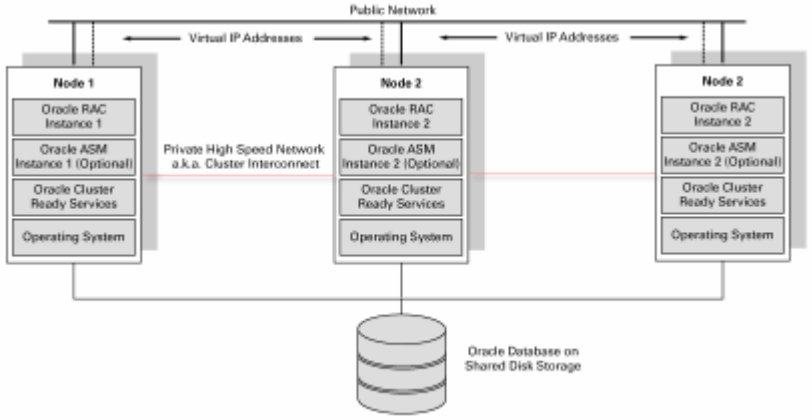
RAC 10g R2 on Red Hat Linux
Detail Design and Best Practices

Alejandro Vargas,
Oracle Israel,
Principal Support Consultant



INDEX

BEFORE STARTING 4
Before Starting Notes and Recommendations 4
Topology Diagram Example 5
OPERATING SYSTEM 6
1) Red Hat Certification 6
2) Configure the Kernel Parameters on each node 8
3) Network Configuration 9
NIC's 9
/etc/hosts 10
4) Interconnect Configuration 11
5) Clock Synchronization 12
6) Swap Space 12
7) Configure Hangcheck Timer on all nodes 12
8) Create /dev/timedev Device on each node 13
9) Check ping from all nodes to all nodes 13
10) Configure SSH 13
11) Configure User Equivalence 14
12) Mount the Oracle Sources Directory 14
STORAGE CONFIGURATION 15
13) Prepare Shared Disks for Oracle Clusterware 15
14) Prepare Shared Disks for Oracle ASM (Automatic Storage Management) 18
15) Configure ASMLib for ASM Management 19
Download ASMLib Rpm's 19
Install ASMLib Rpm's 20
Configure ASMLib on all nodes 20
Create ASM disks on FIRST NODE only 21
Verify ASM Disks Creation 21

