ED-WP-0037-01WE

Best Practices White Paper

Using Oracle Database 11g R2 Automatic Storage Management with FUJITSU Storage (Windows version)

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Contents

1. Introduction

This document describes the most efficient database environment that provides the combined benefits and advantages of the new Oracle Database 11g Release 2 feature, Automatic Storage Management (ASM), and Fujitsu ETERNUS DX storage systems.

Automatic Storage Management is a new feature in Oracle Database 11g Release 2 that provides data management features within the database that simplifies the management of database systems and storage environments. ASM is the combination of a clustered file system and logical volume manager that is tightly integrated and embedded within the Oracle database 11g Release 2.

ASM was specifically designed to operate with Oracle database files. ASM is a standard Oracle Database 11g Release 2 feature that is included at no additional cost with the database system. ASM is designed to optimize the operation of Oracle databases and simplify storage management by virtualizing storage hardware, automating tasks, and optimizing performance and thereby reducing operational overhead, administrator intervention – and human error – and overall management costs.

ASM is Oracle's collection of intelligence and best practices learned over many years. The ASM disk group virtualization interface allows DBAs to easily and dynamically add or remove disks for a particular disk group without interrupting the database operation. ASM will automatically begin to use a new disk as soon as it is added to the disk group, and will automatically rebalance data between old and new disks to continuously optimize I/O performance. ASM also eliminates disk fragmentation and hotspots thereby reducing management overhead.

ASM provides up to 3-way mirroring for higher availability and is an alternative to mirroring provided by the hardware RAID in storage arrays. The Oracle DBA simply defines a failure group within a disk group and ASM will automatically mirror the data across two or more failure groups, which can help to avoid downtime in the event of component failures, such as a disk controller or even entire disk array. This powerful redundancy feature increases availability without any additional management overhead. Since failure groups are automatically managed by ASM, failover or failback activities are fully managed - without the intervention of an operator - by ASM when the failed component is replaced.

Fujitsu's ETERNUS storage systems meet the requirements of a mission-critical-environment. ETERNUS DX8000 S2 series is a highly scalable, large capacity disk array; ETERNUS DX400 S2 series is a mid range disk array; and DX60 S2/DX80 S2/DX90 S2 are entry-level disk arrays. In any ETERNUS model, all major components are redundantly equipped and are hot-swappable to ensure business continuity with high reliability and high availability. ETERNUS storage systems provide an online volume-replication feature that enables non-disruptive database backup operations.

This white paper describes the most efficient method to configure a high-performance, high-availability Oracle database environment by the combination of ASM and ETERNUS.

* In this verification, the PRIMERGY RX350 S7 model was used as the industry standard server.
Database operations require not only high reliability and management features but also scalability.
The PRIMERGY RX350 S7 is a dual CPU rack mount server with both high performance and high scalability, and therefore suitable for this task.
For details of this server, see the following web site.
http://www.fujitsu.com/fts/products/computing/servers/primergy/rack/rx350/

2. Fujitsu's ETERNUS DX Storage Systems

2-1. High Availability

The Fujitsu ETERNUS DX storage system provides high availability that guarantees secure operation in mission critical environments.

All major components are redundantly equipped. In the event of a component failure, the ETERNUS DX storage system automatically reallocates the remaining active components for non-disruptive operation. Plus, all major components are hot-swappable.

Disk drives are configured in RAID groups. In the event of a disk-drive failure, the data is quickly rebuilt in a hot-spare disk to maintain the data redundancy. Plus, the ETERNUS DX storage system constantly monitors each disk drive for pre-failure detection. If one of the disk drives is likely to fail, the ETERNUS proactively copies the data to the hot-spare disk. This enables disk-drive replacement while maintaining the data redundancy.

The interfaces between servers and ETERNUS DX storage systems also deliver a high availability mechanism. This mechanism is provided by the ETERNUS Multipath Driver or GR Multipath Driver that manages multiple Fibre Channel paths. Even if one path fails, operations of a database and/or other applications can continue by automatically rerouting data through the remaining active paths. Such a highly available mechanism guarantees continuous operations even in the event of a server-side HBA failure or switch failure.

Cache in a storage system is a temporary storage of the data written from servers, dependant on a power source – typically a battery – to preserve the data in case of a power failure at the customer site. However, the ETERNUS DX storage system reliably protects the cached data by backing up the data into non-volatile memory in the event of a power failure.

2-2. Performance Tuning

The Fujitsu ETERNUS DX storage system provides features to replace drives or to change RAID configurations without disrupting accesses to the volumes. With these features, it is possible to optimize access performance without stopping operations.

RAID Migration provides two features to reorganize disk drives. One is a feature to include the currently-used RAID drives into the destination RAID group. This feature is useful when reconfiguring the same-specification drives into a different RAID-level group. The other feature is useful when moving the data from the source RAID drives to a different type of target RAID drives, for example, from a 15K rpm-drive RAID group to a 7.2K rpm-drive RAID group. Both features can be used without interrupting accesses to the RAID group, and the switching from the source to destination is automatically performed by the ETERNUS DX storage system.

The QoS（Quality of Service) feature enables storage systems to maintain stable performance without any influence of load change on other applications. This feature can set priority on processing requests from servers and set upper limits on the performance required for each process. Even if processing operations occur simultaneously in each server, storage performance is applied to high-priority processing operations to maintain stable storage performance.

The Automated Storage Tiering feature enables reduction in data management man-hour and management costs by use with the ETERNUS SF Storage Cruiser software. This feature controls data placement in the environment where different types of drives are installed, and optimizes performance and costs. In particular, this feature detects data access frequency and then automatically relocates data between drives according to the set policy.

2-3. Point-in-time Copy Feature

The Fujitsu ETERNUS DX storage system provides a point-in-time copy feature that creates a copy of the source volume data at a certain point in time within the storage system without stopping the operations of a database or other applications.

Demand for system requirements supporting 24 x 365 continuous operations is growing. System administrators must make backups without disrupting business operations, such as database operations, and without putting heavy loads on the servers. ETERNUS DX storage systems provide four types of replication features: Equivalent Copy (EC), One Point Copy (OPC), QuickOPC, and SnapOPC+. With EC, a copy volume is created always in synchronization with the update of a business volume. With OPC, all data in a business volume can be copied on demand. With QuickOPC, all data in a business volume is copied once, and then only updated data is copied to a replicated volume. With SnapOPC+, only the data before update is copied at the time of update, enabling generation managements. These features can be used according to the business requirements.

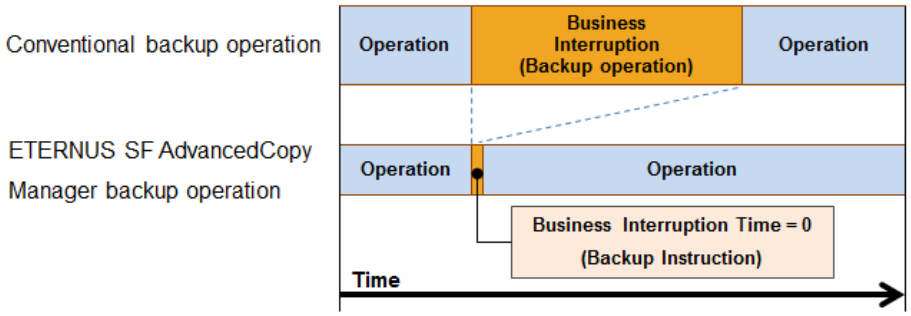
3. Fujitsu Storage Management software

3-1. ETERNUS SF AdvancedCopy Manager

Fujitsu offers the ETERNUS SF AdvancedCopy Manager - an application to control the EC, OPC, Quick OPC, and SnapOPC+ features of the ETERNUS DX storage system. The ETERNUS SF AdvancedCopy Manager enables users to perform backup operations using a uniform operation even in a wide variety of OS environments. It is possible to manage replicated spaces, and to non-disruptively create a consistent database copy synchronizing with the original database operation. It also provides the following features:

- Backup operation without impact to normal operations

The AdvancedCopy features of the ETERNUS DX Disk storage system can perform backup operations without impacting running business applications. Thanks to the high-speed backup, and independent of the data size, business data and system volumes can be backed up without the need to interrupt operations. System volumes can be backed up easily before or after applying a patch or changing an application.

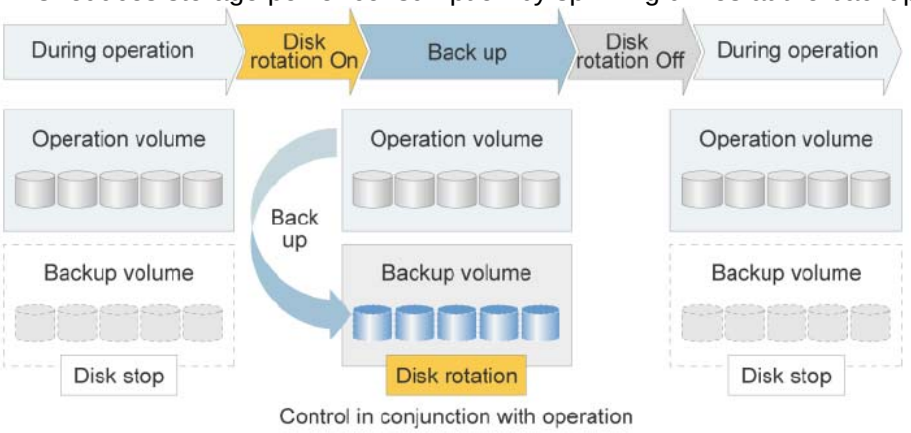


- Backup operation without interrupting the database system

In combination with Oracle's backup feature, this enables backup without interrupting database operations, thereby achieving 24 x 365 continuous operation.

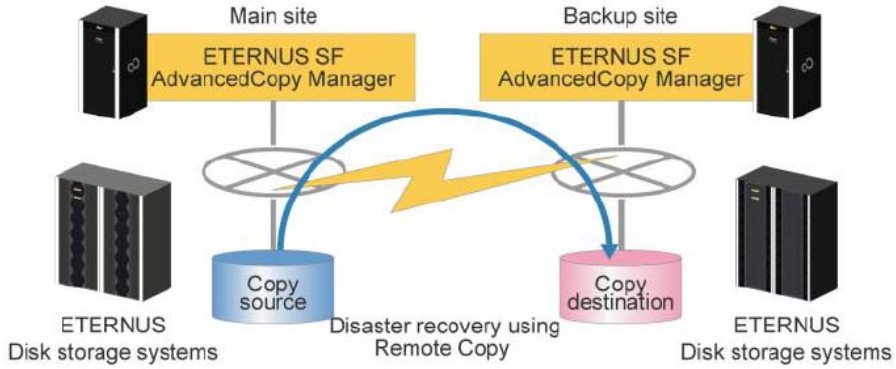
- Power-saving backup

This reduces storage power consumption by spinning drives at the backup site only at the time of backup.



- Implement a disaster recovery solution

Remote copy is available by connecting the ETERNUS DX Disk storage systems via a WAN. For example, a disaster recovery solution can be implemented by installing our disk storage system for storing backup data into a facility where earthquake-resistant measures are taken.



4. Oracle Technologies

4-1. Integration of Grid Infrastructure and Automatic Storage Management

With Oracle Database11g Release 2, ASM is integrated with Grid Infrastructure. Whereas ASM was a component of the Oracle Database in previous releases, it now is a component of Grid Infrastructure in the Oracle Database11g Release 2. Therefore, it is necessary to install Grid Infrastructure when configuring an ASM instance.

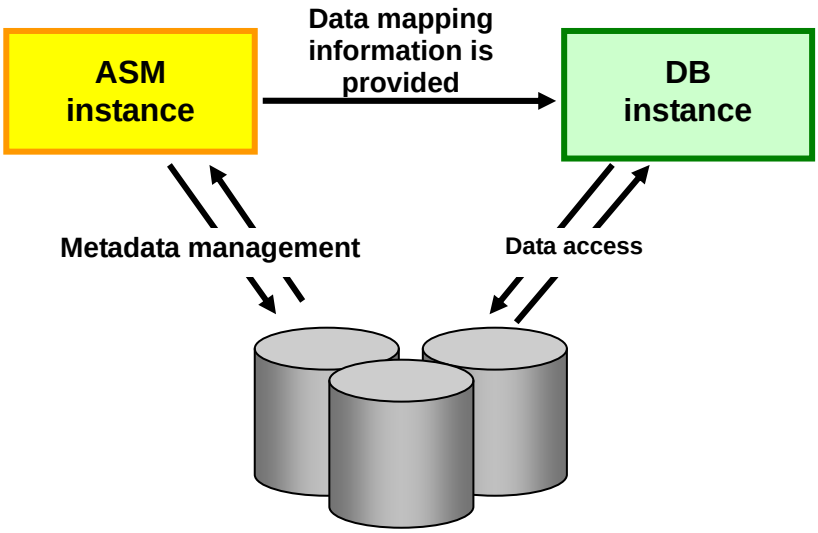
4-2. Automatic Storage Management

ASM enables a disk group to be designated as storage for Oracle database files[*1], OCR, Voting disk, SPFILE for ASM instance and backup files. A disk group consists of multiple disk drives and is managed as a unit by ASM. Any file stored in a disk group is automatically striped over all the disk drives in the group. ASM provides clustering capabilities and is available not only for single SMP machine but across multiple nodes of Oracle Real Application Clusters.

[*1] Control file, data file, SPFILE for database instance, online redo log, archive log, flashback log, changed tracking bitmap, data pump dump set, etc.

4-3. ASM Architecture

The ASM feature is activated by using the 'ASM instance' which is different from the 'DB instance'. The ASM instance manages data mapping information in a disk group by using metadata describing the layout of ASM files.



The DB instance provides for access to data files by using the data mapping information from the ASM instance.

4-4. I/O Distribution

A file (an ASM file) created on a disk group is divided evenly and stored among all the disk drives in the disk group. This prevents I/O concentration on a single disk drive. There are two stripe widths: COARSE (1MB chunks) and FINE (128KB). The default setting for the control file is FINE and for all other files the default setting is COARSE.

4-5. Dynamic Reconfiguration of a Disk Group

When a disk drive is added to or removed from a disk group or if a disk drive fails, ASM automatically redistributes data among all the disk drives. This operation can be performed without interrupting database operations.

4-6. Rebalancing

When a disk group is reconfigured, the data is reallocated so that the load on each disk in the disk group is balanced. This operation is called ‘rebalancing’. Rebalancing has some performance impacts on online transactions because it generates internal accesses for moving data. Rebalancing does not relocate data based on I/O statistics nor is it started as a result of statistics. It is completely driven by the size of the disks in the disk group and is automatically started when the storage configuration changes.

