ORACLE DATABASE 11g

An Oracle White Paper
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Methods for Downgrading from Oracle Database 11*g* Release 2

ORACLE

Introduction

An important best practice when upgrading to Oracle Database 11g Release 2, or when making any major change to a production database, is to always have a well tested fallback strategy. Then, should something unforeseen happen with the production database, an organization can recover and proceed with business as needed.

In some cases it may be acceptable for the fallback strategy to result in loss of changes that were applied to the database over a period of time. For example, if the storage system suffers a catastrophic hardware failure in the middle of a database upgrade, then restoring and recovering a backup may be the best and fastest fallback strategy.

However, there are other situations where reverting to a previous backup may not meet your business needs. For example, suppose that after upgrading to Oracle Database 11g Release 2, you find out a week later than a key application has not been certified with the new release. As a result, it is necessary to downgrade back to the previous release. How can this be accomplished without losing a full week of transactions and processing?

Several methods can be used to downgrade without loss of data. These include: Downgrade script, Export and Import (including Data Pump Export and Import starting with Oracle Database 10g), Oracle Streams, and Oracle GoldenGate. There is no data loss with any of these methods, but each has characteristics that will make them more or less applicable to a given downgrade scenario.

This white paper looks at these various downgrade methods and guidelines for their use. The method you choose will depend on several factors, including the following:

- Target database version
- Different operating system architecture or hardware platform of source and target systems
- Downtime requirements
- Performance requirements
- License Costs

Oracle Database Downgrade Methods

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

Downgrade Script

A database downgrade can be accomplished by using the downgrade script, which is located in the file $ORACLE_HOME/rdbms/admin/catdwgrd.sql. Downgrading in this manner does not rewind time or make the database identical to its pre-upgrade state. Rather, it changes the data dictionary to be compatible with the release from which the database was upgraded.

Oracle binaries of the release to which the user is downgrading should be installed on the server before starting the downgrade process. If the Oracle executables to the desired release have been uninstalled, the Oracle binaries need to be re-installed to the correct release and patch level for the downgrade.

The catdwgrd.sql script must be run in the Oracle Database 11*g* Release 2 environment (source). The script downgrades all the Oracle Database components in the database, essentially undoing the upgrade actions that brought the database up to the current release. If any problems are encountered when the downgrade script is run, then they should be corrected and the script should be rerun. The script can be rerun as many times as necessary.

If the downgrade for a component fails, then an ORA-39709 error is displayed and the SQL*Plus session terminates without downgrading the Oracle Database data dictionary. All components must be successfully downgraded before the Oracle Database data dictionary is downgraded. The problem must be identified and fixed before rerunning the catdwgrd.sql script.

After the downgrade script completes, the second step of the downgrade process is to run the reload script (catrelod.sql) in the older (target) environment. This rebuilds the dictionary to the major release or patch release from which the database was originally upgraded.

The major restriction on the downgrade script is that it cannot be run if the COMPATIBLE parameter has been raised as part of, or after, the upgrade. This is because raising the COMPATIBLE parameter will allow on-disk changes that cannot be understood by the earlier version of Oracle Database. For this reason, downgrades from Oracle Database 11*g* Release 2 to Oracle Database 9*i* are not supported. Downgrades from Oracle Database 11*g* Release 2 to the following versions are supported:

- 10.1.0.5
- 10.2.0.2, 10.2.0.3, 10.2.0.4, 10.2.0.5
- 11.1.0.6, 11.1.0.7

Downgrade script is a good choice if the downgrade environment has the following characteristics:

- Target database version is Oracle Database release 10.1.0.5 or later

Considerations when using Downgrade Script

- Must run the catdwgrd.sql script in the Oracle Database 11*g* Release 2 environment and the catrelod.sql script in the target environment
- COMPATIBLE parameter must not have been changed during or after the upgrade to Oracle Database 11*g* Release 2
- Cannot downgrade to a system with a different operating system architecture
- Not a minimal downtime method

For More Information

- *Oracle Database Upgrade Guide* 11*g* Release 2 (Part Number E10819-02) – Chapter 6
- *My Oracle Support Note* 883335.1 – How to Downgrade from Database 11.2 to Previous Releases
- *My Oracle Support Note* 443890.1 – Complete Checklist for Downgrading the Database from 11*g* to Lower Releases

Oracle Data Pump Export/Import and original Export/Import

Both Oracle Data Pump Export/Import (expdp/impdp) and original Export/Import (exp/imp) can be used to move data between different versions of Oracle Database. These tools are a flexible and powerful way to downgrade a database if the need arises.

