

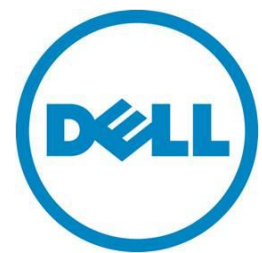
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# Oracle Database Migration to Dell PowerEdge 12<sup>th</sup> Generation Servers and Dell Compellent Storage Systems

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## Executive summary

Database migration has become a routine operation in most IT organizations for modernization, consolidation and platform migration. Migration delivers improved computing power, faster performance, new functions, features, and lowered cost of ownership. But this essential operation invites a lot of risks as well as long operational outages. Migrating Oracle database presents many unique challenges for IT administrators; such as the complexity, data integrity requirements, and 24x7 availability requirements of critical database applications. To address these challenges, Dell offers a near zero downtime migration strategy to move Oracle databases into a new infrastructure with near zero downtime impact. This methodology has been proven to be reliable and repeatable with the adoption by Dell IT for a large scale Oracle database migration project. This methodology brings out the best of Dell Compellent storage features like thin provisioning and a well tested reference architecture using the latest generation Dell PowerEdge servers.

## Introduction

The Dell PowerEdge 12<sup>th</sup> Generation servers and Dell Compellent storage systems are ideal choices for hosting Oracle database workloads by providing not only superior performance, but also lower TCO in terms of manageability, rack space, and power and cooling. For customers who are interested in moving their existing Oracle databases to new Dell hardware, performing a seamless migration is the first challenge they face. In the following sections, this paper examines various Oracle database migration options, including the pros and cons of each option. It details a migration solution adopted by Dell IT that can help customers migrate their existing Oracle databases to the latest releases of Dell hardware with near zero interruption to data availability. A key technology component used in this solution is the Oracle Automatic Storage Management (ASM) disk rebalance feature. This paper provides the recommended best practices on how to implement the migration methodology.

## Dell Solutions for Oracle Databases

Dell solutions for Oracle products are designed to simplify operations, improve usability, and provide cost-effective scalability as your needs grow over time. In addition to providing server and storage hardware, Dell solutions for Oracle include:

- **Dell Configurations for Oracle**—in-depth testing of Oracle configurations for high-demand solutions; documentation and tools that help simplify deployment
- **Integrated Solution Management**—standards-based management of Dell solutions for Oracle that can lower operational costs through integrated hardware and software deployment, monitoring, and updating
- **Oracle Licensing**—licensing options that can simplify customer purchase
- **Dell Enterprise Support and Infrastructure Services for Oracle**—planning, deployment, and maintenance of Dell solutions for Oracle database tools

For more information concerning Dell Solutions for Oracle Database, visit [www.dell.com/oracle](http://www.dell.com/oracle), and the Dell Oracle Solutions wiki page at <http://delltechcenter.com/enterprise>.

## Technology Overview

### Dell PowerEdge 12<sup>th</sup> Generation Servers

Dell PowerEdge 12<sup>th</sup> Generation servers are the newest addition to the PowerEdge server family. Dell PowerEdge 12<sup>th</sup> Generation servers can help improve the IT experience with the following notable features:

- Manage anywhere and anytime with agent-free server management
- Reduce maintenance time with auto-update for replacement parts
- Control cooling costs with better power monitoring and control
- Tailor network to applications with fabric flexibility
- Access information quicker via SATA, SAS, SSD and PCI Express Flash drives
- Data protection using best-in-class RAID
- Protect data at rest with malware resistance and faster encryption
- Keep data safer with firmware signing and encrypted credentials
- Accelerate high-performance computing (HPC) and virtual desktop infrastructure (VDI) through integrated graphics processing unit (GPU) technology

## Oracle Database Migration to Dell PowerEdge 12<sup>th</sup> Generation Servers and Dell Compellent Storage Systems

- Deliver more throughput with major I/O performance enhancements
- Better application performance with dual internal RAID controller options for PowerEdge T620 and R720
- No compromise on performance with greater memory density and capacity along with Intel Xeon E5 processors

Dell PowerEdge 12<sup>th</sup> Generation servers feature the Intel® Xeon® E5-2600 series processors based on the Sandy Bridge-EP architecture, which deliver more computations per second. Intel Xeon E5-2600 series processors provide up to 8 physical cores or 16 logical cores through hyper-threading, and up to 20 MB cache. Intel Xeon E5-2600 series processors also include features such as the new Intel advanced vector extensions, and the optimized turbo boost technology.

Dell PowerEdge 12<sup>th</sup> Generation servers include the express flash PCIe solid state drives to deliver better internal storage performance by connecting directly to the processor via PCIe bus. These PCIe solid state drives have up to 3x performance of standard SAS SSDs and 1000x performance of 15K SAS hard drives.

The PowerEdge R720 (12<sup>th</sup> generation) servers were used in the test configuration for this paper. The R720 server is a two-socket, 2U rack server emphasizing performance and scalability. R720 servers are designed for mid-to-large-size data centers, and are ideal for use as a virtualization or database server. Some highlighted features of the R720 include:

- Large memory footprint 24 DIMMs (768GB)
- Dual SD cards for redundant hypervisor
- CacheCade RAID enhancement to boost I/O
- Internal storage capacity up to 16 x 2.5 HDD or 8 x 3.5 HDD
- Maximum of four optional PCIe flash SSD drives
- Redundant power supply units (PSU)
- Hot plug and swappable PSU, HDDs, and fans

## Dell Compellent Storage Systems

The Dell Compellent Storage Center Storage Area Network (SAN) provides a highly efficient and flexible foundation for enterprise and the cloud. Dell Compellent storage features an innovative Dell Fluid Data architecture to put the right data in the right place at the right time. It enables the storage system to dynamically adapt to changes in your business environment.

Dell Compellent Storage Center provides a fully virtualized storage platform that includes:

- Storage virtualization that abstracts and aggregates resources across the array, providing a high-performance pool of shared storage
- Thin provisioning and automated tiered storage to deliver optimum disk utilization and intelligent data movement
- Space-efficient snapshots and thin replication for continuous data protection without wasted capacity
- Built-in automation and unified storage management to streamline storage provisioning, management, migration, monitoring and reporting

### Reasons Why Customers Migrate to Dell Compellent

Compellent has built-in virtualization to simplify management, maximize efficiency, provide flexibility to adapt to changing requirements, and lower the TCO. Many of these benefits are most noticeable at the time of a hardware refresh.

