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Section 1 - Grid Infrastructure: Clusterware and ASM

Oracle Grid Infrastructure

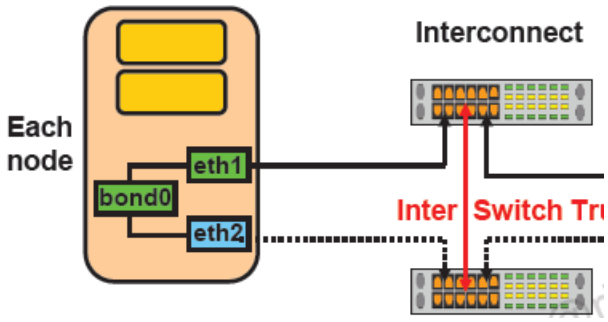
[1] Explain the principles and purposes of clusters

1. Clusterware allows cluster to be managed as a whole, protects the integrity of the cluter, maintain the registry of resources in the cluster and its state, deals with changes in the cluster and provide a common view and access to cluster components.
2. In 11GR2 clusterware is integrated with Automatic Storage Management (ASM) , Provides the capability of ASF Cluster filesystem, a foundation for oracle RAC, a generalized cluster infrastructure for non-database cluster requirement.
3. ASM can be used by clusterware in 11gR2 to host ALL shared file requirements (cluster registry, voting disk, datafiles, controlfiles, spfiles, redo, undo…..
4. Oracle Grid Infrastructure encompasses Oracle Clusterware, ASM and ASM File System
5. Oracle Clusterware is a Shared Disk architecture supporting application load balancing and failover. Its services include Cluster Management, Node monitoring, Event Services, Time Synchronisation, Network management, High Availability etc.,
6. Event Services publishes cluster events so that Applications are aware of changes in the cluster and change their connectivity/behavior.
7. Grid Naming Services can manage network naming within the cluster and manages VIP's

[2] Describe Cluster hardware best practices

1. Each node in a cluster should have atleast 2 Network interface cards. One for public network and one for cluster interconnect. Additional cards are used to connect to storage network, backup etc.,
2. Each NIC should support TCP/IP .
3. Interconnect NIC should support UDP (User data protocol) or RDS (Reliable data socket) for unix/linux communication and TCP for for windows OS communication
4. All platforms use Grid interprocess communication
5. NIC's used for a specific purpose should be named the same on all cluster nodes . If "eth0" is used for public network on a node, all nodes in the cluster should use the name "eth0" for public network.
6. Grid naming services (GNS) can be used to dynamically allocate VIP's using DHCP if needed. DCHCP should be available in the network. GNS is needed if DHCP needs to be used for VIP's. Otherwise Static IP addresses needs to be utilized for VIP's
7. Link Aggregation in the same switch can be used to achieve NIC redundancy OR to increase network bandwidth. This is achieved by bonding the NIC's.

8. Link aggregation can also be achieved using multiple switches equipped with a inter-switch trunk. This is recommended as the best practice configuration for interconnect. Only Active/Standby mode is supported in this configuration.
9. Configure interconnect on the Fastest BUS, ensure NIC names and slots are identical on all nodes, Define flow control: Receive=on, transmit=off, define full-bit rate supported for the NIC, define full duplex autonegotiate, define MTU to be the same between NIC and SWITCH.
10.



[3] Understand Oracle Clusterware Architecture

1. Oracle clusterware is started by the OS INIT deamon /etc/init.d/init.ohasd
2. Oracle clusterware install modifies /etc/inittab to restart ohasd in the vent of a crash
3. Ohasd is the oracle high availability services daemon

Oracle Clusterware processes

ohasd.bin	oclskd.bin
octssd.bin	crsd.bin
oraagent.bin	gipcd.bin
diskmon.bin	mdnsd.bin
ocssd.bin	gpnpd.bin
evmd.bin	scriptagent.bin
cssdagent	oraagent.bin
orarootagent.bin	

4.
5. Oracle Clusterware Process architechture diagram
6. Cluster Ready Services (CRS) is the primary program that handles HA. CRS handles cluster resources and local resources like listener, ASM etc.
7. Cluster Synchronization services (CSS) manages the cluster configuration by managing which nodes are members of the cluster by notifying other nodes when members join and leave the cluster. CSS has 3 component processes. CSS daemon (ocssd), CSS agent (cssdagent), CSS monitor (cssdmonitor). Cssdagent failure results in clusterware restarting the node.
8. Disk Monitor Daemon(diskmon): Monitors and performs input/output fencing for Exadata storage server
9. Event Manager (EVM) : publishes oracle clusterware events to applications
10. Multicast domain name service (mDNS): Allows DNS requests.

11. Oracle Grid Naming Service (GNS): is a gateway between cluter DNS service (mDNS) and external DNS servers.
12. Oracle Notification services (ONS) : is a publish/subscribe service for Fast-Application-Notification.
13. Oracle Root agent (orarootagent) : is a specialized process that manages resources owned by root like network, grid VIP etc.,
14. Cluster kill daemon (oclskd): handles instance/node eviction requests that has been escalated to CSS
15. Grid IPC Daemon : handles inter-instance communication

[4] Describe how Grid Plug and Play affects Clusterware

1. Grid Naming Service is used by Grid Plug n play GPnP to : negotiate network identity for itself (node), acquiring additional information it needs to operate from a profile, configuring itself using data from profile to make itself identifiable in the network
2. GPnP domain is a collection of nodes belonging to a single cluster served by GPnP service
3. Node IP Connectivity : The node must have atleast 1 routable interface for public connectivity outside of GPnP domain. Multiple NIC's needs to be identified in the GPnp Profile for public,interconnect ,storage etc.
4. Node Unique Identifier: Associated with a node is a unique idenitifier established thru OSD.
5. Node Personality: Cluster name, network classifications (public/private), storage to be used for ASM and CSS, Digital signatures, Software image for the node
6. Software Image: Software image in Grid plug and play is a READ ONLY collection of software to be run on the nodes of same type. Image should contain the OS, GPnP Software, a security certificate from provisioning authority, and any other software required to configure the node.
7. GpnP profile is stored in a small xml file
8. Grid Naming Service (GNS) is an integral part of Grid Plug and Play. The only static IP needed for the cluster is the GNS Virtual IP address.
9.
```
[root@my-dns-server ~]# cat /etc/named.conf
// Default initial "Caching Only" name server configuration
...
# Delegate to gns on cluster01
cluster01.example.com #cluster sub-domain# NS cluster01-gns.example.com
# Let the world know to go to the GNS vip
cluster01-gns.example.com 192.0.2.155 # cluster GNS Address
```
10. While using Scan Listener, a request to resolve to cluster01-scan.example.com will be forwarded to 192.0.2.155
11. Each node in the cluster runs a multicast DNS (mDNS) process
12. GNS requires a DHCP server running on the network with enough addresses available to assign VIP and SCAN ip's.
13. Single Client Access Name (SCAN) is the address used by the clients to access the cluster.
14. SCAN is a fully qualified hostname located in the GNS subdomain registered to 3 IP addresses.

15. SCAN provides a stable and highly available name for clients to use and masks the individual VIPs of nodes in the cluster.
16. If GNS is used and DHCP server is available, GNS will assign SCAN IP's. Otherwise, SCAN IP's are defined in the DNS server to resolve to 3 IP's .
17. During installation Listeners are started on nodes for the scan IP address. Requests are routed to the least used instance.
18. 11gr2 and later instances register with Scan listeners only as remote listeners. Upgraded databases register to scan listeners as remote listeners and also to all the local listeners.
19. PICTURE OF GPNP Architecture
20. The `init.ohasd` entry in the `/etc/inittab` file is responsible for:

    1. Starting Oracle Clusterware when the node boots
    2. Mounting shared volumes as required by Oracle Clusterware
    3. Managing node evictions
    4. Restarting `ohasd` in the event of a crash

    The answer is 4.

    Which of the following statements regarding Grid Naming Service is *not* true?

    1. GNS is an integral component of Grid Plug and Play.
    2. Each node in the cluster runs a multicast DNS (mDNS) process.
    3. The GNS virtual IP address must be assigned by DHCP.
    4. The cluster subdomain is defined as a delegated domain.

Answer is 3.

[5] Describe ASM architecture and components

21. ASM manages oracle database files. ACFS manages other files.

22. From 11gr2 ASM Dynamic volume manager (ADVM) is available to support ASM cluster filesystem
23. ASM instance does not have a data dictionary and the only way to connect to ASM is by using system privileges:
24. SYSASM: Privileged group OSASM. Full admin privilege
25. SYSDBA: Privileged group OSDBA for ASM. Access to data on ASM, create and delete files, grant and revoke file access
26. SYSOPER: Privileged group OSOPER for ASM. Limited privilege to start/stop ASM.
27. SYS user on ASM is automatically created with SYSASM privilege.
28. Typical OS Groups are:

oinstall:x:501:	Inventory
dba:x:502:oracle,adtvault	DB
oper:x:503:oracle	DB
asmoper:x:504:grid	ASM oper
asmadmin:x:505:grid	ASM SYSASM
asmdba:x:506:grid,oracle	ASM dba

29. Users can be added to the password file using SQLPLUS grant command OR orapwuser command of ASMCMD
30. ASMCMD users cannot connect thru passwordfile. Their privilege is determined by the OS group.
31. A single OS group 'dba' can be used. Multiple groups are needed for separation of duties.
32. For software installation, separate ORACLE_BASE and ORACLE_HOME for 'grid' account installing the grid/asm installation. Do not place the ORACLE_HOME of grid under ORACLE_BASE of grid.
33. ASM Instance:

    The SGA in an ASM instance is different in memory allocation and usage than the SGA in a database instance. The SGA in the ASM instance is divided into four primary areas as follows:

    - **Shared Pool:** Used for metadata information
    - **Large Pool:** Used for parallel operations
    - **ASM Cache:** Used for reading and writing blocks during rebalance operations
    - **Free Memory:** Unallocated memory available

    The minimum recommended amount of memory for an ASM instance is 256 MB. Automatic memory management is enabled by default on an ASM instance and will dynamically tune the sizes of the individual SGA memory components. The amount of memory that is needed for an ASM instance will depend on the amount of disk space being managed by ASM.

    The second part of the ASM instance is the background processes. An ASM instance can have many background processes; not all are always present.

34. ASM background processes:

- **ARCn:** The archiver processes
- **CKPT:** The checkpoint process
- **DBWn:** The database writer processes
- **DIAG:** The diagnosability process
- **Jnnn:** Job queue processes
- **LGWR:** The log writer process
- **PMON:** The process monitor process
- **PSP0:** The process spawner process
- **QMNn:** The queue monitor processes
- **RECO:** The recoverer process
- **SMON:** The system monitor process
- **VKTM:** The virtual keeper of time process
- **MMAN:** The memory manager process

35. ASM processes when Clustered ASM and ACFS is used.
    - **LMON:** The global enqueue service monitor process
    - **LMDn:** The global enqueue service daemons
    - **LMSn:** The global cache service processes
    - **LCKn:** The lock processes

    Additional processes are started when ADVM volumes are configured.
    - **VDBG:** The Volume Driver Background process forwards ASM requests to lock or unlock an extent for volume operations to the Dynamic Volume Manager driver. The VDBG is a fatal background process so the unplanned death of this process brings down the ASM instance.
    - **VBGn:** Volume Background processes wait for requests from the Dynamic Volume Manager driver, which need to be coordinated with the ASM instance. An example of such a request would be opening or closing an ASM volume file when the Dynamic Volume Manager driver receives an open for a volume (possibly due to a file system mount request) or close for an open volume (possibly due to a file system unmount request). The unplanned death of any of these processes does not have an effect on the ASM instance.
    - **VMB:** Volume Membership Background (VMB) coordinates cluster membership with the ASM instance.
36. ASM Instance primary processes:
    RBAL: Opens all devices as part of discovery and coordinates rebalance operation
    ARBn: One or more slave processes that does rebalance operation
    GMON: Responsible for managing disk level activities like drop/offline of disks and advancing ASM diskgroup compatability
    MARK: Marks ASM allocation units as stale when needed
    Onnn: one or more ASM slave processes forming a pool of connection to the ASM instance for exchanging messages
    PZ9n : one or more parallel slave processes used in fetching data on clustered ASM installations from GV$views.
37. ASM Node listener : This is the process that establishes network connection from ASM clients to ASM instances. Listens on port 1521 by default. Is the same as the database listener. Is capable for listening for all database instances on the same host in addition to ASM, can run concurrently with additional listeners and is named 'tnslsnr' on linux.
38. ASM configuration Files:

SPFILE : Server parameter file defining the ASM instance
Password file: for remote authentication orapw+ASM
Listener.ora : For defining node listener

39. ASM Group Services:
    - Enable the database instance to locate the ASM instance along with credentials to the ASM instance for establishing an Oracle Call Interface (OCI) connection
    - Provide assistance in doing lock recovery. The ASM instance maintains certain locks on behalf of database instances. If a database instance were to fail, ASM uses the group services of `ocssd.bin` to confirm that all database processes are terminated before releasing locks.
    - Offer guarantee that the ASM disk group number that is assigned to a disk group name at run time is unique

    Oracle Clusterware is responsible for node membership and heartbeat monitoring, basic cluster locking, and node evictions.

