

An Oracle White Paper  
September 2009

# Methods for Upgrading to Oracle Database 11g Release 2

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## Introduction

The recommended method for upgrading to Oracle Database 11g Release 2 is to use the Database Upgrade Assistant (DBUA). However, there are circumstances when using the DBUA is not possible and it is more appropriate to use another method.

Choosing a particular method is dependent on several factors. Some of the factors that help determine which upgrade method to use include the following:

- Version from which you are upgrading
- Amount of downtime that is acceptable
- Preference for a graphical user interface (GUI) versus SQL scripts
- Complexity of the upgrade and amount of manual intervention required
- Whether additional disk space or hardware resources are required
- Whether the upgrade involves a different operating system architecture or migration to a new hardware platform

This paper discusses the various upgrade methods and guidelines for their use. It does not discuss the pre-upgrade, upgrade, or post-upgrade steps that a user should follow to ensure a successful upgrade. For information on all these steps, see the following (part numbers and links are provided in the References section):

- *Oracle Database Upgrade Guide 11g Release 2*
- Oracle Database Upgrade Companion 11g Release 2
- Oracle Database 11g Upgrade page on OTN

## Database Upgrade Methods

Depending on the environment, there are several alternatives available when upgrading a database. This section discusses why a particular method would be chosen, lists considerations when using each method, and gives pointers to additional information.

### Database Upgrade Assistant (DBUA)

The DBUA provides a graphical user interface (GUI) that guides a user through an in-place upgrade of a database. It is the recommended method for performing either a major release upgrade or patch release upgrade.

The DBUA automates the upgrade process by performing all of the tasks that would otherwise need to be performed manually. It can be launched during installation of Oracle Database 11g Release 2 with the Oracle Universal Installer or it can be launched as a standalone tool at any time after installation is complete.

The DBUA is a very useful tool because it evaluates the current database and makes appropriate recommendations for configuration options such as tablespace sizes, cluster checks, initialization parameters, and Oracle Automatic Storage Management (ASM) upgrades.

### When to Choose the DBUA Method

Using the DBUA can be a good choice if the upgrade environment has the following characteristics:

- Operating system (OS) remains the same (including upgrades in the same OS family, such as Windows XP to Windows Vista or Solaris 2.8 to Solaris 2.10)
- A GUI is preferred over a manual command-line interface
- Oracle Real Application Clusters (RAC) or Oracle Automatic Storage Management (ASM) is installed  
Much easier and less error prone than manual method – HIGHLY recommended
- Existing Oracle database is at least 9.2.0.4 if upgrading to Oracle Database 11g Release 1 or at least 9.2.0.8 if upgrading to Oracle Database 11g Release 2



### Considerations When Using DBUA

- Databases must be on the same system (in-place upgrade where the new version of Oracle Database is installed on the same server as the existing version). The DBUA cannot upgrade a database remotely.

### For More Information

- *Oracle Database Upgrade Guide 11g* (Release 1 and Release 2)
- Oracle Database Upgrade Companion 11g (Release 1 and Release 2)
- Oracle Database 11g Upgrade page on OTN
- Complete Checklist to Upgrade to 11g Release 2 using DBUA

### Manual Upgrade

A manual upgrade consists of running SQL scripts and utilities from a command line to do an in-place upgrade of a database to the new Oracle Database 11g release. Although a manual upgrade gives finer control over the upgrade process, it is more susceptible to error if any of the upgrade steps are not followed or are performed out of order.

After you have installed Oracle Database 11g Release 2 (11.2) and any required patches, you should analyze your database before upgrading it to the new release. This is done by running the Pre-Upgrade Information Tool. This is a required step if you are upgrading manually, otherwise the `catupgrd.sql` script will terminate with errors.

The Pre-Upgrade Information Tool is a SQL script (utlu112i.sql) that ships with Oracle Database 11g Release 2 (11.2). It performs checks on configuration options such as components, initialization parameters, and tablespace sizes.

### **When to Choose the Manual Upgrade Method**

Performing a manual upgrade can be a good choice if the upgrade environment has the following characteristics:

- Manual command-line interface is preferred over a GUI
- Existing Oracle Database is at least 9.2.0.4 if upgrading to Oracle Database 11g Release 1 or at least 9.2.0.8 if upgrading to Oracle Database 11g Release 2 (a 1-step upgrade). Manual upgrades can be done for databases before 9.2.0.x, but 2 steps are required versus 1. For example, if upgrading from 8.1.7.4, it is necessary to first upgrade to 10.2.0.x and then to 11.1 or 11.2.