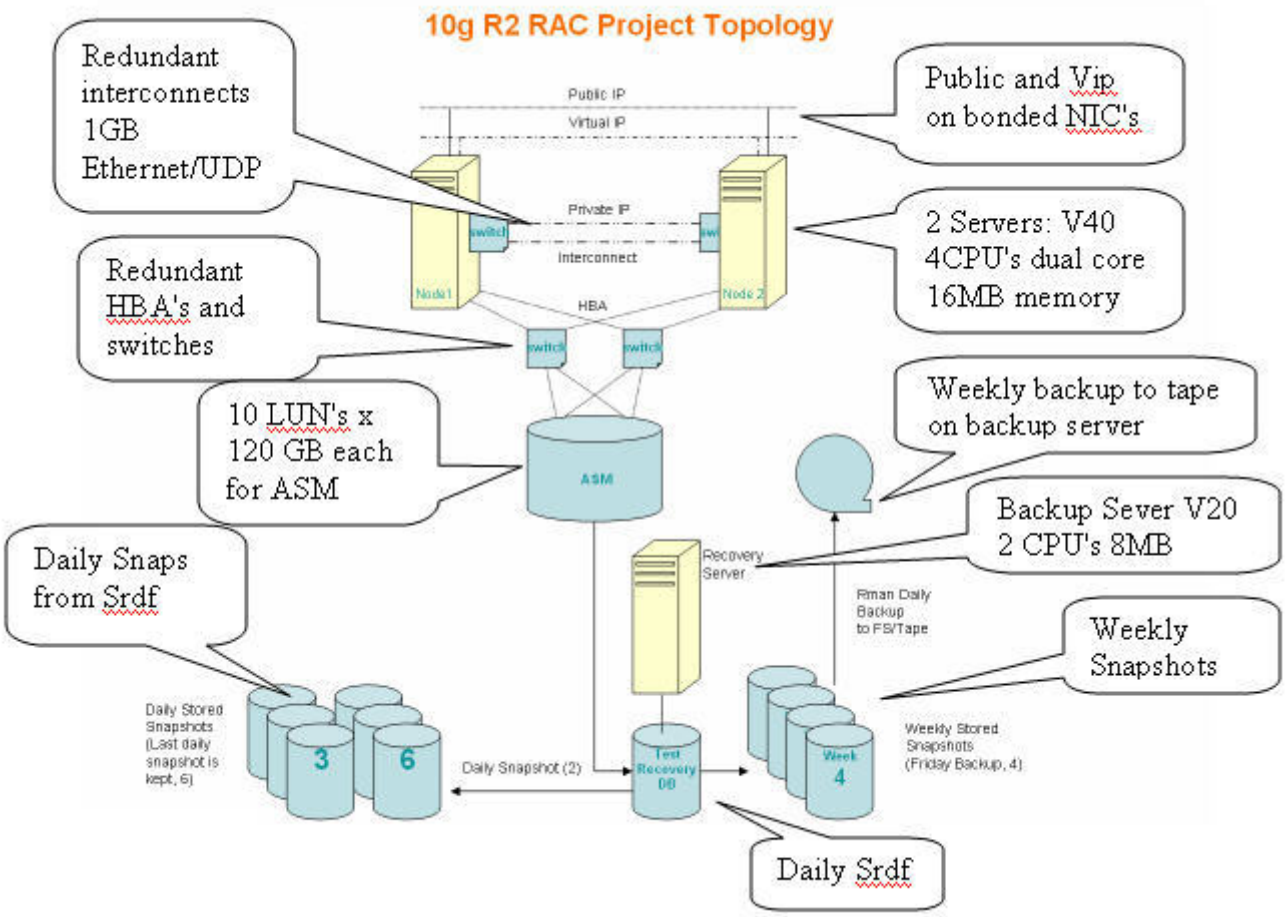
SCAN ASM disks on ALL Other Nodes 22
16) Provision File System for Oracle Software 23
17) Create Local Mount Points for Oracle Software 23
ORACLE USER CONFIGURATION 24
18) Create the Oracle User and Group DBA on All Nodes 24
19) Setup oracle user password 25
20) Set Limits for user Oracle 25
21) Setup Oracle user .cshrc on all nodes 26
ORACLE SOFTWARE INSTALL 30
22) Configure Cluster Verification Utility 30
23) RAC Related Software Install 31
24) Install Oracle Clusterware 31
25) Install ASM Oracle Home 32
26) Install Database Oracle Home 32
27) Install Agent Oracle Home 33
28) Install 10.2.0.3 Patch on CRS, ASM, Database and Agent Oracle Homes 33
29) Create ASM Instance 33
30) Create RAC Database 34
31) Configure XDB for ASM Management 34
MAINTENANCE BEST PRACTICES 35
32) GENERIC 35
33) ASM 36
34) Backup and Recovery 36
35) Interconnect 36
End of the Document. 36

BEFORE STARTING

Before Starting Notes and Recommendations

- Several teams need to collaborate to bring up a RAC project.
- Each project includes different layers of hardware and software that may vary from one project to the next.
- Take the time to draw the project topology
- Add as much details as you can to the topology diagram
- Share this document with all members of the team
- Before starting make a meeting with all members of the team and check that all aspects of the project are well understood.

Topology Diagram Example



OPERATING SYSTEM

1) Red Hat Certification

RAC on Linux, Server Certifications

OS	Product	Certified With	Version	Status	Addtl. Info.	Components	Other	Install Issue
Red Hat Enterprise AS/ES 4	10gR2	Oracle Clusterware	10g	Certified	None	None	None	None
Red Hat Enterprise AS/ES 3	10gR2	Oracle Clusterware	10g	Certified	None	None	None	None
Oracle Enterprise Linux 4	10gR2	Oracle Clusterware	10g	Certified	None	None	None	None

Red Hat 3 should be at least Update 5
Red Hat 4 should be at least Update 2

BEST PRACTICE: Use hugemem Kernel for 32 bit systems, it provides better performance and stability

Check up to date Linux certification on Oracle Metalink, choose the Certification tag, then → Operating Systems → Linux x86 or Linux x86_64 → Real Applications Clusters

More details on RAC Technologies Matrix for Linux x86 Clusters and
RAC Technologies Matrix for Linux x86-64 (AMD64/EM64T) Clusters

Recommended Kernels

It is advisable to choose a kernel that is compatible with ASMLib. To check up to date compatibility matrix go to Oracle ASMLib Downloads for Red Hat Enterprise Linux 4 AS or Oracle ASMLib Downloads for Red Hat Enterprise Linux 3 AS