Starting with Oracle Database 10*g*, Oracle Data Pump Export (expdp) and Import (impdp) can be used to downgrade from Oracle Database 11*g* Release 2 to any previous version from Oracle Database 10*g* or later. If you are downgrading to Oracle Database 9*i* or lower, then original Export (exp) and Import (imp) must be used. In addition to the versions available for downgrade, original exp/imp and Oracle Data Pump expdp/impdp differ in the way that they are used to perform the downgrade itself.

Oracle Data Pump

Any version of Oracle Data Pump expdp is able to produce dump files compatible with previous versions of Oracle Data Pump impdp. Therefore, to downgrade with Oracle Data Pump, the current release of expdp (11.2) is used with the `VERSION` parameter set to the target version of the subsequent import. The import is then performed using Oracle Data Pump impdp for the target release. The rule to remember for Oracle Data Pump operations is to always use the Oracle Data Pump client that is the same version as the database server being accessed.

For example, the following table shows that when you downgrade from Oracle Database 11*g* Release 2 to Oracle Database 10*g* Release 2, Oracle Data Pump Export Release 11.2 is used with the VERSION Parameter set to 10.2. The import version that is used is Oracle Data Pump Import Release 10.2.

Exporting from Oracle Database 11*g* Release 11.2 and Importing Into Oracle Database 11*g* Release 11.1, 10*g* Release 2, or 10*g* Release 1

Export From	Import To	Export Version to Use	Import Version to Use
Release 11.2	Release 11.1	Data Pump Export Release 11.2 with VERSION=11.1	Data Pump Import Release 11.1
Release 11.2	Release 10.2	Data Pump Export Release 11.2 with VERSION=10.2	Data Pump Import Release 10.2
Release 11.2	Release 10.1	Data Pump Export Release 11.2 with VERSION=10.1	Data Pump Import Release 10.1

Original Export and Import

With original Export, the rule is to run the exp and imp clients corresponding to the target database version. For the import, you must run an older version of Export to produce a dump file that is compatible with an older database version. Also, you must run the $ORACLE_HOME/rdbms/admin/catexp.sql script to create the old export views in Oracle Database 11*g* Release 2.

For example, if you are downgrading from Oracle Database 11*g* Release 2 to Oracle Database 9*i* Release 2, the following steps are required:

1. Create an empty database with the original Export and Import utilities.
2. Run the $ORACLE_HOME/rdbms/admin/catexp.sql script in Oracle Database 11*g* Release 2 to create the Oracle Database 9*i* Release 2 export views.
3. Use the Oracle Database *9i* Release 2 export utility to export the data into a dump file.
4. Use the Oracle Database 9*i* Release 2 import utility to import the data and reconstruct the database back to Oracle Database 9*i* Release 2.

To ensure a consistent export, Oracle Database 11*g* Release 2 cannot be available for updates during the export. If changes are made to Oracle Database 11*g* Release 2 after the export, then those changes must be propagated to the new database prior to making it available to users.

Oracle Data Pump Export and Import / original Export and Import are good choices if the downgrade environment has the following characteristics:

- The downgrade involves migration to a different operating system architecture or hardware platform
- The downgrade is to Oracle Database 9i Release 2 or earlier (for original Export/Import) or Oracle Database 10g or later (for Data Pump Export/Import)
- COMPATIBLE has been raised during or since the upgrade to Oracle Database 11g Release 2

Considerations when using Oracle Data Pump Export and Import / original Export and Import

- Downtime may be much longer than other methods, depending on the size of the database (10+ hours for large databases)
- Enough disk space is required to hold two copies of the database, plus the export dump file
- Downgrade to Oracle Database 10*g* or higher is done using Oracle Data Pump Export and Import
- Downgrade to Oracle Database 9*i* or lower is only possible using original Export/Import

For More Information

- *Oracle Database Utilities* 11*g* Release 2 (Part Number E16536)
- *My Oracle Support Note* 208237.1 – How to Downgrade a Database Using Export/Import
- *My Oracle Support Note 158845.1* – How to Export/Import if Source Database is Newer/Older Than Target Database
- *My Oracle Support Note 553337.1* – Export/Import Data Pump Parameter VERSION - Compatibility of Data Pump Between Different Oracle Versions
- *Oracle Database Utilities Technology Portal*

Oracle Streams

Oracle Streams is a solution that supports real-time replication between Oracle databases across various database releases and platforms. It does this in three steps. First, an Oracle Streams capture process retrieves change data extracted from the redo log of a database, either by hot mining the online redo log or by mining archived log files with Oracle LogMiner. After retrieving the data, the capture process formats it into a logical change record (LCR) and places it in a staging area for further processing. The capture process can intelligently filter the LCRs so that only changes are captured. Finally, the changes are applied to the replicated database.