To eliminate the need for future migration projects, once data is on Compellent it can be migrated to additional or future hardware incrementally, easily, non-disruptively, without interruption in snapshot and instant restore options, all from within the storage GUI.

To eliminate economically disruptive transitions and premature obsolescence, several features are helpful. Future disk interconnects, as well as SAN interconnects, can be added to existing controllers. The aforementioned incremental migration allows old and new resources to be effectively managed together with less hassle and less over-provisioned resources than a single-frame model. Disks can be gracefully removed from a virtually-provisioned pool without destroying the pool, so that disk refreshes are easy, routine, and deferred until the disks are too old. In this way older disks can continue to deliver performance benefits competitively even if their capacity is lower than the newer disks. Compellent customers can upgrade the hardware indefinitely simply by replacing the hardware: the software does not have to be re-purchased. This greatly reduces the budgetary hit from an upgrade.

To reduce wasteful over-provisioning of capacity, moving to Compellent built-in virtualization enables thin provisioning without imposing a performance reduction.

To use disk performance more efficiently, Compellent's space-efficient snapshots come without the extra work to move old data out of the way, known as copy-on-write. Compellent has a long history of high customer adoption rates of advanced snapshot technology.

To reduce wasteful over provisioning of higher cost, higher performing tiers, Compellent offers tiering based on historical access patterns so that application performance is more dependable. The tiering uses an appropriate granularity much lower than a GB, reducing over-provisioning, yet large enough to avoid creating a resource penalty at the controller level. The tiering can not only can mix RAID levels but shift the RAID levels used within a tier based on the type of data access. Compellent can tier within a disk to prevent seek times from growing as much as disks fill up: hot data is more concentrated on the disk. With automatic provisioning, the initial setup does not determine the cost of the resources that will be consumed. Therefore Compellent provides charge-back reporting so that the departments driving the expenses can be charged appropriately, and departments with efficient application deployments can benefit from the savings that tiering delivers.

Dell has found that a demonstration of how Compellent is set up and managed is typically the tipping point that moves people to make a change.

Ultimately, the decision to migrate often flows naturally from having seen a Compellent demonstration.

By using Dell to provide the complete data center solution, it becomes easier to make sure that everything needed to support the application requirements are met.

## Oracle Database Migration to Dell PowerEdge 12<sup>th</sup> Generation Servers and Dell Compellent Storage

### Test Configuration

The migration methodology provided in this paper is developed based on the reference configuration shown in Figure 1. The Oracle Real Application Cluster (RAC) database is migrated from the source system to the target system. The reference configuration consists of the following components:

- Source environment:
  - Two Dell PowerEdge 2950 servers running Oracle Enterprise Linux 5 Update 2 (OEL 5.2) x86\_64, and Oracle 11g R1 RAC database version 11.1.0.7
  - Redundant Dell PowerConnect Gigabit Ethernet switches for Oracle cluster interconnect private network
  - Server-storage interconnect using redundant McData Sphereon 4400 Fibre Channel switches
  - Dell|EMC CX3-80 Fibre Channel storage system where the physical data resides
- Target environment:
  - Two Dell PowerEdge R720 servers running Oracle Linux 5 Update 7 (OL 5.7) x86\_64, and Oracle 11g R1 RAC database version 11.1.0.7
  - Redundant Dell PowerConnect Cluster Gigabit Ethernet switches for Oracle cluster interconnect private network
  - Server-storage interconnect using redundant Brocade 5300 Fibre Channel switches
  - Dell Compellent Series 40 Fibre Channel storage system where the physical data resides

Figure 1. Reference configuration of Oracle database migration

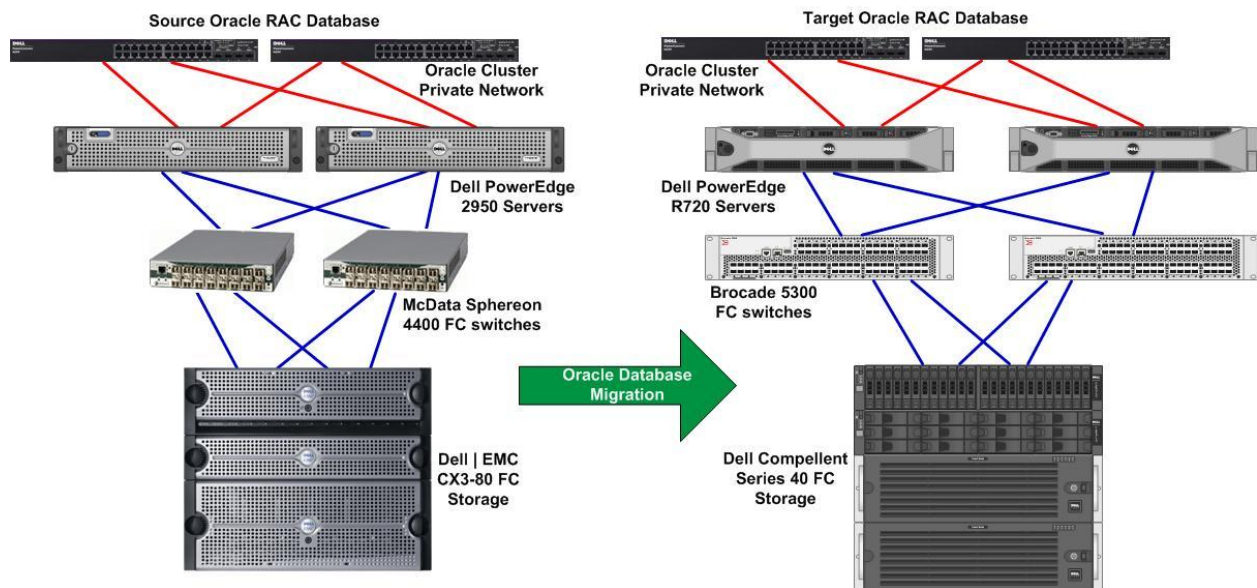




Table 1 shows that the target Oracle database environment contains newer releases of both hardware and software compared to the source environment. The target system consists of not only the latest hardware including servers, storage systems, and SAN switches, but also newer operating system releases on the database servers. The Oracle database version remains unchanged on the target system. It is beyond the scope of this paper to discuss the Oracle database upgrade process. You can find Oracle database upgrade best practices in Oracle documentation.