Compatible Kernels:

AMD64 / Intel em64t Architecture

- Kernel 2.4.21-47.0.1.EL
- Kernel 2.4.21-47.EL
- Kernel 2.4.21-40.EL
- Kernel 2.4.21-37.0.1.EL
- Kernel 2.4.21-37.EL
- Kernel 2.4.21-32.0.1.EL
- Kernel 2.4.21-32.EL
- Kernel 2.4.21-27.0.4.EL
- Kernel 2.4.21-27.EL

Intel IA64 Architecture

```
   Kernel 2.4.21-47.0.1.EL
   Kernel 2.4.21-47.EL
   Kernel 2.4.21-40.EL
   Kernel 2.4.21-37.0.1.EL
   Kernel 2.4.21-37.EL
   Kernel 2.4.21-32.0.1.EL
   Kernel 2.4.21-32.EL
   Kernel 2.4.21-27.0.4.EL
   Kernel 2.4.21-27.EL

Intel IA32 (x86) Architecture

   Kernel 2.4.21-47.0.1.EL
   Kernel 2.4.21-47.EL
   Kernel 2.4.21-40.EL
   Kernel 2.4.21-37.0.1.EL
   Kernel 2.4.21-37.EL
   Kernel 2.4.21-32.0.1.EL
   Kernel 2.4.21-32.EL
   Kernel 2.4.21-27.0.4.EL
   Kernel 2.4.21-27.EL
```

2) Configure the Kernel Parameters on each node

```
As root run the following script on all nodes, to setup kernel parameters:

cat >> /etc/sysctl.conf << EOF
kernel.shmall = 2097152
kernel.shmmax = 2147483648
```

```
kernel.shmmni = 4096
kernel.sem = 250 32000 100 128
fs.file-max = 658576
net.ipv4.ip_local_port_range = 1024 65000
net.core.rmem_default = 262144
net.core.wmem_default = 262144
net.core.rmem_max = 1048536
net.core.wmem_max = 1048536
EOF
```

3) Network Configuration

NIC's

At least two NIC's per server, one for public IP's and One for Interconnect.
NIC's must have the same name on all servers, i.e.:

```
     eth0 public and virtual IP's on all nodes
     eth1 private IP's on all nodes
```

BEST PRACTICES:
- Use NIC bonding to provide redundancy and bandwidth.
- Ensure that all virtual IP's are registered with DNS

The network needs to be configured with 3 IP's on each server:

1) A public IP's registered on DNS

2) A virtual IP's registered on DNS, but NOT defined in the servers.
   It will be defined later during Oracle Clusterware Install
3) A private IP only known to the servers in the RAC configuration,
   to be used by the interconnect.

/etc/hosts

Configure /etc/hosts. They must be identical on all nodes in the cluster.

BEST PRACTICE: clearly identify the type of RAC IP on the name

Example:

```
10.5.225.24     vmractest1              # Public IP on Node 1
10.5.225.36     vmractest2              # Public IP on Node 2
10.5.225.44     vmractest3              # Public IP on Node 3

10.5.225.7      vmractest1-vip          # Virtual IP on Node 1
10.5.225.8      vmractest2-vip          # Virtual IP on Node 2
10.5.225.9      vmractest3-vip          # Virtual IP on Node 3

100.100.100.101 vmractest1-priv         # Private IP on Node 1
100.100.100.102 vmractest2-priv         # Private IP on Node 2
100.100.100.103 vmractest3-priv         # Private IP on Node 3
```

4) Interconnect Configuration

Configure interconnect full duplex / UDP
Interconnect connected through switched Gigabit Ethernet
Use non routable network addresses for private interconnect:
Class A: 10.0.0.0 to 10.255.255.255
Class B: 172.16.0.0 to 172.31.255.255
Class C: 192.168.0.0 to 192.168.255.255

Using other ranges is possible but virtual IP configuration assistant will fail during the last step of Oracle Clusterware installation can be run manually.

Cross cable IS NOT SUPPORTED

BEST PRACTICES:

- Use NIC bonding and redundant interconnects for broader band.
- NIC's to be bonded must be same vendor and type.
- Set NIC and switch frame to Max, verify configuration is the same end to end
- Configure failover and load balancing between the interconnects and switches
- Check that network interfaces are configured correctly in terms of speed, duplex, etc on all nodes.

