Oracle 11g R2 Grid Infrastructure installation on 2 node cluster using Virtualbox

Introduction

Since its inception in Oracle 9i, the Oracle RAC (Real Application Clusters) technology has been an active topic of discussion in the community. Oracle 11gR2 RAC offers high availability, scalability (scaling out capability), manageability, reduced ownership cost, and cloud architecture platform. The RAC technology allows the establishment of multiple instances to a single database server which hosts an enterprise application.

Oracle 11g R2 RAC system necessarily works on grid architecture. The master RAC node must have grid infrastructure installed with the remaining nodes replicated accordingly. The Oracle 11gR2 grid infrastructure installation integrates oracle clusterware and oracle ASM. Oracle Clusterware is responsible for High Availability framework, process monitoring, event management and group membership. On the other hand, oracle ASM suffices the need of a conventional file system while offering multiple add-on features like online disk manipulation, auto I/O load balancing, stripping and mirroring of data and finally ease the data storage management.

The RAC customers/users often report their difficulties and issues in the installation phase. Before planning the grid infrastructure installation, it has to be prepared appropriately so that it suffices all the requirements of a clusterware and memory management. There are multiple areas to be looked upon before the grid installation like network, system kernel parameters, NTPD settings, node connectivity, and ASM disk setup. The document describes the prerequisites of a system to be planned for gird installation. Please note that the document is not a guide for RAC installation but a reference to provide hands-on with RAC installation on oracle virtualbox.

Approach

The document illustrates the installation of Oracle 11gR2 grid infrastructure and 2 node RAC database on virtualbox. The two virtualbox machine images installed with OEL, would serve as the cluster nodes. Initially, we will create only one virtual machine image and do all sorts of configurations required for the grid installation. The master node would be then cloned to create the second node participating in the cluster.

Memory requirements

The host system running the two virtual machine images must have sufficient memory to run both images simultaneously. RAM above 4GB would be best suited for the demo.

Software Requirement

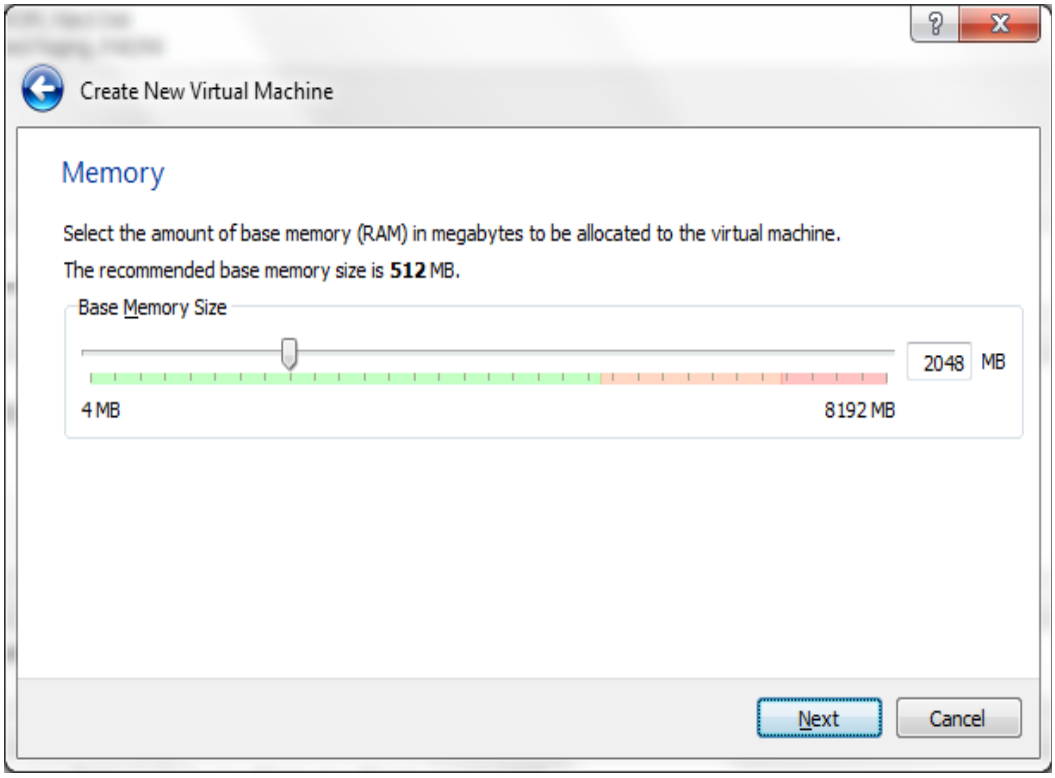
Following software can be procured from Oracle Technology Network in order to follow this demonstration

a) Oracle Virtualbox 4.2
b) Oracle Enterprise Linux 5.6
c) Oracle 11gR2 Grid Infrastructure (64 bit)
d) Oracle 11gR2 Database (64 bit)