    Oracle Clusterware is responsible for the startup and shutdown of the ASM instance along with the dependent database instances and resources, as well as resources on which ASM depends.

40. ASM Disk Groups:

    The ASM disk group consists of one or more ASM disks that provide space and is the fundamental object that ASM manages. Each disk group contains its own metadata and logging information that is required for the management of space within that disk group. ASM files are allocated from disk groups. This is similar to logical volumes or logical units of other disk management solutions. Any ASM file is completely contained within a disk group, but an ASM disk group can contain files from different databases. Although many disk groups can be created, best practices recommend that only two be created. One disk group should be used for all data for multiple databases, and the other disk group should be used for the flash recovery area for multiple databases.

    When you create a disk group, you specify an ASM disk group type based on one of the following three redundancy levels:
    - `Normal` for two-way mirroring
    - `High` for three-way mirroring
    - `External` to not use ASM mirroring and rely on the external hardware for redundancy

    The redundancy level controls how many disk failures are tolerated without dismounting the disk group or losing data. The redundancy level sets a default for number of copies of ASM file extents, but the redundancy is controlled at the file level.

41. ASM Disk Failure Groups:

    A failure group is a subset of the disks in a disk group which could fail at the same time because of shared hardware.
    Failure groups enable the mirroring of metadata and user data
    The default failure group creation puts every disk in its own failure group
    Multiple disks can be place in a single failure group at disk group creation
    Failure groups apply only to normal and high redundancy disk groups
    A normal redundancy disk group requires at least two failure groups

A high redundancy disk group requires atleast 3 failure groups

Failure groups are used to store mirror copies of data when ASM is used for mirroring by declaring the disk group type to be `Normal` or `High` at creation time. A normal redundancy disk group requires at least two failure groups to implement two-way mirroring of files. A high redundancy disk group requires at least three failure groups to implement three-way mirroring of files.

There are always failure groups even if they are not explicitly created. If you do not specify a failure group for a disk, that disk is placed in its own failure group with the failure group name the same as the disk name. Therefore, if 20 disks were in a single disk group, there could be 20 failure groups as well. Failure groups have meaning only when used with normal and high redundancy disk groups.

All failure groups within the same disk group should be created with the same capacity to avoid space allocation problems.

42. ASM Disks: ASM disks are storage devises provisioned to ASM disk groups
They can be formed from any of the 5 sources as follows:
   - A disk or partition from a storage array
   - An entire disk or partitions of a physical disk
   - Logical volumes or logical units (LUN)
   - Network attached files (NFS)
   - Exadata grid disk

   Disks are named when added to a diskgroup using a name different than the OS device name
   May use different OS device names on different nodes
   Are divided into allocation units with sizes 1,2,4,8,16,32, or 64MB
43. ASM Files: ASM supports all database related files.
   - Some supported file types:

Control files	Flashback logs	Data Pump dump sets
Data files	DB SPFILE	Data Guard configuration
Temporary data files	RMAN backup sets	Change tracking bitmaps

Online redo log files, archivelog files, rman data file copies, transport data files, ocr files, asm spfilees etc.,

Each ASM file must be contained within a single disk group, but a single Oracle database can have files in multiple disk groups. You can specify user-friendly aliases for ASM files by creating a hierarchical directory structure and use the directory names as prefixes to the file names.

44. ASM Files Extents and Striping: ASM can use variable size extents to support larger files, reduce memory requirements, and improve performance. Each data extent reside on an individual disk, data extents consist of one or more allocation units,

45. The data extent size is : Equal to AU for the first 20,000 extents, Equal to 4x AU for the next 20000 extents, Equal to 16x AU for extents above 40000 extents. ASM stripes files using extents

with a coarse method for loadbalancing or a fine method to reduce latency. Coarse-grained striping is equal to AU size. Fine-grained striping is always set to 128KB

46. ASM Files : Mirroring: ASM mirroring is specified at the file level.

When ASM allocates an extent for a normal redundancy file (two-way mirroring), ASM allocates a primary extent and a secondary extent. ASM chooses the disk on which to store the secondary extent in a different failure group other than the primary extent. The simultaneous failure of all disks in a failure group does not result in data loss.

The table in the slide lists the default disk group, the supported mirroring levels for files within that disk group, and the default mirroring level for any file created in the disk group unless a custom mirroring level is designated.

With an external redundancy disk group, ASM relies on the storage system to provide RAID functionality. Any write errors will cause a forced dismount of the entire disk group. With normal redundancy, a loss of one ASM disk is tolerated. With high redundancy, a loss of two ASM disks in different failure groups is tolerated.

47. ASM components/Clients : Any active database that is using ASM for its storage is a ASM client. ASM clients are tracked in v$asm_client dynamic performance view. Each file in ASM is associated with a single database

ASM clients are tracked in the `v$asm_client` dynamic performance view. There will exist one row for each combination of distinct database instance name and disk group number being used.

An OCR file stored in ASM is listed as an ASM client with the name +ASM.

ADVM volumes are ASM clients and the file system must be dismounted before the instance can be shut down. ASM volumes have a client name of asmvol.

48. ASM Utilities: Many utilities can be used to administer ASM. Prominent ones are: OUI, ASMCA, OEM, SQLPLUS, ASMCMD, LSNRCTL, SRVCTL, XML DB(ftp and http)

- **Oracle Universal Installer (OUI):** Is used to install the ASM software and can create the initial disk groups
- **ASM Configuration Assistant (ASMCA):** Is used to initially configure the ASM instance and create disk groups. It can be invoked from within the OUI utility.
- **Oracle Enterprise Manager (EM):** Is used to perform central administration of a grid environment, including the ASM instance using a graphical client interface
- **SQL*Plus:** Is used to provide command-line SQL language access to the ASM instance. All ASM commands and administration can be performed with this utility.
- **ASM Command-Line utility (ASMCMD):** Is used for ASM administration from the command line without the SQL language. It uses the UNIX style syntax.
- **Listener controller utility:** (server controller is preferred) Is used to start, stop, and check the status of the listener
- **Server controller utility:** Is used to start, stop, and check the status of all the ASM instances in a cluster environment with a single command
- **XML DB:** Provides FTP and HTTP access to ASM files

49. ASM Scalability: ASM has the following limits. 63 disk groups in a storage system. 10,000 ASM disks in a storage system. 2 TB max storage for each ASM Disk (non-exadata). 4 PetaByte storage for each ASM disk (exadata). 40-Exabyte storage per storage system. 1 million files for

each diskgroup. ASM file size limits (database limit is 128 TB). External redundancy max file size is 140 PB. Normal redundancy max file size is 42 PB. High redundancy max file size is 15 PB.

User creation in ASM.

```
SQL> connect sys as sysasm
Enter password:
Connected.
SQL> create user shaji identified by "Cvsdba1#";

User created.

SQL> grant sysasm to shaji;

Grant succeeded.

SQL> select * from v$pwfile_users;

USERNAME                       SYSDB SYSOP SYSAS
------------------------------ ----- ----- -----
SYS                            TRUE  TRUE  TRUE
ASMSNMP                        TRUE  FALSE FALSE
SHAJI                          FALSE FALSE TRUE
```

- **Local connection using operating system authentication**. Operating system users that are members of the OSASM, OSDBA for ASM, or OSOPER for ASM groups can connect to ASM without providing any additional credentials. For example, an operating system user who is a member of the OSASM group can connect to ASM with full administrative privileges using:

  ```
  CONNECT / AS SYSASM
  ```

  Note: A local connection using AS SYSDBA always uses OS authentication even when using the username/password syntax.
- **Local connection using password file authentication**. The following example shows a local connection using password file authentication:

  ```
  CONNECT sys/<sys_password> AS SYSASM
  ```
- **Remote connection by way of Oracle Net Services using password authentication**. Password-based authentication is also supported remotely using Oracle Net Services. The following example shows a remote connection by way of Oracle Net Services using password authentication.

  ```
  CONNECT sys/<sys_password>@<net_services_alias> AS SYSASM
  ```

Grid Infrastructure Installation

[1] Perform pre-install tasks for Grid Infrastructure

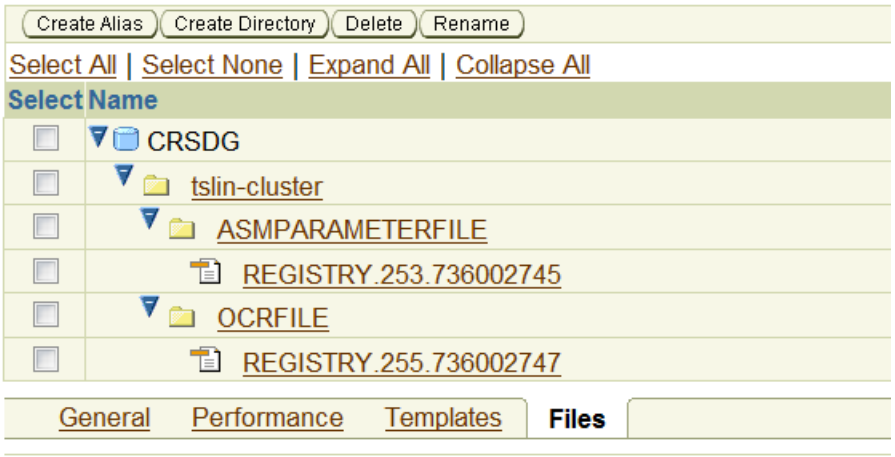
50. Grid Infrastructure files can be stored on ASM, NFS and CFS. ASM cannot store database/grid software. RAW devices are not supported for new installation. Existing RAW device databases can be upgraded to 11gR2.
51. Sizing shared storage for Grid install:
52.

Redundancy	Min. no. of disks	OCR files	Voting disk	Total
External	1	280 MB	280MB	560 MB
Normal	3	560 MB	840 MB	1.4 GB
High	5	840 MB	1.4 GB	2.3 GB

Clusterware be used to provide redundancy. When you use external redundancy, the minimum requirement is for one Oracle Cluster Registry (OCR) file and one voting disk of 280 MB each. If Oracle Clusterware is used for implementing normal redundancy, two OCR files and three voting disks of 280 MB each should be created for a total of 1.4 GB. Only five OCR files may be created, but Oracle Clusterware allows up to 15 voting disks to be created. Always configure an odd number of voting disks.

The user account with which you perform the installation must have write permissions to create the files in the path that you specify during the installation. The OCR file locations should have the `root:oinstall` ownership and the voting disk should have the `crs:oinstall` ownership. All file locations should have `0640` permission patterns. These requirements are only for Oracle Clusterware. Additional space for database and applications need to be planned for.

53. OCR and Cluster Registry can be stored on ASM.



54. Cluster configuration information is maintained in OCR. Each node in the cluster maintains an in-memory copy of OCR , along with the CRSD that accesses its OCR cache. Only one CRSD process actually reads and writes from the OCR and is responsible for refreshing the cache of all

the member nodes. When clients want to update the registry, it communicates to the CRSD on its node which will communicate the same to the CRSD that is responsible for reading/writing to the registry.