5) Clock Synchronization

Synchronize clock along all servers on the cluster. Implement NTP (network time protocol) on all nodes.

6) Swap Space

Two times physical memory up to 4 GB. For more than 4 GB swap space should never be less than physical memory.

7) Configure Hangcheck Timer on all nodes

Install and configure hangcheck timer to be started automatically at reboot.

For all RHEL releases:

```
modprobe hangcheck-timer hangcheck_tick=30 hangcheck_margin=180
cat >> /etc/rc.d/rc.local << EOF
modprobe hangcheck-timer hangcheck_tick=30 hangcheck_margin=180
EOF
```

8) Create /dev/timedev Device on each node

As root:

```
mknod /dev/timedev c 15 0
chmod 644 /dev/timedev
```

It provide better performance for gettimeofday() calls

9) Check ping from all nodes to all nodes

To ensure that communication can be established do ping tests using all the IP's

10) Configure SSH

During the installation of Oracle RAC 10*g* Release 2, OUI needs to copy files to and execute programs on the other nodes in the cluster. In order to allow OUI to do that, you must configure SSH to allow user equivalence.

11) Configure User Equivalence

When user equivalence is established, you won't be prompted for a password again.

on all nodes:
exec /usr/bin/ssh-agent $SHELL
/usr/bin/ssh-add

12) Mount the Oracle Sources Directory

Execute as root:

```
 mount Claraapp:/app2/DBBackup /mnt
```

This directory will be used later to perform all Oracle Database Installations

STORAGE CONFIGURATION

13) Prepare Shared Disks for Oracle Clusterware

Oracle Clusterware require access to disks that are shared by each node in the cluster. The purpose of this shared storage is to locate on it the Oracle Cluster Registry, OCR; the Cluster Voting Disk, and the ASM server parameter file.

BEST PRACTICE: Use fast disks for OCR and Voting Disk.

The shared disks must be configured using one of the following methods.

1. OCFS2 (Release 2) http://oss.oracle.com/projects/ocfs2
2. Raw devices
3. Third party cluster filesystem such as GPFS or Veritas

Recommended configuration is OCFS2.
If using Raw devices, make 3 primary partitions equally sized, +150M, i.e.:

```
Disk /dev/sdc: 10.7 GB, 10737418240 bytes
255 heads, 63 sectors/track, 1305 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot    Start       End    Blocks   Id  System
/dev/sdc1             1        19    152586   83  Linux
/dev/sdc2            20        38    152617+  83  Linux
```

```
/dev/sdc3            39        57    152617+  83  Linux
```

Map the partitions to Raw devices with a script like this:

```
-------- script start on next line -----------
mv /dev/raw/raw1 /dev/raw/votingdisk
mv /dev/raw/raw2 /dev/raw/ocr.dbf
mv /dev/raw/raw3 /dev/raw/spfile+ASM.ora
chmod 660 /dev/raw/{votingdisk,ocr.dbf,spfile+ASM.ora}
chown oracle:dba /dev/raw/{votingdisk,ocr.dbf,spfile+ASM.ora}
echo
echo checking the prepared raw devices:
ls -ltr /dev/raw | grep oracle
echo
-------- script end on previous line -----------
```

Edit the /etc/sysconfig/rawdevices file and add the following lines for the cluster, to map the /dev/raw files to its corresponding devices. Take care to use the corresponding name devices on each node, (***/dev/sdc1*** on node 1 may be ***/dev/sde1*** on node 2!)

```
/dev/raw/votingdisk      /dev/sdc1
/dev/raw/ocr.dbf         /dev/sdc2
/dev/raw/spfile+ASM.ora  /dev/sdc3
```

Start the rawdevice service on all nodes:

```
[root@vmractest1 RAWS]# service rawdevices start
Assigning devices:
           /dev/raw/votingdisk  -->   /dev/sdc1
```

```
/dev/raw/raw1:  bound to major 8, minor 81
           /dev/raw/ocr.dbf  -->   /dev/sdc2
/dev/raw/raw2:  bound to major 8, minor 82
           /dev/raw/spfile+ASM.ora  -->   /dev/sdc3
/dev/raw/raw3:  bound to major 8, minor 83
Done
```

Check Raw devices status:

```
[root@vmractest2 RAWS]# service rawdevices status
/dev/raw/raw1:  bound to major 8, minor 81
/dev/raw/raw2:  bound to major 8, minor 82
/dev/raw/raw3:  bound to major 8, minor 83
```