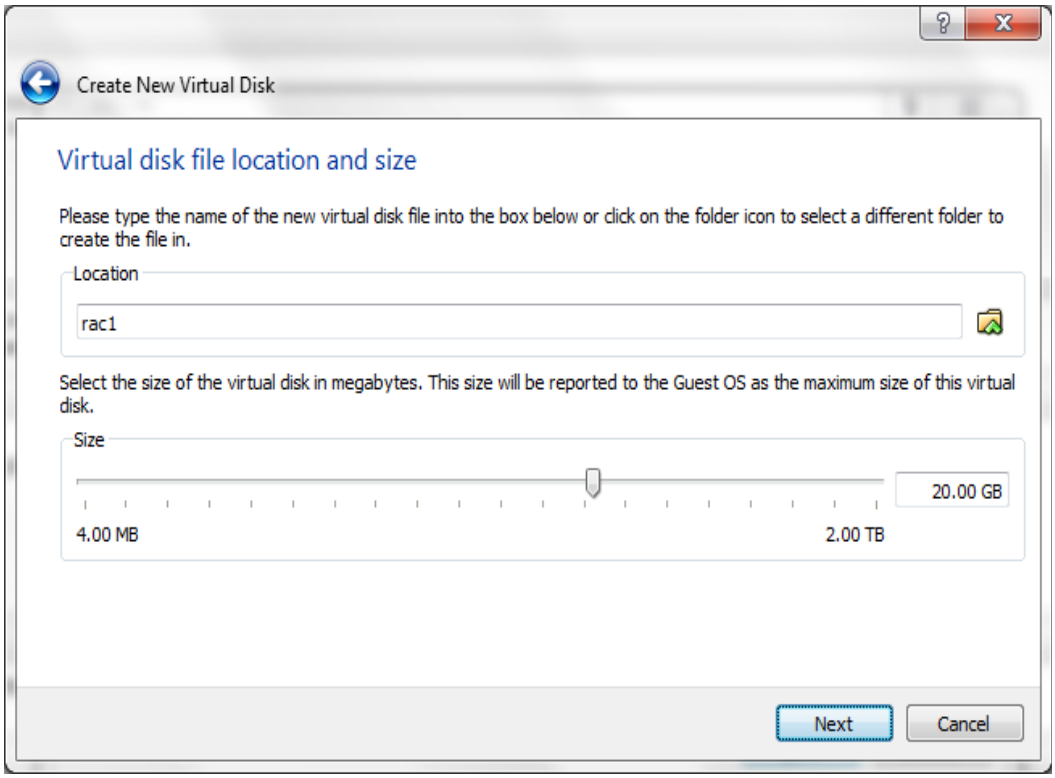
System setup

Create a virtualbox machine image and install Oracle Enterprise Linux on the same. Recommended base memory (RAM) and startup disk size is shown in the below screenshots.

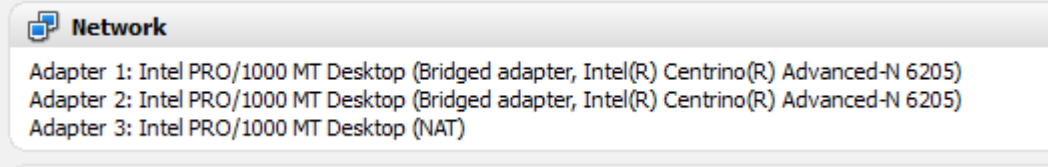
a) RAM sizing



b) Virtual disk sizing



c) Network adaptor setting - Enable two adaptors for bridged networking and one for NAT. Bridged adaptor would serve for public and private network interfaces respectively.



Once the virtual machine image has been created, start the OEL installation using Enterprise-R5-U5-Server-x86_64-dvd.iso disk file.

Select the default settings in all the wizards. Disable the SELinux and firewalls. Do not create additional account as user creation and permissions would be part of a separate activity. Install the virtualbox guest additions to enable the sharing of grid and database software files from host OS location.

Note that the package kernel-uek-devel-2.6.32-300.32.2.el5uek.rpm must be updated for the proper enablement of virtualbox guest additions.

Oracle Installation prerequisites

Let us now look upon the steps to verify and prepare the VM image for grid installation.

a) Mount the shared memory filesystem (/tmpfs) and ensure that it has enough size for automatic memory management.

```
[root@rac1 ~]# umount tmpfs
[root@rac1 ~]# mount -t tmpfs shmfs -o size=1500m /dev/shm
[root@rac1 ~]# vi /etc/fstab
tmpfs /dev/shm tmpfs size=1500m 0 0
```

b) Install the oracle-validated rpm package

```
[root@rac1 ~]# cd /etc/yum.repos.d/
[root@rac1 yum.repos.d]# wget http://public-yum.oracle.com/public-yum-el5.repo
--2012-09-23 07:57:10--  http://public-yum.oracle.com/public-yum-el5.repo
Resolving public-yum.oracle.com... 141.146.44.34
Connecting to public-yum.oracle.com|141.146.44.34|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 3974 (3.9K) [text/plain]
Saving to: `public-yum-el5.repo'

100%[======================================>] 3,974   --.-K/s  in 0.01s

2012-09-23 07:57:11 (315 KB/s) - `public-yum-el5.repo' saved [3974/3974]

[root@rac1 yum.repos.d]# yum install oracle-validated

Loaded plugins: security
el5_latest                                              | 1.4 kB     00:00
el5_latest/primary                                      |  11 MB     03:27
el5_latest                                                         9533/9533
Setting up Install Process
Resolving Dependencies
--> Running transaction check
<<Output Truncated>>
Dependencies Resolved

================================================================================
```

