Oracle Database Appliance: Migration Strategies

Table of Contents

Executive Overview

The Oracle Database Appliance is an engineered system offering that saves time and money by simplifying the deployment, maintenance, and support of a high availability database solution - all supported by a single vendor – Oracle. It is a fully integrated system with software, servers, storage and networking in a single box capable of supporting a wide range of home grown, packaged OLTP and Data Warehousing applications.

The Oracle Database Appliance offers customers a unique pay-as-you-grow software licensing capability allowing seamless scalability from 2 to 72 processor cores without any hardware upgrades. The Oracle Database Appliance X5-2 is a 6 rack unit (RU) server containing two Oracle Linux servers and one storage shelf. Each server features two 18-core Intel Xeon E5-2699 v3 processors, 256 GB of memory, and 10-Gigabit Ethernet (10GbE) external networking connectivity. The two servers are connected together via a redundant InfiniBand interconnect for cluster communication and share direct-attached high performance SAS storage. The appliance contains 128 TB of raw storage that's double-mirrored or triple-mirrored, offering 64 TB or 42.7 TB, respectively, of resilient usable database storage. In addition, there are four 400 GB solid-state drives for frequently accessed data and four 200 GB solid-state drives for database redo logs to boost performance. The appliance is also designed with mission-critical requirements in mind, with hot-swappable and redundant components. It offers an ideal solution for customers who value simplicity and who seek to reduce the required skills, complexity, costs and risks in deploying a highly available database solution. This paper discusses how to move your database data from its current database to the Oracle Database Appliance.

.

Scope

This paper describes various options available to migrate an Oracle Database onto the Oracle Database Appliance. Specific steps required for each of the options are referred to their individual MOS notes or Whitepapers as mentioned in the Appendix.

Introduction

After the Oracle Database Appliance is installed and configured, usually the next step is to load existing data from the current database into the Oracle Database Appliance database. There are flexible data migration options based on your Oracle skill level, the complexity of the option, and the time it takes to move the application data to the Oracle Database Appliance.

Some common factors that will help decide which option is best to migrate the database includes the processing power and resources available on the source system, the available network bandwidth between the source and target, and the volume and complexity of the data and data structures. This white paper describes the data migration options that are available to you and how we can expediently and efficiently advise you how to start using the Oracle Database Appliance while reducing application outage and risk.

This paper presents strategies for migrating to the current version of the Oracle Database Appliance:

» Oracle Database version 12.1.0.2.x

» Oracle Grid Infrastructure version 12.1.0.2.x

» Oracle Linux 6.7

» Maximum configurable local disk space of 64 TB (double-mirrored using ASM) with optional expandable storage using NFS

Network connectivity between the source system and the Oracle Database Appliance must be available. The Oracle Database Appliance offers 10GbE connections. While this paper is written specifically for the Oracle Database Appliance, these data migration options may be familiar to you as these are best practices tested by Oracle to migrate data from one Oracle database to another.

This document is an update to reflect Oracle ASM Cloud File System (ACFS) support with latest versions of Oracle Database Appliance.

Migration Approach

Migrating to the Oracle Database Appliance is not particularly different than migrating to any other Oracle database server. The most common migration strategies follow these steps:

1.   Evaluate migration requirements

2.   Plan and test the migration strategy

3.   Migrate your data to the Oracle Database Appliance

4.   Post-migration verifications and updates

Migration strategies typically use a single migration technique, but some systems will require a blend of approaches. The migration plan, as detailed and thorough as possible, must be tested and evaluated to meet the migration requirements. In addition, an acceptable fallback strategy must be developed, in case unanticipated problems occur, keeping in mind the outage and availability requirements of the business.

No migration will be complete until operational and management processes and procedures are modified and updated specifically for the Oracle Database Appliance.

In evaluating the options for migrating data to the Oracle Database Appliance, there are a number of key criteria and constraints that will provide guidance. These include the following:

- » Data volume (and index volume)
- » Acceptable length of system outage
- » Network bandwidth (one or two GbE or 10GbE connections, fully dedicated)
- » Storage for data staging, as necessary
- » Contingency fallback plan in case of migration failure, or post-migration problems
- » DBA's skilled and experienced to sufficient level for migration technique employed
- » Source system O/S and version
- » Source system database version
- » Data type, character sets, and other miscellaneous considerations

Migration Options

While there are a many possible migration techniques, the two most common options are:

- » Transportable Tablespaces, and
- » Data Pump (Export/Import)

These two options provide the simplest, lowest risk, easily-implemented approaches that will be available for Oracle-to-Oracle migrations.