55. Grid infrastructure installation now gives 3 locations to create OCR files by default and we can specify upto 5 locations. New installations to raw devices are not supported.
56. Managing Voting Disks: Voting disks can be stored on ASM. Each node should be able to access majority of the voting disks otherwise it will be evicted from the cluster.
57. Voting disks are not regular ASM files. Clusterware knows the locations of the files even if ASM is not available. The number of voting disks is determined by the ASM group redundancy setting.
58. A separate failure group is required for each voting disk. Voting disks are managed by CRSCTL utility. If any node in a cluster is not able to communicate to other nodes, then other nodes will realize that there is no heart-beat with the node having troubles and uses the voting disk to evict the node out of the cluster. The node having issues will realize this via voting disks (clusterware) and will reboot. Clusterware supports upto 15 voting disks.
59. Cluster Log files:
    - CRS logs are in `<Grid_Home>/log/<hostname>/crsd/`. The `crsd.log` file is archived every 10 MB (`crsd.l01`, `crsd.l02`, ...).
    - CSS logs are in `Grid_HOME /log/<hostname>/cssd/`. The `cssd.log` file is archived every 20 MB (`cssd.l01`, `cssd.l02`, ...).
    - EVM logs are in `<Grid_Home>/log/<hostname>/evmd`.
    - SRVM (`srvctl`) and OCR (`ocrdump`, `ocrconfig`, `ocrcheck`) logs are in `<Grid_Home>/log/<hostname>/client/` and `$ORACLE_HOME/log/<hostname>/client/`.
    - Important Oracle Clusterware alerts can be found in `alert<nodename>.log` in the `<Grid_Home>/log/<hostname>` directory.

```
[grid@tslinrac02 tslinrac02]$ cd $ORACLE_HOME
[grid@tslinrac02 grid]$ pwd
/u01/app/11.2.0/grid
[grid@tslinrac02 grid]$ cd log
[grid@tslinrac02 log]$ pwd
/u01/app/11.2.0/grid/log
[grid@tslinrac02 log]$ ll
total 12
drwxr-xr-x  2 grid oinstall 4096 Nov 25 12:58 crs/
drwxr-xr-t 23 root oinstall 4096 Nov 25 13:13 tslinrac02/
drwxrwxr-x  4 grid asmadmin 4096 Dec 11 17:39 diag/
[grid@tslinrac02 log]$ ll crs
total 0
[grid@tslinrac02 log]$ ll tslinrac02/
total 1056
drwxr-x--- 2 grid oinstall   4096 Nov 25 13:13 srvm/
drwxr-x--- 2 root oinstall   4096 Nov 25 13:13 gnsd/
drwxr-x--- 4 grid oinstall   4096 Nov 25 13:13 cvu/
drwxrwxr-t 4 root oinstall   4096 Nov 25 13:13 agent/
drwxr-x--- 2 grid oinstall   4096 Nov 25 13:13 admin/
drwxr-xr-x 2 root oinstall   4096 Nov 25 13:13 acfssec/
drwxr-x--- 2 root oinstall   4096 Nov 25 13:13 acfsreplroot/
drwxr-x--- 2 grid oinstall   4096 Nov 25 13:13 acfsrepl/
drwxr-x--- 2 grid oinstall   4096 Nov 25 13:15 mdnsd/
drwxr-x--- 2 root oinstall   4096 Nov 25 13:23 crfmond/
drwxr-x--- 2 root oinstall   4096 Nov 25 13:23 crflogd/
drwxr-x--- 2 grid oinstall   4096 Nov 25 13:23 evmd/
drwxr-x--- 2 grid oinstall   4096 Dec  2 23:29 diskmon/
drwxrwxr-t 5 grid oinstall   4096 Dec 11 17:40 racg/
drwxr-x--- 2 root oinstall   4096 Feb 25 14:21 ohasd/
drwxr-x--- 2 root oinstall   4096 Feb 26 12:33 ctssd/
drwxr-x--- 2 grid oinstall   4096 Apr 27 15:26 client/
drwxr-x--- 2 grid oinstall   4096 Apr 27 15:27 cssd/
drwxr-x--- 2 root oinstall   4096 Apr 27 19:06 crsd/
drwxr-x--- 2 grid oinstall   4096 Apr 29 12:42 gipcd/
drwxr-x--- 2 grid oinstall   4096 May  4 10:02 gpnpd/
-rw-rw-r-- 1 grid oinstall 987788 May  4 13:39 alerttslinrac02.log
[grid@tslinrac02 log]$ ll diag
total 12
drwxrwx--T 3 grid asmadmin 4096 Nov 25 13:14 clients/
drwxr-xr-x 3 grid oinstall 4096 Dec 11 17:39 tnslsnr/
-rw-r----- 1 grid oinstall   13 May  4 10:03 adrci_dir.mif
[grid@tslinrac02 log]$
```

60. Installing ASMLIB Manually: Refer to the Jeff Hunters 11g RAC install on linux using Iscsi

61. Preparing ASMLib: Refer to the Jeff Hunters 11g RAC install on linux using Iscsi

[2] Install Grid Infrastructure

1. Check System requirements: Atleast 1.5GB of memory, 1.5GB of swap space, 1 GB of /tmp and 4-5 GB for software. Check /proc/meminfo for memory/swap settting.

2. Check Network Requirements: Atleast 2 NIC's should be configured for public and private network. Interface names should be same across all nodes . ex: if eth0 is public ip, then public ip on all remaining nodes should be eth0.

```
[root@tslinrac01 install_scripts]# cat /etc/hosts
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1               localhost.localdomain localhost

# Public IP adddresses
192.168.1.101           tslinrac01 tslinrac01.dba.com
192.168.1.102           tslinrac02 tslinrac02.dba.com
192.168.1.103           tslinrac03 tslinrac03.dba.com
192.168.1.104           tslinrac04 tslinrac04.dba.com

# Virtual IP addresses

192.168.1.201           tslinrac01-vip tslinrac01-vip.dba.com
192.168.1.202           tslinrac02-vip tslinrac02-vip.dba.com
192.168.1.203           tslinrac03-vip tslinrac03-vip.dba.com
192.168.1.204           tslinrac04-vip tslinrac04-vip.dba.com

# Private interconnects
192.168.50.11           tslinrac01-priv tslinrac01-priv.dba.com
192.168.50.12           tslinrac02-priv tslinrac02-priv.dba.com
192.168.50.13           tslinrac03-priv tslinrac03-priv.dba.com
192.168.50.14           tslinrac04-priv tslinrac04-priv.dba.com

# Storage server and ip
192.168.1.53            tsstore01     tsstore01.dba.com
192.168.70.10           tsstore01-stg tsstore01-stg.dba.com
192.168.70.11           tslinrac01-stg tslinrac01-stg.dba.com
192.168.70.12           tslinrac02-stg tslinrac02-stg.dba.com
192.168.70.13           tslinrac03-stg tslinrac03-stg.dba.com
192.168.70.14           tslinrac04-stg tslinrac04-stg.dba.com
```

3. Public NIC should support TCP/IP. And Private NIC should support UDP
4. Public IP should be registered in DNS server and/or /etc/hosts file.
5. If GNS is used, then Cluster GNS address must be registered in DNS.
6. Use NTP to synchronise time across all nodes. Mismatch in time can result in node eviction.
7. Software Requirements: Refer to platform documentation on the kernel/os requirements.
8. Ensure all required packages are loaded to the OS
9. Create Users and Groups

Create all the groups

```
groupadd -g 501 oinstall
groupadd -g 502 dba
groupadd -g 503 oper
groupadd -g 504 asmoper
groupadd -g 505 asmadmin
```

```
groupadd -g 506 asmdba
groupadd -g 507 avadmin


# Create all the users
#1. Create account 'grid' to be owning clusterware and ASM
useradd -m -u 501 -g oinstall -G asmadmin,asmdba,asmoper -d /home/grid -s /bin/bash -c "Grid
Infrastructure Owner" grid
echo "set the password for grid"
passwd grid

#2. Create 'oracle'
useradd -m -u 502 -g oinstall -G dba,oper,asmdba -d /home/oracle -s /bin/bash -c "Oracle Software
Owner" oracle

echo "Set the password for oracle"
passwd oracle

#3. Create user 'adtvault'
useradd -m -u 503 -g oinstall -G avadmin,dba -d /home/adtvault -s /bin/bash -c "Audit vault Software
Owner" adtvault
```

10. Set Shell settings for the grid infrastructure user

```
cat >> /etc/security/limits.conf <<EOF
grid soft nproc 2047
grid hard nproc 16384
grid soft nofile 1024
grid hard nofile 65536
oracle soft nproc 2047
oracle hard nproc 16384
oracle soft nofile 1024
oracle hard nofile 65536
EOF

cat >> /etc/pam.d/login <<EOF
# Added for Oracle Shell Limits
session    required     /lib/security/pam_limits.so
session    required     pam_limits.so
EOF
```

11. Install the Grid Software: Refer to the screenshot doc
    https://www.box.net/shared/6x61mq5qmb

[3] Verify the installation

12. Run command "/u01/app/11.2.0/grid/bin/crsctl stat res –t" to check the state.

[4] Configure ASM disk groups

13. Check ASM diskgroup creation via doc : https://www.box.net/shared/m95l2s4496
14. ASM diskgroups can be created via asmca, grid control,sql, asmcmd,

The asmcmd command shown in the slide performs the same operation if the disk_config.xml file is:

```
<dg name="data" redundancy="normal">
 <fg name="fg1">
    <dsk string="/dev/disk1"/>
    <dsk string="/dev/disk2"/> </fg>
<fg name="fg2">
    <dsk string="/dev/disk3"/>
    <dsk string="/dev/disk4"/> </fg>
 <a name="compatible.asm" value="11.2"/>
 <a name="compatible.rdbms" value="11.2"/>
<a name="compatible.advm" value="11.2"/>
</dg>
```

[5] Configure ASM volumes

Refer to doc: https://www.box.net/shared/simtj0dpd1

[6] Make ASM cluster file system

Refer to doc https://www.box.net/shared/simtj0dpd1

[7] Mount ACFS volumes

Refer to doc https://www.box.net/shared/simtj0dpd1

Administering Oracle Clusterware

[1] Display Clusterware management proficiency

1. CRSCTL manages clusterware related operations. Starting/stopping of clusterware, enabling/disabling clusterware daemons, registering cluster resources
2. SRVCTL manages database related operations , starting and stopping instances, services etc.,
3. Enterprise manager : Dbconsole within the cluster and grid control (centralised) can be used to manage the cluster using GUI.
4. Start CRS: Crsctl start crs
5. Stop CRS: crsctl stop crs
   [root@tslinrac02 ~]# crsctl stop crs
   CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources on 'tslinrac02'

6. Enable CRS on a node: crsctl enable crs
   [root@tslinrac02 ~]# crsctl enable crs
   CRS-4622: Oracle High Availability Services autostart is enabled.
7. Disable CRS on a node : crsctl disable crs
   [root@tslinrac02 ~]# crsctl disable crs
   CRS-4621: Oracle High Availability Services autostart is disabled.
8. Check CRS: crsctl check crs
   [root@tslinrac02 ~]# crsctl check crs
   CRS-4638: Oracle High Availability Services is online
   CRS-4537: Cluster Ready Services is online
   CRS-4529: Cluster Synchronization Services is online
   CRS-4533: Event Manager is online
9. Check Cluster: crsctl check cluster
   [root@tslinrac02 ~]# crsctl check cluster
   CRS-4537: Cluster Ready Services is online
   CRS-4529: Cluster Synchronization Services is online
   CRS-4533: Event Manager is online

   NOTE: Check commands does not need ROOT access. Enable/disable/start/stop crsctl commands needs ROOT login
10. Query Voting disks: This can be executed by grid user and does not require CSS To be running
    [grid@tslinrac02 ~]$ crsctl query css votedisk
    ## STATE File Universal Id File Name Disk group
    -- ----- ----------------- --------- ---------
     1. ONLINE 0af83b84fca64f05bf96f027b6fcafc9 (ORCL:SDAVGCRS1) [CRSDG]
     2. ONLINE 3492f4ef75924f56bf57d59ed58f7a6d (ORCL:SDBVGCRS1) [CRSDG]
     3. ONLINE 9c2f851a0bdf4fd1bfd08b8d7da459aa (ORCL:SDCVGCRS1) [CRSDG]
    Located 3 voting disk(s).
11. Check OCR location:
    [grid@tslinrac02 ~]$ cat /etc/oracle/ocr.loc
    ocrconfig_loc=+CRSDG
    local_only=FALSE
12. Check OCR using 'ocrcheck': Run as root to get logical corruption status

    [root@tslinrac02 ~]# ocrcheck
    Status of Oracle Cluster Registry is as follows :
        Version : 3
        Total space (kbytes) : 262120
        Used space (kbytes) : 3236
        Available space (kbytes) : 258884
        ID : 2006039960
        Device/File Name : +CRSDG
                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

13. Checking the integrity of clusterware configuration files: check ocssd.log , ocrcheck, cluvfy
14. Check ocssd.log : grep voting $ORACLE_HOME/log/tslinrac02/cssd/ocssd.log

```
2011-05-09 05:53:28.181: [    CSSD][3041789632]clssnmReadDiscoveryProfile: voting file discovery string()
2011-05-09 05:53:28.286: [    CSSD][3023043472]clssnmvDiskVerify: discovered a potential voting file
2011-05-09 05:53:28.306: [    CSSD][3023043472]clssnmvDiskVerify: discovered a potential voting file
2011-05-09 05:53:28.332: [    CSSD][3023043472]clssnmvDiskVerify: discovered a potential voting file
2011-05-09 05:53:28.337: [    CSSD][3023043472]clssnmCompleteInitVFDiscovery: Completing initial voting file discovery
2011-05-09 05:53:28.337: [    CSSD][3023043472]clssnmCompleteVFDiscovery: Completing voting file discovery
2011-05-09 05:53:28.337: [    CSSD][3023043472]  Listing unique IDs for 3 voting files:
2011-05-09 05:53:28.337: [    CSSD][3023043472]    voting file 1: 0af83b84-fca64f05-bf96f027-b6fcafc9
2011-05-09 05:53:28.337: [    CSSD][3023043472]    voting file 2: 3492f4ef-75924f56-bf57d59e-d58f7a6d
2011-05-09 05:53:28.337: [    CSSD][3023043472]    voting file 3: 9c2f851a-0bdf4fd1-bfd08b8d-7da459aa
2011-05-09 05:53:28.748: [    CSSD][3041789632]clssnmvDiskAvailabilityChange: voting file ORCL:SDCVGCRS1 now online
2011-05-09 05:53:28.778: [    CSSD][3041789632]clssnmvDiskAvailabilityChange: voting file ORCL:SDBVGCRS1 now online
2011-05-09 05:53:28.809: [    CSSD][3041789632]clssnmvDiskAvailabilityChange: voting file ORCL:SDAVGCRS1 now online
```

15. Cluster integrity check via ‘cluvfy’ (run as grid). Gives detailed output

```
[grid@tslinrac01 ~]$ cluvfy comp ocr -n all -verbose

Verifying OCR integrity

Checking OCR integrity...

Checking the absence of a non-clustered configuration...
All nodes free of non-clustered, local-only configurations


ASM Running check passed. ASM is running on all specified nodes

Checking OCR config file "/etc/oracle/ocr.loc"...

OCR config file "/etc/oracle/ocr.loc" check successful


Disk group for ocr location "+CRSDG" available on all the nodes


NOTE:
```

This check does not verify the integrity of the OCR contents. Execute 'ocrcheck' as a privileged user to verify the contents of OCR.