4-7. ASM Mirroring

ASM has three disk group types that support different types of mirroring: (1) normal redundancy, (2) high redundancy, and (3) external redundancy. Normal redundancy disk groups support two-way mirroring. High redundancy disk groups support three-way mirroring. External redundancy disk groups do not provide mirroring. When RAID storage is used, we recommend using the external redundancy disk group.

4-8. ASM Recovery

If the ASM instance shuts down or ends abnormally, the DB instance depending on the ASM instance also ends abnormally. This, however, will not crash the operating system and therefore can be recovered and restarted quickly and efficiently.
With an RAC configuration database, an ASM instance is distributed to each node. This ensures that even if an ASM instance on a certain node ends abnormally, the ASM instances on the other nodes automatically recover and maintain their operations.

4-9. Backup and Restoration of Metadata

With Oracle Database 11g, a feature to back up and restore the metadata of ASM disk groups was added. In the event of a ASM disk group failure, this enables the ASM disk group to be recovered（It can be restored with the same disk path, disk name, failure group, attribution, template and arias directory structure as those at the time of backup）.
Both the backup and restoration features are executed with the ASMCMD utility.

5. Best Practices

5-1. High Reliability and High Availability

The ASM in Oracle Database11g provides a mirroring feature that further enhances Oracle database availability. However, to further enhance availability, ETERNUS DX storage system's high-availability features including its RAID mechanism can be used to provide the optimum solution. The ETERNUS DX storage system can perform maintenance operations including failure detection, retry by switching, and replacement of failed parts concurrently when database operations are running.

5-2. Database Acceleration

Database performance can be enhanced by the combination of the ASM striping feature and the RAID mechanism. The ASM striping feature allocates data across all the disks in the disk group to enhance the entire throughput. Moreover, with the disk group volume configured as RAID0+1 or RAID5, the performance is enhanced by striping within the ETERNUS DX.

Database operations sometimes require performance tuning after the operations have started. ASM optimizes file accesses by distributing file extents to all the disks in a disk group. This means manual tuning is not required.

Moreover, the ETERNUS DX storage system provides RAID migration feature that enables performance tuning from another aspect. With RAID migration, it is possible to change disk drives comprising the RAID group, for example, from 10K rpm drives to 15K rpm drives and to change RAID levels, for example, from RAID5 to RAID0+1, without stopping operations.

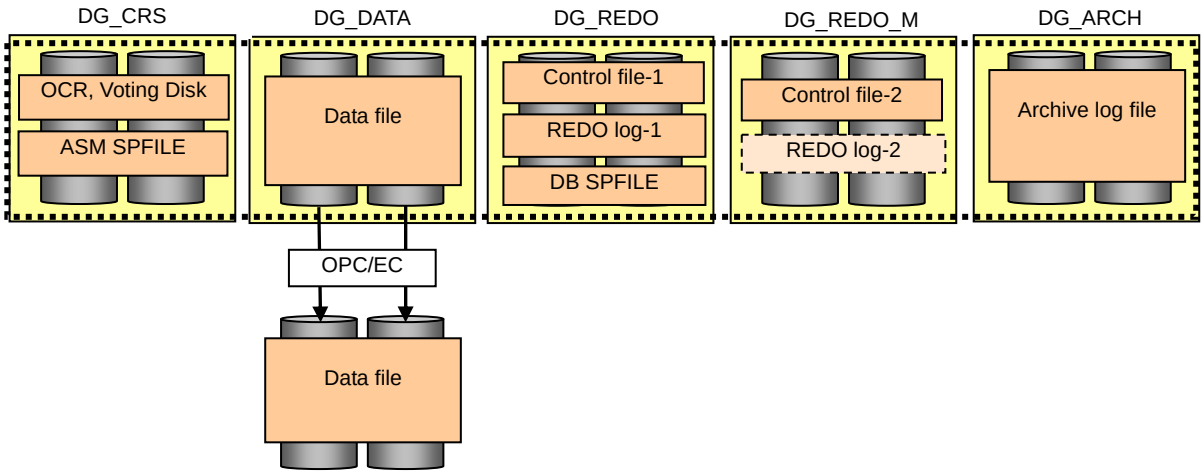
5-3. ASM Disk Group Configuration Guideline

The datafile is huge in size, and does require concurrent backup and rapid recovery - so it is best to use Advanced Copy for the backup of the datafile. It is also best to allocate each file in a separate disk group for ease of operation at the time of restoration. If Advanced Copy is used for the datafile backup, then the redo log file should never be placed in the same disk group as the datafile. Otherwise, Advanced Copy will overwrite all the data of the disk group at the time of restore.

In order to maximize the benefits of the ETERNUS DX Advanced Copy feature, we recommend configuring ASM disk groups as described in the figure below.

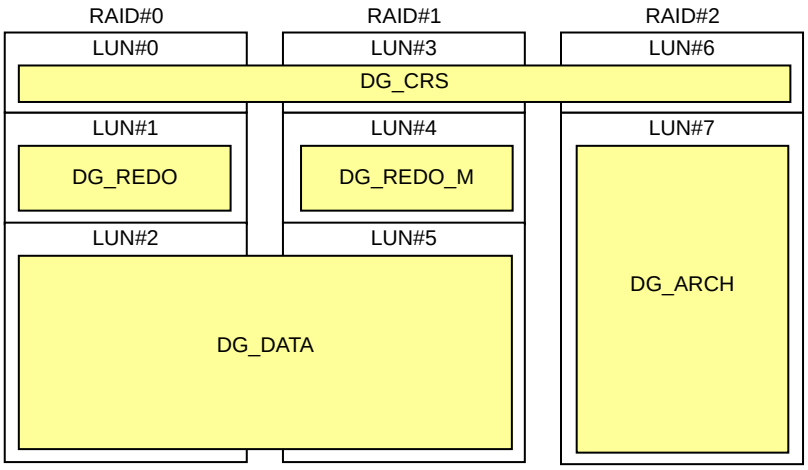
(1) Create five disk groups.
   ① For OCR, Voting disk and SPFILE for ASM（DG_CRS）
   ② For data file (DG_DATA)
   ③ For redo log file (DG_REDO
   ④ For mirror of control file (DG_REDO_M)
   ⑤ For archive log file（DG_ARCH）
(2) Set 11.2.0.0.0 as compatible.asm attribute and compatible.rdbms attribute of all disk groups
   * Unless the above setting is performed when metadata is backed up with the ASMCMD utility, the metadata cannot be restored properly due to the failure of 11.2.0.1.0.
(3) Allocate only data files to DG_DATA. Data files are backed up with the ETERNUS DX Advanced Copy features（OPC/EC）. For details of the backup for other files, see "7-2. Backup/Recovery Procedures and Usage Example".
(4) Allocate all redo log files and control files to DG_REDO
(5) Allocate all mirrors of control files to DG_REDO_M
(6) Allocate archive log files to DG_ARCH
(7) Allocate OCR, Voting disk, SPFILE for ASM instance to DG_CRS

* Note: If you want to maximize the availability of redo log files, then you can place a mirror of all redo log file logs in the mirror disk group（DG_REDO_M).



Regarding RAID configurations for the ETERNUS DX storage system, RAID0+1 is recommended for online volumes to provide performance and reliability, and RAID5 is recommended for backup volumes for cost-effectiveness. To maximize performance, it is reccomended that each disk group is placed in different RAID groups. However, because of advancements in disk capacities, it is unrealistic that all the disk groups can be placed in different RAID groups. Therefore, it is necessary to place a small number of disk groups per RAID group, e.g., placing infrequently accessed disk groups to the same RAID group.

RAID placement of disk group (Example)



5-4. Backup of AdvancedCopy Manager Operational Information

The ETERNUS SF Manager and AdvancedCopy Manager contain various repositories and management information as operational information. The operational information is important information that is required to operate the ETERNUS SF Manager and AdvancedCopy Manager. In the event of an unexpected accident and a shortage of repository capacity due to a long-term operation, a significant change in operational status may occur. Therefore it is recommended to back up the operational information periodically.
For details of the backup methods of the ETERNUS SF Manager and AdvancedCopy Manager operational information, see “9.1 Maintenance of Database” and “Maintenance method of ETERNUS SF Manager Database” in “ETERNUS SF Advanced Copy Manager Operator's Guide (Windows)”.

6. Conclusion

To configure a high-performance, high-availability, and high-operability database environment with a combination of the Oracle 11g ASM feature and the Fujitsu ETERNUS DX storage system, the following points must be considered.

(1) For disk groups where OCR, Voting disk or SPFILE for ASM instance is stored, configure disk groups with high redundancy or normal redundancy. For the others, configure disk groups with external redundancy.
(2) Set 11.2.0.0.0 as compatible.asm attribute and compatible.rdbms attribute of all disk groups
*Unless the above setting is made when metadata is backed up with the ASMCMD utility, the metadata cannot be restored properly due to a failure of 11.2.0.1.0.
(3) Employ RAID0+1 or RAID5 for volumes to be registered in a disk group.
(4) Create five disk groups: DG_CRS, DG_DATA, DG_REDO, DG_REDO_M and DG_ARCH. Allocate OCR, Voting disk and ASM SPFILE to DG_CRS. Allocate only data files to DG_DATA. Allocate redo log files and control files to DG_REDO. Allocate mirrors of control files to DG_REDO_M. Allocate archive log files to DG_ARCH.
(5) For maximum availability of redo log files, it is recommended to place mirrors of redo log files in control file mirror disk group（DG_REDO_M）.
(6) RAID Migration feature enables performance tuning by changing the rotational speed of disk drive and/or the RAID levels concurrently with online operations.
(7) For data files, execute backup and recovery of the ASM file system using the Advanced Copy feature of ETERNUS DX storage system
(8) Back up and recover archive logs, control files and SPFILE for database instance using RMAN
(9) Back up and recover metadata of disk groups with the ASMCMD utility
(10) Back up and recover SPFILE for ASM instance using SQL*Plus
(11) Back up and recover OLR, OCR and Voting disk using ocrconfig

7. Appendix

As described above, this Best Practices document explains the basic features available through the combination of Oracle 11g ASM, ETERNUS DX, and ETERNUS SF AdvancedCopy Manager CCM.

7-1. Hardware and software requirements

Here is a listing of the equipment and components you will need:

- ETERNUS SF AdvancedCopy Manager 15.1
- Windows Server 2008 R2
- Oracle Database 11g Release 2
- Oracle Real Application Clusters 11g Release 2
- Oracle Grid Infrastructure 11g Release 2

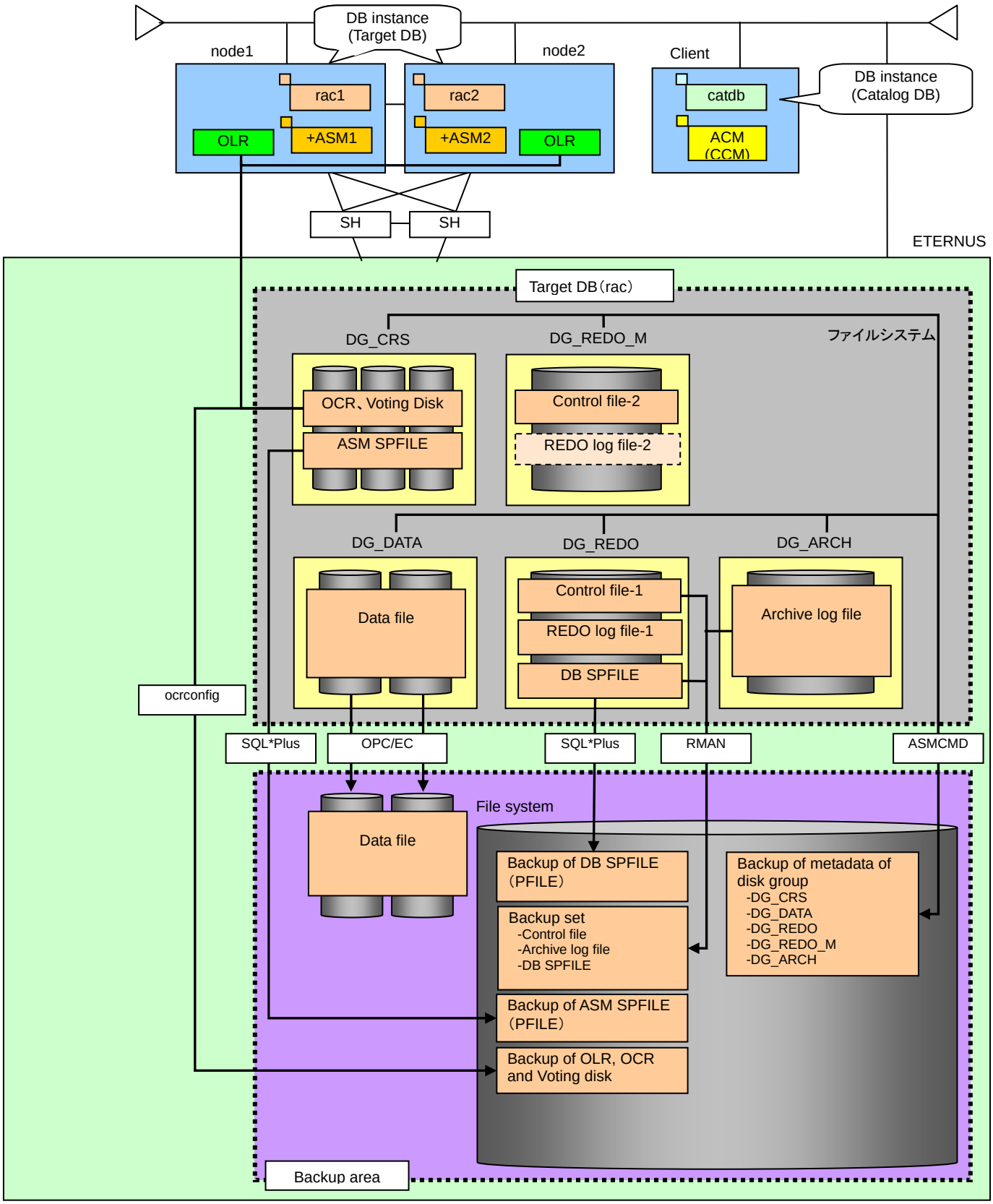
Prerequisites: Before starting this procedure, it is required that you have a storage management server available, with agent installed.

7-2. Backup/Recovery Procedures and Usage Example

This section describes the step-by-step procedure to back up and recover the ASM file system using the AdvancedCopy Manager CCM.

Backup/Recovery is available in both RAC nodes.