**Table 1. Hardware and software configurations of the source and the target Oracle systems**

		Source system	Target system
Hardware	Server	Dell PowerEdge 2950 servers	Dell PowerEdge R720 servers
	Storage	Dell EMC CX3-80 FC storage	Dell Compellent Series 40 FC storage
	SAN switch	McData Sphereon 4400 FC switches	Brocade 5300 FC switches
Software	OS on database servers	OEL 5.2 x86_64	OL 5.7 x86_64
	Oracle database	Oracle RAC 11.1.0.7	Oracle RAC 11.1.0.7

Table 2 shows the Dell|EMC storage volume configuration of the source database.

**Table 2. Volume configuration of the source database**

Used for	Volume	Size	File system format	ASM disk name
Oracle RAC Clusterware disks	3 volumes of OCR disks	1 GB each	Block device	N/A
	2 volumes of Voting disks	1 GB each	Block device	N/A
Oracle database	6 volumes for data area	100 GB each	ASM	data1; data2; data3; data4; data5; data6
	6 volumes for Flash Recovery Area (FRA)	100 GB each	ASM	fra1; fra2; fra3; fra4; fra5; fra6
	1 volume for spfile of ASM instance	1 GB	Block device	N/A

## Migration Options

There are many different ways to migrate the Oracle database described in the above reference configuration. Among them, some commonly used technologies are:

- **Oracle Data Pump Export and Import utility** is a feature of the Oracle database that enables data and metadata movement between Oracle databases. This method involves the exporting of the source database into export dump files, presenting the dump files to the target database, and then importing them into the target database. This method can be slow for large systems and can incur an extended downtime during the migration process.
- **Oracle Transportable Tablespace** is an Oracle database feature to copy a set of tablespaces from one database to another. This method involves exporting the metadata, transporting the datafiles from the source database to the target database, and then importing the datafiles to the target

database. This method is typically faster than the export and import utility by avoiding extracting data and instead directly integrating datafiles into the target database. However, an extended downtime for large databases can still occur.

- **Oracle Golden Gate software** provides real-time data replication between Oracle databases. Golden Gate software enables the capability to migrate Oracle database with zero database downtime and minimal application switchover downtime. Golden Gate software is licensed separately from Oracle databases.
- **Compellent Thin Import** is an array-based data migration tool provided by the Dell Compellent storage systems. Thin Import migrates data from external storage systems to thin-provisioned volumes on the Compellent system. This helps eliminate the allocated but unused space in the source data, and deliver more usable capacity on the Compellent system. Thin Import is primarily an offline activity that incurs database downtime.

## Oracle Automatic Storage Management (ASM) Disk Rebalance

Oracle ASM is a volume manager and a file system for Oracle database files that supports single-instance Oracle database and Oracle RAC configurations. Oracle ASM is Oracle's recommended storage management solution, which provides an alternative to conventional volume managers, file systems, and raw devices. Oracle ASM uses disk groups to store data files. Oracle ASM disk group is a collection of disks that Oracle ASM manages as a unit. Within a disk group, Oracle ASM exposes a file system interface for Oracle database files. The content of files that are stored in a disk group is evenly distributed to eliminate hot spots and to provide uniform performance across the disks. The performance is comparable to the performance of raw devices.

Oracle ASM provides the disk rebalance feature where disks can be added or removed from a disk group while a database continues to access files from the disk group. When adding or removing disks from a disk group, Oracle ASM automatically redistributes the file contents and eliminates the need for downtime when redistributing the content. The adding or removing disks from a disk group can be executed using the `ALTER DISKGROUP` SQL statement within the ASM instance. To control the speed and resource consumption of the rebalance operation, you can include the `REBALANCE POWER` clause in the `ALTER DISKGROUP` statement. The `REBALANCE POWER` clause specifies the degree of parallelism, and thus the speed of the rebalance operation. It can be set to a value from 0 to 11 for Oracle database versions 11.2.0.2 or lower. A value of 0 halts a rebalancing operation. The default rebalance power is set by the `ASM_POWER_LIMIT` initialization parameter with a default value of 1.

The SQL syntax to add disks into a disk group is:

```
alter diskgroup diskgroup_name
add disk 'disk_path'
rebalance power n;
```

For example,

```
SQL> alter diskgroup data
      add disk '/dev/mapper/data1p1'
      rebalance power 0;
```

The SQL syntax to drop disks into a disk group is:

## Oracle Database Migration to Dell PowerEdge 12<sup>th</sup> Generation Servers and Dell Compellent Storage Systems

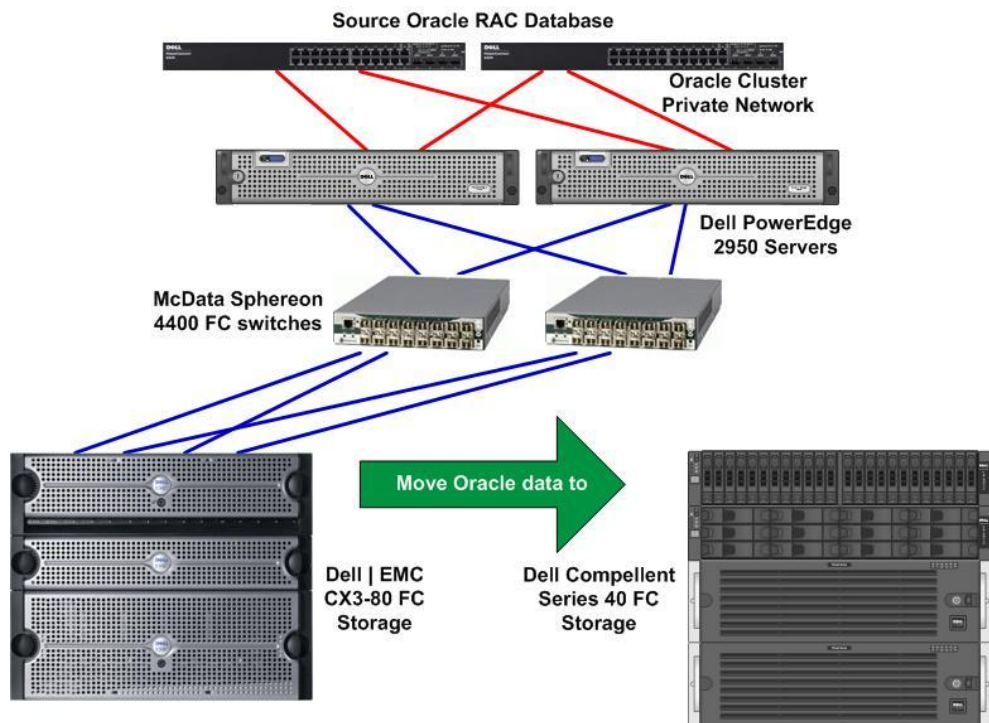
```
alter diskgroup diskgroup_name
drop disk disk_name
rebalance power n;
```