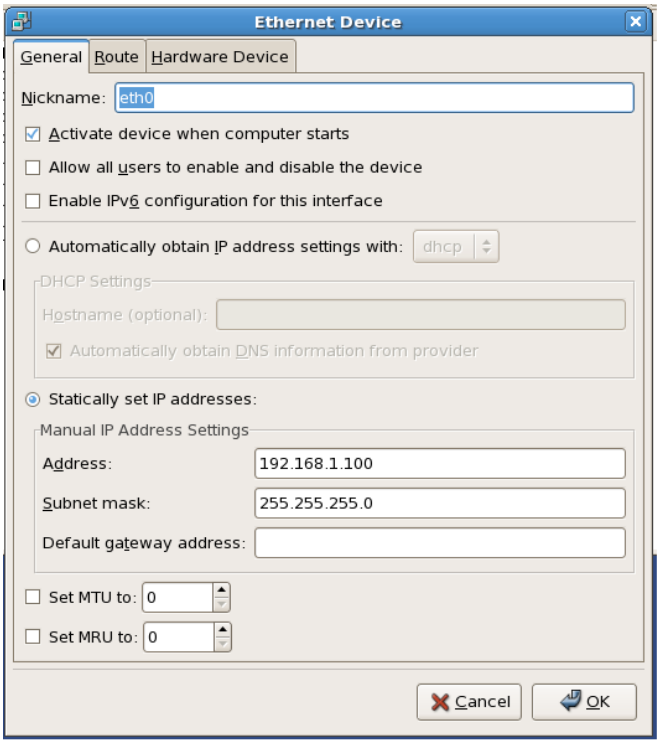
```
 Package                       Arch   Version                     Repository  Size
================================================================================
Installing:
 oracle-validated              x86_64 1.1.0-15.el5                el5_latest  24 k
Updating:
 udev                          x86_64 095-14.27.0.3.el5_7.1       el5_latest 2.4 M
Installing for dependencies:
 device-mapper-multipath-libs x86_64 0.4.9-46.0.5.el5            el5_latest 168 k
 iscsi-initiator-utils         x86_64 6.2.0.872-13.0.1.el5        el5_latest 1.0 M
 kernel-uek                    x86_64 2.6.32-300.32.2.el5uek      el5_latest  26 M
 kernel-uek-firmware           noarch 2.6.32-300.32.2.el5uek      el5_latest 3.7 M
 libXp                         i386   1.0.0-8.1.el5               el5_latest  22 k
 libaio-devel                  i386   0.3.106-5                   el5_latest  12 k
 libaio-devel                  x86_64 0.3.106-5                   el5_latest  11 k
 oraclelinux-release           x86_64 5-8.0.2                     el5_latest 2.7 k
 ql2xxx-firmware               noarch 1.01.01-0.2.el5             el5_latest 442 k
 sysstat                       x86_64 7.0.2-11.el5                el5_latest 187 k
 unixODBC                      x86_64 2.2.11-10.el5               el5_latest 291 k
 unixODBC-devel                i386   2.2.11-10.el5               el5_latest 738 k
 unixODBC-devel                x86_64 2.2.11-10.el5               el5_latest 793 k
 unixODBC-libs                 i386   2.2.11-10.el5               el5_latest 551 k
 unixODBC-libs                 x86_64 2.2.11-10.el5               el5_latest 554 k
Updating for dependencies:
 device-mapper-multipath       x86_64 0.4.9-46.0.5.el5            el5_latest  97 k
 irqbalance                    x86_64 2:0.55-17.el5               el5_latest  21 k
 kexec-tools                   x86_64 1.102pre-154.0.3.el5_8.1    el5_latest 602 k
 kpartx                        x86_64 0.4.9-46.0.5.el5            el5_latest 465 k
 libbdevid-python              x86_64 5.1.19.6-75.0.9.el5         el5_latest  69 k
 mkinitrd                      i386   5.1.19.6-75.0.9.el5         el5_latest 482 k
 mkinitrd                      x86_64 5.1.19.6-75.0.9.el5         el5_latest 471 k
 nash                          x86_64 5.1.19.6-75.0.9.el5         el5_latest 1.4 M
 util-linux                    x86_64 2.13-0.59.0.1.el5           el5_latest 1.9 M

Transaction Summary
================================================================================
Install      16 Package(s)
Upgrade      10 Package(s)

Total download size: 42 M
Is this ok [y/N]:y
<<Output truncated>>
```

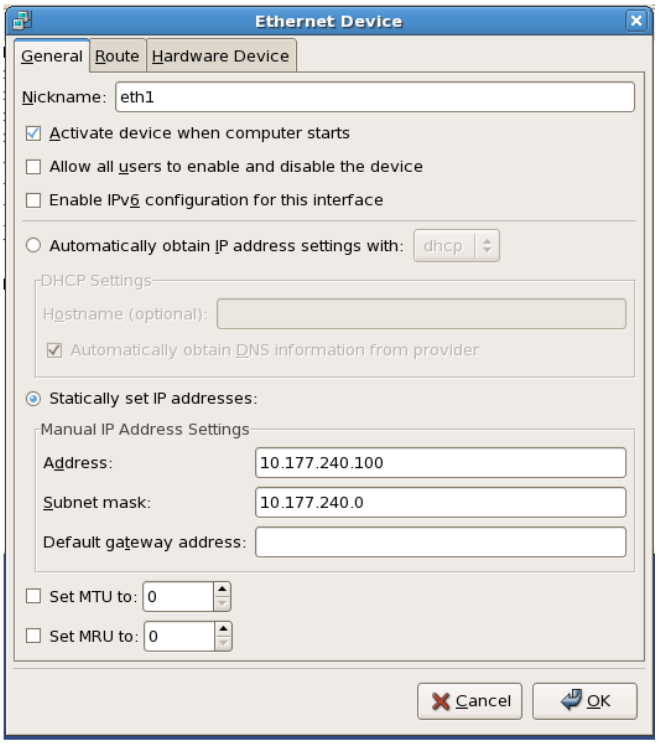
c) Edit the /etc/hosts file to add public ip, private ip and virtual ip addresses for the proposed two nodes. Here note that we are including the network configuration for the second node as well. The reason for the pre configuration is to sync the network settings at both the nodes.

```
[root@rac1 ~]# 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
::1             localhost6.localdomain6 localhost6

#Public
192.168.1.100   rac1.oracle.com rac1
192.168.1.200   rac2.oracle.com rac2

#Private
10.177.240.100  rac1-priv.oracle.com    rac1-priv
10.177.240.200  rac2-priv.oracle.com    rac2-priv
```

```
#Virtual
192.168.1.10     rac1-vip.oracle.com      rac1-vip
192.168.1.11     rac2-vip.oracle.com      rac2-vip
```

In addition, manually set the public and private ip for eth0 and eth1 network interfaces as shown in the below screen dump.