- Data file
  It is available even if both RAC nodes are stopped because copy processing is completed in a storage system by using CCM
- Other than data file
  Before executing backup/recovery, mount a backup area (file system) on ETERNUS to a node where backup/recovery will be executed



7-2-1. Backup/Recovery Procedures and Usage Example

Backup of database

1. Archive the current redo log file
   Execute it on the database instance in node1

```
SQL> alter system archive log current;
```

2. Start the backup mode for the database
   Execute it on the database instance in node1

```
SQL> alter database begin backup;
```

3. Confirm that rebalance of ASM is not in execution
   Execute it on the ASM instance in node1

```
SQL> select * from v$asm_operation;
```

   There is no problem when 0 rows returned. If the other rows returned, stop rebalance as follows

```
SQL> alter diskgroup DG_DATA rebalance power 0;
```

   Check v$asm_operation again

```
SQL> select * from v$asm_operation;
```

4. With the AdvancedCopy feature, back up all the partitions that belong to the disk group of the data file
   Reference: <7-2-3 Usage Example of Backup Procedure>

5. Release the backup mode for the database
   Execute it on the database instance in node1

```
SQL> alter database end backup;
```

6. Back up the archive log. The current control file and SPFILE of database instance are backed up by the automatic backup feature
   Execute it on the recovery manager in node1

```
RMAN> backup archivelog all;
```

7. With the ASMCMD utility, back up the metadata of all disk groups
   Execute it on the ASM instance in node1
   *Before backup, confirm that 11.2.0.0.0 is set for compatible.asm attribute and compatible.rdbms attribute of all disk groups. Unless the above setting is made when metadata is backed up with the ASMCMD utility, the metadata cannot be restored properly due to a failure of 11.2.0.1.0.

```
ASMCMD> md_backup E:¥backup¥meta¥md_bk
```

8. Back up SPFILE of database instance and ASM instance as a text-based file
   Execute it on the database instance and the ASM instance in node1, respectively

```
<Database instance>
SQL> create pfile='E:¥backup¥pfile_db¥initrac.ora' from spfile;

<ASM instance>
SQL> create pfile='E:¥backup¥pfile_asm¥initasm.ora' from spfile;
```

* When adding a data file to the database, it is necessary to back up the entire database immediately

Backup of OCR, Voting disk

1. With ocrconfig, back up OCR
   Execute it in node1
   *When using Oracle Clusterware 11g Release 2（11.2）, Voting disk is backed up in OCR. Therefore, it is ok to back up only OCR.

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrconfig –manualbackup
```

Backup of Oracle Local Registry (OLR)

1. With ocrconfig, back up OLR in all nodes
Execute it in node1 and node2, respectively

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrconfig –local –manualbackup
```

7-2-2. Recovery Procedure

In case of a disk group failure of a data file

1. Stop the database instance with the ABORT option
Execute it in node1

```
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop database
–d rac –o abort
```

2. Delete the disk group of a data file. In the case of RAC, it is necessary to dismount the disk group in all the nodes (node2) other than the node of RAC (node1) where the deletion command is executed before deletion.
Execute it on the ASM instance in node1
*If the target disk group in the node where the deletion command is executed is dismounted, use the force option to delete it.

```
SQL> drop diskgroup DG_DATA [force] including contents;
```

3. With the AdvancedCopy feature, restore all the partitions that belong to the disk group of the data file.
Reference: <7-2-4 Usage Example of Recovery Procedure>

4. Mount the disk group of the data file
Execute it on the ASM instance in node1

```
SQL> alter diskgroup DG_DATA mount;
```

5. Start the database instance with the Mount option
Execute it on the database instance in node1

```
RMAN> startup mount;
```

6. Execute complete recovery
Execute it on the recovery manager in node1

```
RMAN> recover database;
```

7. Open the database
Execute it on the recovery manager in node1

```
RMAN> alter database open;
```

8. In the case of RAC, mount the disk group of the data file in all the nodes (node2) other than the node (node1) where the step 4 is executed
Execute it on the ASM instance in node2

```
SQL> alter diskgroup DG_DATA mount;
```

9. In the case of RAC, start the database instance in all the nodes (node2) other than the node (node1) where the step 7 is executed
Execute it in node1

```
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl start instance
–d rac –n node2
```

In case of a failure of all the disk groups other than DG_CRS

1. Stop the database instance with the ABORT option
   Execute it in node1

```
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop database
–d rac -o abort
```

2. Delete all the disk groups other than DG_CRS. In the case of RAC, it is necessary to dismount the disk group in all the nodes (node2) other than the node of RAC (node1) where the deletion command is executed before deleting the disk group
   Execute it on the ASM instance in node1
   *If the target disk group in the node where the deletion command is executed is dismounted, use the force option to delete it.

```
SQL> drop diskgroup DG_DATA [force] including contents;
SQL> drop diskgroup DG_REDO [force] including contents;
SQL> drop diskgroup DG_REDO_M [force] including contents;
SQL> drop diskgroup DG_ARCH [force] including contents;
```

3. Restore the metadata of DG_REDO, DG_REDO_M, DG_ARCH disk groups form the backup metadata
   Execute it on the ASMCMD utility in node1

```
ASMCMD > md_restore E:¥backup¥meta¥md_bk --full –G 'DG_REDO'
ASMCMD > md_restore E:¥backup¥meta¥md_bk --full –G 'DG_REDO_M'
ASMCMD > md_restore E:¥backup¥meta¥md_bk --full –G 'DG_ARCH'
```

4. With the AdvancedCopy feature, restore all the partitions that belong to the disk group of the data file.
   Reference: <7-2-4 Usage Example of Recovery Procedure>

5. Mount the disk group of the data file
   Execute it on the ASM instance in node1

```
SQL> alter diskgroup DG_DATA mount;
```

6. Specify the initialization parameter for backup, and start the database instance in nomount mode
   Execute it on the recovery manager in node1

```
RMAN> startup nomount pfile='E:¥backup¥pfile_db¥initrac.ora';
```

7. Restore the control file that is automatically backed up
   Execute it on the recovery manager in node1

```
RMAN> restore controlfile from autobackup;
```

8. Mount the database
   Execute it on the recovery manager in node1

```
RMAN> alter database mount;
```

9. Restore the backed up server parameter file
   Execute it on the recovery manager in node1

```
RMAN> restore spfile;
```

10. Execute incomplete recovery
    Execute it on the recovery manager in node1

```
RMAN> recover database until sequence 28 thread 1;
```

11. Open the database with the RESETLOGS option
    Execute it on the recovery manager in node1

```
RMAN> alter database open resetlogs;
```

12. In the case of RAC, mount all the disk groups other than DG_CRS in all the nodes (node2) other than the node (node1) where the step 5 is executed
    Execute it on the database instance in node2

```
SQL> alter diskgroup DG_DATA, DG_REDO, DG_REDO_M, DG_ARCH mount;
```

13. To restart the database instance from the server parameter file, stop the database instance
    Execute it in node1

```
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop database
–d rac
```

14. Start all the database instances
    Execute it in node1

```
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl start database
–d rac
```

15. Delete the invalid entry of archive log files
    Execute it on the recovery manager in node1

```
RMAN> crosscheck archivelog all;
RMAN> delete expired archivelog all;
```

In case of a disk group failure of DG_CRS

1. Stop CRS in all nodes
   Execute it in node1 and node2, respectively

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl stop crs –f
```

2. Clear all disk headers of DG_CRS with the ocopy command
   *Prepare a binary zero dummy file for overwriting. In this document, C:¥tmp¥file0 is used.
   Execute it in node1

```
cmd> ocopy C:¥tmp¥file0 ¥¥.¥ORCLDISKDATA3
cmd> ocopy C:¥tmp¥file0 ¥¥.¥ORCLDISKDATA4
cmd> ocopy C:¥tmp¥file0 ¥¥.¥ORCLDISKDATA8
```

3. Create a symbolic link to the DG_CRS disk group
   Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥asmtool –add ¥Device¥Harddisk4¥Partition1
ORCLDISKDATA3
cmd> C:¥app¥11.2.0¥grid¥bin¥asmtool –add ¥Device¥Harddisk5¥Partition1
ORCLDISKDATA4
cmd> C:¥app¥11.2.0¥grid¥bin¥asmtool –add ¥Device¥Harddisk9¥Partition1
ORCLDISKDATA8
```

4. Start CRS in exclusive mode
   Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl start crs –excl
```

5. Stop crsd
   Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl stop resource ora.crsd –init
```

6. Restore the metadata in the DG_CRS disk group
   Execute it on the ASMCMD utility in node1

```
ASMCMD> md_restore E:¥backup¥meta¥md_bk --full  -G 'DG_CRS'
```

7. Shut down the ASM instance
   Execute it on the ASM instance in node1

```
SQL> shutdown immediate
```

8. Start the ASM instance using the backed up pfile
   Execute it on the ASM instance in node1

```
SQL> startup pfile='E:¥backup¥pfile_asm¥initasm.ora';
```

9. Recreate the server parameter file of the ASM instance
   Execute it on the ASM instance in node1

```
SQL> create spfile='+DG_CRS' from pfile='E:¥backup¥pfile_asm¥initasm.ora';
```

10. Restore OCR
    Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrconfig -restore
E:¥backup¥ocr¥backup_20121130_151838.ocr
```

11. Recreate Voting disk into DG_CRS disk group
    Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl replace votedisk +DG_CRS
```

12. Stop the CRS running in exclusive mode
    Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl stop crs -f
```

13. Start CRS in all nodes
    Execute it in node1 and node2, respectively

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl start crs
```

In case of an OLR failure

1. Stop CRS in the target node (node1)
   Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl stop crs
```

2. Restore CLR from backup
   Execute it in node1
   *If there is no <host name.olr> file under {GI installation destination}/cdata, it is necessary to create an empty file with the same name

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrconfig -local –restore
E:¥backup¥olr¥node1¥backup_20121130_130937.olr
```

3. Start CRS in the target node (node1)
   Execute it in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl start crs
```

7-2-3. Usage Example of Backup Procedure

Backup of database

Archive the current redo log file
Execute this command on the database instance in node1

```
SQL> alter system archive log current;

The system has changed
```

Srart the backup mode for the database
Execute this command on the database instance in node1

```
SQL> alter database begin backup;

The database has changed
```

Confirm if rebalance of ASM is in execution
Execute this command on the ASM instance in node1

```
SQL> select * from v$asm_operation;

No record has been selected
```

With the AdvancedCopy feature, back up all the partitions that belong to the disk group of the data file *Execute it excluding the -diff option only at the time of

the initial copy
Execute this command on the OS command line in ASM management server

```
cmd>C:¥ETERNUS_SF¥CCM¥bin¥acopc start -g dg_online –diff

et440s2/0x01:et440s2/0x16
# DATE : 2012/12/07 09:59:47 - << Differential OPC Started >>
#
From:BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=1/Adr_high=0/Adr_low=0/size_high=0/size_low=0
#
To  :BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=16/Adr_high=0/Adr_low=0

et440s2/0x02:et440s2/0x17
# DATE : 2012/12/07 09:59:49 - << Differential OPC Started >>
#
From:BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=2/Adr_high=0/Adr_low=0/size_high=0/size_low=0
#
To  :BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=17/Adr_high=0/Adr_low=0

et440s2/0x08:et440s2/0x18
# DATE : 2012/12/07 09:59:51 - << Differential OPC Started >>
#
From:BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=8/Adr_high=0/Adr_low=0/size_high=0/size_low=0
#
To  :BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=18/Adr_high=0/Adr_low=0

et440s2/0x09:et440s2/0x19
# DATE : 2012/12/07 09:59:53 - << Differential OPC Started >>
#
From:BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=9/Adr_high=0/Adr_low=0/size_high=0/size_low=0
#
To  :BoxID=3030455445524e555344584d5332455434343253412323232323 4c4434353331313
4333030322323/Olu=19/Adr_high=0/Adr_low=0

  Succeeded : 4
  Failed    : 0
```

Confirm the start of the copy
Execute this command on the OS command line in ASM management server

```
cmd>c:¥ETERNUS_SF¥CCM¥bin¥acopc query -g dg_online

Copy Group Name : dg_online
Copy Group Type : QuickOPC
Disk Array Name : et440s2 (00ETERNUSDXMS2ET442SA#####LD4531143002##)

Source      <=> Target      SID  OPC Status     Copy Phase Copied Block
------------ --- ------------ ---- -------------- ---------- ------------
et440s2/0x01 ==> et440s2/0x16 0x4A "OPC Executing" "Tracking"    62914048
et440s2/0x02 ==> et440s2/0x17 0x4B "OPC Executing" "Tracking"    62914560
et440s2/0x08 ==> et440s2/0x18 0x4C "OPC Executing" "Tracking"    62914560
et440s2/0x09 ==> et440s2/0x19 0x4D "OPC Executing" "Tracking"    62914560
```

End the backup mode of database
Execute this command on the database instance in node1

```
SQL> alter database end backup;

The database has changed
```

Back up all the archive log files. It is backed up with the current control file and SPFILE automatic backup feature of database instance
Execute this command on RMAN in node1

```
RMAN>   backup archivelog all;