OCR integrity check passed

[2] Demonstrate OCR backup and recovery techniques

1. In 11gR2, voting disk data is automatically backed up in the OCR as part of any configuration change. Voting disk data is automatically restored to any new voting disk that is added. Using 'dd' to backup/restore may result in loss of voting disk. Prior to 11gR2, use of 'dd' to backup voting disk after installation was required. From 11gR2 onwards, dd is not supported to backup voting disk. Voting disk is now automatically backed up and manual backup is not required. Use crsctl delete/add command to remove and add a new voting disk. Voting disk data is automatically restored when a new device is added.
2. To add voting disk to non-ASM storage, use the following commands:
   Crsctl delete css votedisk <path_to_voting_disk> OR
   Crsctl delete css votedisk voting_disk_GUID (where voting_disk_guid is obtained from the column 'File Universal Id' from crsctl query css votedisk command
   Crsctl add css votedisk <path_to_voting_Disk>
3. To add a voting disk to ASM:
   Crsctl replace votedisk +asm_disk_group_name
4. Migrate voting disk between ASM and non-ASM storage:
   Crsctl replace css votedisk {+asm_disk_Group | path_to_voting_disk}
5. Locating OCR automatic backups: ocrconfig -showbackup auto . OCR is automatically backed up. ONLY ONE NODE performs the backup. To show the host and location of the backup file, use the command listed below. Files could be spread across nodes due to outage. The backup frequency and retention policy are: Every four hours. CRS keeps the last three copies. End of Every day: CRS keeps the last two copies. End of Every week: CRS keeps the last 2 copies.

   [grid@tslinrac02 ~]$ ocrconfig -showbackup auto

   tslinrac01 2011/05/04 22:38:44 /u01/app/11.2.0/grid/cdata/tslin-cluster/backup00.ocr

   tslinrac01 2011/05/04 18:38:43 /u01/app/11.2.0/grid/cdata/tslin-cluster/backup01.ocr

   tslinrac01 2011/05/04 14:38:42 /u01/app/11.2.0/grid/cdata/tslin-cluster/backup02.ocr

   tslinrac01 2011/05/03 22:38:38 /u01/app/11.2.0/grid/cdata/tslin-cluster/day.ocr

   tslinrac02 2011/04/27 20:33:16 /u01/app/11.2.0/grid/cdata/tslin-cluster/week.ocr
6. The backup file names generated by automatic ocr backup should not be changed.
7. OCR Automatic backup location should be changed to a shared storage location shared by all nodes. The backup location will be used for both automatic and manual backup. If CRS is stopped on all nodes, then the schedule of the backup Is suspended.
8. Change OCR Backup location: ocrconfig -backuploc /backup_nfs/ocr_backup

9. DO NOT place the OCR backup location on a ASM filesystem
10. Adding, Replacing and repairing OCR locations: Clusterware can manage upto 5 redundant locations.
    Ocrconfig –add +DATA2 ---ASM
    Ocrconfig -add /dev/sde1 --- LUNS shared on all nodes. Check more on this. Whether it is a LUN or can be on NFS
    ----To replace the current location
    Ocrconfig –replace /dev/sde1 –replacement +DATA2
    --To repair OCR configuration. THIS SHOULD BE EXECUTED AFTER STOPPING CRS
    Ocrconfig –repair –add +DATA1
11. Delete an OCR location: DO NOT perform ocr deletion until and unless there is another ocr location active and online

    Ocrconfig –delete +DATA2 (manually remove the files from ASM dg using ASMCMD)
    Ocrconfig –delete /dev/sde1
12. To migrate OCR between ASM to non-asm location and vice versa, check the version of CRS to make sure it is 11g Release 2
    [root@tslinrac01 backup_nfs]# crsctl query crs activeversion
    Oracle Clusterware active version on the cluster is [11.2.0.2.0]
13. MANUAL backup of OCR:
    [root@tslinrac01 backup_nfs]# ocrconfig -manualbackup

    tslinrac01 2011/05/10 06:14:36 /backup_nfs/ocr_backup/backup_20110510_061436.ocr
    [root@tslinrac01 backup_nfs]# ocrconfig -showbackup manual

    tslinrac01 2011/05/10 06:14:36 /backup_nfs/ocr_backup/backup_20110510_061436.ocr
14. MANUAL Logical export backup of OCR:
    [root@tslinrac01 ocr_backup]# ocrconfig -export /backup_nfs/ocr_backup/ocr.export1
    [root@tslinrac01 ocr_backup]# ls -ltr
    total 7516
    -rw-------+ 1 root root 7565312 May 10 06:16 backup_20110510_061436.ocr
    -rw-rw-rw-+ 1 root root 113772 May 10 2011 ocr.export1
15. Recovering OCR using physical backups:
    Ocrconfig –showbackup locate backups
    Crsctl stop cluster –all Stop clusterware on ALL nodes
    Crsctl stop crs stop oracle HA services on all nodes. Run on all nodes
    Ocrconfig –restore <full path to ocr physical backup file>
    Crsctl start crs Start oracle HA services on all nodes. Execute on all nodes
    Cluvfy comp ocr –n all check the OCR integrity

16. Recovering OCR using logical backups:
    Locate the logical backup file of ocr (where it was backed up to)

Crsctl stop cluster –all
Crsctl stop crs run on all nodes
Ocrconfig –restore /backup_nfs/ocr_backup/ocr.export1 restore from the logical export
Crsctl start crs start oracle ha services on all nodes. Execute on all nodes
Cluvfy comp ocr –n all check the ocr integrity

17. Oracle LOCAL Registry: Each cluster node has a local registry for node specific resources called local registry. OLR is installed and configured when clusterware is installed. One of its functions is to facilitate clusterware startup where ASM stores the OCR and voting disks. This enables the node to join the cluster. Check local registry status by running the command:

```
[root@tslinrac01 ~]# ocrcheck -local
Status of Oracle Local Registry is as follows :
        Version                  :        3
        Total space (kbytes)     :    262120
        Used space (kbytes)      :      2580
        Available space (kbytes) :    259540
        ID                       : 1962692928
        Device/File Name         : /u01/app/11.2.0/grid/cdata/tslinrac01.olr
                                   Device/File integrity check succeeded

        Local registry integrity check succeeded

        Logical corruption check succeeded
```

18. OLR display contents on screen: ocrdump -local –stdout
19. OLR. Make a manual logical backup: ocrconfig -local -export /backup_nfs/ocr_backup/ocr.local1
20. OLR. Import from logical backup: ocrconfig –local –import /backup_nfs/ocr_backup/ocr.local1
21. OLR. Modify OLR file on local node: ocrconfig –local –repair olr <file_name>

[3] Managing Network Settings

1. List the network interfaces available to cluster

```
[grid@tslinrac01 ~]$ oifcfg iflist -p -n
eth0  192.168.70.0  PRIVATE  255.255.255.0
eth1  192.168.1.0  PRIVATE  255.255.255.0
eth2  192.168.50.0  PRIVATE  255.255.255.0
eth2  169.254.0.0  UNKNOWN  255.255.0.0
```

2. To determine the public and private interfaces configured in clusterware:

```
[grid@tslinrac01 ~]$ oifcfg getif
eth1  192.168.1.0  global  public
eth2  192.168.50.0  global  cluster_interconnect
```

3. To determine VIP interace IP, subnet, hostname :

```
[grid@tslinrac01 ~]$ srvctl config nodeapps -a
Network exists: 1/192.168.1.0/255.255.255.0/eth1, type static
VIP exists: /tslinrac01-vip/192.168.1.201/192.168.1.0/255.255.255.0/eth1, hosting node tslinrac01
VIP exists: /tslinrac02-vip/192.168.1.202/192.168.1.0/255.255.255.0/eth1, hosting node tslinrac02
```

4. Explore changing VIP address
5. Explore changing the interconnect adapter
6. Explore SCAN listener

Managing Clusterware

[1] Perform prerequisite steps for extending a cluster
[2] Use Oracle Universal Installer (OUI) to add a node to an Oracle Clusterware home
[3] Use OUI to remove a node from an Oracle Clusterware home

Making Applications Highly Available With Oracle Clusterware

[1] Describe the High Availability components of Oracle Clusterware
[2] Contrast Policy-Managed and Administration Managed databases
[3] Describe the functionality of server pools
[4] Describe application placement policies
[5] Create an application Virtual IP (VIP)
[6] Manage application resources

Troubleshooting Oracle Clusterware

[1] Locate Oracle Clusterware log files
[2] Gather all log files using diagcollection.pl
[3] Enable resource debugging
[4] Enable component-level debugging
[5] Enable tracing for Java-based tools
[6] Troubleshoot the Oracle Cluster Registry (OCR) file

Administering ASM Instances

[1] Understand and apply ASM initialization parameters

1. ASM init parameters can be set via ALTER SYSTEM or ALTER SESSION statements
2. INSTANCE_TYPE=ASM is the only mandatory parameter
3. ASM specific parameters are:

```
NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
asm_diskgroups                       string      ORADATA01, ORAFRA01, ACFS1
asm_diskstring                       string
asm_power_limit                      integer     1
asm_preferred_read_failure_groups    string
```

4. A PFILE or SPFILE can be used to manage parameters. In a clustered ASM environment, SPFILE is by default placed in a ASM diskgroup. It can also be located on a clustered filesystem.
5. ASM_DISKGROUPS : ASM_DISKGROUPS specifies a list of disk groups that ASM automatically mounts on startup. It uses the default value NULL. Set value is ignored during some circumstances like STARTUP NOMOUNT. Can be dynamically set using ALTER SYSTEM. Is

automatically modified when a disk group is created, deleted, mounted or unmounted while using a spfile. It must be manually adjusted if using a PFILE.

6. At instance startup, ASM instance attempts to mount the following groups:
   - Diskgroup specified by ASM_DISKGROUPS parameter
   - Disk group used by cluster synchronisation services (CSS) for voting disks
   - Disk group used by oracle clusterware for cluster registry
   - Disk group used by ASM to store the ASM spfile.
7. ASM_DISKSTRING: This specifies a list of strings that limits the set of disks that ASM instance discovers. Uses the default value of NULL. This means ASM looks at the default path looking for disks that it has read-write access to. Default path is platform specific. Default search path includes ASMLIB disks. It can use * and ? wildcard characters. Can be set dynamically using ALTER SYSTEM . The change will be rejected if the new value cannot find disks on currently mounted disk groups.

   The default value of the ASM_DISKSTRING parameter is a NULL string. A NULL value causes ASM to search a default path for all disks in the system to which the ASM instance has read-and-write access. The default search path is platform specific. The following list shows the default search path for a selection of common platforms:

   Linux: /dev/raw/*

   AIX: /dev/rhdisk*

   HP-UX: /dev/rdisk/*

   Solaris: /dev/rdsk/*

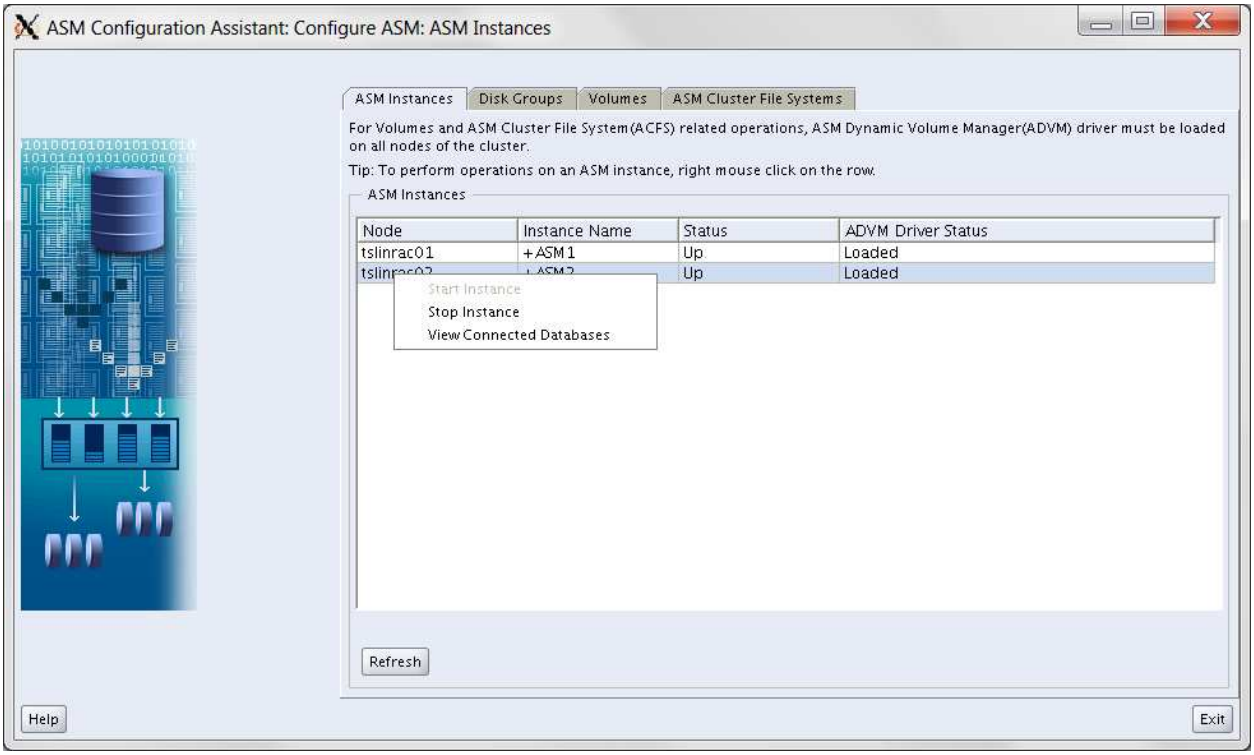
   Windows: \\.\ORCLDISKn

8. ASM_POWER_LIMIT: Default is 1. This specifies the default power of rebalancing. 1 is the lowest power which means ASM will use minimal resource during rebalancing. Allowable range is between 0 to 11. 0 disables rebalance operations. Lower values uses lesser resource but takes a longer time for rebalancing. Higher values uses more resources but finishes rebalance operations faster. This parameter can be set dynamically.
9. INSTANCE_TYPE: INSTANCE_TYPE should be set to ASM. This is a mandatory requirement for asm instances.
10. CLUSTER_DATABASE : If this is set to TRUE, then it means storage clustering is enabled. Clustered ASM instance can support, RAC and non-RAC databases. All instances in a cluster should have the same settings.
11. MEMORY_TARGET: Memory target specifies the total amount of memory used by an ASM instance. Default is 272MB. Minimum is 256MB. Smaller than 256 MB are ignored.

[2] Manage ASM instances and associated processes

1. [grid@tslinrac01 ~]$ srvctl status asm
   ASM is running on tslinrac01,tslinrac02
2. [grid@tslinrac01 ~]$ srvctl status asm -n tslinrac02
   ASM is running on tslinrac02
3. Srvctl start asm –n <hostname>

4. Srvctl start asm (on all nodes)
5. Srvctl stop asm (on all nodes)
6. Srvctl start asm [-n node] [-o startoptions]
   Start options can be : FORCE, MOUNT, OPEN, NOMOUNT, RESTRICT
7. Srvctl stop asm [-n node] [-o stopoptions]
   Stopoptions can be : NORMAL, IMMEDIATE, TRANSACTIONAL, ABORT
8. Srvctl can be used to manage a non-clustered ASM too.
9. Starting/Stopping ASM using SQLPLUS:
   - ORACLE_SID=+ASM1; export ORACLE_SID
   - ORACLE_HOME=/u01/app/11.2.0/grid; export ORACLE_HOME
   - $ORACLE_HOME/bin/sqlplus / as SYSASM
   - Startup;
10. Starting/stopping using ASMCA



11. Starting/stopping using ASMCMD

```
$ asmcmd
ASMCMD [+] > shutdown

ASMCMD [+] > shutdown --immediate

ASMCMD [+] > shutdown --abort

ASMCMD> startup --nomount --pfile asm_init.ora

ASMCMD> startup --mount
```

12. Starting/stopping ASM instances containing OCR and voting disks:
    - Will be automatically restarted by high availability services daemon
    - Use crsctl stop crs
    - Stopping oracle clusterware will stop asm also using above command.

      [root@tslinrac01 ~]# crsctl stop crs

```
CRS-2791: Starting shutdown of Oracle High Availability Services-managed
resources on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.crsd' on 'tslinrac01'
CRS-2790: Starting shutdown of Cluster Ready Services-managed resources
on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.oc4j' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.ACFS1.dg' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.CRSDG.dg' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.registry.acfs' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.racdb.svc_racdb1.svc' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.cvu' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.LISTENER_SCAN1.lsnr' on 'tslinrac01'
CRS-2677: Stop of 'ora.racdb.svc_racdb1.svc' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.racdb.db' on 'tslinrac01'
CRS-2672: Attempting to start 'ora.racdb.svc_racdb1.svc' on 'tslinrac02'
CRS-2676: Start of 'ora.racdb.svc_racdb1.svc' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.cvu' on 'tslinrac01' succeeded
CRS-2672: Attempting to start 'ora.cvu' on 'tslinrac02'
CRS-2677: Stop of 'ora.LISTENER_SCAN1.lsnr' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.scan1.vip' on 'tslinrac01'
CRS-2677: Stop of 'ora.scan1.vip' on 'tslinrac01' succeeded
CRS-2672: Attempting to start 'ora.scan1.vip' on 'tslinrac02'
CRS-2676: Start of 'ora.cvu' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.racdb.db' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.ORADATA01.dg' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.ORAFRA01.dg' on 'tslinrac01'
CRS-2676: Start of 'ora.scan1.vip' on 'tslinrac02' succeeded
CRS-2672: Attempting to start 'ora.LISTENER_SCAN1.lsnr' on 'tslinrac02'
CRS-2676: Start of 'ora.LISTENER_SCAN1.lsnr' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.registry.acfs' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.oc4j' on 'tslinrac01' succeeded
CRS-2672: Attempting to start 'ora.oc4j' on 'tslinrac02'
```

```
CRS-2677: Stop of 'ora.ORADATA01.dg' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.ORAFRA01.dg' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.ACFS1.dg' on 'tslinrac01' succeeded
CRS-2676: Start of 'ora.oc4j' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.CRSDG.dg' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.asm' on 'tslinrac01'
CRS-2677: Stop of 'ora.asm' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.LISTENER.lsnr' on 'tslinrac01'
CRS-2677: Stop of 'ora.LISTENER.lsnr' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.tslinrac01.vip' on 'tslinrac01'
CRS-2677: Stop of 'ora.tslinrac01.vip' on 'tslinrac01' succeeded
CRS-2672: Attempting to start 'ora.tslinrac01.vip' on 'tslinrac02'
CRS-2676: Start of 'ora.tslinrac01.vip' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.ons' on 'tslinrac01'
CRS-2677: Stop of 'ora.ons' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.net1.network' on 'tslinrac01'
CRS-2677: Stop of 'ora.net1.network' on 'tslinrac01' succeeded
CRS-2792: Shutdown of Cluster Ready Services-managed resources on
'tslinrac01' has completed
CRS-2677: Stop of 'ora.crsd' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.crf' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.ctssd' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.evmd' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.asm' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.drivers.acfs' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.mdnsd' on 'tslinrac01'
CRS-2677: Stop of 'ora.mdnsd' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.asm' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.cluster_interconnect.haip' on
'tslinrac01'
CRS-2677: Stop of 'ora.drivers.acfs' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.crf' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.cluster_interconnect.haip' on 'tslinrac01'
succeeded
CRS-2677: Stop of 'ora.evmd' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.ctssd' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.cssd' on 'tslinrac01'
CRS-2677: Stop of 'ora.cssd' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.gipcd' on 'tslinrac01'
CRS-2673: Attempting to stop 'ora.diskmon' on 'tslinrac01'
CRS-2677: Stop of 'ora.gipcd' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd' on 'tslinrac01'
CRS-2677: Stop of 'ora.diskmon' on 'tslinrac01' succeeded
CRS-2677: Stop of 'ora.gpnpd' on 'tslinrac01' succeeded
CRS-2793: Shutdown of Oracle High Availability Services-managed resources
on 'tslinrac01' has completed
CRS-4133: Oracle High Availability Services has been stopped.
[root@tslinrac01 ~]# ps -ef | grep pmon
root      2722 31110  0 23:34 pts/1    00:00:00 grep pmon
[root@tslinrac01 ~]# ps -ef |grep oracle
root      2725 31110  0 23:34 pts/1    00:00:00 grep oracle
oracle   15577     1  0 May23 ?        00:00:01
/u01/app/oracle/product/agent10g/agent10g/perl/bin/perl
/u01/app/oracle/product/agent10g/agent10g/bin/emwd.pl agent
```

```
/u01/app/oracle/product/agent10g/agent10g/tslinrac01/sysman/log/emagent.n
ohup
oracle   15593 15577  0 May23 ?        00:01:59
/u01/app/oracle/product/agent10g/agent10g/bin/emagent
[root@tslinrac01 ~]# ps -ef | grep grid
root      2985 31110  0 23:34 pts/1    00:00:00 grep grid
```

13. crsctl start crs
    Starts high availability services, asm, databases etc.,

[3] Monitor ASM using the V$ASM dynamic performance views

1. v$asm_alias
2. v$ASM_DISK

```
  1* select
group_number,disk_number,MOUNT_STATUS,HEADER_STATUS,MODE_STATUS,STATE,REDUNDANCY,FAILGROU
P from v$asm_disk
SQL> /

GROUP_NUMBER DISK_NUMBER MOUNT_S HEADER_STATU MODE_ST STATE    REDUNDA FAILGROUP
------------ ----------- ------- ------------ ------- -------- ------- ------------------
------------
           0           3 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           0           8 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           0          12 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           0          13 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           0          14 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           0          16 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           0          18 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           0          17 CLOSED  PROVISIONED  ONLINE  NORMAL   UNKNOWN
           1           2 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN ACFS1FG1
           2           0 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN SDAVGCRS1
           3           0 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN SDAVGDB1

GROUP_NUMBER DISK_NUMBER MOUNT_S HEADER_STATU MODE_ST STATE    REDUNDA FAILGROUP
------------ ----------- ------- ------------ ------- -------- ------- ------------------
------------
           4           0 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN SDAVGFRA1
           1           0 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN ACFS1FG2
           2           1 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN SDBVGCRS1
           3           1 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN SDBVGDB1
           4           1 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN SDBVGFRA1
           1           3 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN ACFS1FG3
           2           2 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN SDCVGCRS1
           1           1 CACHED  MEMBER       ONLINE  NORMAL   UNKNOWN ACFS1FG4

19 rows selected.
```

3. v$ASM_DISKGROUP
4. v$ASM_OPERATION
5. V$ASM_FIlESYSTEM
6. V$ASM_ATTRIBUTE
7. V$ASM_DISK_IOSTAT
8. V$ASM_DISKGROUP_STAT
9. V$ASM_TEMPLATE

10. V$ASM_CLIENT
11. V$ASM_DISK_STAT
12. V$ASM_FILE
13. V$ASM_ACFSVOLUME

Administering ASM Disk Groups

[1] Create and delete ASM disk groups

1. Creating a Diskgroup using SQLPLUS

   Create the diskgroup with 2 failgroups with slices from different disks.

```
CREATE DISKGROUP TEST_DG NORMAL REDUNDANCY DISK
'ORCL:SDAVGDB2'SIZE 51199 M ,'ORCL:SDBVGDB2'SIZE 51199 MCREATE
DISKGROUP ORADATA02 NORMAL REDUNDANCY
  FAILGROUP FAILG1 DISK
    'ORCL:SDAVGDB2' SIZE 51199 M,
    'ORCL:SDBVGDB2' SIZE 51199 M
  FAILGROUP FAILG2 DISK
    'ORCL:SDCVGDB1' SIZE 51199 M,
    'ORCL:SDDVGDB2' SIZE 51199 M
  ATTRIBUTE 'au_size'='4M',
    'compatible.asm' = '11.2',
    'compatible.rdbms' = '11.2',
    'compatible.advm' = '11.2';
```

   Node: Connect to remaining ASM instances and mount the newly created diskgroup.

```
SQL> connect / as sysasm
Connected.
SQL>  alter diskgroup ORADATA02 mount;
```

2. Creating a new diskgroup using ASMCMD

   Use “chdg” to create diskgroup using ASMCMD. Details to chdg should be provided in XML format.

```
ASMCMD> chdg '<chdg> <dg name="DATA" power="3"> <drop> <fg
name="FG1"> </fg> <dsk name="DATA_0001" /> </drop> <add> <fg
name="FG2"> <dsk string="/dev/disk5"/> </fg> </add> </chdg>'
```

[2] Set the attributes of an existing ASM disk group

Disk group attributes are parameters that are bound to a disk group, rather than an Oracle ASM instance.

Disk group attributes can be set when a disk group is created or altered, unless otherwise noted in the following list.

- ACCESS_CONTROL.ENABLED

  This attribute can only be set when altering a disk group.

  For information about the ACCESS_CONTROL.ENABLED attribute, see "Using SQL Statements to Set Disk Group Attributes for Oracle ASM File Access Control".

- ACCESS_CONTROL.UMASK

  This attribute can only be set when altering a disk group.

  For information about the ACCESS_CONTROL.UMASK attribute, see "Using SQL Statements to Set Disk Group Attributes for Oracle ASM File Access Control".