Restart the network service.

```
[root@rac1 ~]# service network restart
Shutting down interface eth0:                              [  OK  ]
Shutting down interface eth1:                              [  OK  ]
Shutting down interface eth2:                              [  OK  ]
Shutting down loopback interface:                          [  OK  ]
Bringing up loopback interface:                            [  OK  ]
Bringing up interface eth0:                                [  OK  ]
Bringing up interface eth1:                                [  OK  ]
Bringing up interface eth2:
Determining IP information for eth2... done.
                                                           [  OK  ]
```

d) Verify the system kernel requirements. The oracle-validated installation would reset the parameters as required for the oracle database installation.

```
[root@rac1 ~]# /sbin/sysctl -p
net.ipv4.ip_forward = 0
net.ipv4.conf.default.rp_filter = 1
net.ipv4.conf.default.accept_source_route = 0
kernel.core_uses_pid = 1
net.ipv4.tcp_syncookies = 1
fs.file-max = 6815744
kernel.msgmni = 2878
```

```
kernel.msgmax = 8192
kernel.msgmnb = 65536
kernel.sem = 250 32000 100 142
kernel.shmmni = 4096
kernel.shmall = 1073741824
kernel.shmmax = 4398046511104
kernel.sysrq = 1
net.core.rmem_default = 262144
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
net.core.wmem_max = 1048576
fs.aio-max-nr = 3145728
net.ipv4.ip_local_port_range = 9000 65500
vm.min_free_kbytes = 51200
```

e) Verify the limits.conf values. Like kernel parameters, these values are too set by oracle-validated package.

```
[root@rac1 ~]# cat /etc/security/limits.conf

# Oracle-Validated setting for nofile soft limit is 131072
oracle   soft   nofile    131072

# Oracle-Validated setting for nofile hard limit is 131072
oracle   hard   nofile    131072

# Oracle-Validated setting for nproc soft limit is 131072
oracle   soft   nproc    131072

# Oracle-Validated setting for nproc hard limit is 131072
oracle   hard   nproc    131072

# Oracle-Validated setting for core soft limit is unlimited
oracle   soft   core    unlimited

# Oracle-Validated setting for core hard limit is unlimited
oracle   hard   core    unlimited

# Oracle-Validated setting for memlock soft limit is 50000000
oracle   soft   memlock    50000000

# Oracle-Validated setting for memlock hard limit is 50000000
oracle   hard   memlock    50000000
```

f) Verify the /etc/pam.d/login values. Include the entry [highlighted below as bold]

```
[root@rac1 ~]# cat /etc/pam.d/login

auth [user_unknown=ignore success=ok ignore=ignore default=bad] pam_securetty.so
auth       include      system-auth
account    required     pam_nologin.so
account    include      system-auth
password   include      system-auth
# pam_selinux.so close should be the first session rule
session    required     pam_selinux.so close
session    optional     pam_keyinit.so force revoke
session    required     pam_loginuid.so
session    include      system-auth
```

```
session    optional     pam_console.so
# pam_selinux.so open should only be followed by sessions to be executed in the
user context
session    required     pam_selinux.so open
session    required     pam_limits.so
```

g) Verify whether SELinux has been disabled.

```
[root@rac1 ~]# cat /etc/selinux/config

# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#       enforcing - SELinux security policy is enforced.
#       permissive - SELinux prints warnings instead of enforcing.
#       disabled - SELinux is fully disabled.
SELINUX=disabled
# SELINUXTYPE= type of policy in use. Possible values are:
#       targeted - Only targeted network daemons are protected.
#       strict - Full SELinux protection.
SELINUXTYPE=targeted
```

h) Synchronization setup for NTPD and restart. Include “-x” in the OPTIONS to enable the server synchronization.

```
[root@rac1 ~]# service ntpd stop
Shutting down ntpd:                                        [FAILED]
[root@rac1 ~]# chkconfig ntpd off
[root@rac1 ~]# rm /var/run/ntpd.pid
[root@rac1 ~]# vi /etc/sysconfig/ntpd
OPTIONS="-x -u ntp:npt -p /var/run/ntpd.pid"
[root@rac1 ~]# service ntpd restart
```

i) Create groups and users. Note that “oracle” user is part of oinstall and dba groups

```
[root@rac1 ~]# groupadd -g 500 oinstall
[root@rac1 ~]# groupadd -g 501 dba
[root@rac1 ~]# groupadd -g 502 oper
[root@rac1 ~]# groupadd -g 503 asmadmin
[root@rac1 ~]# useradd -u 1000 -g oinstall -G dba,oper,asmadmin oracle
```

j) Create the grid home and oracle home directories

```
[root@rac1 ~]# mkdir -p /u01/app/11.2.0/grid
[root@rac1 ~]# mkdir -p /u01/app/oracle/product/11.2.0/dbhome_1
[root@rac1 ~]# chown -R oracle:oinstall /u01
[root@rac1 ~]# chmod -R 775 /u01
```

k) Edit the .bash_profile of “oracle” user.

```
[root@rac1 ~]# vi /home/oracle/.bash_profile
#Get the aliases and functions
if [ -f ~/.bashrc ]; then
        . ~/.bashrc
fi

#ORACLE SETTINGS
TMP=/tmp; export TMP
TMPDIR=$TMP; export TMPDIR
```

```
ORACLE_HOSTNAME=rac1.oracle.com; export ORACLE_HOSTNAME
ORACLE_UNQNAME=RAC1; export ORACLE_UNQNAME
ORACLE_BASE=/u01/app/oracle; export ORACLE_BASE
ORACLE_HOME=$ORACLE_BASE/product/11.2.0/dbhome_1; export ORACLE_HOME
ORACLE_SID=rac1; export ORACLE_SID
ORACLE_TERM=term; export ORACLE_TERM
PATH=/usr/sbin:$PATH; export PATH
PATH=$ORACLE_HOME/bin:$PATH; export PATH

LD_LIBRARY_PATH=$ORACLE_HOME/lib:/lib:/usr/lib; export LD_LIBRARY_PATH
CLASSPATH=$ORACLE_HOME/JRE:$ORACLE_HOME/jlib:$ORACLE_HOME/rdbms/jlib; export
CLASSPATH

if [ $USER = "oracle" ]; then
   if [ $SHELL = "/bin/ksh" ]; then
      ulimit -p 16384
      ulimit -n 65336
  else
      ulimit -u 16384 -n 65336
    fi
fi

# User specific environment and startup programs

PATH=$PATH:$HOME/bin

export PATH
umask 0022

echo ORACLE_HOME = $ORACLE_HOME
echo ORACLE_SID = $ORACLE_SID
```