For example,

```
SQL> alter diskgroup data
      drop disk DATA_0006
      rebalance power 10;
```

A common use case of the Oracle ASM disk rebalance feature is the Oracle database migration to a different storage system while the database servers remain unchanged. In the migration scenario illustrated in Figure 2 below, the source Oracle 11g R1 RAC database runs on two PowerEdge 2950 servers, Dell|EMC CX3-80 Fibre Channel storage system, and McData Fibre Channel switches. The Dell|EMC CX3-80 Fibre Channel storage system is being replaced with the Dell Compellent storage system, while other components in the configuration remain unchanged.

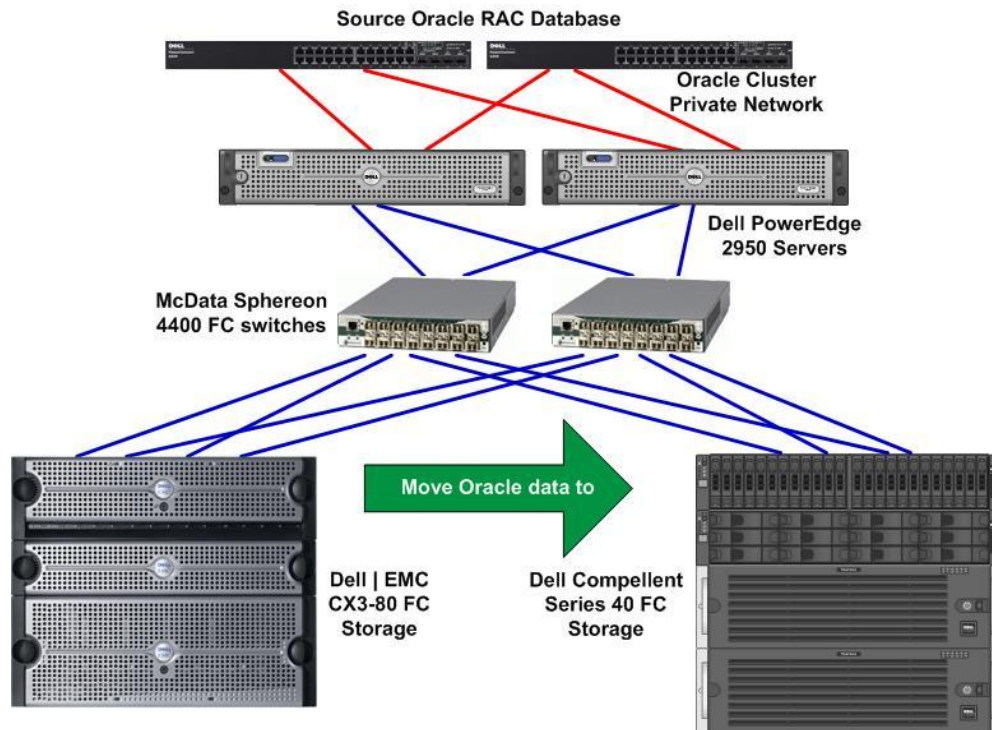
Figure 2. Oracle ASM disk rebalance to move Oracle database to a different storage system



The Oracle ASM disk rebalance feature can be effectively utilized for this type of migration scenario. The high level steps for migration are:

1. Cable the Dell Compellent storage front-end ports to the McData switches. See Figure 3.

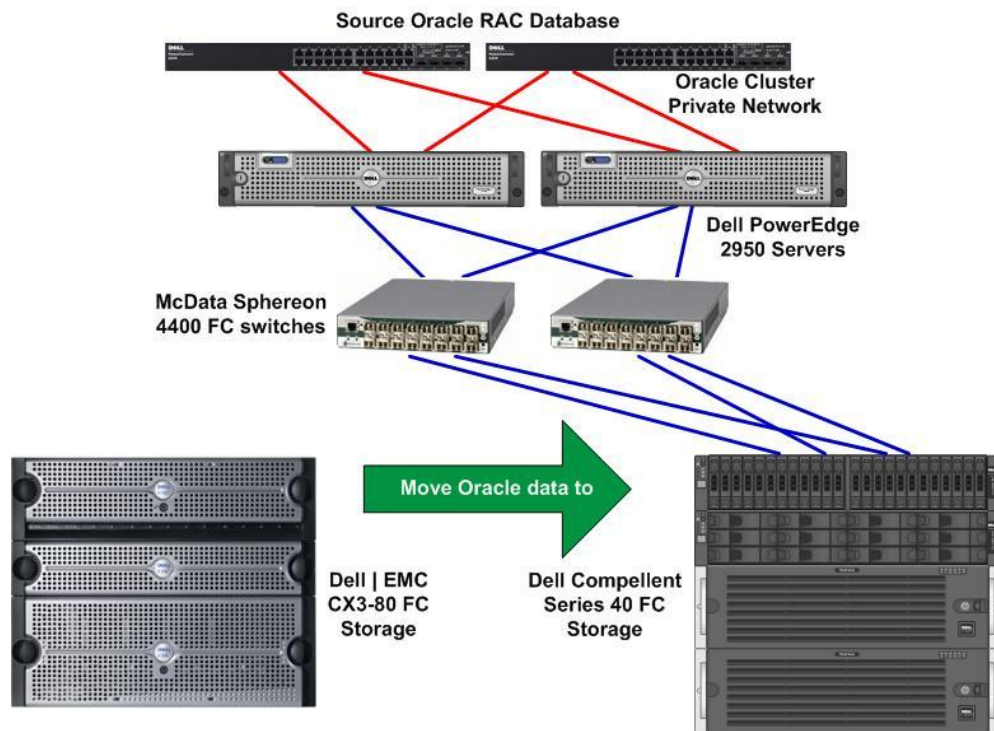
Figure 3. Attach Dell Compellent storage to the source database configuration