- AU_SIZE

  This attribute can only be set when creating a disk group. When you create a disk group, you can set the Oracle ASM allocation unit size with the AU_SIZE disk group attribute. The values can be 1, 2, 4, 8, 16, 32, or 64 MB, depending on the specific disk group compatibility level. Larger AU sizes typically provide performance advantages for data warehouse applications that use large sequential reads. Default is 1M.

- CELL.SMART_SCAN_CAPABLE

  This attribute is only applicable to Oracle Exadata storage.

- COMPATIBLE.ASM

  The value for the disk group COMPATIBLE.ASM attribute determines the minimum software version for an Oracle ASM instance that can use the disk group. This setting also affects the format of the data structures for the Oracle ASM metadata on the disk. The format of other file contents is determined by Oracle ASM Dynamic Volume Manager (Oracle ADVM) and the database instance.

  For Oracle ASM in Oracle Database 11g, 10.1 is the default setting for the COMPATIBLE.ASM attribute when using the SQL CREATE DISKGROUP statement, the ASMCMD mkdg command, and Oracle Enterprise Manager Create Disk Group page. When creating a disk group with ASMCA, the default setting is 11.2..

- COMPATIBLE.RDBMS

  The value for the disk group COMPATIBLE.RDBMS attribute determines the minimum COMPATIBLE database initialization parameter setting for any database instance that is allowed to use the disk group.

Before advancing the COMPATIBLE.RDBMS attribute, ensure that the values for the COMPATIBLE initialization parameter for all of the databases that access the disk group are set to at least the value of the new setting for COMPATIBLE.RDBMS.

For example, if the COMPATIBLE initialization parameters of the databases are set to either 11.1 or 11.2, then COMPATIBLE.RDBMS can be set to any value between 10.1 and 11.1 inclusively.

For Oracle ASM in Oracle Database 11g, 10.1 is the default setting for the COMPATIBLE.RDBMS attribute when using the SQL CREATE DISKGROUP statement, the ASMCMD mkdg command, ASMCA Create Disk Group page, and Oracle Enterprise Manager Create Disk Group page.

- COMPATIBLE.ADVM

  The value for the disk group COMPATIBLE.ADVM attribute determines whether the disk group can contain Oracle ASM volumes. The value must be set to 11.2 or higher. Before setting this attribute, the COMPATIBLE.ASM value must be 11.2 or higher. Also, the Oracle ADVM volume drivers must be loaded in the supported environment.

  By default, the value of the COMPATIBLE.ADVM attribute is empty until set.

- DISK_REPAIR_TIME

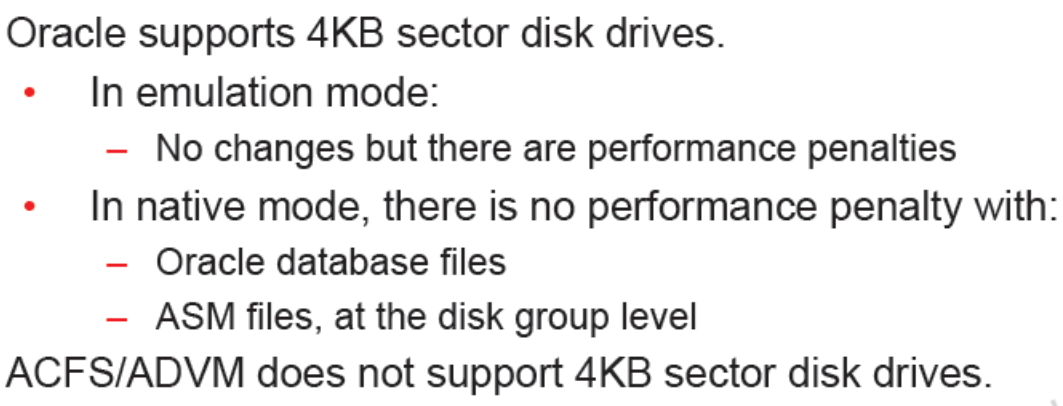
  This attribute can only be set when altering a disk group.

  For information about the DISK_REPAIR_TIME attribute, see "Oracle ASM Fast Mirror Resync".

- SECTOR_SIZE

  This attribute can only be set when creating a disk group.

  For information about the SECTOR_SIZE attribute, see "Specifying the Sector Size for Drives".



There are two types of 4 KB sector disks: emulation mode and native mode.

- 4 KB sector disks in emulation mode have eight logical sectors per physical sector (as shown in the slide). They maintain a 512-byte interface to their 4 KB physical sectors—that is, the logical block address (LBA) references 512 bytes on disk.
- 4 KB sector disks in native mode have one logical sector per physical sector (as shown in the slide). So, there is only the 4 KB interface. In other words, the LBA references 4096 bytes on disk.

Emulation mode can hurt performance because the disk drive reads the 4 KB sector into disk cache memory, changes the 512-byte section, and then writes the entire 4 KB sector back to disk. For example, when redo is being written to disk in 512 chunks, each write requires a read of the 4KB sector, an update of the 512-byte section, and then a write. With native mode, the 4 KB sector is written without requiring a read and update.

In addition to the disk group attributes listed in this section, template attributes are also assigned to a disk group. For information about template attributes, see "Managing Disk Group Templates".

You can display disk group attributes with the V$ASM_ATTRIBUTE view and the ASMCMD lsattr command. For an example of the use of the V$ASM_ATTRIBUTE view, see Example 6-1. For information about the lsattr command, see "lsattr".

Table 4-2 Examples of disk group compatibility attribute settings

COMPATIBLE.ASM	COMPATIBLE.RDBMS	COMPATIBLE.ADVM	ASM Instance Version	COMPATIBLE Setting for RDBMS Instance
10.1	10.1	n/a	>= 10.1	>= 10.1
11.1	10.1	n/a	>= 11.1	>= 10.1
11.2	11.1	11.2	>= 11.2	>= 11.1
11.2	11.2	11.2	>= 11.2	>= 11.2

Table 4-3 Features enabled by disk group compatibility attribute settings

Disk Group Features Enabled	COMPATIBLE.ASM	COMPATIBLE.RDBMS	COMPATIBLE.ADVM
Support for larger AU sizes (32 or 64 MB)	>= 11.1	>= 11.1	n/a
Attributes are displayed in the `V$ASM_ATTRIBUTE` view	>= 11.1	n/a	n/a
Fast mirror resync	>= 11.1	>= 11.1	n/a
Variable size extents	>= 11.1	>= 11.1	n/a
Exadata storage	>= 11.1.0.7	>= 11.1.0.7	n/a
Intelligent Data Placement	>= 11.2	>= 11.2	n/a
OCR and voting files in a disk group	>= 11.2	n/a	n/a
Sector size set to nondefault value	>= 11.2	>= 11.2	n/a
Oracle ASM SPFILE in a disk group	>= 11.2	n/a	n/a
Oracle ASM File Access Control	>= 11.2	>= 11.2	n/a
Volumes in disk groups	>= 11.2	n/a	>= 11.2
`ASM_POWER_LIMIT` value up to `1024`	>= 11.2.0.2	n/a	n/a
Encryption, replication, security, tagging	>= 11.2.0.2	n/a	>= 11.2.0.2

Table 4-4 Maximum Oracle ASM file sizes for disk groups with AU_SIZE equal to 1 MB

Redundancy	COMPATIBLE.RDBMS = 10.1	COMPATIBLE.RDBMS >= 11.1
External	16 TB	140 PB
Normal	5.8 TB	23 PB
High	3.9 TB	15 PB

[3] Perform ongoing maintenance tasks on ASM disk groups

Add data to the newly created diskgroup. This is to test the effects of rebalance operations.

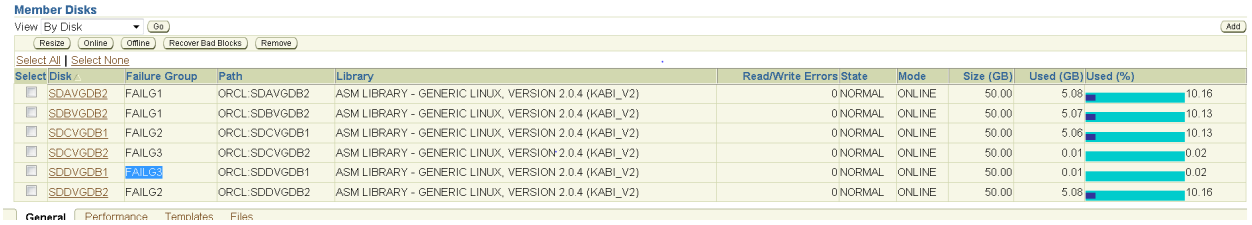
```
CREATE DISKGROUP ORADATA02 NORMAL REDUNDANCY
  FAILGROUP FAILG1 DISK
    'ORCL:SDAVGDB2' SIZE 51199 M,
    'ORCL:SDBVGDB2' SIZE 51199 M
  FAILGROUP FAILG2 DISK
    'ORCL:SDCVGDB1' SIZE 51199 M,
    'ORCL:SDDVGDB2' SIZE 51199 M
  ATTRIBUTE 'au_size'='4M',
    'compatible.asm' = '11.2',
    'compatible.rdbms' = '11.2',
    'compatible.advm' = '11.2';
```

1. Extend and existing diskgroup by adding disks and specifying failgroup and without rebalancing

   ```
   SQL> !cat alter_dg_oradata02_add_disk.sql
   ALTER DISKGROUP ORADATA02
   ADD FAILGROUP  FAILG3 DISK
    'ORCL:SDCVGDB2' SIZE 51199 M,
    'ORCL:SDDVGDB1' SIZE 51199 M
   ;
   ```

2. Rebalance the diskgroup after adding a disk with low rebalance power and note down the cpu consumption

   Data distribution before rebalance.




```
 1  select a.GROUP_NUMBER,a.name,b.NAME,b.FAILGROUP,b.OS_MB,b.total_mb,b.free_mb
  2  from  v$asm_diskgroup a,v$asm_disk b
  3  where a.GROUP_NUMBER=b.GROUP_NUMBER
  4* and a.group_number=5
SQL> /

GROUP_NUMBER NAME                           NAME                           FAILGROUP                       OS_MB
TOTAL_MB     FREE_MB
------------ ------------------------------ ------------------------------ ------------------------------ ---------- --
-------- ----------
           5 ORADATA02                      SDDVGDB2                       FAILG2                          51199
51196      45992
           5 ORADATA02                      SDCVGDB1                       FAILG2                          51199
51196      46012
           5 ORADATA02                      SDCVGDB2                       FAILG3                          51199
51196      51188
           5 ORADATA02                      SDAVGDB2                       FAILG1                          51199
51196      45996
           5 ORADATA02                      SDDVGDB1                       FAILG3                          51199
51196      51188
           5 ORADATA02                      SDBVGDB2                       FAILG1                          51199
51196      46008

6 rows selected.
```

SQL> !cat alter_dg_oradata02_rebalance_2.sql
ALTER DISKGROUP oradata02 REBALANCE POWER 2 WAIT;

Diskgroup altered.

Elapsed: 00:08:44.68

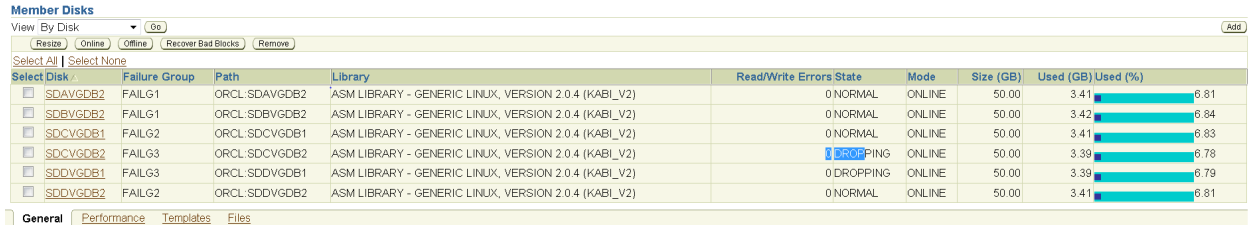
```
  1* select * from v$ASM_OPERATION
SQL> /

GROUP_NUMBER OPERA STAT      POWER     ACTUAL      SOFAR   EST_WORK   EST_RATE EST_MINUTES ERROR_CODE
------------ ----- ---- ---------- ---------- ---------- ---------- ---------- ----------- ------------------------------
----------------
           5 REBAL RUN           2          2        636       2144        368           4
```

It took 8 minutes with power limit set to 2.