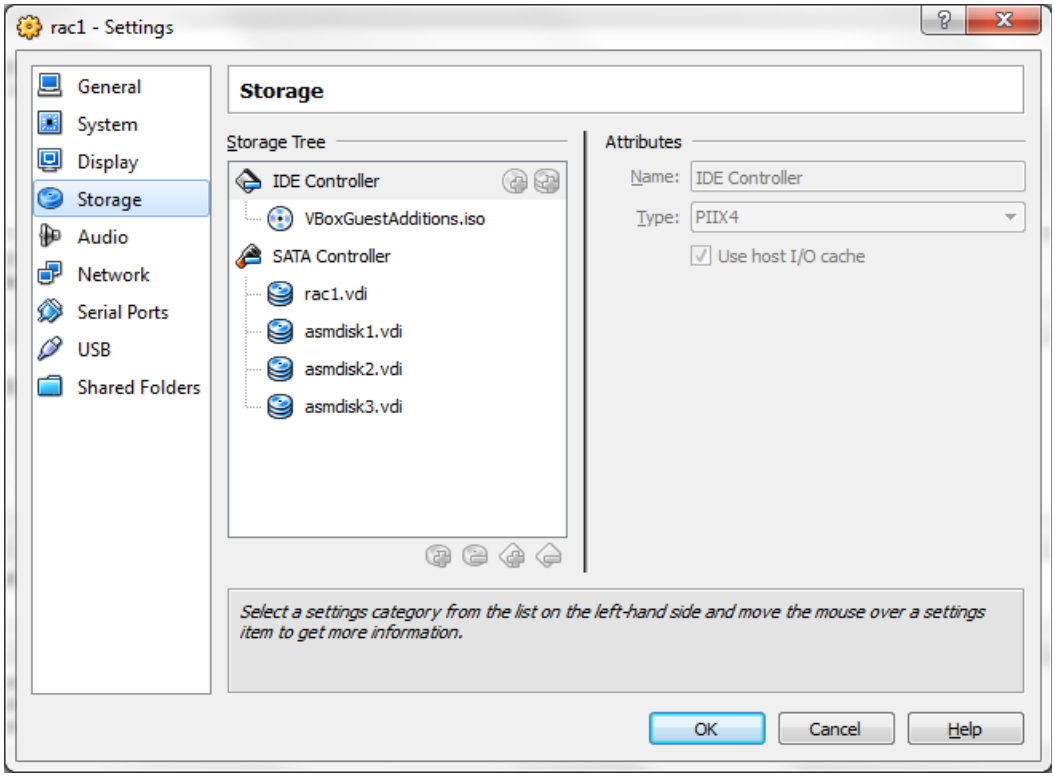
l) Note the “umask” of “oracle” user is set to default as “0022”. If not add the default umask in .bash_profile and .bashrc also

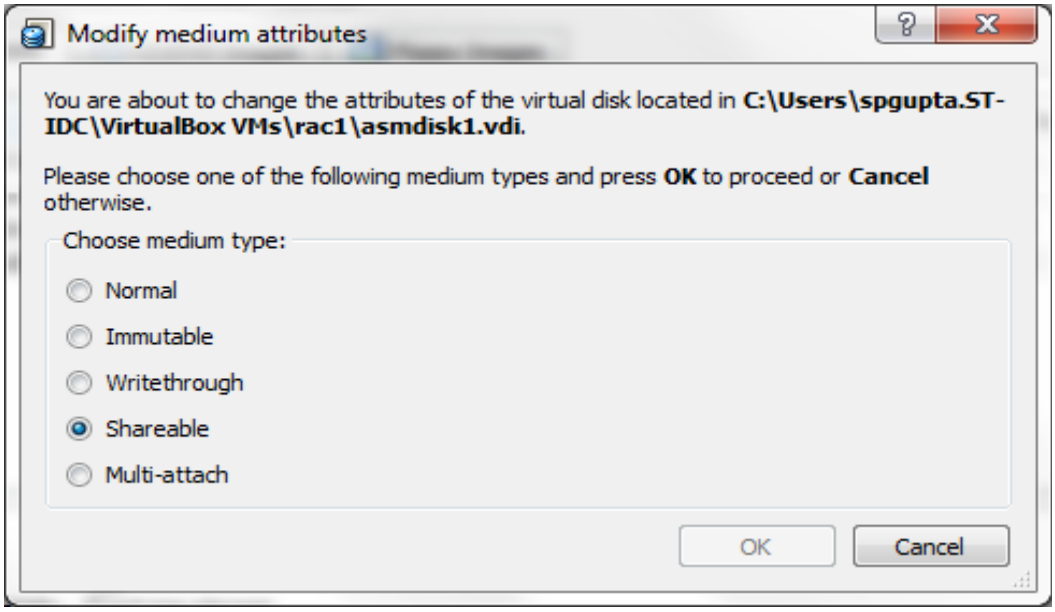
```
[oracle@rac1 ~]$ umask
0022
```

m) Shutdown the virtualmachine

```
[oracle@rac1 ~]$ shutdown now
```

n) Create the sharable disks under “Storage”. Create three new hard disks of fixed size. By default, they will be created as “Normal”. Edit the disk properties from virtual manager and make them “Sharable”.