2. Create storage volumes in the Compellent storage for hosting Oracle clusterware OCR and voting disks, as well as Oracle data files.
3. Perform zoning in the McData switches to associate the Dell PowerEdge 2950 servers' WWN's with the Compellent front end ports WWN's.
4. Create volume partitions on the PowerEdge 2950 servers.
5. Configure Device Mapper Multipath (DM Multipath) to the volumes on the PowerEdge 2950 servers.
6. Stamp the volumes as ASM disks on the PowerEdge 2950 servers.
7. Convert the source Dell|EMC volumes from using EMC PowerPath to DM Multipath on the PowerEdge 2950 servers. This step is necessary to ensure the Dell|EMC disks and Compellent disks use unified multipathing software. The Dell Professional Services (DPS) team has developed an automation script for the conversion of EMC PowerPath to DM Multipath. DPS can be engaged at [www.dell.com/services](http://www.dell.com/services).
8. Move the Oracle RAC Clusterware OCR and voting disks from Dell|EMC disks to Compellent disks. The following My Oracle Support (MOS) note at <https://support.oracle.com> provides detailed step-by-step instructions on how to perform the move; therefore, the steps are not repeated in this paper.  
ID 428681.1 - OCR / Vote disk maintenance operations: add / remove / replace / move
9. Move the Oracle data files from Dell|EMC disks to Compellent disks using Oracle ASM disk rebalance.
10. Remove access to Dell|EMC disks from the PowerEdge servers.

11. Remove zoning to Dell|EMC disks from the McData switches.
12. Detach Dell|EMC storage from McData switches. See Figure 4.

Figure 4. Detach Dell|EMC storage from the source database configuration



## Near Zero Downtime Oracle Database Migration to New Infrastructure and Operating Systems

Another use case of the Oracle ASM disk rebalance feature is for the migration scenario depicted in Figure 1. Unlike the migration scenario in Figure 2, the Oracle database is migrated to a completely separated infrastructure with newer storage, servers, SAN switches, as well as, a newer release of operating systems running on the database servers. The use of Oracle ASM rebalance in this type of migration is less familiar to most administrators. The following sections provide a detailed discussion of a near zero downtime migration methodology developed and tested by Dell engineers.

### Preparing the Target System

The target database volumes must be of equal or larger size than the source database volumes. Table 3 shows the Compellent volume configurations that are similar to the source database volumes shown in Table 2.

NOTE: The ASM disks must be named differently than the source database; otherwise, the ASM disk rebalance will not work in a later step.

Table 3. Volume configuration of the target database

Used for	Volume	Size	File system format	ASM disk name
Oracle RAC Clusterware disks	3 volumes of OCR disks	1 GB each	Block device	N/A
	2 volumes of Voting disks	1 GB each	Block device	N/A
Oracle database	6 volumes for data area	100 GB each	ASM	data7; data8; data9; data10; data11; data12
	6 volumes for Flash Recovery Area (FRA)	100 GB each	ASM	fra7; fra8; fra9; fra10; fra11; fra12
	1 volume for spfile of ASM instance	1 GB	Block device	N/A

The high level steps to prepare the target system include:

1. Create volumes in the Compellent storage and map to the target servers (PowerEdge R720).
2. Perform zoning in the Brocade switches to associate the Dell PowerEdge R720 servers' WWN's with the Compellent front-end ports WWN's.
3. Create volume partitions on the two PowerEdge R720 servers.
4. Configure DM Multipath to the volumes on the two PowerEdge R720 servers.
5. Stamp the volumes as ASM disks on the two PowerEdge R720 servers. Again, ASM disks need to have different names as the source database or data migration does not work later. The screen output of the `service oracleasm listdisks` command is shown below.

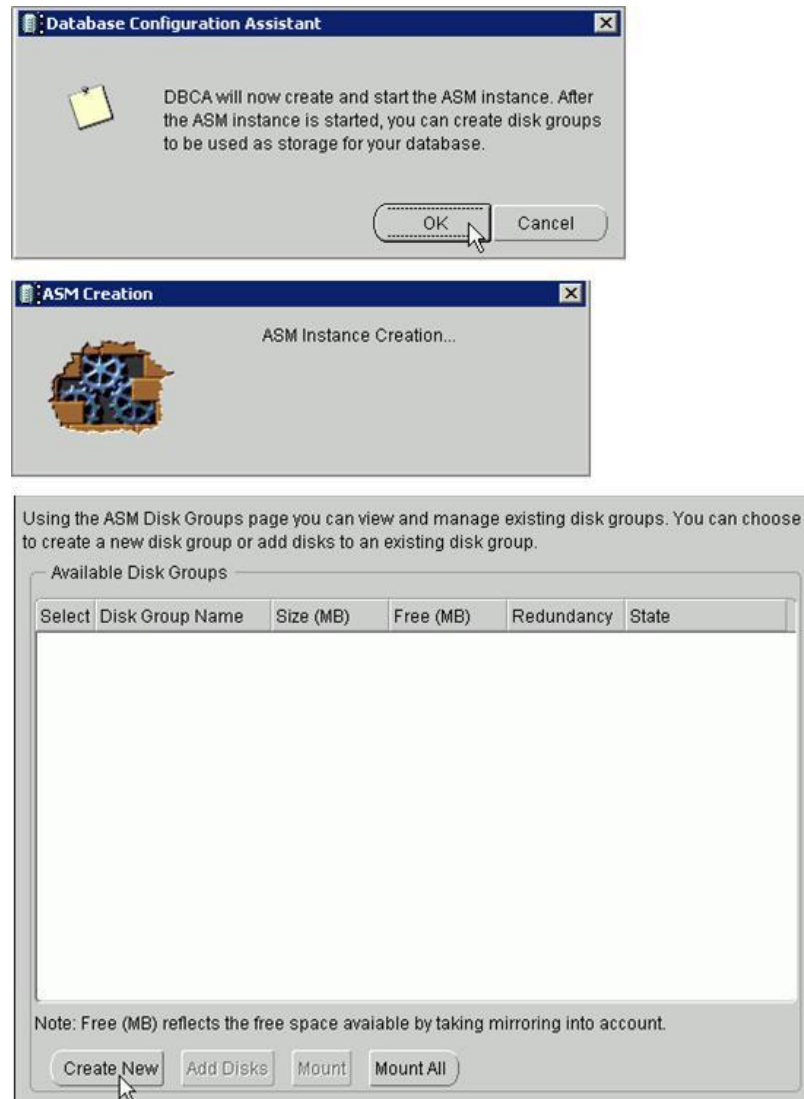
```
# service oracleasm listdisks
DATA10
DATA11
DATA12
DATA7
DATA8
DATA9
FRA10
FRA11
FRA12
FRA7
FRA8
FRA9
```