Backup has started (Start time: 12-12-06)
The current log has been archived
Channel: ORA_DISK_1 has been assigned
Channel ORA_DISK_1: SID=192 Instance=rac1 device type =DISK
Channel ORA_DISK_1: Starting archive log backup set
Channel ORA_DISK_1: Specifying archive log for the backup set
Input archive log thread=1 Order=7 Record ID=3 Stamp=801170772
Input archive log thread=2 Order=4 Record ID=1 Stamp=801170605
Input archive log thread=1 Order=8 Record ID=4 Stamp=801170772
Input archive log thread=1 Order=9 Record ID=5 Stamp=801170773
Input archive log thread=2 Order=5 Record ID=2 Stamp=801170626
Input archive log thread=2 Order=6 Record ID=6 Stamp=801170776
Input archive log thread=1 Order=10 Record ID=7 Stamp=801170788
Input archive log thread=2 Order=7 Record ID=8 Stamp=801170788
Input archive log thread=1 Order=11 Record ID=9 Stamp=801170800
Input archive log thread=2 Order=8 Record ID=10 Stamp=801170800
Input archive log thread=1 Order=12 Record ID=11 Stamp=801171457
Input archive log thread=2 Order=9 Record ID=12 Stamp=801171457
Input archive log thread=1 Order=13 Record ID=13 Stamp=801171481
Input archive log thread=2 Order=10 Record ID=14 Stamp=801171481
Input archive log thread=1 Order=14 Record ID=15 Stamp=801242818
Input archive log thread=2 Order=11 Record ID=17 Stamp=801243202
Input archive log thread=1 Order=15 Record ID=16 Stamp=801243010
Input archive log thread=1 Order=16 Record ID=18 Stamp=801243202
Input archive log thread=1 Order=17 Record ID=19 Stamp=801243394
Input archive log thread=2 Order=12 Record ID=21 Stamp=801243774
Input archive log thread=1 Order=18 Record ID=20 Stamp=801243587
Input archive log thread=1 Order=19 Record ID=22 Stamp=801243776
Input archive log thread=1 Order=20 Record ID=23 Stamp=801243962
Input archive log thread=2 Order=13 Record ID=25 Stamp=801244113
Input archive log thread=1 Order=21 Record ID=24 Stamp=801244037
Input archive log thread=1 Order=22 Record ID=26 Stamp=801244115
Input archive log thread=1 Order=23 Record ID=27 Stamp=801244193
Input archive log thread=2 Order=14 Record ID=29 Stamp=801244348
Input archive log thread=1 Order=24 Record ID=28 Stamp=801244271
Input archive log thread=1 Order=25 Record ID=30 Stamp=801244349
Input archive log thread=1 Order=26 Record ID=31 Stamp=801244424
Input archive log thread=2 Order=15 Record ID=33 Stamp=801244566
Input archive log thread=1 Order=27 Record ID=32 Stamp=801244499
Input archive log thread=1 Order=28 Record ID=34 Stamp=801244568
Input archive log thread=1 Order=29 Record ID=35 Stamp=801244632
Input archive log thread=2 Order=16 Record ID=37 Stamp=801244756
Input archive log thread=1 Order=30 Record ID=36 Stamp=801244695
Input archive log thread=1 Order=31 Record ID=38 Stamp=801244758
Input archive log thread=1 Order=32 Record ID=39 Stamp=801266666
Input archive log thread=2 Order=17 Record ID=41 Stamp=801267310
Input archive log thread=1 Order=33 Record ID=40 Stamp=801266990
Input archive log thread=1 Order=34 Record ID=42 Stamp=801267311
Input archive log thread=1 Order=35 Record ID=43 Stamp=801270168
Input archive log thread=2 Order=18 Record ID=45 Stamp=801271174
Input archive log thread=1 Order=36 Record ID=44 Stamp=801270169
Input archive log thread=1 Order=37 Record ID=48 Stamp=801329359
Input archive log thread=2 Order=19 Record ID=46 Stamp=801271174
Input archive log thread=2 Order=20 Record ID=47 Stamp=801329358
Input archive log thread=2 Order=21 Record ID=51 Stamp=801330044
```

```
Input archive log thread=1 Order=38 Record ID=49 Stamp=801329756
Input archive log thread=1 Order=39 Record ID=50 Stamp=801330044
Input archive log thread=1 Order=40 Record ID=52 Stamp=801330241
Input archive log thread=2 Order=22 Record ID=53 Stamp=801330242
Input archive log thread=1 Order=41 Record ID=55 Stamp=801330450
Input archive log thread=2 Order=23 Record ID=54 Stamp=801330449
Input archive log thread=2 Order=24 Record ID=57 Stamp=801331094
Input archive log thread=1 Order=42 Record ID=56 Stamp=801331092
Input archive log thread=1 Order=43 Record ID=58 Stamp=801331398
Input archive log thread=2 Order=25 Record ID=61 Stamp=801332010
Input archive log thread=1 Order=44 Record ID=59 Stamp=801331671
Input archive log thread=1 Order=45 Record ID=60 Stamp=801332008
Channel ORA_DISK_1: Start piece1(12-12-06)
Channel ORA_DISK_1: Piece1(12-12-06)has been completed
Piece handle=E:¥RMAN¥0BNS6MPM_1_1 Tag=TAG20121206T161340 Comment=NONE
Channel ORA_DISK_1: Backup set has been completed. Elapsed time: 00:01:45
Backup has been completed(Completion time: 12-12-06)

Control File and SPFILE Auto backup has started (Start time: 12-12-06)
Piece handle=E:¥RMAN¥C-2389143809-20121206-01 Comment=NONE
Control File and SPFILE Autobackup have been completed(Completion time: 12-12-06)
```

Back up the metadata of all disk groups with the ASMCMD utility
***Before backup, confirm that 11.2.0.0.0 is set for compatible.asm attribute and compatible.rdbms attribute of all disk groups. Unless the above setting is made when metadata is backed up with the ASMCMD utility, the metadata cannot be restored properly due to a failure of 11.2.0.1.0.**

Execute this command on the ASMCMD utility and the ASM instance in node1

```
SQL> SELECT dg.name AS diskgroup, SUBSTR(a.name,1,24) AS name,
  2  SUBSTR(a.value,1,24) AS value FROM V$ASM_DISKGROUP dg, V$ASM_ATTRIBUTE a
  3  WHERE  dg.group_number = a.group_number
  4  and a.name in ('compatible.rdbms','compatible.asm');

DISKGROUP      NAME                   VALUE
-------------- ---------------------- --------------------
DG_CRS         compatible.asm         11.2.0.0.0
DG_CRS         compatible.rdbms       11.2.0.0.0
DG_REDO        compatible.asm         11.2.0.0.0
DG_REDO        compatible.rdbms       11.2.0.0.0
DG_DATA        compatible.asm         11.2.0.0.0
DG_DATA        compatible.rdbms       11.2.0.0.0
DG_REDO_M      compatible.asm         11.2.0.0.0
DG_REDO_M      compatible.rdbms       11.2.0.0.0
DG_ARCH        compatible.asm         11.2.0.0.0
DG_ARCH        compatible.rdbms       11.2.0.0.0

ASMCMD [+] > md_backup E:¥backup¥meta¥md_bk
Disk group metadata to be backed up: DG_CRS
Disk group metadata to be backed up: DG_REDO
Disk group metadata to be backed up: DG_DATA
Disk group metadata to be backed up: DG_REDO_M
Disk group metadata to be backed up: DG_ARCH
Current alias directory path: crs
Current alias directory path: crs/ASMPARAMETERFILE
Current alias directory path: crs/OCRFILE
Current alias directory path: RAC/CONTROLFILE
Current alias directory path: RAC/PARAMETERFILE
Current alias directory path: RAC
Current alias directory path: RAC/ONLINELOG
Current alias directory path: RAC
Current alias directory path: RAC/DATAFILE
Current alias directory path: RAC/TEMPFILE
Current alias directory path: RAC
```

```
Current alias directory path: RAC/CONTROLFILE
Current alias directory path: RAC/ONLINELOG
Current alias directory path: rac
Current alias directory path: rac/ARCHIVELOG/2012_12_05
Current alias directory path: rac/ARCHIVELOG/2012_12_06
Current alias directory path: rac/ARCHIVELOG/2012_12_04
Current alias directory path: rac/ARCHIVELOG
Current alias directory path: rac/arch
```

Back up the server parameter files of database instance and ASM instance as a text-based file
Execute this command on the database instance and the ASM instance in node1, respectively

```
<Database instance>
SQL> create pfile='E:¥backup¥pfile_db¥initrac.ora' from spfile;

A file has been created

<ASM instance>
SQL> create pfile='E:¥backup¥pfile_asm¥initasm.ora' from spfile;

File created.
```

Backup of OCR, Voting disk

With the ocrconfig command, back up OCR
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrconfig -manualbackup

node1     2012/12/09 17:17:45
C:¥app¥11.2.0¥grid¥cdata¥crs¥backup_20121209_171745.ocr
```

Backup of Oracle Local Registry (OLR)

With the ocrconfig command, back up OLR
Execute this command on the OS command lines in all nodes (node1, node2)

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrconfig –local –manualbackup

node1     2012/12/09 17:20:14
C:¥app¥11.2.0¥grid¥cdata¥node1¥backup_20121209_172014.olr

node1     2012/12/04 15:43:34
C:¥app¥11.2.0¥grid¥cdata¥node1¥backup_20121204_154334.olr
```

7-2-4. Usage Example of Recovery Procedure

In case of a disk group failure of a data file

With the ABORT option, stop the database instance
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_CRS.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_DATA.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.LISTENER.lsnr
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.asm
               ONLINE  ONLINE       node1                    Started
               ONLINE  ONLINE       node2                    Started
ora.gsd
               OFFLINE OFFLINE      node1
               OFFLINE OFFLINE      node2
ora.net1.network
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.ons
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.registry.acfs
               ONLINE  ONLINE       node1
               ONLINE  OFFLINE      node2
```

```
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
     1       ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
     1       ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
     1       ONLINE  ONLINE      node1
ora.cvu
     1       OFFLINE OFFLINE
ora.node1.vip
     1       ONLINE  ONLINE      node1
ora.node2.vip
     1       ONLINE  ONLINE      node2
ora.oc4j
     1       ONLINE  ONLINE      node2
ora.rac.db
     1       ONLINE  ONLINE      node1                Open
     2       ONLINE  ONLINE      node2                Open
ora.scan1.vip
     1       ONLINE  ONLINE      node2
ora.scan2.vip
     1       ONLINE  ONLINE      node1
ora.scan3.vip
     1       ONLINE  ONLINE      node1

cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop database –d rac
-o abort

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res -t

--------------------------------------------------------------------------------
NAME          TARGET  STATE       SERVER                STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_CRS.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_DATA.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_REDO.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_REDO_M.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.LISTENER.lsnr
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.asm
              ONLINE  ONLINE      node1                Started
              ONLINE  ONLINE      node2                Started
ora.gsd
              OFFLINE OFFLINE     node1
              OFFLINE OFFLINE     node2
ora.net1.network
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.ons
```

```
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.registry.acfs
              ONLINE  ONLINE      node1
              ONLINE  OFFLINE     node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1       ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
      1       ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
      1       ONLINE  ONLINE      node1
ora.cvu
      1       OFFLINE OFFLINE
ora.node1.vip
      1       ONLINE  ONLINE      node1
ora.node2.vip
      1       ONLINE  ONLINE      node2
ora.oc4j
      1       ONLINE  ONLINE      node2
ora.rac.db
      1       OFFLINE OFFLINE                           Instance Shutdown
      2       OFFLINE OFFLINE                           Instance Shutdown
ora.scan1.vip
      1       ONLINE  ONLINE      node2
ora.scan2.vip
      1       ONLINE  ONLINE      node1
ora.scan3.vip
      1       ONLINE  ONLINE      node1
```

Dismount the disk group of a data file
Execute this command on the ASM instance in node2

```
SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME    MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------ ----------------------------------------
DG_ARCH       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA9
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA1
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA2
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA6
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA7
DG_REDO       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA0
DG_REDO_M     CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER  NAME           STATE       TYPE
------------ ------------- ----------- ---------
           1  DG_CRS        MOUNTED     NORMAL
           2  DG_ARCH       MOUNTED     EXTERN
           3  DG_DATA       MOUNTED     EXTERN
           4  DG_REDO       MOUNTED     EXTERN
           5  DG_REDO_M     MOUNTED     EXTERN

SQL> alter diskgroup DG_DATA dismount;

Diskgroup altered.
```

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

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_ARCH        MOUNTED     EXTERN
           4 DG_REDO        MOUNTED     EXTERN
           5 DG_REDO_M      MOUNTED     EXTERN

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------- ----------------------------------------
DG_ARCH      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
             CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA1
             CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA2
             CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA6
             CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA7
DG_REDO      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA0
DG_REDO_M    CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5
```

Delete the disk group of a data file.
Execute this command on the ASM instance in node1

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

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_ARCH        MOUNTED     EXTERN
           3 DG_DATA        MOUNTED     EXTERN
           4 DG_REDO        MOUNTED     EXTERN
           5 DG_REDO_M      MOUNTED     EXTERN

SQL> drop diskgroup DG_DATA  including contents;

Diskgroup dropped.

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_ARCH        MOUNTED     EXTERN
           4 DG_REDO        MOUNTED     EXTERN
           5 DG_REDO_M      MOUNTED     EXTERN

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------- ----------------------------------------
DG_ARCH      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA1
```

```
               CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA2
               CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA6
               CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA7
DG_REDO        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA0
DG_REDO_M      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5
```

With the AdvancedCopy feature, restore all the partitions that belong to the disk group of the data file.
Execute this command on the OS command line in ASM management server

```
cmd> C:¥ETERNUS_SF¥CCM¥bin¥acopc start -g dg_online –r

et440s2/0x01:et440s2/0x16
# DATE : 2012/12/07 10:36:41 - << OPC Started >>
# From:BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=16/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=1/Adr_high=0/Adr_low=0

et440s2/0x02:et440s2/0x17
# DATE : 2012/12/07 10:36:42 - << OPC Started >>
# From:BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=17/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=2/Adr_high=0/Adr_low=0

et440s2/0x08:et440s2/0x18
# DATE : 2012/12/07 10:36:43 - << OPC Started >>
# From:BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=18/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=8/Adr_high=0/Adr_low=0

et440s2/0x09:et440s2/0x19
# DATE : 2012/12/07 10:36:45 - << OPC Started >>
# From:BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=19/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=9/Adr_high=0/Adr_low=0

  Succeeded : 4
  Failed    : 0
```

Confirm restoration
Execute this command on the OS command line in ASM management server

```
cmd>c:¥ETERNUS_SF¥CCM¥bin¥acopc query -g dg_online -r

Copy Group Name : dg_online
Copy Group Type : QuickOPC
Disk Array Name : et440s2 (00ETERNUSDXMS2ET442SA#####LD4531143002##)

Source      <=> Target      SID  OPC Status     Copy Phase Copied Block
------------ --- ------------ ---- -------------- ---------- ------------
et440s2/0x01 <== et440s2/0x16 0x65 "OPC Executing" "Copying"     55574528
et440s2/0x02 <== et440s2/0x17 0x66 "OPC Executing" "Copying"     55574528
et440s2/0x08 <== et440s2/0x18 0x67 "OPC Executing" "Copying"     57671680
et440s2/0x09 <== et440s2/0x19 0x68 "OPC Executing" "Copying"     55574528
```

Mount the disk group of the data file
Execute this command on the ASM instance in node1

```
SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
```

```
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------- ----------------------------------------
DG_ARCH      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA1
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA2
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA6
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA7
DG_REDO      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA0
DG_REDO_M    CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_ARCH        MOUNTED     EXTERN
           0 DG_DATA        DISMOUNTED  EXTERN
           4 DG_REDO        MOUNTED     EXTERN
           5 DG_REDO_M      MOUNTED     EXTERN

SQL> alter diskgroup DG_DATA mount;

Diskgroup altered.

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------- ----------------------------------------
DG_ARCH      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
DG_DATA      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA1
DG_DATA      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA2
DG_DATA      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA6
DG_DATA      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA7
DG_REDO      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA0
DG_REDO_M    CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_ARCH        MOUNTED     EXTERN
           3 DG_DATA        MOUNTED     EXTERN
           4 DG_REDO        MOUNTED     EXTERN
           5 DG_REDO_M      MOUNTED     EXTERN
```