o) Restart the virtual machine RAC1. Check the installation of ASM packages. The rpm packages “oracleasmlib”, “oracleasm-support” and “oracleasm” are mandatory for the ASM configuration. The packages “oracleasm-support” and “oracleasm” are available in the oracle-validated installation package. The package “oracleasmlib” has to be downloaded from OTN corresponding to the kernel version.

```
[root@rac1 ~] yum list installed oracleasm*

oracleasm-2.6.18-308.el5.x86_64              2.0.5-1.el5               installed
oracleasm-support.x86_64                     2.1.7-1.el5               installed
```

```
oracleasmlib.x86_64                      2.0.4-1.el5               installed
```

p) Configure oracleasm

```
[root@rac1 ~]# /etc/init.d/oracleasm configure

Configuring the Oracle ASM library driver.
This will configure the on-boot properties of the Oracle ASM library
driver. The following questions will determine whether the driver is
loaded on boot and what permissions it will have. The current values
will be shown in brackets ('[]'). Hitting <ENTER> without typing an
answer will keep that current value. Ctrl-C will abort.
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
Scan for Oracle ASM disks on boot (y/n) [y]: y
Writing Oracle ASM library driver configuration: done

[root@rac1 ~]# /etc/init.d/oracleasm status
Checking if ASM is loaded: yes
Checking if /dev/oracleasm is mounted: yes
```

q) Create the ASM disks

```
[root@rac1 ~]# ls /dev/sd*
/dev/sda   /dev/sda1   /dev/sda2   /dev/sdb   /dev/sdc   /dev/sdd
[root@rac1 ~]# cd /dev
[root@rac1 dev]# fdisk sdb
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel. Changes will remain in memory only,
until you decide to write them. After that, of course, the previous
content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-652, default 1):
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-652, default 652):
Using default value 652

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
[root@rac1 dev]# fdisk sdc
<<Similar operation as done in /dev/sdb>>
[root@rac1 dev]# fdisk sdd
<<Similar operation as done in /dev/sdb>>
[root@rac1 ~]# /etc/init.d/oracleasm createdisk ASM1 /dev/sdb1
Marking disk "ASM1" as an ASM disk:                        [OK]
[root@rac1 ~]# /etc/init.d/oracleasm createdisk ASM2 /dev/sdc1
Marking disk "ASM2" as an ASM disk:                        [OK]
```

```
[root@rac1 ~]# /etc/init.d/oracleasm createdisk ASM3 /dev/sdd1
Marking disk "ASM3" as an ASM disk:                        [OK]
[root@rac1 ~]# /etc/init.d/oracleasm listdisks
ASM1
ASM2
ASM3
[root@rac1 ~]# /etc/init.d/oracleasm scandisks
Scanning the system for Oracle ASMLib disks:               [  OK  ]
[root@rac1 ~]# /etc/init.d/oracleasm querydisk ASM1
Disk "ASM1" is a valid ASM disk
```

r) Unzip the Grid Infrastructure folder. Change ownership of “grid” folder to “oracle:oinstall” Install the RPM package “cvuqdisk” from the /install/grid/rpm folder

```
[root@rac1 install]# ls -lt
-rwxr-x--- 1 root root 1111416131 Sep 18 18:01 linux.x64_11gR2_database_2of2.zip
-rwxr-x--- 1 root root 1239269270 Sep 18 18:00 linux.x64_11gR2_database_1of2.zip
-rwxr-x--- 1 root root 1051619328 Sep 18 18:00 grid.zip
[root@rac1 install]# unzip grid.zip
<<Output truncated>>
[root@rac1 install]# rpm -Uvh /grid/rpm/cvuqdisk-1.0.7-1.rpm
Preparing...                ########################################### [100%]
Using default group oinstall to install package
   1:cvuqdisk               ########################################### [100%]
[root@rac1 install]# chown -R oracle:oinstall ./grid/
```

s) Shutdown Node RAC1

t) Clone the RAC1 to RAC2. It might take up some time. Once the cloned image RAC2 is done, remove the additional sharable disks from RAC2 image under the “Storage” attribute. Add the existing sharable disks (from RAC1 image).

u) Start RAC2 node. Edit the eth0 and eth1 ip addresses. Change the hostname, Edit the /home/oracle/.bash_profile.

v) Go to node RAC1 and establish the ssh connectivity. The user “oracle” must have a password so as to establish passwordless connectivity between the two nodes. The script asks for the “oracle” user passwords and updates the “authorized_keys”, “id_rsa” keys, and “known_hosts” files at /home/oracle/.ssh location.

```
[root@rac1 sshsetup]$ sh sshUserSetup.sh -user oracle -hosts "rac1 rac2"
-noPromptPassphrase
```

w) Verify the cluster setup using cluvfy.sh. The cluster verification utility verifies the nodes for ssh connectivity, user equivalence, free memory, kernel parameters, package existence, and ntpd clock synchronization. Note that the cluster verfiication utility is employed in the pre-cluster installation stage (`-pre crsinst`).

```
[root@rac1 ~]# sh cluvfy.sh stage -pre crsinst -n rac1,rac2 -verbose >
ClusterVerify.log

<<Output truncated>>
Pre-check for cluster services setup was successful.
```

Oracle Grid Infrastructure Installation

The prerequisite checks and validations required for the Oracle software installation is now complete. Now, we shall move ahead to install the oracle grid infrastructure software.