Other notable options, which are not included in this white paper, include Oracle Streams, Insert/Select or Create Table as Select (CTAS) across database links, Oracle Recovery Manager (RMAN) incremental backups, and Custom procedural approaches (PL/SQL, etc.)

Migration Options

Migration Technique	Complexity (Risk)	Skill Level	Outage Window	Selectivity	Extra Storage	Prep Work	Post Work
Transportable Tablespaces	Medium	Medium	Medium	Low	Yes	Medium	Low
Data Pump (Export / Import)	Low	Low	Long	Medium	Yes	Low	Medium
Recovery Manager	Medium	Medium	Short	Low	No	Low	Low
Procedural Approaches	High	Medium	Long	High	No	High	Medium

Evaluating the relative merits of the migration techniques is often a matter of personal experience, rather than quantifiable. The ratings and indicators used in this table are only meant to provide general guidelines.

» Complexity (Risk) – the overall level of complexity inherent in the approach equates to risk, either as the number of steps involved, the skill or experience level required conducting the steps, or the amount of manual involvement required.

» Skill Level – the experience and comfort level with the technique. Most DBAs have some experience with one or more of these techniques, especially with export/import. The degree of experience or familiarity with these techniques will reduce levels of risk with the more complex approaches.

» Outage Window – the length of outage that would be acceptable to the business, remembering that the data migration is only a part of the overall system migration. The elapsed length of time for the data migration will depend greatly on volume, network connectivity and the migration technique employed.

» Selectivity – the degree of selectivity required for the migration, whether all the data from the source database is to be migrated, only specific tables are to be migrated, or specific rows are to be migrated. Not a key factor for many migration projects, but important for some, especially in cases of consolidated source databases, aging data sources, or as part of larger information lifecycle management strategy.

» Extra Storage – if additional storage is required for the migration technique, most likely as storage for staging files. Typically, this will mean double the storage required for the datafiles. Best practices, for performance, suggest that this extra storage be located on the Oracle Database Appliance's /cloudfs directory rather than on an externally available storage system.

» Prep & Post Work – the degree of work required preparing for the migration and complete the migration after the data has been transferred. The prep work is usually more extensive for customized approaches, while it is relatively small for Oracle utilities such as Data Pump or Export/Import. Post migration work would include index builds, enabling constraints, endian conversions, etc. These steps can contribute greatly to the overall elapsed time of the migration approach.

Transportable Tablespaces

Using the Transportable Tablespace approach is a manageable method for transferring entire user tablespaces from a source Oracle database to the target database on the Oracle Database Appliance. The new Cross-Platform Transportable Tablespace (XTTS) feature introduced in the Oracle Database 11g Release 2 database enable this approach even between heterogeneous endian systems.

Conceptually, the use of XTTS is simply a five step method:

1. Prepare for the migration

2. Export the metadata from the source database

3. Copy the datafiles from the source system to the target system using Oracle Recovery Manager

4. Import the metadata into the target database

5. Finalize the migration

The advantages that make this approach attractive are:

» Simple, all-encompassing approach – allows a user to migrate all of the data within individual user tablespaces, without having to rebuild indexes or re-validate constraints

» If Linux to Linux, will support migrations from older source databases to the Oracle Database Appliance which will not require endian conversion

» If the source database is at the same level as the target on the Oracle Database Appliance, then XTTS can manage any endian conversion from Oracle Database 11.2 onwards

» Faster migration than via Data Pump, though somewhat more complex

In addition, there may be complications due to objects being stored in the SYSTEM tablespace or objects owned by the privileged accounts, SYS and SYSTEM. See the Oracle Database Administrator's Guide Documentation for a full list of XTTS limitations and restrictions. Link to the documentation is located in the References section.

Oracle Data Pump

Oracle Data Pump is the simplest migration approach. While it is fairly foolproof, it is also the slower of the two recommended alternatives.