Start the database instance with the Mount option
Execute this command on the recovery manager in node1

```
RMAN> startup mount

The Oracle instance has started
The database has been mounted
```

```
The total size of the system global area is 5027385344 bytes

Fixed Size                  2237008 bytes
Variable Size            1006636464 bytes
Database Buffers         4009754624 bytes
Redo Buffers               8757248 bytes
```

Execute complete recovery
Execute this command on the recovery manager in node1

```
RMAN> recover database;

Recover has started (Start time: 12-12-06)
Channel: ORA_DISK_1 has been assigned
Channel ORA_DISK_1: SID=146 Instance=rac1 Device type=DISK

Starting media recovery

The archive log of the thread 1 (Order 43)exists in the disk as the
file+DG_ARCH/rac/arch/arc0000000043_0801161793.0001
The archive log of the thread 1 (Order 44)exists in the disk as the
file+DG_ARCH/rac/arch/arc0000000044_0801161793.0001
The archive log of the thread 1 (Order 45)exists in the disk as the
file+DG_ARCH/rac/arch/arc0000000045_0801161793.0001
The archive log of the thread 2 (Order 25)exists in the disk as the
file+DG_ARCH/rac/arch/arc0000000025_0801161793.0002
Archive log file name=+DG_ARCH/rac/arch/arc0000000043_0801161793.0001 Thread=1
Order=43
Media recovery has been completed. Elapsed time: 00:01:02
Recovery has been completed(Completion time: 12-12-06)
```

Open the database
Execute this command on the recovery manager in node1

```
RMAN> alter database open;

The database has opened
Starting a full resynchronization of the recovery catalog
The full resynchronization has been completed。
```

For all the ASM instances, mount the disk group of the data file
Execute this command on the ASM instance in node2

```
SQL> alter diskgroup DG_DATA mount;

Diskgroup altered.

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME    MOUNT_S   HEADER_STATU  PATH
------------ --------- ------------ --------------------------
DG_ARCH       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA9
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
DG_DATA       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA1
DG_DATA       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA2
DG_DATA       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA6
DG_DATA       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA7
DG_REDO       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA0
DG_REDO_M    CACHED     MEMBER       ¥¥.¥ORCLDISKDATA5
```

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

GROUP_NUMBER NAME            STATE       TYPE
------------ ------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_ARCH        MOUNTED     EXTERN
           3 DG_DATA        MOUNTED     EXTERN
           4 DG_REDO        MOUNTED     EXTERN
           5 DG_REDO_M      MOUNTED     EXTERN
```

Start all the database instances
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE       SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_CRS.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_DATA.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.LISTENER.lsnr
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.asm
               ONLINE  ONLINE      node1                    Started
               ONLINE  ONLINE      node2                    Started
ora.gsd
               OFFLINE OFFLINE     node1
               OFFLINE OFFLINE     node2
ora.net1.network
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.ons
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.registry.acfs
               ONLINE  ONLINE      node1
               ONLINE  OFFLINE     node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1        ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
      1        ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
      1        ONLINE  ONLINE      node1
ora.cvu
      1        OFFLINE OFFLINE
ora.node1.vip
      1        ONLINE  ONLINE      node1
```

```
ora.node2.vip
     1       ONLINE  ONLINE      node2
ora.oc4j
     1       ONLINE  ONLINE      node2
ora.rac.db
     1       ONLINE  ONLINE      node1                 Open
     2       OFFLINE OFFLINE                           Instance Shutdown
ora.scan1.vip
     1       ONLINE  ONLINE      node2
ora.scan2.vip
     1       ONLINE  ONLINE      node1
ora.scan3.vip
     1       ONLINE  ONLINE      node1

cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl start instance -d rac
-n node2

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE       SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_CRS.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_DATA.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.LISTENER.lsnr
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.asm
               ONLINE  ONLINE      node1                 Started
               ONLINE  ONLINE      node2                 Started
ora.gsd
               OFFLINE OFFLINE     node1
               OFFLINE OFFLINE     node2
ora.net1.network
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.ons
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.registry.acfs
               ONLINE  ONLINE      node1
               ONLINE  OFFLINE     node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
     1       ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
     1       ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
     1       ONLINE  ONLINE      node1
```

```
ora.cvu
     1       OFFLINE OFFLINE
ora.node1.vip
     1       ONLINE  ONLINE      node1
ora.node2.vip
     1       ONLINE  ONLINE      node2
ora.oc4j
     1       ONLINE  ONLINE      node2
ora.rac.db
     1       ONLINE  ONLINE      node1                  Open
     2       ONLINE  ONLINE      node2                  Open
ora.scan1.vip
     1       ONLINE  ONLINE      node2
ora.scan2.vip
     1       ONLINE  ONLINE      node1
ora.scan3.vip
     1       ONLINE  ONLINE      node1
```

In case of a failure a disk group other than DG_CRS

With the ABORT option, shut down the database instance
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE       SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_CRS.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_DATA.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.LISTENER.lsnr
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.asm
               ONLINE  ONLINE      node1                  Started
               ONLINE  ONLINE      node2                  Started
ora.gsd
               OFFLINE OFFLINE     node1
               OFFLINE OFFLINE     node2
ora.net1.network
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.ons
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.registry.acfs
               ONLINE  ONLINE      node1
               ONLINE  OFFLINE     node2
```

```
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
     1       ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
     1       ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
     1       ONLINE  ONLINE      node1
ora.cvu
     1       OFFLINE OFFLINE
ora.node1.vip
     1       ONLINE  ONLINE      node1
ora.node2.vip
     1       ONLINE  ONLINE      node2
ora.oc4j
     1       ONLINE  ONLINE      node2
ora.rac.db
     1       ONLINE  ONLINE      node1                Open
     2       ONLINE  ONLINE      node2                Open
ora.scan1.vip
     1       ONLINE  ONLINE      node2
ora.scan2.vip
     1       ONLINE  ONLINE      node1
ora.scan3.vip
     1       ONLINE  ONLINE      node1

cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop database -d rac
-o abort

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_CRS.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_DATA.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.LISTENER.lsnr
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.asm
               ONLINE  ONLINE      node1                Started
               ONLINE  ONLINE      node2                Started
ora.gsd
               OFFLINE OFFLINE     node1
               OFFLINE OFFLINE     node2
ora.net1.network
               ONLINE  ONLINE      node1
               ONLINE  ONLINE      node2
ora.ons
               ONLINE  ONLINE      node1
```

```
              ONLINE  ONLINE      node2
ora.registry.acfs
              ONLINE  ONLINE      node1
              ONLINE  OFFLINE     node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1       ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
      1       ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
      1       ONLINE  ONLINE      node1
ora.cvu
      1       OFFLINE OFFLINE
ora.node1.vip
      1       ONLINE  ONLINE      node1
ora.node2.vip
      1       ONLINE  ONLINE      node2
ora.oc4j
      1       ONLINE  ONLINE      node2
ora.rac.db
      1       OFFLINE OFFLINE                           Instance Shutdown
      2       OFFLINE OFFLINE                           Instance Shutdown
ora.scan1.vip
      1       ONLINE  ONLINE      node2
ora.scan2.vip
      1       ONLINE  ONLINE      node1
ora.scan3.vip
      1       ONLINE  ONLINE      node1
```

Dismount all the disk groups other than DG_CRS
Execute this command on the ASM instance in node2

```
SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME    MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------ --------------------------
DG_ARCH       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA9
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS        CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA1
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA2
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA6
DG_DATA       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA7
DG_REDO       CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA0
DG_REDO_M     CACHED    CANDIDATE     ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER  NAME           STATE       TYPE
------------ ------------- ----------- ---------
           1  DG_CRS        MOUNTED     NORMAL
           2  DG_ARCH       MOUNTED     EXTERN
           3  DG_DATA       MOUNTED     EXTERN
           4  DG_REDO       MOUNTED     EXTERN
           5  DG_REDO_M     MOUNTED     EXTERN

SQL> alter diskgroup DG_DATA, DG_REDO, DG_REDO_M, DG_ARCH dismount;

Diskgroup altered.
```

```
SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------ ----------------------------------------
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA1
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA2
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA6
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA7
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA0
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1   DG_CRS         MOUNTED       NORMAL
```

Delete all the disk groups other than DG_CRS.
Execute this command on the ASM instance in node1

```
SQL> drop diskgroup DG_DATA including contents;

Diskgroup dropped.

SQL> drop diskgroup DG_REDO including contents;

Diskgroup dropped.

SQL> drop diskgroup DG_REDO_M including contents;

Diskgroup dropped.

SQL> drop diskgroup DG_ARCH including contents;

Diskgroup dropped.

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------ ----------------------------------------
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA1
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA2
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA6
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA7
             CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA0
            CLOSED    CANDIDATE     ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1   DG_CRS         MOUNTED       NORMAL
```

From the backup of the metadata acquired with the ASMCMD utility, restore the metadata of DG_REDO, DG_REDO_M and DG_ARCH
Execute this command on the ASMCMD utility in node1

```
ASMCMD >  md_restore /backup/meta/md_bk --full -G 'DG_REDO'
Current Diskgroup metadata being restored: DG_REDO
Diskgroup DG_REDO created!
System template BACKUPSET modified!
System template FLASHFILE modified!
System template CHANGETRACKING modified!
System template TEMPFILE modified!
System template ONLINELOG modified!
System template FLASHBACK modified!
System template CONTROLFILE modified!
System template DATAGUARDCONFIG modified!
System template ASMPARAMETERFILE modified!
System template DATAFILE modified!
System template OCRFILE modified!
System template XTRANSPORT modified!
System template PARAMETERFILE modified!
System template DUMPSET modified!
System template ARCHIVELOG modified!
System template AUTOBACKUP modified!
Directory +DG_REDO/RAC re-created!
Directory +DG_REDO/RAC/CONTROLFILE re-created!
Directory +DG_REDO/RAC/ONLINELOG re-created!
Directory +DG_REDO/RAC/PARAMETERFILE re-created!

ASMCMD >  md_restore /backup/meta/md_bk --full -G 'DG_REDO_M'
Current Diskgroup metadata being restored: DG_REDO_M
Diskgroup DG_REDO_M created!
System template ONLINELOG modified!
System template XTRANSPORT modified!
System template CONTROLFILE modified!
System template DATAFILE modified!
System template BACKUPSET modified!
System template DUMPSET modified!
System template CHANGETRACKING modified!
System template OCRFILE modified!
System template DATAGUARDCONFIG modified!
System template TEMPFILE modified!
System template ASMPARAMETERFILE modified!
System template FLASHFILE modified!
System template PARAMETERFILE modified!
System template FLASHBACK modified!
System template AUTOBACKUP modified!
System template ARCHIVELOG modified!
Directory +DG_REDO_M/RAC re-created!
Directory +DG_REDO_M/RAC/ONLINELOG re-created!
Directory +DG_REDO_M/RAC/CONTROLFILE re-created!

ASMCMD > md_restore /backup/meta/md_bk --full -G 'DG_ARCH'
Current Diskgroup metadata being restored: DG_ARCH
Diskgroup DG_ARCH created!
System template BACKUPSET modified!
System template FLASHFILE modified!
System template CHANGETRACKING modified!
System template TEMPFILE modified!
System template ONLINELOG modified!
System template FLASHBACK modified!
System template CONTROLFILE modified!
System template DATAGUARDCONFIG modified!
System template ASMPARAMETERFILE modified!
System template DATAFILE modified!
System template OCRFILE modified!
```

```
System template XTRANSPORT modified!
System template PARAMETERFILE modified!
System template DUMPSET modified!
System template ARCHIVELOG modified!
System template AUTOBACKUP modified!
Directory +DG_ARCH/rac re-created!
Directory +DG_ARCH/rac/arch re-created!
Directory +DG_ARCH/rac/ARCHIVELOG re-created!
Directory +DG_ARCH/rac/snapcf re-created!
Directory +DG_ARCH/rac/CONTROLFILE re-created!
Directory +DG_ARCH/rac/ARCHIVELOG/2012_12_04 re-created!
Directory +DG_ARCH/rac/ARCHIVELOG/2012_12_05 re-created!
Directory +DG_ARCH/rac/ARCHIVELOG/2012_12_06 re-created!