You can use Oracle Streams to downgrade from Oracle Database 11*g* Release 2 to Oracle Database 11*g* Release 1, Oracle Database 10*g* Release 2 and Release 1, and Oracle Database 9*i* Release 2. Downgrading using Oracle Streams is one of the methods that results in the least downtime. The process involves the following steps:

1. Create an Oracle Streams capture process for Oracle Database 11*g* Release 2.
2. Make a copy of Oracle Database 11*g* Release 2 using Oracle Recovery Manager (RMAN), transportable tablespaces, a physical standby, or Oracle Data Pump (Export and Import). While the copy is being made, the original database remains fully operational.
3. Downgrade the copy of the database. While that process is going on, any changes that are occurring in the Oracle Database 11*g* Release 2 production environment are stored in the redo logs.

4. After the downgraded copy is available, configure Oracle Streams propagations and apply processes. A propagation is configured at the source database and identifies the target database. Apply processes are configured at the target database.
5. After Oracle Streams propagation is configured, synchronize the source and target databases by starting the Oracle Streams processes on both releases of the database.
6. After the source and target databases are synchronized, switch users from the source system to the target system. The only downtime is the time needed for clients to reconnect.

If users want to go back to the original Oracle Database 11*g* Release 2 environment, Oracle Streams can be configured to synchronize the database in reverse as well.

Oracle Streams is a good choice if the downgrade environment has the following characteristics:

- Zero downtime is a requirement
- The downgrade involves migration to a different operating system architecture or hardware platform
- The target database is Oracle Database 9i Release 2 or higher

Considerations when using Oracle Streams

- Performance restrictions may occur in an OLTP environment if the Oracle Streams capture, propagation, and apply processes cannot keep up with the transaction load on the source database
- A significant amount of expertise is required by the database administrator
- There are some data type restrictions

For More Information

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

Oracle GoldenGate

Oracle GoldenGate is a replication solution that is similar in concept to Oracle Streams. The main technical difference is that Oracle GoldenGate operates outside of the database, whereas Oracle Streams operates inside the database. Oracle GoldenGate uses a different technology to capture information from redo logs. Oracle GoldenGate also supports more data types than Oracle Streams.

Oracle GoldenGate can be used to downgrade from Oracle Database 11*g* Release 2 to Oracle Database 11*g* Release 1, Oracle Database 10*g* Release 2 and Release 1, Oracle Database 9*i* Release 2 and Release1, and Oracle Database 8*i* Release 1. It is the method that requires the least downtime, and can be used to move between different platforms. Oracle GoldenGate is a separately licensed option of Oracle Database. The general process for using it to downgrade is as follows:

1. Turn on GoldenGate online capture to capture any changes that occur in the Oracle Database 11*g* Release 2 production database.
2. Make a copy of Oracle Database 11*g* Release 2 using Oracle Recovery Manager (RMAN), transportable tablespaces, a physical standby, or Oracle Data Pump (Export and Import). While making the copy, the original database remains fully operational.
3. Downgrade the copy of the database. While that process is going on, any changes that are occurring in the production environment are being captured.
4. After the downgrade of the target copy of the database is complete, start the Oracle GoldenGate apply process to synchronize the source and target databases.
5. Once everything is synchronized, switch the users from the source system to the target system. Downtime is limited to the amount of time it takes to move the users or application servers to the target system.

If users want to go back to the original Oracle Database 11*g* Release 2 environment, Oracle GoldenGate can be configured to synchronize the database in reverse as well.

Oracle GoldenGate is a good choice if the downgrade environment has the following characteristics:

- Zero downtime is a requirement
- The downgrade involves migration to a different operating system architecture or hardware platform
- The migration requires transformations from one data type to another

Considerations when using Oracle GoldenGate**:**

- An Oracle GoldenGate license is required
- There are some data type restrictions

For More Information:

- *Oracle GoldenGate Technology Portal*

Conclusion

Having a well tested fallback strategy is vital to any production database environment. When the need arises, it may be possible to downgrade an Oracle database to an earlier version without losing data. Choosing the appropriate downgrade 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 downgrade methods and choose the one that best suits business requirements.

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