3. Restart the rebalance operation with a higher rebalance power and note down the cpu consumption.
   SQL> !cat alter_dg_oradata02_drop_failg3.sql
   ALTER DISKGROUP oradata02 drop DISKS IN FAILGROUP FAILG3;

   SQL> @alter_dg_oradata02_drop_failg3.sql

   Diskgroup altered.




```
 1  select a.GROUP_NUMBER,a.name,b.NAME,b.FAILGROUP,b.total_mb,b.free_mb,MODE_STATUS,b.STATE
 2  from  v$asm_diskgroup a,v$asm_disk b
 3  where a.GROUP_NUMBER=b.GROUP_NUMBER
 4* and a.group_number=5
SQL> /

GROUP_NUMBER NAME                 NAME                 FAILGROUP            TOTAL_MB    FREE_MB MODE_ST STATE
```

```
------------ ------------------------------ ------------------------------ ------------------------------ ---------- ---------- ------- --------
       5 ORADATA02                    SDDVGDB2                       FAILG2                          51196      47708 ONLINE  NORMAL
       5 ORADATA02                    SDCVGDB1                       FAILG2                          51196      47700 ONLINE  NORMAL
       5 ORADATA02                    SDCVGDB2                       FAILG3                          51196      47724 ONLINE  DROPPING
       5 ORADATA02                    SDAVGDB2                       FAILG1                          51196      47708 ONLINE  NORMAL
       5 ORADATA02                    SDDVGDB1                       FAILG3                          51196      47720 ONLINE  DROPPING
       5 ORADATA02                    SDBVGDB2                       FAILG1                          51196      47696 ONLINE  NORMAL

6 rows selected.

SQL>  select * from v$asm_operation;

GROUP_NUMBER OPERA STAT     POWER     ACTUAL     SOFAR   EST_WORK   EST_RATE EST_MINUTES ERROR_CODE
------------ ----- ---- ---------- ---------- ---------- ---------- ---------- ----------- ----------------------------------------------------------------
       5 REBAL WAIT        0
```

Rebalance it manual.

```
SQL> ALTER DISKGROUP oradata02 REBALANCE POWER 11 wait;
```


```
top - 21:57:03 up 2 days,  2:11,  2 users,  load average: 1.65, 1.43, 1.32
Tasks: 305 total,   2 running, 303 sleeping,   0 stopped,   0 zombie
Cpu(s):  5.6%us,  3.2%sy,  0.0%ni, 20.6%id, 47.4%wa,  6.0%hi, 17.2%si,  0.0%st
Mem:   4154652k total,  3771728k used,   382924k free,   208128k buffers
Swap:  4096564k total,        0k used,  4096564k free,  2406536k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
10644 grid      15   0  534m 129m  39m S  6.0  3.2   0:11.51 oracle
 3242 root      RT   0 76220  73m  46m R  1.7  1.8  11:44.05 osysmond.bin


 1* select * from v$asm_operation
SQL> /


GROUP_NUMBER OPERA STAT     POWER     ACTUAL     SOFAR   EST_WORK   EST_RATE EST_MINUTES ERROR_CODE
------------ ----- ---- ---------- ---------- ---------- ---------- ---------- ----------- ----------------------------------------------------------------
       5 REBAL RUN        11         11       1437       2375        475           1



 1  select
a.GROUP_NUMBER,a.name,b.NAME,b.FAILGROUP,b.OS_MB,b.total_mb,b.free_mb,MOUNT_STATUS,HEADER_STATUS,MODE_STATUS,b.STATE
 2  from  v$asm_diskgroup a,v$asm_disk b
 3  where a.GROUP_NUMBER=b.GROUP_NUMBER
 4* and a.group_number=5
SQL> /

GROUP_NUMBER NAME                 NAME                 FAILGROUP                       OS_MB   TOTAL_MB    FREE_MB MOUNT_S
HEADER_STATU MODE_ST STATE
------------ ------------------------------ ------------------------------ ------------------------------ ---------- ---------- ---------- ------- ------------ ------- --------
       5 ORADATA02                    SDBVGDB2                       FAILG1                          51199      51196      46000 CACHED  MEMBER       ONLINE
NORMAL
       5 ORADATA02                    SDAVGDB2                       FAILG1                          51199      51196      46004 CACHED  MEMBER       ONLINE
NORMAL
       5 ORADATA02                    SDDVGDB2                       FAILG2                          51199      51196      46000 CACHED  MEMBER       ONLINE
NORMAL
       5 ORADATA02                    SDCVGDB1                       FAILG2                          51199      51196      46004 CACHED  MEMBER       ONLINE
NORMAL
```

Elapsed: 00:00:00.23

Now add the disks back again.

```
SQL> !cat alter_dg_oradata02_add_disk.sql
ALTER DISKGROUP ORADATA02
ADD FAILGROUP  FAILG3 DISK
  'ORCL:SDCVGDB2' SIZE 51199 M,
  'ORCL:SDDVGDB1' SIZE 51199 M
;

SQL> @alter_dg_oradata02_add_disk.sql

Diskgroup altered.

Elapsed: 00:00:13.49
```

Now manually rebalance.

```
SQL> !cat alter_dg_oradata02_rebalance_6.sql
ALTER DISKGROUP oradata02 REBALANCE POWER 8 ;

SQL> @alter_dg_oradata02_rebalance_6.sql



Diskgroup altered.

Elapsed: 00:00:07.53
```

It took 8 minutes with power limit set to 2
It took 5-6 minutes with power limit set to 8

```
SQL> /

GROUP_NUMBER OPERA STAT     POWER    ACTUAL     SOFAR   EST_WORK   EST_RATE EST_MINUTES ERROR_CODE
------------ ----- ---- ---------- ---------- ---------- ---------- ---------- ----------- ----------
           5 REBAL RUN         8          8        487       2130        349           4


select
a.GROUP_NUMBER,a.name,b.NAME,b.FAILGROUP,b.OS_MB,b.total_mb,b.free_mb,MOUNT_STATUS,HEADER_STATUS,
MODE_STATUS,b.STATE
from  v$asm_diskgroup a,v$asm_disk b
where a.GROUP_NUMBER=b.GROUP_NUMBER
and a.group_number=5
/SQL>   2    3    4    5

GROUP_NUMBER NAME                           NAME                           FAILGROUP
OS_MB   TOTAL_MB    FREE_MB MOUNT_S HEADER_STATU MODE_ST STATE
------------ ------------------------------ ------------------------------ ----------------------
-------- ---------- ---------- ---------- ------- ------------ ------- --------
```

```
          5 ORADATA02                       SDDVGDB2                       FAILG2
51199     51196      47708 CACHED  MEMBER       ONLINE  NORMAL
          5 ORADATA02                       SDCVGDB1                       FAILG2
51199     51196      47700 CACHED  MEMBER       ONLINE  NORMAL
          5 ORADATA02                       SDCVGDB2                       FAILG3
51199     51196      47720 CACHED  MEMBER       ONLINE  NORMAL
          5 ORADATA02                       SDAVGDB2                       FAILG1
51199     51196      47708 CACHED  MEMBER       ONLINE  NORMAL
          5 ORADATA02                       SDDVGDB1                       FAILG3
51199     51196      47724 CACHED  MEMBER       ONLINE  NORMAL
          5 ORADATA02                       SDBVGDB2                       FAILG1
51199     51196      47696 CACHED  MEMBER       ONLINE  NORMAL

6 rows selected.

Elapsed: 00:00:00.22
```

4. Adding/dropping disks in the same command:
   This is useful when replacing disks and avoids multiple rebalance operations.
   ALTER DISKGROUP FRA
   ADD Disk 'ORCL:SDE7' NAME 'FRA_DISK5' size 977 M,
   Disk 'ORCL:SDE8' NAME 'FRA_DISK6' size 977 M
   DROP DISK FRA_DISK1, FRA_DISK2;

5. Drop a disk from the newly created diskgroup.
   Drop diskgroup data;
   Drop diskgroup data including contents;
   Drop diskgroup data force including contents;

6. Undropping disks in a disk group
   This feature can be used to cancel any pending asm disk drop operations.

   ALTER DISKGROUP <dg> UNDROP disks;

7. Mounting disk groups and unmounting disk groups
   ALTER DISKGROUP DATA MOUNT;
   AKTER DISKGROUP DG1, DG2 MOUNT;
   ALTER DISKGROUP ALL DISMOUNT;
8. View ALL connected clients
   SQL> select g.name disk_group,c.*
     2 from v$asm_client c,v$asm_diskgroup g
     3 where c.group_number=g.group_number
     4 and g.name='ORADATA01';

```
DISK_GROUP                     GROUP_NUMBER INSTANCE_N DB_NAME  STATUS       SOFTWARE_V
COMPATIBLE
------------------------------ ------------ ---------- -------- ------------ ---------- -
---------
ORADATA01                                 3 racdb1     racdb    CONNECTED    11.2.0.2.0
11.2.0.0.0
```

9. Checking consistency of disk group metadata
   alter diskgroup ORADATA01 check [REPAIR | NOREPAIR];

   Diskgroup altered.
10. ASM Fast Mirror Resync

    Whenever ASM is unable to write an extent, ASM takes the associated disk offline. If the corresponding disk group uses ASM mirroring (NORMAL or HIGH redundancy), at least one mirror copy of the same extent exists on another disk in the disk group.

    Before Oracle Database 11*g*, ASM assumed that an offline disk contains only stale data and no longer reads from such disks. Shortly after a disk is put offline, ASM drops it from the disk group by re-creating the extents allocated to the disk on the remaining disks in the disk group using mirrored extent copies. This process is quite resource intensive and can take hours to complete. If the disk is replaced or the failure is repaired, the disk must be added again and another rebalance operation must take place.

    ASM fast mirror resync significantly reduces the time required to resynchronize a transient failure of a disk. When a disk goes offline following a transient failure, ASM tracks the extents that are modified during the outage. When the transient failure is repaired, ASM can quickly resynchronize only the ASM disk extents that have been affected during the outage.

    Using ASM fast mirror resync, the failed disk is taken offline but not dropped if you have set the DISK_REPAIR_TIME attribute for the corresponding disk group. The setting for this attribute determines the duration of disk outage that ASM will tolerate while still being able to resynchronize after you complete the repair. Note that the tracking mechanism uses one bit for each modified extent and is very efficient.
11. Preferred Read Failure Groups.

    In a multisite cluster, with separate storage at each site, preferred read failure groups allow every node in the cluster to read from its local disks resulting in better performance.

    With Oracle Database 11*g*, you can do this by configuring the preferred mirror read using the new initialization parameter, ASM_PREFERRED_READ_FAILURE_GROUPS. The disks in the identified failure groups become the preferred read disks. Thus, every node can be configured to read from its local extent copy. This results in higher efficiency and performance, and reduced network traffic. The setting for this parameter is instance specific.

    If there is more than one mirrored copy and you have set a value for the ASM_PREFERRED_READ_FAILURE_GROUPS parameter, ASM first reads the copy that resides on a preferred read disk. If that read fails, ASM attempts to read from another mirrored copy that might not be on a local preferred read disk.

    You can use the PREFERRED_READ column in the V$ASM_DISK view to determine whether a particular disk belongs to a preferred read failure group.

    To identify performance issues with the ASM preferred read failure groups, use the V$ASM_DISK_IOSTAT view. This view displays input/output statistics for each ASM client.

12. ASM Disk statistics.

1* select sum(read_errs)+sum(write_errs) errors from v$asm_disk

SQL> /

ERRORS

0

```
  1  select instname ,g.name diskgroup,sum(reads) reads,sum(writes)
writes,sum(BYTES_READ) BYTES_READ,sum(BYTES_WRITTEN) BYTES_WRITTEN
  2   from v$asm_disk_iostat i,v$asm_diskgroup g
  3   where i.group_number=g.group_number
  4*  group by instname,g.name
SQL>
INSTNAME                                                         DISKGROUP
READS     WRITES BYTES_READ BYTES_WRITTEN
---------------------------------------------------------------- ------------------------
------ ---------- ---------- ---------- -------------
+ASM1                                                            ACFS1
0          0          0             0
+ASM1                                                            CRSDG
0          0          0             0
racdb1                                                           ORAFRA01
1269      30776   75123200     523048960
racdb1                                                           ORADATA01
129563      43366 2865952768     619517952
racdb1                                                           ORADATA02
1035         24    8478720        196608
```

[4] Explain key performance and scalability considerations for ASM disk groups

1. Create separate disk groups for data and FRA
2. Disks in a diskgroup should have same size and characteristics
3. Use separate disk groups for each database . This has benefits and drawbacks. Using same diskgroup uses storage efficiently but introduces a single point of failure for all databases

Administering ASM Files, Directories, and Templates

[1] Use different client tools to access ASM files

[2] Describe the format of a fully qualified ASM file name

[3] Explain how ASM files, directories and aliases are created and managed

[4] Understand and manage disk group templates

Administering ASM Cluster File Systems

[1] Administer ASM Dynamic Volume Manager
[2] Manage ASM volumes
[3] Implement ASM Cluster File System
[4] Manage ASM Cluster File System (ACFS)
[5] Use ACFS Snapshots
[6] Using command line tools to Manage ACFS

Section 2 - Real Application Clusters

Real Application Clusters Database Installation

[1] Install the Oracle database software
[2] Create a cluster database
[3] Perform post-database creation tasks
[4] Perform a single instance to RAC conversion

RAC Database Administration

[1] Use Enterprise Manager cluster database pages
[2] Define redo log files in a RAC environment
[3] Define undo tablespaces in a RAC environment
[4] Start and stop RAC databases and instances
[5] Modify initialization parameters in a RAC environment