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME    MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------- ---------------------------
DG_ARCH       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA9
DG_CRS        CACHED    MEMBER         ¥¥.¥ORCLDISKDATA3
DG_CRS        CACHED    MEMBER         ¥¥.¥ORCLDISKDATA4
DG_CRS        CACHED    MEMBER         ¥¥.¥ORCLDISKDATA8
              CLOSED    CANDIDATE      ¥¥.¥ORCLDISKDATA1
              CLOSED    CANDIDATE      ¥¥.¥ORCLDISKDATA2
              CLOSED    CANDIDATE      ¥¥.¥ORCLDISKDATA6
              CLOSED    CANDIDATE      ¥¥.¥ORCLDISKDATA7
DG_REDO       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA0
DG_REDO_M      CACHED MEMBER          ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER  NAME           STATE       TYPE
------------ ------------- ----------- ---------
           1  DG_CRS         MOUNTED     NORMAL
           2  DG_REDO        MOUNTED     EXTERN
           3  DG_REDO_M      MOUNTED     EXTERN
           4  DG_ARCH        MOUNTED     EXTERN
```

With the AdvancedCopy feature, restore all the partitions that belong to the disk group of the data file.
Execute this command on the OS command line in ASM management server

```
cmd> c:¥ETERNUS_SF¥CCM¥bin¥acopc start -g dg_online –r

et440s2/0x01:et440s2/0x16
# DATE : 2012/12/07 13:28:26 - << OPC Started >>
# From:BoxID=3030455445524e555344584d5332455434343253412323232343c4434353331313
4333030322323/Olu=16/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d5332455434343253412323232343c4434353331313
4333030322323/Olu=1/Adr_high=0/Adr_low=0

et440s2/0x02:et440s2/0x17
# DATE : 2012/12/07 13:28:27 - << OPC Started >>
# From:BoxID=3030455445524e555344584d5332455434343253412323232343c4434353331313
4333030322323/Olu=17/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d5332455434343253412323232343c4434353331313
4333030322323/Olu=2/Adr_high=0/Adr_low=0

et440s2/0x08:et440s2/0x18
# DATE : 2012/12/07 13:28:28 - << OPC Started >>
# From:BoxID=3030455445524e555344584d5332455434343253412323232343c4434353331313
4333030322323/Olu=18/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d5332455434343253412323232343c4434353331313
```

```
4333030322323/Olu=8/Adr_high=0/Adr_low=0

et440s2/0x09:et440s2/0x19
# DATE : 2012/12/07 13:28:30 - << OPC Started >>
# From:BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=19/Adr_high=0/Adr_low=0/size_high=0/size_low=0
# To  :BoxID=3030455445524e555344584d533245543434325341232323234c4434353331313
4333030322323/Olu=9/Adr_high=0/Adr_low=0

  Succeeded : 4
  Failed    : 0
```

Confirm restoration
Execute this command on the OS command line in ASM management server

```
cmd>c:¥ETERNUS_SF¥CCM¥bin¥acopc query -g dg_online -r

Copy Group Name : dg_online
Copy Group Type : QuickOPC
Disk Array Name : et440s2 (00ETERNUSDXMS2ET442SA#####LD4531143002##)

Source      <=> Target      SID  OPC Status     Copy Phase Copied Block
------------ --- ------------ ---- -------------- ---------- ------------
et440s2/0x01 <== et440s2/0x16 0x61 "OPC Executing" "Copying"     56623104
et440s2/0x02 <== et440s2/0x17 0x62 "OPC Executing" "Copying"     56623104
et440s2/0x08 <== et440s2/0x18 0x63 "OPC Executing" "Copying"     58720256
et440s2/0x09 <== et440s2/0x19 0x64 "OPC Executing" "Copying"     56623104
```

Mount the disk group of the data file
Execute this command on the ASM instance in node1

```
SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------- --------------------------
DG_ARCH      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER        ¥¥.¥ORCLDISKDATA8
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA1
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA2
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA6
             CLOSED    MEMBER        ¥¥.¥ORCLDISKDATA7
DG_REDO      CACHED    MEMBER        ¥¥.¥ORCLDISKDATA0
DG_REDO_M    CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_REDO        MOUNTED     EXTERN
           3 DG_REDO_M      MOUNTED     EXTERN
           4 DG_ARCH        MOUNTED     EXTERN
           0 DG_DATA        DISMOUNTED

SQL> alter diskgroup DG_DATA mount;

Diskgroup altered.

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
```

```
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME   MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------ --------------------------
DG_ARCH      CACHED    MEMBER         ¥¥.¥ORCLDISKDATA9
DG_CRS       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA3
DG_CRS       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA4
DG_CRS       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA8
DG_DATA      CACHED    MEMBER         ¥¥.¥ORCLDISKDATA1
DG_DATA      CACHED    MEMBER         ¥¥.¥ORCLDISKDATA2
DG_DATA      CACHED    MEMBER         ¥¥.¥ORCLDISKDATA6
DG_DATA      CACHED    MEMBER         ¥¥.¥ORCLDISKDATA7
DG_REDO      CACHED    MEMBER         ¥¥.¥ORCLDISKDATA0
DG_REDO_M    CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1 DG_CRS         MOUNTED     NORMAL
           2 DG_REDO        MOUNTED     EXTERN
           3 DG_REDO_M      MOUNTED     EXTERN
           4 DG_ARCH        MOUNTED     EXTERN
           5 DG_DATA        MOUNTED     EXTERN
```

Specify the initialization parameter for backup, and start the database instance in nomount mode
Execute this command on the recovery manager in node1

```
RMAN> startup nomount pfile='E:¥backup¥pfile_db¥initrac.ora';

The Oracle instance has started

The total size of the system global area is 5027385344 bytes

Fixed Size                  2237008 bytes
Variable Size            1040190896 bytes
Database Buffers         3976200192 bytes
Redo Buffers               8757248 bytes
```

Restore the automatic backup control file
Execute this command on the recovery manager in node1

```
RMAN> restore controlfile from autobackup;

Restoration has started (Start time:  12-12-06)
Channel: ORA_DISK_1 has been assigned
Channel ORA_DISK_1: SID=123 Instance=rac1 Device type=DISK

Channel ORA_DISK_1: Looking for automatic backup of a day of the week: 20121206
Channel ORA_DISK_1: The automatic backup has been found:
E:¥rman¥c-2389143809-20121206-04
Channel ORA_DISK_1: Restoring the control file from automatic backup
E:¥rman¥c-2389143809-20121206-04
Channel ORA_DISK_1: Restoration of the control file from automatic backup has been
completed
Output fine name=+DG_REDO/rac/control01.ctl
Output fine name=+DG_REDO_M/rac/control02.ctl
Restoration has been completed(Completion time: 12-12-06)
```

Mount the database
Execute this command on the recovery manager in node1

```
RMAN> alter database mount;
```

```
The database has been mounted
Channel: ORA_DISK_1 has been released
```

Restore the backed up server parameter file
Execute this command on the recovery manager in node1

```
RMAN > restore spfile;

Restoration has started (Start time: 12-12-06)
Channel: ORA_DISK_1 has been assigned
Channel ORA_DISK_1: SID=146 Instance=rac1 Device type=DISK

Channel ORA_DISK_1: Starting restoration of the data file backup set
Channel ORA_DISK_1: SPFILE is being restored
Output fine name=+DG_REDO/rac/spfilerac.ora
Channel ORA_DISK_1: Reading from backup piece E:¥RMAN¥C-2389143809-20121206-04
Channel ORA_DISK_1: Piece handle=E:¥RMAN¥C-2389143809-20121206-04
Tag=TAG20121206T191905
Channel ORA_DISK_1: The backup piece 1 has been restored
Channel ORA_DISK_1: The restoration has been completed. Elapsed time: 00:00:01
Restoration has been completed(Completion time: 12-12-06)
```

Execute incomplete recovery
Execute this command on the recovery manager in node1

```
RMAN> recover database until sequence 5 thread 1;

Recover has started (Start time: 12-12-06)
Using channel ORA_DISK_1

Starting media recovery

Channel ORA_DISK_1: Starting restoration of archive log to the default destination
Channel ORA_DISK_1: Restoring archive log
Archive log thread=1 Order=2
Channel ORA_DISK_1: Restoring archive log
Archive log thread=2 Order=3
Channel ORA_DISK_1: Restoring archive log
Archive log thread=1 Order=3
Channel ORA_DISK_1: Restoring archive log
Archive log thread=1 Order=4
Channel ORA_DISK_1: Reading from backup piece E:¥RMAN¥0KNS71KO_1_1
Channel ORA_DISK_1: Piece handle=E:¥RMAN¥0KNS71KO_1_1 Tag=TAG20121206T191634
Channel ORA_DISK_1: The backup piece 1 has been restored
Channel ORA_DISK_1: The restoration has been completed. Elapsed time: 00:00:15
Archive log file name=+DG_ARCH/rac/arch/arc0000000002_0801336739.0001 Thread=1
Order=2
Archive log file name=+DG_ARCH/rac/arch/arc0000000003_0801336739.0002 Thread=2
Order=3
Archive log file name=+DG_ARCH/rac/arch/arc0000000003_0801336739.0001 Thread=1
Order=3
Archive log file name=+DG_ARCH/rac/arch/arc0000000004_0801336739.0001 Thread=1
Order=4
Media recovery has been completed. Elapsed time: 00:00:57
Recovery has been completed(Completion time: 12-12-06)
```

Open the database with the RESETLOGS option
Execute this command on the recovery manager in node1

```
RMAN> alter database open resetlogs;

The database has opened
New incarnation of database has been registered in recovery catalog
```

```
Starting a full resynchronization of the recovery catalog
The full resynchronization has been completed
```

For all the ASM instances, mount all the disk groups other than DG_CRS
Execute this command on the ASM instance in node2

```
SQL> alter diskgroup DG_DATA, DG_REDO, DG_REDO_M, DG_ARCH mount;

Diskgroup altered.

SQL> select ag.name "GROUP_NAME", ad.mount_status, ad.header_status, ad.path
  2  from v$asm_disk ad, v$asm_diskgroup ag
  3  where ad.group_number != 0 and ad.group_number = ag.group_number;

GROUP_NAME    MOUNT_S   HEADER_STATU   PATH
------------ --------- ------------ --------------------------
DG_ARCH       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA9
DG_CRS        CACHED    MEMBER         ¥¥.¥ORCLDISKDATA3
DG_CRS        CACHED    MEMBER         ¥¥.¥ORCLDISKDATA4
DG_CRS        CACHED    MEMBER         ¥¥.¥ORCLDISKDATA8
DG_DATA       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA1
DG_DATA       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA2
DG_DATA       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA6
DG_DATA       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA7
DG_REDO       CACHED    MEMBER         ¥¥.¥ORCLDISKDATA0
DG_REDO_M     CACHED    MEMBER        ¥¥.¥ORCLDISKDATA5

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER  NAME           STATE       TYPE
------------ -------------- ----------- ---------
           1  DG_CRS         MOUNTED     NORMAL
           2  DG_ARCH        MOUNTED     EXTERN
           3  DG_DATA        MOUNTED     EXTERN
           4  DG_REDO        MOUNTED     EXTERN
           5  DG_REDO_M      MOUNTED     EXTERN
```

To restart the database instace from the server parameter file, stop the database instance
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res –t
--------------------------------------------------------------------------------
NAME          TARGET  STATE       SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_CRS.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_DATA.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_REDO.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_REDO_M.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.LISTENER.lsnr
              ONLINE  ONLINE      node1
```

```
              ONLINE  ONLINE      node2
ora.asm
              ONLINE  ONLINE      node1                  Started
              ONLINE  ONLINE      node2                  Started
ora.gsd
              OFFLINE OFFLINE     node1
              OFFLINE OFFLINE     node2
ora.net1.network
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.ons
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.registry.acfs
              ONLINE  ONLINE      node1
              ONLINE  OFFLINE     node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1       ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
      1       ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
      1       ONLINE  ONLINE      node1
ora.cvu
      1       OFFLINE OFFLINE
ora.node1.vip
      1       ONLINE  ONLINE      node1
ora.node2.vip
      1       ONLINE  ONLINE      node2
ora.oc4j
      1       ONLINE  ONLINE      node2
ora.rac.db
      1       ONLINE  ONLINE     node1                  Open
      2       OFFLINE OFFLINE                           Instance Shutdown
ora.scan1.vip
      1       ONLINE  ONLINE      node2
ora.scan2.vip
      1       ONLINE  ONLINE      node1
ora.scan3.vip
      1       ONLINE  ONLINE      node1

cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop instance -d rac
-n node1 –o immediate

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res –t
--------------------------------------------------------------------------------
NAME          TARGET  STATE       SERVER                 STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_CRS.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_DATA.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_REDO.dg
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.DG_REDO_M.dg
```

```
              ONLINE  ONLINE       node1
              ONLINE  ONLINE       node2
ora.LISTENER.lsnr
              ONLINE  ONLINE       node1
              ONLINE  ONLINE       node2
ora.asm
              ONLINE  ONLINE       node1                    Started
              ONLINE  ONLINE       node2                    Started
ora.gsd
              OFFLINE OFFLINE      node1
              OFFLINE OFFLINE      node2
ora.net1.network
              ONLINE  ONLINE       node1
              ONLINE  ONLINE       node2
ora.ons
              ONLINE  ONLINE       node1
              ONLINE  ONLINE       node2
ora.registry.acfs
              ONLINE  ONLINE       node1
              ONLINE  OFFLINE      node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1       ONLINE  ONLINE       node2
ora.LISTENER_SCAN2.lsnr
      1       ONLINE  ONLINE       node1
ora.LISTENER_SCAN3.lsnr
      1       ONLINE  ONLINE       node1
ora.cvu
      1       OFFLINE OFFLINE
ora.node1.vip
      1       ONLINE  ONLINE       node1
ora.node2.vip
      1       ONLINE  ONLINE       node2
ora.oc4j
      1       ONLINE  ONLINE       node2
ora.rac.db
      1       OFFLINE OFFLINE                          Instance Shutdown
      2       OFFLINE OFFLINE                          Instance Shutdown
ora.scan1.vip
      1       ONLINE  ONLINE       node2
ora.scan2.vip
      1       ONLINE  ONLINE       node1
ora.scan3.vip
      1       ONLINE  ONLINE       node1
```

Start all the database instances
Execute this command on the OS command line in node1

```
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl start database -d rac

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status res –t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
              ONLINE  ONLINE       node1
              ONLINE  ONLINE       node2
ora.DG_CRS.dg
              ONLINE  ONLINE       node1
              ONLINE  ONLINE       node2
ora.DG_DATA.dg
```

```
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.LISTENER.lsnr
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.asm
               ONLINE  ONLINE       node1                    Started
               ONLINE  ONLINE       node2                    Started
ora.gsd
               OFFLINE OFFLINE      node1
               OFFLINE OFFLINE      node2
ora.net1.network
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.ons
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.registry.acfs
               ONLINE  ONLINE       node1
               ONLINE  OFFLINE      node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1        ONLINE  ONLINE       node2
ora.LISTENER_SCAN2.lsnr
      1        ONLINE  ONLINE       node1
ora.LISTENER_SCAN3.lsnr
      1        ONLINE  ONLINE       node1
ora.cvu
      1        OFFLINE OFFLINE
ora.node1.vip
      1        ONLINE  ONLINE       node1
ora.node2.vip
      1        ONLINE  ONLINE       node2
ora.oc4j
      1        ONLINE  ONLINE       node2
ora.rac.db
      1        ONLINE  ONLINE       node1                    Open
      2        ONLINE  ONLINE       node2                    Open
ora.scan1.vip
      1        ONLINE  ONLINE       node2
ora.scan2.vip
      1        ONLINE  ONLINE       node1
ora.scan3.vip
      1        ONLINE  ONLINE       node1
```