14) Prepare Shared Disks for Oracle ASM (Automatic Storage Management)

BEST PRACTICES:
- The I/O subsystem must be scaleable. If I/O is the bottleneck adding nodes to the cluster will not result in improved performance.
- Use a large number of equally sized disks.
- Use I/O Multipathing
-

ASM do require unformatted block devices. The Storage Administrator shall provide equally sized LUN's for data storage. These LUN's need to have a unique primary partition that span all the blocks of the LUN, i.e.:

```
Disk /dev/sde: 10.7 GB, 10737418240 bytes
255 heads, 63 sectors/track, 1305 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes

   Device Boot    Start       End    Blocks   Id  System
/dev/sde1             1      1305  10482381   83  Linux
```

BEST PRACTICES:
- Disks within a disk group must be of the same size and type to take advantage of ASM data distribution and striping capabilities.
- Use diskgroups with a number of equally sized and same type of disks, at least 4.
- Make sure disks span several backend disk adapters
- Make LUN stripe as close as 1MB, the ASM stripe, as possible.
- Use Disk Labeling

- Use redundant HBA's
- Use Multipathing

15) Configure ASMLib for ASM Management

BEST PRACTICE: Always use ASMLib when available.

Download ASMLib Rpm's

ASMLib 2.0 is delivered as a set of three Linux packages:
- oracleasmlib-2.0 - the ASM libraries
- oracleasm-support-2.0 - utilities needed to administer ASMLib
- oracleasm - a kernel module for the ASM library

Each Linux distribution has its own set of ASMLib 2.0 packages, and within each distribution, each kernel version has a corresponding oracleasm package.

Determine which kernel you are:

```
[root@vmractest1 root]# uname -rm
2.4.21-37.EL i686
```

Use this information to find the correct ASMLib packages on OTN:

1. Point your Web browser to:
Oracle ASMLib Downloads for Red Hat Enterprise Linux 4 AS for Red Hat 4 or
Oracle ASMLib Downloads for Red Hat Enterprise Linux 3 AS for Red Hat 3
2. Download the oracleasmlib and oracleasm-support packages for your version of Linux
3. Download the oracleasm package corresponding to your kernel.

In the example above, the oracleasm-2.4.21-37.EL-1.0.4-1.i686.rpm package was used.

Install ASMLib Rpm's

```
[root@vmractest1 ASMlib]# ls -ltr
total 116
-rwxrwxrwx    1 3096 513  22160 Apr  5  2006 oracleasm-support-2.0.1-1.i386.rpm
-rwxrwxrwx    1 3096 513  73145 Apr  5  2006 oracleasm-2.4.21-37.EL-1.0.4-1.i686.rpm
-rwxrwxrwx    1 3096 513  13436 Apr  5  2006 oracleasmlib-2.0.1-1.i386.rpm

[root@vmractest1 ASMlib]# rpm -Uvh oracleasm-2.4.21-37.EL-1.0.4-1.i686.rpm \
>                                  oracleasmlib-2.0.1-1.i386.rpm \
>                                  oracleasm-support-2.0.1-1.i386.rpm
Preparing...                ########################################### [100%]
   1:oracleasm-support      ########################################### [ 33%]
   2:oracleasm-2.4.21-37.EL ########################################### [ 67%]
   3:oracleasmlib           ########################################### [100%]
```

Configure ASMLib on all nodes

```
[root@vmractest1 ASMlib]# /etc/init.d/oracleasm configure
```

```
Default user to own the driver interface []: oracle
Default group to own the driver interface []: dba
Start Oracle ASM library driver on boot (y/n) [n]: y
Fix permissions of Oracle ASM disks on boot (y/n) [y]: y
Writing Oracle ASM library driver configuration:           [  OK  ]
Creating /dev/oracleasm mount point:                       [  OK  ]
Loading module "oracleasm":                                [  OK  ]
Mounting ASMlib driver filesystem:                         [  OK  ]
Scanning system for ASM disks:                             [  OK  ]
```

Create ASM disks on FIRST NODE only

```
/etc/init.d/oracleasm createdisk DISK_NAME device_name
Tip: Enter the DISK_NAME in UPPERCASE letters.
Ex:
[root@vmractest1 ASMlib]# /etc/init.d/oracleasm createdisk VOL1 /dev/sdc1
Marking disk "/dev/sdc1" as an ASM disk:                   [  OK  ]

[root@vmractest1 ASMlib]# /etc/init.d/oracleasm createdisk VOL2 /dev/sdd1
Marking disk "/dev/sdd1" as an ASM disk:                   [  OK  ]
[root@vmractest1 ASMlib]# /etc/init.d/oracleasm createdisk VOL3 /dev/sde1
Marking disk "/dev/sde1" as an ASM disk:                   [  OK  ]
```