6. Install Oracle RAC Clusterware 11.1.0.7 on the two PowerEdge R720 servers.
7. Install Oracle Database 11.1.0.7 binary on the two PowerEdge R720 servers.
8. Use the Oracle tool Database Configuration Assistant (DBCA) to create the Oracle ASM instance without creating the database instance. In Oracle release 11.1.0.7, the creation of the ASM instance and the creation of the database instance are combined in the DBCA tool. Once ASM



instance has been created in the DBCA *Storage Options* window, abort DBCA after it reaches the DBCA *ASM Disk Groups* window so that only the ASM instance is created. The screenshots of DBCA are shown in Figure 5. NOTE: It is not necessary to pre-create any ASM disk groups in the target system.

Figure 5. Create ASM instance without database instance on target systems using DBCA



9. Set the `ASM_DISKGROUPS` parameter in the ASM instance to include the disk group names of the source database. For example,

```
SQL> ALTER SYSTEM SET asm_diskgroups='DATA','FRA' SCOPE=BOTH SID='*';
```

10. Copy the database `init.ora` files from the source database servers to the target database servers under `$ORACLE_HOME/dbs`. For example, run the following command from the source database servers.

```
$ scp <filename.ora> oracle@<target server IP>:<target server destination>
```

Ensure the `init.ora` file contains the location to the database spfile stored in the ASM disk group such as:

```
$ more initmigtst1.ora
SPFILE='+DATA/migtst/initmigtst.ora'
```

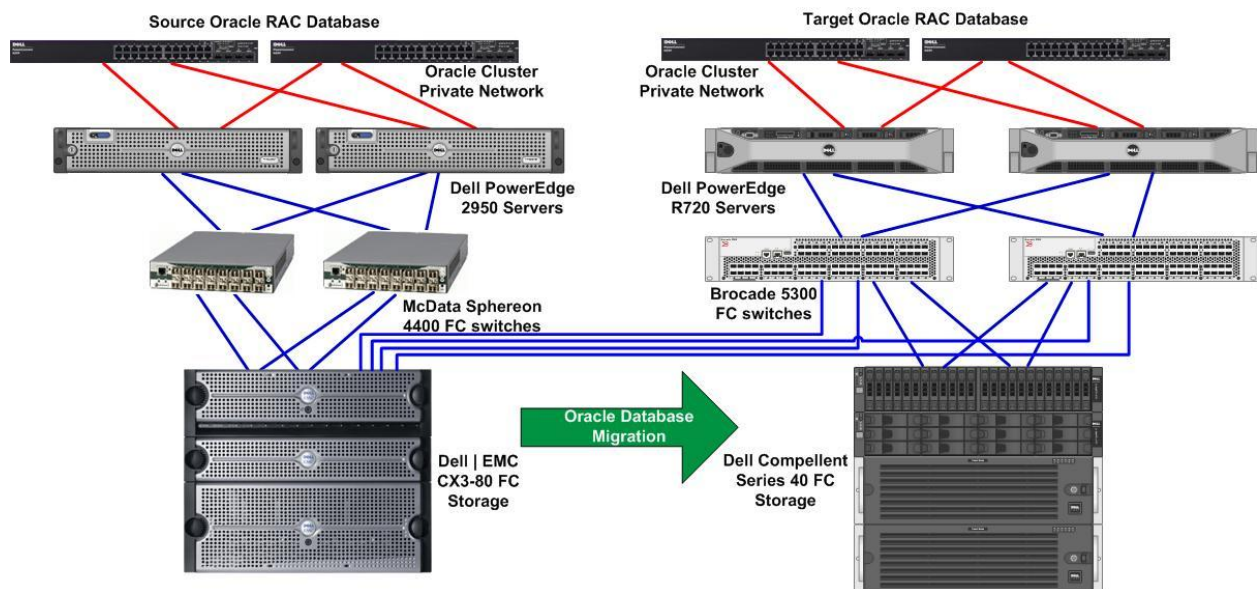
11. Shut down the target ASM instances.