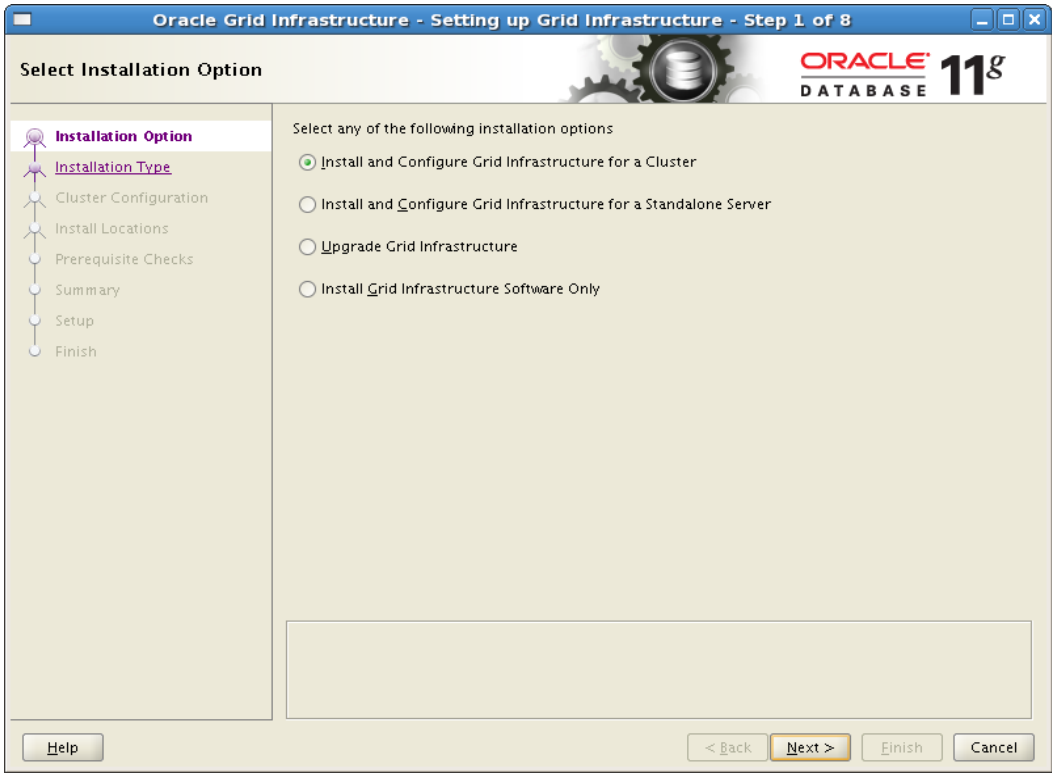
a) Execute “xhost +” as the root user for xwindow configuration.

```
[root@rac1 grid]# xhost +
access control disabled, clients can connect from any host
```

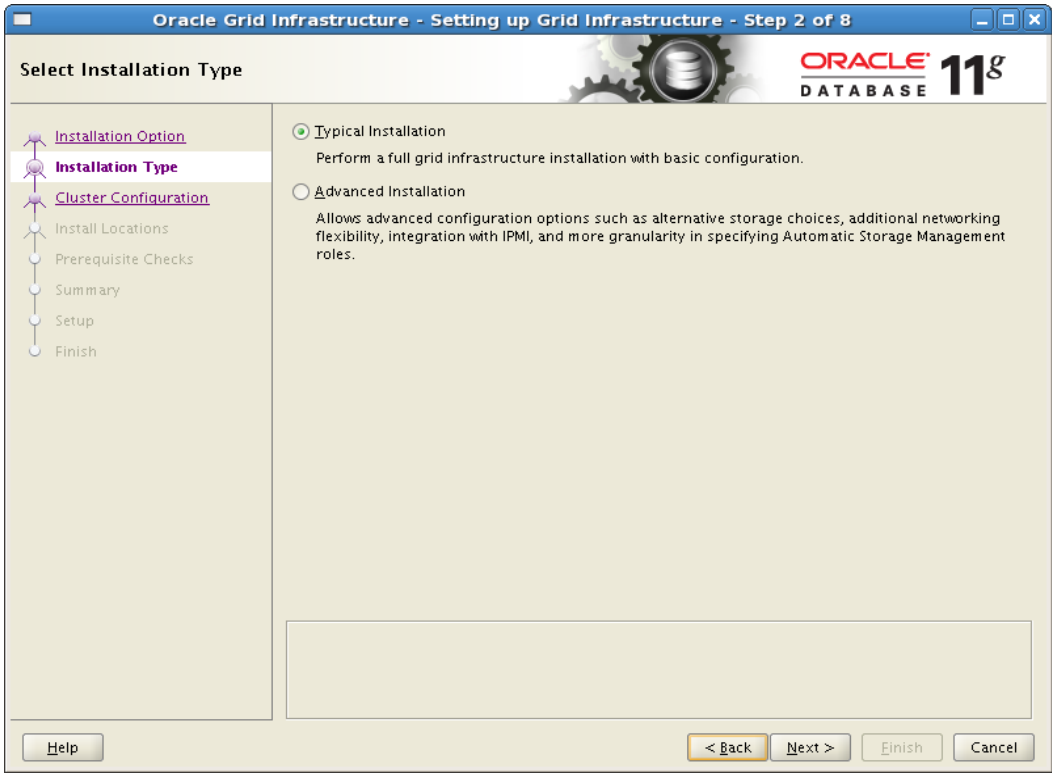
b)Switch to Oracle user and run the software Installer

```
[root@rac1 grid]# su oracle
[oracle@rac1 grid]# sh runInstaller

Checking Temp space: must be greater than 120 MB.   Actual 8213 MB    Passed
Checking swap space: must be greater than 150 MB.   Actual 3999 MB    Passed
Checking monitor: must be configured to display at least 256 colors.    Actual
16777216    Passed
Preparing to launch Oracle Universal Installer from /tmp/OraInstall2012-09-23_05-
16-40PM. Please wait ...
```

c) The installer open the wizard to select the “Installation Option”. Select “Install and Configure Grid Infrastructure for a Cluster” and click “Next”.