Verify ASM Disks Creation

```
 [root@vmractest1 ASMlib]# /etc/init.d/oracleasm listdisks
```

```
VOL1
VOL2
VOL3
```

SCAN ASM disks on ALL Other Nodes

```
[root@vmractest2 ASMlib_install]# /etc/init.d/oracleasm scandisks
Scanning system for ASM disks:                             [  OK  ]
[root@vmractest3 ASMlib_install]# /etc/init.d/oracleasm scandisks
Scanning system for ASM disks:                             [  OK  ]

And then check that everything is as in the first node:
[root@vmractest2 ASMlib_install]# /etc/init.d/oracleasm listdisks
VOL1
VOL2
VOL3

[root@vmractest3 ASMlib_install]# /etc/init.d/oracleasm listdisks
VOL1
VOL2
VOL3
```

16) Provision File System for Oracle Software

Oracle Install on RAC 10g R2 comprises 4 Oracle Homes:

10g CRS
10g ASM
10g Database
10g Agent

3GB per Oracle Home provides the minimum space required for install and operation

17) Create Local Mount Points for Oracle Software

The path to Oracle software must be the same in all nodes.

(Note that a shared Oracle Home based on OCFS2 may be used)

Repeat this step on all nodes:

```
[root@vmractest1 RAWS]# mkdir -p /oradisk/app01/oracle/product/10gDB
[root@vmractest1 RAWS]# mkdir -p /oradisk/app01/oracle/product/10gASM
[root@vmractest1 RAWS]# mkdir -p /oradisk/app01/oracle/product/10gCRS
[root@vmractest1 RAWS]# mkdir -p /oradisk/app01/oracle/product/10gAgent

[root@vmractest1 RAWS]# chown -R oracle:dba /oradisk
[root@vmractest1 RAWS]# chmod -R 775 /oradisk
```

ORACLE USER CONFIGURATION

18) Create the Oracle User and Group DBA on All Nodes

```
[root@vmractest1 root]# /usr/sbin/groupadd dba
[root@vmractest1 root]# /usr/sbin/useradd –u 500 -m -G dba oracle -s /bin/tcsh
[root@vmractest1 root]# id oracle
uid=500(oracle) gid=501(oracle) groups=501(oracle),500(dba)
```

The User ID and Group IDs must be the same on all cluster nodes. Using the information from the id oracle command, create the Oracle Groups and User Account on the remaining cluster nodes:

```
/usr/sbin/groupadd -g 500 dba
/usr/sbin/useradd oracle -m -u 500 -g dba –s /bin/tcsh
```

19) Setup oracle user password

```
[root@vmractest3 root]# passwd oracle
```

20) Set Limits for user Oracle

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

 cat >> /etc/pam.d/login << EOF
 session required /lib/security/pam_limits.so
 EOF


cat >> /etc/profile << EOF
if [ \$USER = "oracle" ]; then
 if [ \$SHELL = "/bin/ksh" ]; then
 ulimit -p 16384
 ulimit -n 65536
 else
 ulimit -u 16384 -n 65536
 fi
```

```
 umask 022
fi
EOF

cat >> /etc/csh.login << EOF
if ( \$USER == "oracle" ) then
 limit maxproc 16384
 limit descriptors 65536
 umask 022
endif
EOF
```

21) Setup Oracle user .cshrc on all nodes

```
--------- .cshrc start on next line ----------
umask 022
unlimit

# Oracle Homes
# ============
setenv ORACLE_BASE      /oradisk/app01/oracle
setenv ORA_CRS_HOME     /oradisk/app01/oracle/product/10gCRS
setenv ASM_HOME         /oradisk/app01/oracle/product/10gASM
setenv AGENT_HOME       /oradisk/app01/oracle/product/agent10g
setenv DBS_HOME         /oradisk/app01/oracle/product/10gDB
setenv ORACLE_HOME      $DBS_HOME