### Presenting Dell|EMC Volumes to the Target Database Servers

Perform the following steps to present the volumes from the source Dell|EMC storage array to the target PowerEdge R720 servers:

1. Cable the Dell|EMC storage front end ports to the Brocade switches in the target system as shown in Figure 6.

Figure 6. Attach Dell|EMC storage to the target database configuration



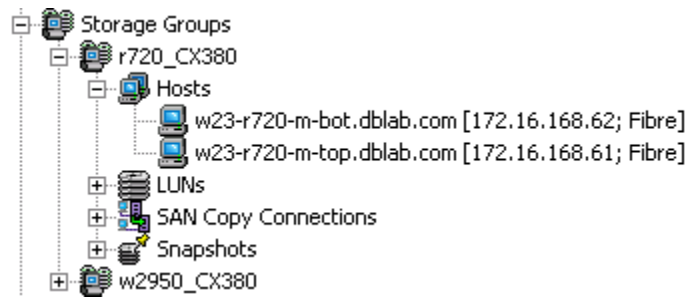
2. Perform zoning in the Brocade switches to associate the PowerEdge R720 servers' WWN's with the Dell|EMC front end port WWN's.
3. Install EMC NaviAgent client on both PowerEdge R720 servers and start up the NaviAgent client. For example,

```
# rpm -Uvh naviagentcli-6.24.2.5.0-1.noarch.rpm

# service naviagent start
```
4. Create a new storage group in the Dell|EMC storage manager to include the two PowerEdge R720 servers; add the LUNs of the source database into the storage group. Only the 6 volumes of the data area and the 6 volumes of the FRA area in Table 2 need to be added to the new storage group. In the example below, a new storage group called `r720_CX380` includes the two PowerEdge R720 servers.



Figure 7. Create a new storage group in Dell|EMC storage manager



5. Reboot target servers to discover the Dell|EMC disks.
6. Configure DM Multipath for the Dell|EMC disks.
7. Change ownership of the Dell|EMC disks to `oracle:dba`. For example,

```
brw-rw---- 1 oracle dba      253, 67 Jul  5 17:05 /dev/mapper/data1p1
brw-rw---- 1 oracle dba      253, 58 Jul  5 17:05 /dev/mapper/data2p1
brw-rw---- 1 oracle dba      253, 64 Jul  5 17:05 /dev/mapper/data3p1
brw-rw---- 1 oracle dba      253, 57 Jul  5 17:05 /dev/mapper/data4p1
brw-rw---- 1 oracle dba      253, 63 Jul  5 17:05 /dev/mapper/data5p1
brw-rw---- 1 oracle dba      253, 56 Jul  5 17:05 /dev/mapper/data6p1
brw-rw---- 1 oracle dba      253, 62 Jul  5 16:31 /dev/mapper/fra1p1
brw-rw---- 1 oracle dba      253, 61 Jul  5 16:31 /dev/mapper/fra2p1
brw-rw---- 1 oracle dba      253, 55 Jul  5 16:21 /dev/mapper/fra3p1
brw-rw---- 1 oracle dba      253, 60 Jul  5 15:44 /dev/mapper/fra4p1
brw-rw---- 1 oracle dba      253, 59 Jul  5 16:21 /dev/mapper/fra5p1
brw-rw---- 1 oracle dba      253, 49 Jul  5 16:21 /dev/mapper/fra6p1
```

8. The ASM disks from the source database can now be seen from the `service oracleasm listdisks` command output. In the following example, ASM disks `data[1-6]` and `fra[1-6]` are from the source Dell|EMC storage system; ASM disks `data[7-12]` and `fra[7-12]` are from the target Dell Compellent storage system.

```
# service oracleasm listdisks
DATA1
DATA10
DATA11
DATA12
DATA2
DATA3
DATA4
DATA5
DATA6
DATA7
DATA8
DATA9
FRA1
FRA10
FRA11
FRA12
```

FRA2  
FRA3  
FRA4  
FRA5  
FRA6  
FRA7  
FRA8  
FRA9

### Starting Up Database on the Target System

The preparation steps described in the previous two sections *Preparing the target system* and *Presenting Dell|EMC volumes to the target database servers* do not impact the source database availability. All steps are performed while the source database is up and running. At this point, the target database is ready to be brought up.

1. Shut down the source database instances and ASM instances.
2. Start up the ASM instances on the target database servers. The ASM disk groups from the source database should be automatically mounted upon the ASM instance startup.

```
SQL> select name, state from v$asm_diskgroup;
```

NAME	STATE
DATA	MOUNTED
FRA	MOUNTED

3. Start up the database instances on both target database servers using SQL Plus. For example,

```
SQL> startup;
```

### Quick Application Switch Over to the Target Database

Database applications connect to databases by specifying a database connection string in the `tnsnames.ora` file of the Oracle client. After the database is brought up on the target servers, one can manually update the connection string in the `tnsnames.ora` file to reflect the target system information. For example, the connect string to the source database is:

```
MIGRTST =  
  (DESCRIPTION =  
    (ADDRESS = (PROTOCOL = TCP) (HOST = w21-2950-m-top-vip) (PORT = 1521))  
    (ADDRESS = (PROTOCOL = TCP) (HOST = w21-2950-m-bot-vip) (PORT = 1521))  
    (LOAD_BALANCE = yes)  
    (CONNECT_DATA =  
      (SERVER = DEDICATED)  
      (SERVICE_NAME = migrtst)  
    )  
  )  
)
```

After database is brought on the target servers, the connect string should be updated to:

```
MIGRTST =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP) (HOST = w23-r720-m-top-vip) (PORT = 1521))
    (ADDRESS = (PROTOCOL = TCP) (HOST = w23-r720-m-bot-vip) (PORT = 1521))
    (LOAD_BALANCE = yes)
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = migrtst)
    )
  )
)
```

In a production environment, the manual update of TNS entries in the application clients is time consuming and tedious. You can solve this challenge by using a variety of technologies.

- F5 Big-IP Global Traffic Manager (formerly 3DNS) technology. Big-IP Global Traffic Manager (GTM) provides capability to seamlessly direct application to a different data source. Users are not aware of the switch.
- CNAME. A CNAME is a type of resource record in the Domain Name System (DNS) that specifies that the domain name is an alias of another. CNAME can facilitate quick application switch over to a different database.
- Oracle Single Client Access Name (SCAN) is a new Oracle RAC 11g Release 2 feature that provides a single name for clients to access Oracle databases running in a cluster. The benefit is that the client's connect information does not need to change if you add or remove nodes in the cluster.

### Migrating Data to the Target System

Once the application is pointed to the target database, data access can immediately resume while data is being migrated in the background from the source ASM disks to the target ASM disks. Data migration with ASM disk rebalance is an online procedure that does not impact the database availability.