### **Considerations When Using Manual Upgrades**

- Cannot upgrade to a system with a different operating system architecture

### **For More Information**

- *Oracle Database Upgrade Guide 11g* (Release 1 and Release 2)
- Oracle Database Upgrade Companion 11g (Release 1 and Release 2)
- Oracle Database 11g Upgrade page on OTN
- Complete Checklist for Manual Upgrades to 11g Release 2

### **Export and Import**

This method involves using either the Data Pump Export and Import utilities or the original Export and Import utilities. In either case, the utilities physically copy all or part of the data from the current database to a new Oracle Database 11g. When upgrading from Oracle Database 10g or higher, Data Pump Export and Import are strongly recommended because they provide improved performance and better manageability.

To have two physical copies of the database, along with the dump file set generated by the Export utility, a significant amount of disk space may be required. However, the user has the flexibility (especially with Data Pump) to choose subsets of the database to export such as tablespaces, schemas, tables, and rows, leaving the original database unchanged. In addition, Data Pump Export and Import have two features that can help with the issue of disk space. First, Data Pump Import can be used in network mode, which allows the new Oracle Database to be directly loaded across the network from the old database being upgraded. Thus, no intervening dump files are required. Second, when using Data Pump Export and Import in

Oracle Database 11g, the imported data can be compressed with the Oracle Advanced Compression option to improve performance (only when going from 11g Release 1 to 11g Release 2 or for patch set upgrades from Oracle Database 11g onward).

Data Pump Export/Import and original Export/Import do not change the existing database, which enables the database to remain available throughout the upgrade process. Data Pump Export and Import use Oracle Flashback Technology to get a consistent view of the data. However, neither Data Pump Export/Import nor original Export/Import provide consistent snapshots by default.

Because the current database can remain available, the existing production database can be kept available for read-only transactions while the new Oracle Database 11g database is being built at the same time by Data Pump Export/Import or original Export/Import. The current database can be deleted once the upgraded system is determined to be fully functional.

Note that Data Pump Export/Import is supported starting in Oracle Database 10g. When upgrading an Oracle database that is older than 10g, original Export and Import must be used.

#### **When to Choose the Export and Import Utilities**

The Data Pump Export and Import utilities or the original Export and Import utilities can be a good choice if the upgrade environment has the following characteristics:

- The upgrade involves migration to a different operating system architecture or hardware platform
- Source database is running on a version such as 8.0.3 or 8.1.6 that is not directly upgradable to the target version
- Side-by-side testing of the old and new versions of Oracle Database is needed (because an entirely new database is created)
- New database will be restructured (that is, new tablespaces will be created and populated by imported data, or a new partitioning scheme will be implemented)

#### **Considerations When Using the Export and Import Utilities**

- Downtime will be much longer than other methods, depending on the size of the database (10+ hours for large databases). This can be tested by running a test export into the file system and then doubling or tripling the amount of time that would be required for the subsequent import
- Additional disk space will be necessary to store both the export dump files and the new copy of the database

#### **For More Information**

- *Oracle Database Upgrade Guide 11g* (Release 1 and Release 2)

- *Oracle Database Utilities 11g Release 2*
- Oracle Database Upgrade Companion 11g (Release 1 and Release 2)
- Oracle Database 11g Upgrade page on OTN
- Oracle Database Utilities page on OTN

## Oracle Transportable Tablespaces (TTS)

Oracle Transportable Tablespaces (TTS) is an option for performing database upgrades in less than one hour for databases that have simple schemas and where the data files do not need to be transferred as part of the transport process (such as when the data files will be used in place, or when shared storage is available in a system migration).

With this method, an empty 11g Oracle database is created and data is moved from the existing database to the new 11g database. Metadata for tables and indexes, and the objects needed to support the tables and indexes in the tablespaces, is exported from the existing database and then imported into the new database using Data Pump Export/Import or original Export/Import. The majority of time taken for the upgrade is for the metadata export and import, and this is where there may be less than optimal performance.

The TTS method has been used effectively to reduce database upgrade time. However, because it was not originally designed as a database upgrade method, it does not have the same level of automation as the DBUA. Consider whether the added testing time and complexity of performing a TTS upgrade are worth the potentially reduced downtime during the upgrade.

Starting with Oracle Database 10g, tablespaces can be moved across platforms. Many, but not all, platforms are supported for cross-platform tablespace transport. If you are moving between platforms having different endian formats (big endian versus little endian), a Recovery Manager (RMAN) CONVERT DATABASE command is required. Note that the time needed for the RMAN CONVERT DATABASE command to be executed is essentially equivalent to the time needed for an RMAN backup of the database.