# Base Path and Path
# ==================
```

```
setenv BASE_PATH
$ORACLE_BASE/scripts/general:/usr/kerberos/sbin:/usr/kerberos/bin:/usr/local/sbin:/usr/loca
l/bin:/sbin:/bin:/usr/sbin:/usr/bin:/usr/X11R6/bin:/root/bin:/oradisk/app01/oracle/scripts:
/usr/local/maint/oracle:/crmdb/app01/oracle/product/db_scripts/RAC:/crmdb/app01/oracle/prod
uct/db_scripts
setenv PATH ${ORACLE_HOME}/bin:${BASE_PATH}

# Set environment aliases
# =======================
alias 10db  'setenv ORACLE_HOME $DBS_HOME; setenv PATH ${ORACLE_HOME}/bin:${BASE_PATH}'
alias 10gc  'setenv ORACLE_HOME $AGENT_HOME; setenv PATH ${ORACLE_HOME}/bin:${BASE_PATH}'
alias 10crs 'setenv ORACLE_HOME $ORA_CRS_HOME; setenv PATH ${ORACLE_HOME}/bin:${BASE_PATH}'
alias 10asm 'setenv ORACLE_HOME $ASM_HOME; setenv PATH ${ORACLE_HOME}/bin:${BASE_PATH}'

# Cluster Verification utility
# ============================
setenv CV_HOME /oradisk/app01/cluvfy
setenv CV_JDKHOME /oradisk/app01/cluvfy/jd14
setenv CV_DESTLOC /oradisk/app01/cluvfy/out
setenv CVUQDISK_GRP dba

# DBA aliases
# ===========
alias cdo 'cd $ORACLE_HOME\/\!*'
alias dbs 'cd $ORACLE_HOME/dbs\/\!*'
alias sts 'setenv ORACLE_SID $1'
alias sql "sqlplus '/ as sysdba'"
alias tns 'cd $ORACLE_HOME/network/admin; clear; ps -efa | grep tns | grep -v grep; ls -
ltr'
```

```
alias ora 'clear ; echo ----------- ; echo ORA Environement Variables: ; echo " "; env |
grep ASM ;env | grep ORA | grep -v NO | grep -v NLS | sort | more ; echo -----------; echo
ORACLE Databases Running: ; echo " "; ps -efa | grep smon | grep -v grep |more ; echo -----
------ ; echo ORACLE Databases registered in Oratab: ; echo " " ; more /etc/oratab | grep -
v #; echo ----------- '

# Check Cluster Aliases
# =====================
alias chkcrs '/home/oracle/chkcrs'
alias chkocrbk 'clear;echo OCR BACKUPS AVAILABLE:; echo; 10crs; ocrconfig -showbackup; echo
; echo'

# Set Prompt
# ==========
setenv v_alrt `hostname`
alias cd 'chdir \!*; set prompt="{$LOGNAME} $cwd [$v_alrt] > "'
cd .

# Other settings
# ==============
setenv DB_SCRIPTS $ORACLE_BASE/scripts
setenv NLS_DATE_FORMAT 'dd/mm/yyyy hh24:mi:ss'
setenv TEMP /tmp
setenv TMPDIR /tmp
setenv EDITOR vi
setenv ORACLE_TERM xsun5
setenv EPC_DISABLED TRUE
alias cdbo 'cd ~/obackup/db\/\!*'
alias ll 'ls -lrt'
alias av 'cd $ORACLE_BASE/scripts/av'
```

```
alias avd 'setenv DISPLAY  10.13.33.156:0.0'
alias duk '/usr/xpg4/bin/du -xk |sort -rn|more'
alias disp 'setenv DISPLAY $1'
alias grid 'clear; cat $HOME/.grid'
alias mnt 'echo mount ranstorage3:/vol/files2/DBBackup /mnt'
alias rmn 'rman target / nocatalog'
--------- .cshrc finish on previous line ----------
```

ORACLE SOFTWARE INSTALL

22) Configure Cluster Verification Utility

Cluster Verification utility is executed at the end of the Oracle Clusterware Install, it is convenient, but not required, to configure it beforehand on all nodes.

The Cluster Verification Utility is included on the 10g Installation DVD or can be downloaded from OTN at
http://www.oracle.com/technology/products/database/clustering/cvu/cvu_download_homepage.html

Create a directory for it

```
mkdir –p /oradisk/app01/cluvfy/out
```

Copy the install files to /oradisk/app01/cluvfy and unzip them.
Change ownership to oracle:dba

```
chown –R oracle:dba /oradisk/app01/cluvfy
```

Install as root cvuqdisk-1.0.1-1.rpm