Managing Backup and Recovery for RAC

[1] Configure the RAC database to use ARCHIVELOG mode and the flash recovery area
[2] Recover from media failure and instance failures
[3] Tune instance recovery in RAC
[4] Configure RMAN for the RAC environment

RAC DB Monitoring and Tuning

[1] Determine RAC-specific tuning components
[2] Determine RAC-specific wait events, global enqueues, and system statistics
[3] Implement the most common RAC tuning tips
[4] Use the Cluster Database Performance pages
[5] Use the Automatic Workload Repository (AWR) in RAC
[6] Use Automatic Database Diagnostic Monitor (ADDM) in RAC

Services

[1] Configure and manage services in a RAC environment
[2] Use services with client applications
[3] Use services with the Database Resource Manager and scheduler
[4] Configure services aggregation and tracing

High Availability Connections (Appendix-D)

[1] Configure client-side, connect-time load balancing and connect-time failover
[2] Configure server-side, connect-time load balancing
[3] Use the Load Balancing Advisory (LBA)
[4] Describe the benefits of Fast Application Notification (FAN)
[5] Configure server-side callouts
[6] Configure Transparent Application Failover (TAF)

Design for High Availability

[1] Design a Maximum Availability Architecture in your environment
[2] Determine the best RAC and Data Guard topologies for your environment
[3] Configure the Data Guard Broker configuration files in a RAC environment
[4] Patch your RAC system in a rolling fashion

Appendix

Commands and outputs

SRVCTL

1. To list the virtual ip information on the node (run srvctl from the grid user/clusterware home)
   [grid@tslinrac01 ~]$ srvctl config nodeapps -a
   Network exists: 1/192.168.1.0/255.255.255.0/eth1, type static
   VIP exists: /tslinrac01-vip/192.168.1.201/192.168.1.0/255.255.255.0/eth1, hosting node tslinrac01
   VIP exists: /tslinrac02-vip/192.168.1.202/192.168.1.0/255.255.255.0/eth1, hosting node tslinrac02

CRSCTL

1. Check the state of the cluster resources :
   /u01/app/11.2.0/grid/bin/crsctl stat res –t
2. /u01/app/11.2.0/grid/bin/crsctl query css votedisk
   # Query to list voting disks.
   ## STATE File Universal Id File Name Disk group
   -- ----- ----------------- --------- ---------
   1. ONLINE 0af83b84fca64f05bf96f027b6fcafc9 (ORCL:SDAVGCRS1) [CRSDG]
   2. ONLINE 3492f4ef75924f56bf57d59ed58f7a6d (ORCL:SDBVGCRS1) [CRSDG]
   3. ONLINE 9c2f851a0bdf4fd1bfd08b8d7da459aa (ORCL:SDCVGCRS1) [CRSDG]
   Located 3 voting disk(s).
3. STOP crs:
   [root@tslinrac02 ~]# crsctl stop crs
   CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources on 'tslinrac02'

CRS-2673: Attempting to stop 'ora.crsd' on 'tslinrac02'
CRS-2790: Starting shutdown of Cluster Ready Services-managed resources on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.LISTENER.lsnr' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.racdb.svc_racdb2.svc' on 'tslinrac02'
CRS-2677: Stop of 'ora.racdb.svc_racdb2.svc' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.LISTENER.lsnr' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.tslinrac02.vip' on 'tslinrac02'
CRS-2677: Stop of 'ora.tslinrac02.vip' on 'tslinrac02' succeeded
CRS-2672: Attempting to start 'ora.tslinrac02.vip' on 'tslinrac01'
CRS-2676: Start of 'ora.tslinrac02.vip' on 'tslinrac01' succeeded
CRS-2672: Attempting to start 'ora.racdb.svc_racdb2.svc' on 'tslinrac01'
CRS-2676: Start of 'ora.racdb.svc_racdb2.svc' on 'tslinrac01' succeeded
CRS-2673: Attempting to stop 'ora.ACFS1.dg' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.CRSDG.dg' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.registry.acfs' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.racdb.db' on 'tslinrac02'
CRS-2677: Stop of 'ora.registry.acfs' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.racdb.db' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.ORADATA01.dg' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.ORAFRA01.dg' on 'tslinrac02'
CRS-2677: Stop of 'ora.ACFS1.dg' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.ORADATA01.dg' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.ORAFRA01.dg' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.CRSDG.dg' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.asm' on 'tslinrac02'
CRS-2677: Stop of 'ora.asm' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.ons' on 'tslinrac02'
CRS-2677: Stop of 'ora.ons' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.net1.network' on 'tslinrac02'
CRS-2677: Stop of 'ora.net1.network' on 'tslinrac02' succeeded
CRS-2792: Shutdown of Cluster Ready Services-managed resources on 'tslinrac02' has completed
CRS-2677: Stop of 'ora.crsd' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.drivers.acfs' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.crf' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.ctssd' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.evmd' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.asm' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.mdnsd' on 'tslinrac02'
CRS-2677: Stop of 'ora.asm' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.cluster_interconnect.haip' on 'tslinrac02'
CRS-2677: Stop of 'ora.drivers.acfs' on 'tslinrac02' succeeded

CRS-2677: Stop of 'ora.mdnsd' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.crf' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.cluster_interconnect.haip' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.evmd' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.ctssd' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.cssd' on 'tslinrac02'
CRS-2677: Stop of 'ora.cssd' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.gipcd' on 'tslinrac02'
CRS-2673: Attempting to stop 'ora.diskmon' on 'tslinrac02'
CRS-2677: Stop of 'ora.diskmon' on 'tslinrac02' succeeded
CRS-2677: Stop of 'ora.gipcd' on 'tslinrac02' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd' on 'tslinrac02'
CRS-2677: Stop of 'ora.gpnpd' on 'tslinrac02' succeeded
CRS-2793: Shutdown of Oracle High Availability Services-managed resources on 'tslinrac02' has completed
CRS-4133: Oracle High Availability Services has been stopped.

4. START crs:
   [root@tslinrac02 ~]# crsctl start crs
   CRS-4123: Oracle High Availability Services has been started.
   [root@tslinrac02 ~]# ps -ef |grep grid
   root 23166 1 5 05:52 ? 00:00:01 /u01/app/11.2.0/grid/bin/ohasd.bin reboot
   grid 23282 1 2 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/oraagent.bin
   grid 23294 1 0 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/mdnsd.bin
   grid 23303 1 3 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/gpnpd.bin
   root 23314 1 2 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/orarootagent.bin
   grid 23317 1 5 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/gipcd.bin
   root 23331 1 3 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/osysmond.bin
   root 23342 1 1 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/cssdmonitor
   root 23358 1 1 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/cssdagent
   grid 23360 1 0 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/diskmon.bin -d -f
   grid 23376 1 5 05:53 ? 00:00:00 /u01/app/11.2.0/grid/bin/ocssd.bin
5. DISABLE crs:
6. ENABLE crs:

7. CHECK crs: crsctl check crs
   [root@tslinrac02 ~]# crsctl check crs
   CRS-4638: Oracle High Availability Services is online
   CRS-4537: Cluster Ready Services is online
   CRS-4529: Cluster Synchronization Services is online
8. CHECK cluster: crsctl check cluster
   [root@tslinrac02 ~]# crsctl check cluster
   CRS-4537: Cluster Ready Services is online
   CRS-4529: Cluster Synchronization Services is online

CRS-4533: Event Manager is online

9. Check Cluster registry location:
   [grid@tslinrac02 ~]$ cat /etc/oracle/ocr.loc
   ocrconfig_loc=+CRSDG
   local_only=FALSE
10. Check cluster registry location: using ocrcheck
    [root@tslinrac02 ~]# ocrcheck
    Status of Oracle Cluster Registry is as follows :
        Version : 3
        Total space (kbytes) : 262120
        Used space (kbytes) : 3236
        Available space (kbytes) : 258884
        ID : 2006039960
        Device/File Name : +CRSDG
                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
11. Check CRS version
    [root@tslinrac01 backup_nfs]# crsctl query crs activeversion
    Oracle Clusterware active version on the cluster is [11.2.0.2.0]
12. Sdf
13. Sdf

OCRCONFIG

1. Locating OCR automatic backups: ocrconfig -showbackup auto

   [grid@tslinrac02 ~]$ ocrconfig -showbackup auto

   tslinrac01 2011/05/04 22:38:44 /u01/app/11.2.0/grid/cdata/tslin-cluster/backup00.ocr

   tslinrac01 2011/05/04 18:38:43 /u01/app/11.2.0/grid/cdata/tslin-cluster/backup01.ocr

   tslinrac01 2011/05/04 14:38:42 /u01/app/11.2.0/grid/cdata/tslin-cluster/backup02.ocr

   tslinrac01 2011/05/03 22:38:38 /u01/app/11.2.0/grid/cdata/tslin-cluster/day.ocr

   tslinrac02 2011/04/27 20:33:16 /u01/app/11.2.0/grid/cdata/tslin-cluster/week.ocr
2. Change OCR Backup location: ocrconfig -backuploc /backup_nfs/ocr_backup

3. Manual OCR backup and manual logical export of OCR:

```
[root@tslinrac01 backup_nfs]# ocrconfig -manualbackup

tslinrac01     2011/05/10 06:14:36     /backup_nfs/ocr_backup/backup_20110510_061436.ocr
[root@tslinrac01 backup_nfs]# ll /backup_nfs/ocr_backup/backup_20110510_061436.ocr
-rw-------+ 1 root root 7565312 May 10  2011 /backup_nfs/ocr_backup/backup_20110510_061436.ocr
[root@tslinrac01 backup_nfs]# ocrconfig -showbackup manual

tslinrac01     2011/05/10 06:14:36     /backup_nfs/ocr_backup/backup_20110510_061436.ocr
[root@tslinrac01 ocr_backup]# ocrconfig -export /backup_nfs/ocr_backup/ocr.export1
[root@tslinrac01 ocr_backup]# ls -ltr
total 7516
-rw-------+ 1 root root 7565312 May 10 06:16 backup_20110510_061436.ocr
-rw-rw-rw-+ 1 root root  113772 May 10  2011 ocr.export1
```

ASM Disk operations

1. Create ASM diskgroup

```
CREATE DISKGROUP ORADATA02 NORMAL REDUNDANCY
  FAILGROUP FAILG1 DISK
    'ORCL:SDAVGDB2' SIZE 51199 M,
    'ORCL:SDBVGDB2' SIZE 51199 M
  FAILGROUP FAILG2 DISK
    'ORCL:SDCVGDB1' SIZE 51199 M,
    'ORCL:SDDVGDB2' SIZE 51199 M
  ATTRIBUTE 'au_size'='4M',
    'compatible.asm' = '11.2',
    'compatible.rdbms' = '11.2',
    'compatible.advm' = '11.2';
```

2. Extend and existing diskgroup by adding disks and specifying failgroup and without rebalancing

```
ALTER DISKGROUP ORADATA02
ADD FAILGROUP  FAILG3 DISK
  'ORCL:SDCVGDB2' SIZE 51199 M,
  'ORCL:SDDVGDB1' SIZE 51199 M
;
```

3. List ASM disks of a disk group.

```
select a.GROUP_NUMBER,a.name,b.NAME,b.FAILGROUP,b.OS_MB,b.total_mb,b.free_mb
from  v$asm_diskgroup a,v$asm_disk b
where a.GROUP_NUMBER=b.GROUP_NUMBER
and a.group_number=5;
```

4. Rebalance a disk group.

```
ALTER DISKGROUP oradata02 REBALANCE POWER 2 WAIT;
```

5. List the current state of disks in a disk group
   Select
   a.GROUP_NUMBER,a.name,b.NAME,b.FAILGROUP,b.total_mb,b.free_mb,MODE_STATUS,b.STATEfrom v$asm_diskgroup a,v$asm_disk bwhere a.GROUP_NUMBER=b.GROUP_NUMBERand a.group_number=5

6. List current ASM operations.

   select * from v$asm_operation;

7. Drop all disks from a failure group
   ALTER DISKGROUP oradata02 drop DISKS IN FAILGROUP FAILG3;

ASMCMD

1. Listing disks.

```
[grid@tslinrac01 ~]$ asmcmd
ASMCMD> lsdg
State    Type    Rebal  Sector  Block       AU  Total_MB  Free_MB  Req_mir_free_MB
Usable_file_MB  Offline_disks  Voting_files  Name
MOUNTED  NORMAL  N         512   4096  1048576    204796   102085            25740
38172              0             N  ACFS1/
MOUNTED  NORMAL  N         512   4096  1048576      6138     5212              309
2451               0             Y  CRSDG/
MOUNTED  NORMAL  N         512   4096  1048576    102398       10                0
5              0             N  ORADATA01/
MOUNTED  NORMAL  N         512   4096  4194304    307176   286256             6988
139634               0             N  ORADATA02/
MOUNTED  NORMAL  N         512   4096  1048576    102398   101726                0
50863              0             N  ORAFRA01/
ASMCMD>
```

2. Listing ASM operations

```
ASMCMD> lsop
Group_Name  Dsk_Num  State  Power
ASMCMD>
```

3.