Delete the invalid entry of archive log files
Execute this command on the recovery manager in node1

```
RMAN> crosscheck archivelog all;

Starting a full resynchronization of the recovery catalog
The full resynchronization has been completed
Channel: ORA_DISK_1 has been assigned
Channel ORA_DISK_1: SID=48 Instance=rac1 Device type=DISK
Verification of archive log has failed
Archive log file name=+DG_ARCH/rac/arch/arc0000000007_0801161793.0001 Record ID=3
Stamp=801170772
```

```
Verification of archive log has failed
Archive log file name=+DG_ARCH/rac/arch/arc0000000008_0801161793.0001 Record ID=4
Stamp=801170772
Verification of archive log has failed
        Archive log file name=+DG_ARCH/rac/arch/arc0000000009_0801161793.0001
Record ID=5 Stamp=801170773

         :

Verification of archive log has been successfully completed
Archive log file name=+DG_ARCH/rac/arch/arc0000000001_0801344123.0002 Record ID=83
Stamp=
801344153
81 objects have been cross-checked

RMAN> list archivelog all;

The list of archive log copies of the database, db_unique_name RAC
=====================================================================

Key     Thrd Seq     S Low time
------- ---- ------- - --------
32      1    7       X 12-12-04
       Name: +DG_ARCH/rac/arch/arc0000000007_0801161793.0001

33      1    8       X 12-12-04
       Name: +DG_ARCH/rac/arch/arc0000000008_0801161793.0001

     :

1338    1    2       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000002_0801344123.0001

1315    2    1       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000001_0801344123.0002

RMAN> delete expired archivelog all;

Channel: ORA_DISK_1 has been released
Channel: ORA_DISK_1 has been assigned
Channel ORA_DISK_1: SID=48 Instance=rac1 Device type=DISK
The list of archive log copies of the database, db_unique_name RAC
=====================================================================

Key     Thrd Seq     S Low time
------- ---- ------- - --------
32      1    7       X 12-12-04
       Name: +DG_ARCH/rac/arch/arc0000000007_0801161793.0001

33      1    8       X 12-12-04
       Name: +DG_ARCH/rac/arch/arc0000000008_0801161793.0001

         :

1041    2    2       X 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000002_0801336739.0002


Do you want to delete this object (enter YES or NO)?yes
The archive log has been deleted
Archive log file name=+DG_ARCH/rac/arch/arc0000000007_0801161793.0001 Record ID=3
Stamp=801170772

       :
```

```
The archive log has been deleted
Archive log file name=+DG_ARCH/rac/arch/arc0000000001_0801336739.0002 Record ID=72
Stamp=801336769
The archive log has been deleted
Archive log file name=+DG_ARCH/rac/arch/arc0000000002_0801336739.0002 Record ID=74
Stamp=801342182
74EXPIRED objects have been deleted

RMAN> list archivelog all;

The list of archive log copies of the database, db_unique_name RAC
=====================================================================

Key     Thrd Seq     S Low time
------- ---- ------- - --------
1187    1    2       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000002_0801336739.0001

1186    1    3       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000003_0801336739.0001

1185    1    4       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000004_0801336739.0001

1184    2    3       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000003_0801336739.0002

1337    1    1       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000001_0801344123.0001

1338    1    2       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000002_0801344123.0001

1315    2    1       A 12-12-06
       Name: +DG_ARCH/rac/arch/arc0000000001_0801344123.0002
```

In case of a disk group failure of DG_CRS

Stop CRS in node1
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status resource -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_CRS.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_DATA.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE       node1
```

```
              ONLINE  ONLINE      node2
ora.LISTENER.lsnr
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.asm
              ONLINE  ONLINE      node1                Started
              ONLINE  ONLINE      node2                Started
ora.gsd
              OFFLINE OFFLINE     node1
              OFFLINE OFFLINE     node2
ora.net1.network
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.ons
              ONLINE  ONLINE      node1
              ONLINE  ONLINE      node2
ora.registry.acfs
              ONLINE  ONLINE      node1
              ONLINE  OFFLINE     node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1       ONLINE  ONLINE      node2
ora.LISTENER_SCAN2.lsnr
      1       ONLINE  ONLINE      node1
ora.LISTENER_SCAN3.lsnr
      1       ONLINE  ONLINE      node1
ora.cvu
      1       OFFLINE OFFLINE
ora.node1.vip
      1       ONLINE  ONLINE      node1
ora.node2.vip
      1       ONLINE  ONLINE      node2
ora.oc4j
      1       ONLINE  ONLINE      node2
ora.rac.db
      1       ONLINE  ONLINE      node1                Open
      2       ONLINE  ONLINE      node2                Open
ora.scan1.vip
      1       ONLINE  ONLINE      node2
ora.scan2.vip
      1       ONLINE  ONLINE      node1
ora.scan3.vip
      1       ONLINE  ONLINE      node1

cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop database –d rac

cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop listener
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop scan_listener
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop scan
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop oc4j
cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop nodeapps

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl stop crs -f
CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources
on ‘node1’
CRS-2673: Attempting to stop ‘ora.crf’ on ‘node1’
CRS-2673: Attempting to stop ‘ora.ctssd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.evmd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.asm'on ‘node1’
CRS-2673: Attempting to stop ‘ora.mdnsd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.drivers.acfs'on ‘node1’
CRS-2677: Stop of ‘ora.mdnsd'on ‘node1’ succeeded
```

```
CRS-2677: Stop of 'ora.crf'on 'node1' succeeded
CRS-2677: Stop of 'ora.evmd'on 'node1' succeeded
CRS-2677: Stop of 'ora.ctssd'on 'node1' succeeded
CRS-2677: Stop of 'ora.asm'on 'node1' succeeded
CRS-2673: Attempting to stop 'ora.cssd'on 'node1'
CRS-2677: Stop of 'ora.cssd'on 'node1' succeeded
CRS-2673: Attempting to stop 'ora.gipcd'on 'node1'
CRS-2677: Stop of 'ora.gipcd'on 'node1' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd'on 'node1'
CRS-2677: Stop of 'ora.gpnpd'on 'node1' succeeded
CRS-2677: Stop of 'ora.drivers.acfs'on 'node1' succeeded
CRS-2793: Shutdown of Oracle High Availability Services-managed resources on 'node1'
has been completed
CRS-4133: Oracle High Availability Services has been stopped
```

Stop CRS in node2
Execute this command on the OS command line in node2

```
[root@node2]# /u01/app/11.2.0/grid/bin/crsctl stop crs -f
CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources
on 'node2'
CRS-2673: Attempting to stop 'ora.mdnsd'on 'node2'
CRS-2673: Attempting to stop 'ora.crf'on 'node2'
CRS-2673: Attempting to stop 'ora.ctssd'on 'node2'
CRS-2673: Attempting to stop 'ora.evmd'on 'node2'
CRS-2673: Attempting to stop 'ora.asm'on 'node2'
CRS-2673: Attempting to stop 'ora.drivers.acfs'on 'node2'
CRS-2677: Stop of 'ora.crf'on 'node2' succeeded
CRS-2677: Stop of 'ora.mdnsd'on 'node2' succeeded
CRS-2677: Stop of 'ora.evmd'on 'node2' succeeded
CRS-2677: Stop of 'ora.ctssd'on 'node2' succeeded
CRS-2677: Stop of 'ora.asm'on 'node2' succeeded
CRS-2673: Attempting to stop 'ora.cssd'on 'node2'
CRS-2677: Stop of 'ora.cssd'on 'node2' succeeded
CRS-2673: Attempting to stop 'ora.gipcd'on 'node2'
CRS-2677: Stop of 'ora.gipcd'on 'node2' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd'on 'node2'
CRS-2677: Stop of 'ora.gpnpd'on 'node2' succeeded
CRS-2677: Stop of 'ora.drivers.acfs'on 'node2' succeeded
CRS-2793: Shutdown of Oracle High Availability Services-managed resources on 'node2'
has been completed
CRS-4133: Oracle High Availability Services have been stopped
```

With the ocopy command, clear the disk header of DG_CRS
Execute this command on the OS command line in node1

```
cmd> ocopy C:¥tmp¥file0 ¥¥.¥ORCLDISKDATA3
¥¥.¥ORCLDISKDATA3
cmd> ocopy C:¥tmp¥file0 ¥¥.¥ORCLDISKDATA4
¥¥.¥ORCLDISKDATA4
cmd> ocopy C:¥tmp¥file0 ¥¥.¥ORCLDISKDATA8
¥¥.¥ORCLDISKDATA8
```

Create a symbolic link to DG_CRS
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ asmtool –list
NTFS                ¥Device¥Harddisk0¥Partition1          100M
NTFS                ¥Device¥Harddisk0¥Partition2       237850M
ORCLDISKDATA0       ¥Device¥Harddisk1¥Partition1        40957M
ORCLDISKDATA1       ¥Device¥Harddisk2¥Partition1        30717M
ORCLDISKDATA2       ¥Device¥Harddisk3¥Partition1        30717M
                    ¥Device¥Harddisk4¥Partition1         1022M
```

```
                    ¥Device¥Harddisk5¥Partition1          1022M
ORCLDISKDATA5       ¥Device¥Harddisk6¥Partition1         40957M
ORCLDISKDATA6       ¥Device¥Harddisk7¥Partition1         30717M
ORCLDISKDATA7       ¥Device¥Harddisk8¥Partition1         30717M
                    ¥Device¥Harddisk9¥Partition1          1022M
ORCLDISKDATA9       ¥Device¥Harddisk10¥Partition1       102397M

cmd> asmtool -add ¥Device¥Harddisk4¥Partition1 ORCLDISKDATA3

cmd> asmtool -add ¥Device¥Harddisk5¥Partition1 ORCLDISKDATA4

cmd> asmtool -add ¥Device¥Harddisk9¥Partition1 ORCLDISKDATA8

cmd> C:¥app¥11.2.0¥grid¥bin¥ asmtool –list
NTFS                ¥Device¥Harddisk0¥Partition1          100M
NTFS                ¥Device¥Harddisk0¥Partition2       237850M
ORCLDISKDATA0       ¥Device¥Harddisk1¥Partition1         40957M
ORCLDISKDATA1       ¥Device¥Harddisk2¥Partition1         30717M
ORCLDISKDATA2       ¥Device¥Harddisk3¥Partition1         30717M
ORCLDISKDATA3       ¥Device¥Harddisk4¥Partition1          1022M
ORCLDISKDATA4       ¥Device¥Harddisk5¥Partition1          1022M
ORCLDISKDATA5       ¥Device¥Harddisk6¥Partition1         40957M
ORCLDISKDATA6       ¥Device¥Harddisk7¥Partition1         30717M
ORCLDISKDATA7       ¥Device¥Harddisk8¥Partition1         30717M
ORCLDISKDATA8       ¥Device¥Harddisk9¥Partition1          1022M
ORCLDISKDATA9       ¥Device¥Harddisk10¥Partition1       102397M
```

Start CRS in exclusive mode
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl start crs –excl
CRS-4123: Oracle High Availability Services has been started
CRS-2672: Attempting to start ‘ora.mdnsd'on ‘node1’
CRS-2676: Start of ‘ora.mdnsd'on ‘node1’
CRS-2672: Attempting to start ‘ora.gpnpd'on ‘node1’
CRS-2676: Start of ‘ora.gpnpd'on ‘node1’
CRS-2672: Attempting to start ‘ora.cssdmonitor'on ‘node1’
CRS-2672: Attempting to start ‘ora.gipcd'on ‘node1’
CRS-2676: Start of ‘ora.gipcd'on ‘node1’
CRS-2676: Start of ‘ora.cssdmonitor'on ‘node1’
CRS-2672: Attempting to start ‘ora.cssd'on ‘node1’
CRS-2676: Start of ‘ora.cssd'on ‘node1’
CRS-2672: Attempting to start ‘ora.ctssd'on ‘node1’
CRS-2672: Attempting to start ‘ora.drivers.acfs'on ‘node1’
CRS-2676: Start of ‘ora.ctssd'on ‘node1’
CRS-2676: Start of ‘ora.drivers.acfs'on ‘node1’
CRS-2672: Attempting to start ‘ora.asm'on ‘node1’
CRS-2674: Start of ‘ora.asm'on ‘node1'failed
CRS-2673: Attempting to stop ‘ora.drivers.acfs'on ‘node1’
CRS-2678: 'ora.drivers.acfs'on ‘node1' has experienced an unrecoverable failure
CRS-4000: Command Start failed, or completed with errors.
```

Stop crsd
Execute this command on the OS command line in node1

```
cmd> /u01/app/11.2.0/grid/bin/crsctl stop resource ora.crsd –init
```

Restore the metadata of DG_CRS
Execute this command on the ASM instance and the ASMCMD utility in node1

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

GROUP_NUMBER  NAME           STATE       TYPE
------------  -------------  ----------- ---------
```

```
           0  DG_ARCH        DISMOUNTED
           0  DG_DATA        DISMOUNTED
           0  DG_REDO        DISMOUNTED
           0  DG_REDO_M      DISMOUNTED

ASMCMD> md_restore E:¥backup¥meta¥md_bk --full  -G 'DG_CRS'
Current Diskgroup metadata being restored: DG_CRS
Diskgroup DG_CRS created!
System template XTRANSPORT modified!
System template ONLINELOG modified!
System template DATAGUARDCONFIG modified!
System template AUTOBACKUP modified!
System template TEMPFILE modified!
System template OCRFILE modified!
System template ARCHIVELOG modified!
System template CONTROLFILE modified!
System template DUMPSET modified!
System template BACKUPSET modified!
System template ASMPARAMETERFILE modified!
System template FLASHBACK modified!
System template PARAMETERFILE modified!
System template FLASHFILE modified!
System template DATAFILE modified!
System template CHANGETRACKING modified!
Directory +DG_CRS/crs re-created!
Directory +DG_CRS/crs/ASMPARAMETERFILE re-created!
Directory +DG_CRS/crs/OCRFILE re-created!

SQL> select group_number, name, state, type from v$asm_diskgroup;

GROUP_NUMBER  NAME           STATE       TYPE
------------ -------------- ----------- ---------
           0  DG_ARCH        DISMOUNTED
           0  DG_DATA        DISMOUNTED
           0  DG_REDO        DISMOUNTED
           0  DG_REDO_M      DISMOUNTED
           1  DG_CRS         MOUNTED      NORMAL
```

Shut down the ASM instance
Execute this command on the ASM instance in node1

```
SQL> shutdown immediate
ASM diskgroups dismounted
ASM instance shutdown
```

Specify the initialization parameter of backup and start the ASM instance
Execute this command on the ASM instance in node1

```
SQL> startup pfile='E:¥backup¥pfile_asm¥initasm.ora'
ASM instance started

Total System Global Area  284008448 bytes
Fixed Size                  2147392 bytes
Variable Size             256695232 bytes
ASM Cache                 25165824 bytes
ASM diskgroups mounted
```

Recreate the server parameter file of the ASM instance
Execute this command on the ASM instance in node1

```
SQL> create spfile='+DG_CRS' from pfile' ='E:¥backup¥pfile_asm¥initasm.ora';
File created.
```

Restore OCR

Execute this command on the OS command line in node1

```
cmd>                    C:¥app¥11.2.0¥grid¥bin¥ocrconfig                    -restore
E:¥backup¥ocr¥ backup_20121209_171745.ocr
```