```
groupadd orainst
rpm –i cvuqdisk-1.0.1-1.rpm
edit /etc/group and add oracle to group orainst
```

Add to the .cshrc the following settings

```
setenv CV_HOME /oradisk/app01/cluvfy
setenv CV_JDKHOME /oradisk/app01/cluvfy
setenv CV_DESTLOC /oradisk/app01/cluvfy/out
setenv CVUQDISK_GRP dba
```

23) RAC Related Software Install

Create separate software locations for RAC:

CRS Home
ASM Home
RDBMS Home
Agent Home

A step by step Install guide can be found on OTN

24) Install Oracle Clusterware

Unset all oracle related variables, execute the runInstaller from the clusterware directory.

BEST PRACTICE: crs Authentication directories ORA_CRS_HOME/css/auth, crs/auth, srvm/auth and evm/auth should be located on disks with good performance. Avoid NFS mount for them.

25) Install ASM Oracle Home

Unset all oracle related variables, execute the runInstaller from the database directory.

BEST PRACTICES:
- Use external redundancy with high end redundant storage.
- Use ASM mirroring with low end storage
- Use Oracle Managed Files for databases with ASM storage, i.e.: db_create_file_dest=+DATADG
- If using split mirror technologies have 2 disk groups at least, one for data and one for archives.
- Adjust ASM init.ora processes parameter to 25 + 15n; where n is the number of databases connected to the ASM instance.

26) Install Database Oracle Home

Unset all oracle related variables, execute the runInstaller from the database directory.

BEST PRACTICES:
- If using ASM external redundancy increase shared_pool by 2MB + 1MB per every 100GB of database space in ASM.
- If using ASM normal redundancy increase shared_pool by 4MB + 2MB per every 100GB of database space in ASM.
- If using ASM high redundancy increase shared_pool by 6MB + 3MB per every 100GB of database space in ASM.

- Use automatic segment space management (ASSM) that is essential for RAC performance.
- Use asynch I/O
- Increase init.ora parameter parallel_execution_message_size from default to 4096 or 8192
- Set init.ora parameter parallel_min_servers to cpu_count -1
- Increase cache size for sys.audsess$ sequence to 10,000.

27) Install Agent Oracle Home

Unset all oracle related variables, execute the runInstaller from the Grid Control Software directory.

28) Install 10.2.0.3 Patch on CRS, ASM, Database and Agent Oracle Homes

Unset all oracle related variables, execute the runInstaller from the Patchset Software directory and choose the home you whish to patch.

29) Create ASM Instance

Point to the ASM Home, run DBCA, choose create ASM Instance.

30) Create RAC Database

Point to the Database Home, run DBCA, choose create RAC Database.

31) Configure XDB for ASM Management

Point to the Database Home, follow the procedure to configure XDB.

MAINTENANCE BEST PRACTICES

32) GENERIC

- Define SLA's for performance and availability for each service or application
- Use Grid Control to manage CRS, ASM, Database and Applications
- Use a separate RAC with identical configuration for testing
- All changes to the production environment must be previously tested on a separate environment
- Apply changes to one system element at a time, first on test then on production.
- Keep a change log
- Implement services to manage workload
- Configure OSWatcher to have handy information about the OS layer in case of need, see on Metalink Note:301137.1, OS Watcher User Guide
- Configure RDA to have handy information to Oracle Support in case of need, see on Metalink Note:314422.1, Remote Diagnostic Agent Getting Started.
  RDA 4.5+ includes RAC data collection capability. It can be used in place of RAC Diagnostics tool RACDDT.
- Establish support mechanisms and escalation procedures.
- Make sure DBA's have well tested procedures about how to deal with problems and collect required diagnostics.
- Use Racdiag.sql to check database during normal behavior and be able to compare results, see on Metalink Note:135714.1

33) ASM

- Perform all disk mounts at once
- Add or remove ASM disks at once, not one by one, to reduce the number of rebalance operations.
- Perform rebalance with ASM_POWER_LIMIT set to 2 times the number of drives, with max 11.
- Always shutdown instances before shutting down ASM.

34) Backup and Recovery

- Use Rman to backup database files
- Use change tracking file for Rman
- Backup OCR and Voting disk periodically
- Establish a backup and recovery procedure and test it

35) Interconnect

- Monitor interconnect max 70% bandwidth. Block receive times should be significantly less than disc access times.

End of the Document.