### **When to Choose the TTS Method**

The TTS method can be a good choice if the upgrade environment has the following characteristics:

- Downtime must be less than one hour
- Data files do not need to be transferred as part of the transport process
- Existing database's object structure is not complex

### **Considerations When Using TTS**



- Metadata gets transported from the existing database to the new database and may increase upgrade time. If desired, a time estimate can be obtained by performing a metadata-only export on the source database.
- Higher level of skill is required for the database administrator (DBA)

#### **For More Information**

- *Oracle Database Administrator's Guide 11g Release 2*
- *Oracle Database Backup and Recovery User's Guide 11g Release 2*
- Database Upgrade Using Transportable Tablespaces: Oracle Database 11g Release 1 (white paper)
- Platform Migration Using Transportable Tablespaces: Oracle Database 11g Release 1 (white paper)
- Platform Migration Using Transportable Database: Oracle Database 11g and 10g Release 2 (white paper)

#### **Oracle Data Guard SQL Apply (Logical Standby)**

Starting with Oracle Database 10g (10.1.0.3), Data Guard SQL Apply (logical standby) can be used to perform a database rolling upgrade with minimal downtime. The upgrade can be to a later Oracle Database release or patch set. The overall downtime can be as little as the time it takes to perform a switchover.

What is Oracle Data Guard? Oracle Data Guard provides the management, monitoring, and automation software infrastructure to create and maintain one or more standby databases to protect Oracle data from failures, disasters, errors, and data corruptions. There are two types of standby databases. A physical standby uses Redo Apply to maintain a block for block, exact replica of the primary database. A logical standby uses SQL Apply and contains the same logical information as the primary database, although the physical organization and structure of the data can be different. SQL Apply also enables rolling upgrades by allowing the synchronization of a standby database with a primary database that is using an earlier release of the Oracle Database.

A database rolling upgrade entails first upgrading a logical standby database to a later Oracle release or patch set, and then allowing SQL Apply to re-synchronize the primary and standby databases. When the DBA is satisfied that the upgrade has been successful, the process is completed by using a Data Guard switchover operation to transition the standby to the primary role. The only downtime experienced by applications is the time needed to complete the switchover process and reconnect clients to the new primary database. The actual database upgrade is performed while applications continue to access the original production database.

Beginning with Oracle Database 11g, Data Guard physical standby users can also benefit from rolling database upgrades by temporarily converting a physical standby to a transient logical standby database, enabling SQL Apply to synchronize the primary and standby databases while they operate at different Oracle releases or patch sets. The transient logical process is attractive because it can use existing physical standby databases and it only requires a single catalog upgrade to migrate both primary and standby databases to the new Oracle release. When the upgrade process is complete, the configuration reverts to its original state of having a primary with a physical standby database.

### **When to Choose Oracle Data Guard SQL Apply**

The Oracle Data Guard SQL Apply method can be a good choice if the upgrade environment has the following characteristics:

- Oracle Data Guard SQL Apply is installed
- Minimal downtime is a requirement
- Current database is at least 10.1.0.3

### **Considerations When Using Oracle Data Guard SQL Apply**

- Operating systems must be the same on both databases
- Higher level of skill is required for the database administrator

### **For More Information**

- *Oracle Database Administrator's Guide* 11g Release 2
- *Oracle Data Guard Concepts and Administration* 11g Release 2
- Oracle Maximum Availability Architecture Best Practices page on OTN
- Database Rolling Upgrade Using Data Guard SQL Apply – Oracle Database 11g and 10g Release 2 (white paper)
- Database Rolling Upgrade Using Physical Standby Databases and the Transient Logical Rolling Upgrade Process (white paper)

## **Online Database Upgrade with Oracle Streams**

Oracle Streams can be used to achieve little or no database downtime during database or patchset upgrades. A database can be migrated to different platform, for example Intel Solaris to Intel Linux, or to a different character set. A copy of the current database is upgraded using Oracle Streams to keep changes synchronized during the upgrade process. The only downtime that occurs is during the switch from the current database to the new database.

### When to Choose the Oracle Streams Method

An online database upgrade using Oracle Streams can be a good choice if the upgrade environment has the following characteristics:

- Operating systems are different
- Little or no downtime is a requirement
- Current database is at least 9.2

### Considerations When Using Oracle Streams

- Performance restrictions may occur in an OLTP environment if the copy of the database does not keep up with existing database
- Significant amount of expertise is required by the database administrator

### For More Information

- *Oracle Database Administrator's Guide* 11g Release 2
- *Oracle Streams Concepts and Administration* 11g Release 2, Appendix D

## Conclusion

The DBUA is the preferred method for upgrading a database to Oracle Database 11g Release 2. However, in situations where it is not possible to use the DBUA, other options are available.

Choosing the appropriate upgrade method depends on the database environment, the amount of downtime that is acceptable, and the DBA's knowledge and tolerance for complexity. It is important for the DBA to understand the various upgrade methods and choose the one that best suits business requirements.

## References

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See Appendix D for setup procedure

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See Appendix D for setup procedure



Upgrade Methods for Upgrading to Oracle  
Database11g Release 2  
September 2009  
Author: Carol Palmer

Oracle Corporation  
World Headquarters  
500 Oracle Parkway  
Redwood Shores, CA 94065  
U.S.A.

Worldwide Inquiries:  
Phone: +1.650.506.7000  
Fax: +1.650.506.7200  
oracle.com



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