Verify the integrity of OCR
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrcheck
Status of Oracle Cluster Registry is as follows :
       Version               :         3
       Total space (KB)     :     262120
       Used space(KB)      :       3248
       Available space(KB) :     258872
        ID                    :  153785193
        Device/File Name        :      +DG_CRS
                                 Device/File integrity check succeeded

                                 Device/File not configured

                                 Device/File not configured

                                 Device/File not configured

                                 Device/File not configured

       Cluster registry integrity check succeeded

       Logical corruption check succeeded
```

Execute restoration of Voting disk
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl replace votedisk +DG_CRS
Successful addition of voting disk 71e4d9d91ea04f1fbf582a25fcd7b0f7
Successful addition of voting disk 2b7ca48add5f4f3abfcbf4a406867908
Successful addition of voting disk 8cf92545f3934f4cbf71c83f6727bb99
Successfully replaced voting disk group with +DG_CRS.
CRS-4266: Voting file(s) successfully replaced
```

Stop the CRS running in exclusive mode
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl stop crs -f
CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources
on ‘node1’
CRS-2673: Attempting to stop ‘ora.drivers.acfs'on ‘node1’
CRS-2673: Attempting to stop ‘ora.ctssd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.asm'on ‘node1’
CRS-2673: Attempting to stop ‘ora.mdnsd'on ‘node1’
CRS-2677: Stop of ‘ora.mdnsd'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.drivers.acfs'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.asm'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.ctssd'on ‘node1’ succeeded
CRS-2673: Attempting to stop ‘ora.cssd'on ‘node1’
CRS-2677: Stop of ‘ora.cssd'on ‘node1’ succeeded
CRS-2673: Attempting to stop ‘ora.gipcd'on ‘node1’
CRS-2677: Stop of ‘ora.gipcd'on ‘node1’ succeeded
CRS-2673: Attempting to stop ‘ora.gpnpd'on ‘node1’
CRS-2677: Stop of ‘ora.gpnpd'on ‘node1’ succeeded
CRS-2793: Shutdown of Oracle High Availability Services-managed resources on ‘node1’
has been completed
CRS-4133: Oracle High Availability Services has been stopped
```

Start CRS
Execute this command on the OS command lines in all nodes (node1, node2)

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl start crs
CRS-4123: Oracle High Availability Services has been started

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status resource -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_CRS.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_DATA.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.LISTENER.lsnr
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.asm
               ONLINE  ONLINE       node1                    Started
               ONLINE  ONLINE       node2                    Started
ora.gsd
               OFFLINE OFFLINE      node1
               OFFLINE OFFLINE      node2
ora.net1.network
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.ons
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.registry.acfs
               ONLINE  ONLINE       node1
               ONLINE  OFFLINE      node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1        ONLINE  ONLINE       node2
ora.LISTENER_SCAN2.lsnr
      1        ONLINE  ONLINE       node1
ora.LISTENER_SCAN3.lsnr
      1        ONLINE  ONLINE       node1
ora.cvu
      1        OFFLINE OFFLINE
ora.node1.vip
      1        ONLINE  ONLINE       node1
ora.node2.vip
      1        ONLINE  ONLINE       node2
ora.oc4j
      1        ONLINE  ONLINE       node2
ora.rac.db
      1        ONLINE  ONLINE       node1                    Open
      2        ONLINE  ONLINE       node2                    Open
```

```
ora.scan1.vip
     1       ONLINE  ONLINE      node2
ora.scan2.vip
     1       ONLINE  ONLINE      node1
ora.scan3.vip
     1       ONLINE  ONLINE      node1
```

In case of an OLR failure

*For the recovery of OLR, it is only necessary to recover the node where the OLR failed. However, below explains the procedure for OLR failures in all nodes.

Stop CRS in node1
Execute this command on the OS command line in node1

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl status resource -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_CRS.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_DATA.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.LISTENER.lsnr
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.asm
               ONLINE  ONLINE       node1                    Started
               ONLINE  ONLINE       node2                    Started
ora.gsd
               OFFLINE OFFLINE      node1
               OFFLINE OFFLINE      node2
ora.net1.network
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.ons
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.registry.acfs
               ONLINE  ONLINE       node1
               ONLINE  OFFLINE      node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
     1       ONLINE  ONLINE       node2
ora.LISTENER_SCAN2.lsnr
     1       ONLINE  ONLINE       node1
ora.LISTENER_SCAN3.lsnr
     1       ONLINE  ONLINE       node1
```

```
ora.cvu
     1       OFFLINE OFFLINE
ora.node1.vip
     1       ONLINE  ONLINE      node1
ora.node2.vip
     1       ONLINE  ONLINE      node2
ora.oc4j
     1       ONLINE  ONLINE      node2
ora.rac.db
     1       ONLINE  ONLINE      node1                 Open
     2       ONLINE  ONLINE      node2                 Open
ora.scan1.vip
     1       ONLINE  ONLINE      node2
ora.scan2.vip
     1       ONLINE  ONLINE      node1
ora.scan3.vip
     1       ONLINE  ONLINE      node1

cmd> C:¥app¥Administrator¥product¥11.2.0¥dbhome_1¥bin¥srvctl stop database –d rac

cmd> C:¥app¥11.2.0¥grid¥bin¥srvctl stop listener
cmd> C:¥app¥11.2.0¥grid¥bin¥srvctl stop scan_listener
cmd> C:¥app¥11.2.0¥grid¥bin¥srvctl stop scan
cmd> C:¥app¥11.2.0¥grid¥bin¥srvctl stop oc4j
cmd> C:¥app¥11.2.0¥grid¥bin¥srvctl stop nodeapps

cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl stop crs
CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources
on ‘node1’
CRS-2673: Attempting to stop ‘ora.crsd'on ‘node1’
CRS-2790: Starting shutdown of Cluster Ready Services-managed resources on ‘node1’
CRS-2673: Attempting to stop ‘ora.DG_CRS.dg'on ‘node1’
CRS-2673: Attempting to stop ‘ora.DG_ARCH.dg'on ‘node1’
CRS-2673: Attempting to stop ‘ora.DG_DATA.dg'on ‘node1’
CRS-2673: Attempting to stop ‘ora.DG_REDO.dg'on ‘node1’
CRS-2673: Attempting to stop ‘ora.DG_REDO_M.dg'on ‘node1’
CRS-2677: Stop of ‘ora.DG_CRS.dg'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.DG_ARCH.dg'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.DG_DATA.dg'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.DG_REDO.dg'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.DG_REDO_M.dg'on ‘node1’ succeeded
CRS-2673: Attempting to stop ‘ora.asm'on ‘node1’
CRS-2677: Stop of ‘ora.asm'on ‘node1’ succeeded
CRS-2792: Shutdown of Cluster Ready Services-managed resources on ‘node1’ has been
completed
CRS-2677: Stop of ‘ora.crsd'on ‘node1’ succeeded
CRS-2673: Attempting to stop ‘ora.mdnsd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.gpnpd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.cssdmonitor'on ‘node1’
CRS-2673: Attempting to stop ‘ora.ctssd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.evmd'on ‘node1’
CRS-2673: Attempting to stop ‘ora.asm'on ‘node1’
CRS-2677: Stop of ‘ora.cssdmonitor'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.mdnsd'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.gpnpd'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.evmd'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.ctssd'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.asm'on ‘node1’ succeeded
CRS-2673: Attempting to stop ‘ora.cssd'on ‘node1’
CRS-2677: Stop of ‘ora.cssd'on ‘node1’ succeeded
CRS-2673: Attempting to stop ‘ora.diskmon'on ‘node1’
CRS-2673: Attempting to stop ‘ora.gipcd'on ‘node1’
CRS-2677: Stop of ‘ora.gipcd'on ‘node1’ succeeded
CRS-2677: Stop of ‘ora.diskmon'on ‘node1’ succeeded
```

```
CRS-2793: Shutdown of Oracle High Availability Services-managed resources on ‘node1’
has been completed
CRS-4133: Oracle High Availability Services have been stopped
```

Stop CRS in node2
Execute this command on the OS command line in node2

```
[root@node2]# C:¥app¥11.2.0¥grid¥bin¥crsctl stop crs
CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources
on ‘node2’
CRS-2673: Attempting to stop ‘ora.crsd'on ‘node2’
CRS-2790: Starting shutdown of Cluster Ready Services-managed resources on ‘node2’
CRS-2673: Attempting to stop ‘ora.CRS.dg'on ‘node2’
CRS-2673: Attempting to stop ‘ora.registry.acfs'on ‘node2’
CRS-2673: Attempting to stop ‘ora.DG_ARCH.dg'on ‘node2’
CRS-2673: Attempting to stop ‘ora.DG_DATA.dg'on ‘node2’
CRS-2673: Attempting to stop ‘ora.DG_REDO.dg'on ‘node2’
CRS-2673: Attempting to stop ‘ora.DG_REDO_M.dg'on ‘node2’
CRS-2677: Stop of ‘ora.DG_ARCH.dg'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.DG_DATA.dg'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.DG_REDO.dg'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.DG_REDO_M.dg'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.registry.acfs'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.CRS.dg'on ‘node2’ succeeded
CRS-2673: Attempting to stop ‘ora.asm'on ‘node2’
CRS-2677: Stop of ‘ora.asm'on ‘node2’ succeeded
CRS-2792: Shutdown of Cluster Ready Services-managed resources on ‘node2’ has been
completed
CRS-2677: Stop of ‘ora.crsd'on ‘node2’ succeeded
CRS-2673: Attempting to stop ‘ora.drivers.acfs'on ‘node2’
CRS-2673: Attempting to stop ‘ora.ctssd'on ‘node2’
CRS-2673: Attempting to stop ‘ora.evmd'on ‘node2’
CRS-2673: Attempting to stop ‘ora.asm'on ‘node2’
CRS-2673: Attempting to stop ‘ora.mdnsd’on ‘node2’
CRS-2677: Stop of ‘ora.mdnsd'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.evmd'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.drivers.acfs'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.ctssd'on ‘node2’ succeeded
CRS-2677: Stop of ‘ora.asm'on ‘node2’ succeeded
CRS-2673: Attempting to stop ‘ora.cssd'on ‘node2’
CRS-2677: Stop of ‘ora.cssd'on ‘node2’ succeeded
CRS-2673: Attempting to stop ‘ora.crf'on ‘node2’
CRS-2677: Stop of ‘ora.crf'on ‘node2’ succeeded
CRS-2673: Attempting to stop ‘ora.gipcd'on ‘node2’
CRS-2677: Stop of ‘ora.gipcd'on ‘node2’ succeeded
CRS-2673: Attempting to stop ‘ora.gpnpd'on ‘node2’
CRS-2677: Stop of ‘ora.gpnpd'on ‘node2’ succeeded
CRS-2793: Shutdown of Oracle High Availability Services-managed resources on ‘node2’
has been completed
CRS-4133: Oracle High Availability Services has been stopped
```

With the ocrconfig command, restore OLR
***When OLR is removed, it is necessary to create an empty file in（{GI installation destination}/cdata/host name.olr）**

Execute this command on the OS command lines in all nodes (node1, node2)

```
cmd> C:¥app¥11.2.0¥grid¥bin¥ocrconfig -local -restore
/backup/olr/node1/backup_20121130_130937.olr

cmd> C:¥app¥11.2.0¥grid¥bin¥ocrcheck -local
Status of Oracle Local Registry is as follows:
      Version                  :        3
```

```
       Total space (KB)    :    262120
       Used space(KB)      :      2140
       Available space(KB) :    259980
        ID                    :  607279485
        Device/File Name       : C:¥app¥11.2.0¥grid¥cdata¥node1.olr
                              Device/File integrity check succeeded

        Local registry integrity check succeeded

        Logical corruption check succeeded
```

Start CRS
Execute this command on the OS command lines in all nodes (node1, node2)

```
cmd> C:¥app¥11.2.0¥grid¥bin¥crsctl start crs
CRS-4123: Oracle High Availability Services has been started

cmd> C:¥app¥11.2.0¥grid¥bin¥rsctl status resource -t
--------------------------------------------------------------------------------
NAME           TARGET  STATE        SERVER                   STATE_DETAILS
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.DG_ARCH.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_CRS.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_DATA.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.DG_REDO_M.dg
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.LISTENER.lsnr
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.asm
               ONLINE  ONLINE       node1                    Started
               ONLINE  ONLINE       node2                    Started
ora.gsd
               OFFLINE OFFLINE      node1
               OFFLINE OFFLINE      node2
ora.net1.network
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.ons
               ONLINE  ONLINE       node1
               ONLINE  ONLINE       node2
ora.registry.acfs
               ONLINE  ONLINE       node1
               ONLINE  OFFLINE      node2
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1        ONLINE  ONLINE       node2
ora.LISTENER_SCAN2.lsnr
      1        ONLINE  ONLINE       node1
ora.LISTENER_SCAN3.lsnr
      1        ONLINE  ONLINE       node1
```

```
ora.cvu
     1       OFFLINE OFFLINE
ora.node1.vip
     1       ONLINE  ONLINE      node1
ora.node2.vip
     1       ONLINE  ONLINE      node2
ora.oc4j
     1       ONLINE  ONLINE      node2
ora.rac.db
     1       ONLINE  ONLINE      node1                Open
     2       ONLINE  ONLINE      node2                Open
ora.scan1.vip
     1       ONLINE  ONLINE      node2
ora.scan2.vip
     1       ONLINE  ONLINE      node1
ora.scan3.vip
     1       ONLINE  ONLINE      node1
```

7-3. Additional Technical References

Oracle web site

(1) Oracle Real Application Clusters
http://www.oracle.com/technology/products/database/clustering/index.html

Fujitsu's storage management software web site

(1) ETERNUS SF AdvancedCopy Manager
http://www.fujitsu.com/global/services/computing/storage/eternus/products/eternus-sf/advance/

Fujitsu's ETERNUS storage system wib site

(1) FUJITSU Disk Storage Systems
http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/

(2) FUJITSU ETERNUS DX series Enterprise disk array
http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/dx-enterprise/

(3) FUJITSU ETERNUS DX series Midrange disk array
http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/dx-mid/

(4) FUJITSU ETERNUS DX series Entry disk array
http://www.fujitsu.com/global/services/computing/storage/eternus/products/diskstorage/dx-entry/

(5) White Paper:「MAID for Green Energy Conservation with Fujitsu ETERNUS Storage Systems」
http://www.fujitsu.com/downloads/STRSYS/system/eternus_MAID_whitepaper.pdf

About This White Paper
This white paper is intended to provide technical information and an overview of Oracle Database 11g R2 Automatic Storage Management feature and Fujitsu ETERNUS DX storage systems.

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