN.

The database was restored and the archivelogs were applied, through the previously performed backup, to perform the backup restoration, the following commands were executed, STARTUP NOMOUNT, RESTORE CONTROLFILE FROM "BACKUP FILES PATH", RESTORE DATABASE, RECOVER DATABASE AND ALTER DATABASE OPEN RESETLOGS;

3.5 DIRECT VERSION UPGRADE WITH DATABASE UPGRADE ASSISTANT (BDUA)

The Database Upgrade Assistant (DBUA) is a graphical tool developed in java provided by Oracle to assist in the version upgrade process, with a low complexity and a very fast process. (ORACLE, 2021).

Figure 08 - Oracle migration and update methods table

Method	Complexity	Speed	Minimum Source Version	Move to New Server	Change O/S	Change Data Layout, character set, encryption, compression
Unplug, Plug and Upgrade	Med	Fastest	12.1.0.1	Yes	No	No
Database Upgrade Assistant	Low	Fastest	11.2.0.3	No	No	No
Command-line Upgrade	Med	Fastest	11.2.0.3	Yes	No	No

Source: <https://www.oracle.com/technetwork/database/upgrade/overview/upgrading-oracle-database-wp-122-3403093.pdf>.

A direct upgrade is one where the Database Upgrade Assistant (DBUA) or command-line upgrade script is used to upgrade your database to Oracle Database 19c. Direct upgrade is supported when the source database is running one of the versions shown in the following table.(ORACLE,2021).

Using the DBUA tool, it is possible to do a direct upgrade to oracle database 19c, as long as our source environment complies with the prerequisites shown in (Figure 09).

Figure 09 - Prerequisites table for direct upgrade

TABLE 1. DIRECT UPGRADE PATHS FOR ORACLE DATABASE 19C		
SOURCE RELEASE	SOURCE PATCH SET OR RELEASE	Direct Upgrade Supported?
Oracle Database 12c Release 2	18c	Yes
	12.2.0.1	Yes
Oracle Database 12c	12.1.0.2	Yes
	12.1.0.1	No. Use another method
Oracle Database 11g Release 2	11.2.0.4	Yes
	11.2.0.1, 11.2.0.2, 11.2.0.3	No. Use another method
Oracle Database 11g Release 1 and earlier	All	No. Use another method

Source: <https://www.oracle.com/africa/a/tech/docs/twp-upgrade-oracle-database-19c.pdf>

The new source environment perfectly supports the direct upgrade process, thus, the direct upgrade was done using the DBUA tool.

4. RESULTS AND DISCUSSIONS.

There are several methods of updating the oracle software database version, as well as the update through the command line manually, executed by the dba itself with the help of the oracle's official documentation or in automatic ways with the tools DbUpgrade, Autoupgrade or the DBUA . Another way to update would be with the export and import of tablespaces, the transportable tablespaces (TTS), with the complete or traditional Oracle database feature. We can also use Oracle Data Pump Export / Import, using the logical backup of information, we have the Export and Import utilities to move data from one database to another, being done before the oracle software update.

DBUA uses the silent update method, ie without creating a copy or other database instance, and minimizes manual effort, but has less flexibility than updating manually. (ORACLE, 2021).

The steps of these projects are basically as follows: performing a full backup, installing oracle linux 7.7, then installing oracle database 11g, then restoring the database, and then running DBUA.

This study demonstrated that automatic and direct version update with the DBUA (Database Configuration Assistant) tool is the easiest way, with medium complexity and a quick process, in addition to being strongly recommended by Oracle, as long as your scenario is within of the prerequisite criteria required.

5. CONSIDERATIONS.

In this work, appropriate techniques for oracle projects were addressed, such as migration and upgrade, the upgrade of the Oracle database 11g to the oracle database 19c version, applying techniques and best practices with studies of official documents and tools made available by Oracle, the same way was followed the manuals for installation and configuration of the operating system oracle linux 7.7.

The importance of upgrading the Oracle database 11g version is due to the discontinuation of support. Migration from Linux Red Hat 4.4.7-3 operating system to Oracle Linux 7.7 is necessary due to incompatibility with Oracle database 19c.

It was observed that, with the update of oracle database 11g to the Oracle database 19c version and the migration of the Linux operating system Red Hat 4.4.7-3 to Oracle Linux 7.7, the database is prepared to receive new update patches and also a possible intervention with regard to making your services in the cloud, with version 19c, it becomes simpler and faster the methods and processes of a new upgrade and even a new migration of environments using the method of unplug and plug.

It was noticed that, in this way, it was necessary to apply the techniques covered in this work for the migration and update to version 19c, leaving a scenario fully updated, safe and ready to receive new updates.

It is concluded that the study presents techniques with fundamental steps to perform the operating system migration and the upgrade from Oracle Database 11g to Oracle Database 19c, with tools that Oracle itself

makes available on its official website.

BIBLIOGRAPHIC REFERENCES

GIL, A. C. (2008). MÉTODOS E TÉCNICAS DE PESQUISA SOCIAL. SÃO PAULO: EDITORA ATLAS S.A.

ORACLE. (2001). INTRODUCTION TO ORACLE DATABASE. Acesso em 2020, disponível em INTRODUCTION TO ORACLE DATABASE: <https://docs.oracle.com/database/121/CNCPT/intro.htm#CNCPT001>

ORACLE. (2016). UPGRADINGAND MIGRATINGTO ORACLE DATABASE 12CRELEASE 2(12.2.0.1). Acesso em 2021, disponível em UPGRADINGAND MIGRATINGTO ORACLE DATABASE 12C RELEASE 2(12.2.0.1): <https://www.oracle.com/technetwork/database/upgrade/overview/upgrading-oracle-database-wp-122-3403093.pdf>

ORACLE. (2019). UPGRADE AND MIGRATE TO ORACLE DATABASE 19C. Acesso em 2021, disponível em UPGRADE AND MIGRATE TO ORACLE DATABASE 19C: <https://www.oracle.com/africa/a/tech/docs/twp-upgrade-oracle-database-19c.pdf>

ORACLE. (2021). DATABASE UPGRADE GUIDE. Acesso em 2021, disponível em DATABASE UPGRADE GUIDE: <https://docs.oracle.com/en/database/oracle/oracle-database/19/upgrd/index.html>

ORACLE. (2021). ORACLE DATABASE 11G DOCUMENTATION. Acesso em 2021, disponível em ORACLE DATABASE 11G DOCUMENTATION: https://docs.google.com/document/d/1mp8erFFM2HnaFRImk9GrWz9Fy7LM0GTiWlB91m_hMII/edit#

ORACLE. (2021). ORACLE DATABASE 19C. Acesso em 2021, disponível em ORACLE DATABASE 19C: <https://www.oracle.com/br/database/technologies/>

ORACLE. (2021). ORACLE LINUX. Acesso em 2021, disponível em ORACLE LINUX: <https://www.oracle.com/linux/>

ORACLE. (2021). ORACLE MULTITENANT . Acesso em 2021, disponível em ORACLE MULTITENANT : <https://www.oracle.com/br/database/multitenant/>

ORACLE. (2021). ORACLE RECOVERY MANAGER (RMAN). Acesso em 2021, disponível em ORACLE RECOVERY MANAGER (RMAN): <https://www.oracle.com/database/technologies/high-availability/rman.html>