The variety of features available with Oracle Data Pump enables you to optimize performance and manageability for a number of different scenarios. The data can be staged on the Oracle Database Appliance for faster import, which is recommended but there is also the capability within Oracle Data Pump to directly export/import across the network without staging the data.   This is slower, but does not require interim storage. In addition, parallelism is highly manageable, as is post import processing which include index rebuilds, but the data constraints should not need to be revalidated.

For an overview of the features of Oracle Data Pump and how they can be employed for such a migration, refer to the Oracle Database Utilities documentation for the target Oracle Database Appliance database version. You should review the documentation for a list of restrictions, such as no support for LONG and LONG RAW and object datatypes. Plus, further information about supported versions is available in MOS Note 553337.1 - *Export/Import DataPump Parameter VERSION - Compatibility of Data Pump Between Different Oracle Versions.*

ASM to ACFS Migration

One of the fundamental architectural changes introduced in ODA 12.1.2.0.0 and later releases is the option to store databases in Oracle ASM Cluster File System (ACFS), which is created on top of ASM. Prior to version 12.1.2.0.0, the data files were stored on ASM. ODA 12.1.2.0.x releases supports database versions 11.2.0.2.x , 11.2.0.3.x, 11.2.0.4.x and 12.1.0.2.x. For databases versions equal or higher than 11.2.0.4.0, the default storage option will be ACFS while any older version of the database created using oakcli, will be created on ASM storage. All existing databases on an upgraded ODA will remain ASM databases.

One of the biggest advantages provided by ACFS based non-CDB databases is the capability of creating snapshot databases. This feature helps in faster, space efficient database cloning for development and testing purposes. The oakcli interface provides support for creating snapshot databases for non-CDB environments (CDB databases have the feature PDB Snapshot Cloning for this purpose). As the snapshot database feature is only supported on ACFS based environment, an ODA administrator might consider to migrate existing ASM databases to ACFS based storage. There might be other scenarios like setting up a new test environment from an existing production environment or setting up data guard on ACFS based storage. Mind that snapshot database feature is only for 11.2.0.4.x and 12.1.0.2 databases, you may migrate databases of older versions to ACFS but you will not be able to utilize the snapshot feature.

For migrating databases from another host to ACFS on ODA, please refer this White Paper: Migrate a database from another host to ACFS on ODA

Reducing the Outage and Providing Options for Fallback

In some instances, the database migration must be accomplished faster than can be managed directly with the two recommended approaches. In these cases, there needs to be an offline mechanism to instantiate the target database and simultaneously bring it in sync with the source system as transactional activity continues. The outage to occur will be when the primary database is switched from the source legacy system to the target Oracle Database Appliance. The recommended techniques for this approach to reducing the outage length include Oracle GoldenGate replication and Oracle Data Guard.

The processing sequence would follow these steps:

» Establish update processing method (from source to target)

» Instantiate the target database (ie. take an offline copy of the source database and migrate it to the target Oracle Database Appliance, with indexes and constraints in place

» Begin managed update processing against the target Oracle Database Appliance system (ie. apply changes occurring on the source system to the target system, to bring the target system up to date with the source and keep the two systems in sync)

» When ready, take a brief outage to switch roles between the legacy and Oracle Database Appliance system is now running the primary database.

The actual business outage is limited to switching the roles of the legacy and Oracle Database Appliance system. This same technique would have the additional benefit of providing a fallback in case a fatal problem occurred on the Oracle Database Appliance that would require a switch back to the legacy system.

Oracle GoldenGate

Oracle GoldenGate provides a well-proven, fully-functioned solution for providing replication processing to and from the Oracle Database Appliance, between heterogeneous systems (including non-Oracle sources) that can be used to reduce a database/application outage and give a simple role reversal as required.

However, this functionality typically requires specialized skills and experience with the Oracle GoldenGate software, and an extended period for configuration. There are also some limitations on the data types that can be replicated using this approach. For further information, please refer to the GoldenGate documentation listed in the Reference section and The Best Practices and Recommendations for using Oracle GoldenGate for Low Downtime Replication to the Oracle Database Appliance (My Oracle Support Note 1391398.1) are available.