The ASM disk names and disk paths can be viewed in the ASM instance. For example,

```
SQL> select name || ' ' || path || ' ' || total_mb || ' ' || header_status from
v$asm_disk;
```

```
NAME || ' ' || PATH || ' ' || TOTAL_MB || ' ' || HEADER_STATUS
```

```
-----
```

```
/dev/mapper/data7p1 0 CANDIDATE
/dev/mapper/ocrvote5p1 0 FOREIGN
/dev/mapper/data11p1 0 CANDIDATE
/dev/mapper/fra7p1 0 CANDIDATE
/dev/mapper/data9p1 0 CANDIDATE
/dev/mapper/fra9p1 0 CANDIDATE
/dev/mapper/fra11p1 0 CANDIDATE
/dev/mapper/ocrvote4p1 0 FOREIGN
/dev/mapper/data8p1 0 CANDIDATE
/dev/mapper/data12p1 0 CANDIDATE
/dev/mapper/data10p1 0 CANDIDATE
```

## Oracle Database Migration to Dell PowerEdge 12<sup>th</sup> Generation Servers and Dell Compellent Storage Systems

```
/dev/mapper/fra8p1 0 CANDIDATE
/dev/mapper/ocrvote3p1 0 FOREIGN
/dev/mapper/fra12p1 0 CANDIDATE
/dev/mapper/fra10p1 0 CANDIDATE
DATA_0000 /dev/mapper/data1p1 102398 MEMBER
DATA_0002 /dev/mapper/data3p1 102398 MEMBER
DATA_0004 /dev/mapper/data5p1 102398 MEMBER
FRA_0000 /dev/mapper/fra1p1 102398 MEMBER
FRA_0001 /dev/mapper/fra2p1 102398 MEMBER
FRA_0003 /dev/mapper/fra4p1 102398 MEMBER
FRA_0004 /dev/mapper/fra5p1 102398 MEMBER
DATA_0001 /dev/mapper/data2p1 102398 MEMBER
DATA_0003 /dev/mapper/data4p1 102398 MEMBER
DATA_0005 /dev/mapper/data6p1 102398 MEMBER
FRA_0002 /dev/mapper/fra3p1 102398 MEMBER
FRA_0005 /dev/mapper/fra6p1 102398 MEMBER
```

Use the following commands to add target ASM disks into the disk group without a disk rebalance, and drop the source ASM disks with specifying a rebalance power. This helps to restrict the disk rebalance to run only one time when dropping disks.

```
alter diskgroup data
add disk
'/dev/mapper/data7p1',
'/dev/mapper/data8p1',
'/dev/mapper/data9p1',
'/dev/mapper/data10p1',
'/dev/mapper/data11p1',
'/dev/mapper/data12p1'
rebalance power 0;
```

```
alter diskgroup fra
add disk
'/dev/mapper/fra7p1',
'/dev/mapper/fra8p1',
'/dev/mapper/fra9p1',
'/dev/mapper/fra10p1',
'/dev/mapper/fra11p1',
'/dev/mapper/fra12p1'
rebalance power 0;
```

```
alter diskgroup data
drop disk
DATA_0000,
DATA_0001,
DATA_0002,
DATA_0003,
DATA_0004,
DATA_0005
rebalance power 10;

alter diskgroup fra
drop disk
FRA_0000,
FRA_0001,
FRA_0002,
FRA_0003,
FRA_0004,
FRA_0005
rebalance power 10;
```

By default, the `ALTER DISKGROUP` statement does not wait until the operation is complete before returning. Query the `V$ASM_OPERATION` view to monitor the status of the ASM disk rebalance operation.

## Post Migration Tasks

1. As user `oracle`, register the database and database instances as the cluster resources from node 1 of the target RAC cluster.

```
srvctl add database -d db_unique_name -o oracle_home
srvctl add instance -d db_unique_name -i inst_name -n node_name
```

For example,

```
$ srvctl add database -d migrtst -o /u01/app/oracle/product/11.1.0/db_1
$ srvctl add instance -d migrtst -i migrtst1 -n w23-r720-m-top
$ srvctl add instance -d migrtst -i migrtst2 -n w23-r720-m-bot
```

2. Remove access to the Dell|EMC disks from the target PowerEdge R720 servers.
3. Remove zoning to Dell|EMC disks from the Brocade switches.
4. Detach Dell|EMC storage from Brocade switches.

## Key Benefits of the Migration Solution

To summarize, the key strengths of the migration solution provided in this paper are:

- The migration solution is near zero downtime, typically less than one minute and in most cases only seconds.
- The migration solution utilizes native Oracle database feature, without incurring additional license cost to purchase additional migration tools.

- The migration solution is applicable to Oracle databases using the Oracle ASM file system. Oracle ASM is the recommended file system by Oracle with the majority of the customer implementations.
- The migration solution avoids the complexity involved in moving Oracle RAC Clusterware disks, by building a separated Oracle RAC cluster on the target system.
- The migration solution moves Oracle database from the traditional storage system to the thin provisioned Dell Compellent storage that delivers optimum disk utilization.

## Dell IT Case Study

In the past, to support the data growth of global applications, Dell IT was required to provision storage to accommodate at least 18 months of estimated growth. It was a challenge to support growing applications on IT infrastructure. With the traditional storage system, the provisioning process had to cater for the estimated growth, resulted a far more storage needed to be provisioned than was immediately required.

In the last 6 months, Dell IT has successfully migrated 500 Oracle databases and 200 SQL Server databases that are using 700TB of storage space to Dell Compellent storage systems.

By leveraging the Dell Compellent thin provisioning feature, Dell IT teams are now able to provision less upfront storage for applications and increase capacity when needed. Additional storage is being allocated to Oracle databases with the Oracle ASM rebalancing methodology described in the paper, which is seamless to the application users.

This allows the storage administrator to execute provisioning requests on a much faster basis. Getting the benefit of Dell Compellent Fluid Data architecture is what facilitates true storage virtualization and a highly-granular approach to storage tiering. Applications on Dell Compellent storage experiencing 200% performance increases in IOPs on random reads and writes, and 15% performance increasing on sequential reads and writes.

## Summary

Traditional Oracle database migration methods often cause major disruptions to data access, or may incur high costs involved in purchasing additional migration tools. By taking advantages of the native Oracle database ASM disk rebalance feature, this paper presents a near zero downtime migration methodology, which can help maintain the availability of applications during Oracle database migration.

## References

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