Oracle Data Guard

Oracle Data Guard is a somewhat simpler alternative to providing much of the replication functionality offered by Oracle GoldenGate. In this case, the Oracle Data Guard standby is instantiated via the normal migration mechanisms, then replication is initiated in order to bring the standby up to date with the source system and to keep it in sync until the database roles are switched.

One advantage of the Data Guard solution over Oracle GoldenGate would be its support for all native Oracle data types. But, Data Guard could not be employed for the replication of non-Oracle data sources.

For more information on Oracle Data Guard and Oracle Database Appliance, please see the best practices white paper on OTN.

Non-Oracle to Oracle Database Migration

Oracle offers a wide range of migration services to help you optimize your usage of Oracle technology. Through the use of tools, resources, and proven best practices, Oracle can provide support for migrating from legacy or non-Oracle technologies to Oracle, helping you reduce the effort, cost, and risk - helping you to get your solution to market more quickly and easily. Oracle SQL Developer is an intuitive tool that enables you to migrate a database, including the schema objects, triggers, and stored procedures, to an Oracle Database using a simple point-and-click process. You can either use the tools available or employ Oracle services to help you complete the migration from a non-Oracle database. For more information, please see the Oracle Database Migration Technology OTN web page.

Summary and Recommendations

The migration of the legacy Oracle database to the Oracle Database Appliance can best be accomplished via Transportable Tablespaces, RMAN incremental backups or Oracle Data Pump. All are proven, simple approaches. However, when used standalone, all of these approaches requires some system outages lasting the length of the migration. If the business can support such an extended outage, then these are the best and simplest ways to complete the migration.

If the business access to the database cannot suffer a long outage, then these techniques may be augmented with the replication functionality provided by Oracle GoldenGate or Oracle Data Guard. Using these tools, the outage can be reduced significantly, but at the cost of greater complexity and the required skill/experience levels.

Appendix: References

Oracle Database Appliance

» Oracle Database Appliance - 2.1 Supported Versions & Known Issues (My Oracle Support Note 888888.1)
» Information Center: Oracle Database Appliance (My Oracle Support Note 1417713.2)
» Oracle Database Appliance Documentation homepage

Oracle Database Documentation

» Oracle Database 12c Release 1 (12.1) documentation homepage
» Oracle Database Administrator's Guide 12c Release 1 (12.1)
» Oracle Database Utilities 12c Release 1 (12.1)
» Oracle OLAP DML Reference for Oracle Database 12c Release 1 (12.1)
» Oracle Database Performance Tuning Guide 12c Release 1 (12.1)
» Migrating OLAP From 32 To 64 Bits (My Oracle Support Note 352306.1)
» Enabling a Constraint in Parallel (My Oracle Support Note 124848.1)

Data Pump Documentation and References

» Export/Import DataPump Parameter VERSION - Compatibility of Data Pump Between Different Oracle Versions (My Oracle Support Note 553337.1)

Data Guard Documentation and References

» Data Guard 12c Best Practices OTN homepage
» Best Practices for Migrating to Exadata White Paper
» Reduce Transportable Tablespace Downtime using Cross Platform Incremental Backups (My Oracle Support Note 1389592.1)

GoldenGate Documentation and References

» How to set up basic Oracle GoldenGate(OGG) and implement high availability(HA) in Oracle Database Appliance(ODA) environment using Oracle Clusterware
» Oracle GoldenGate Best Practices: Instantiation from an Oracle Source Database (My Oracle Suport Note 1276058.1)
» Zero-Downtime Database Upgrades Using Oracle GoldenGate White Paper
» Oracle GoldenGate High Availability using Oracle Clusterware White Paper
» GoldenGate Certification Matrix

Non-Oracle to Oracle Migration

» Oracle Database Migration Technologies homepage

ASM Cluster File System (ACFS)

» Benefits of Oracle ACFS
» FAQ - Storing Database Files on ACFS on ODA

ORACLE®

CONNECT WITH US

blogs.oracle.com/oracle

facebook.com/oracle

twitter.com/oracle

oracle.com

Hardware and Software, Engineered to Work Together

Oracle Database Appliance: Migration Strategies - June 2016
Author: RAC Pack

Oracle is committed to developing practices and products that help protect the environment