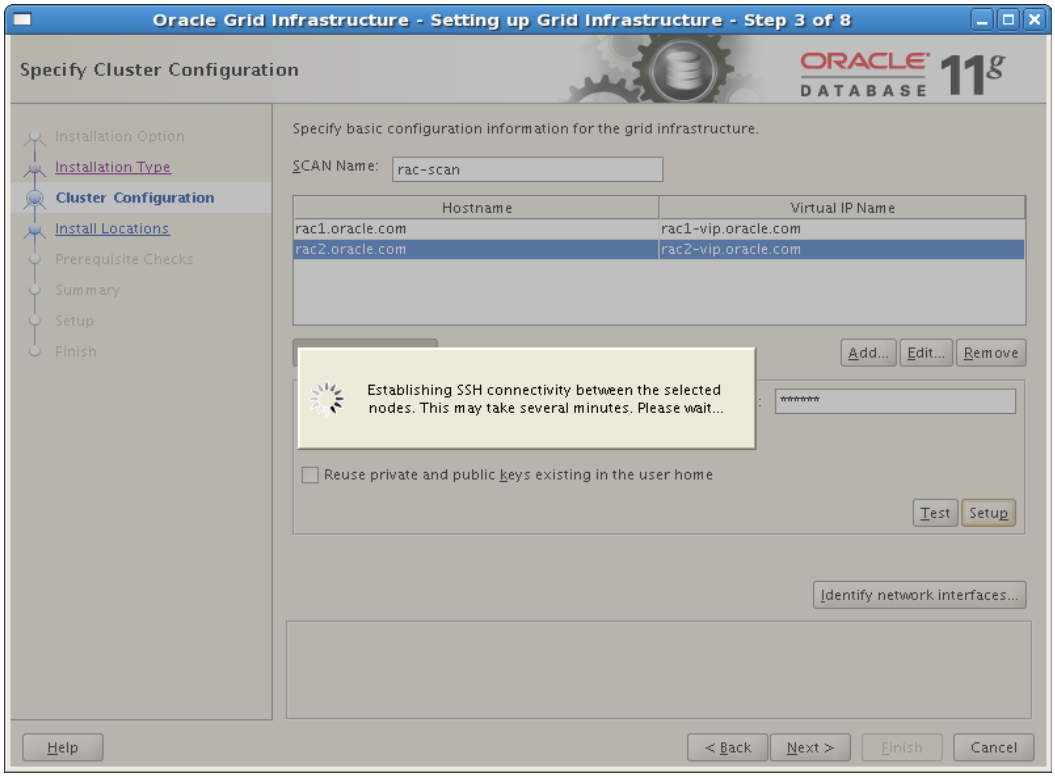
d) The next wizard prompts for the selection for “Installation Type”. Select “Typical Installation” to prioritize default settings and click “Next”. The “Advanced Installation” options lets you to select the language, different passwords and GNS settings for SCAN cluster name.



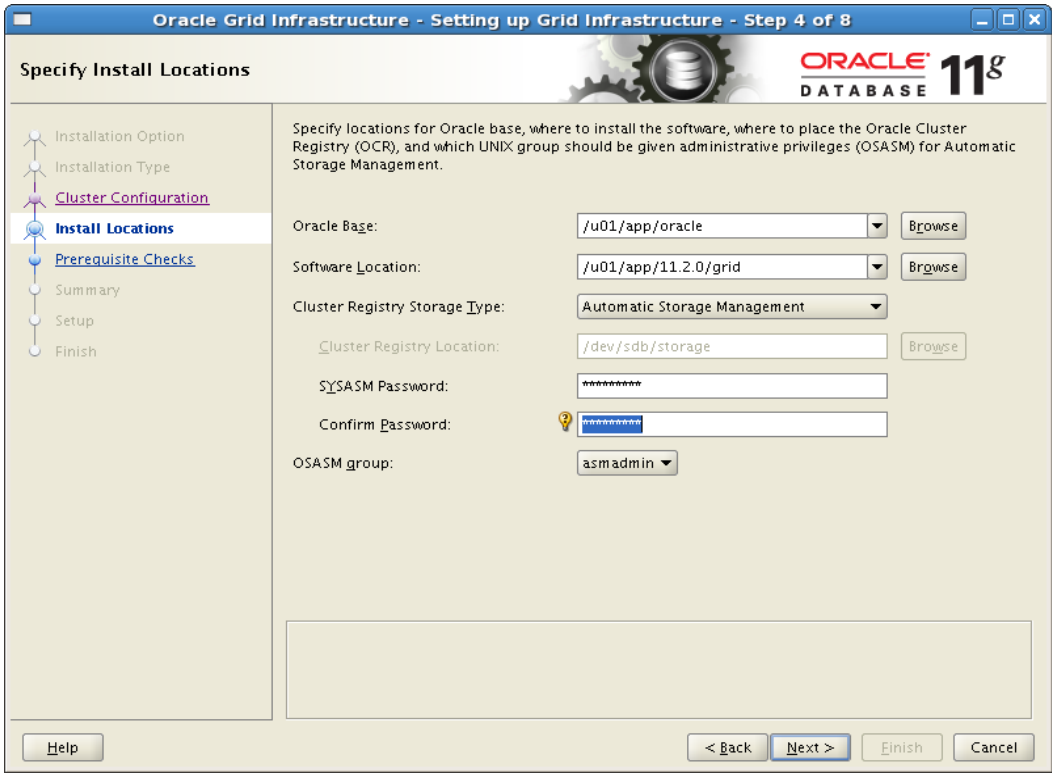
e) The third wizard does the “Cluster Configuration”. It will show a default, but modifiable SCAN name and only the master RAC node i.e. RAC1 here.

Click “Add” button to add the other participating nodes (public hostname and virtual hostname) in the cluster. Here, rac2.oracle.com (public) and rac2-vip.oracle.com (virtual hostname) is added.

Click “SSH Connectivity” to setup and test the SSH connectivity between the cluster nodes. Provide the “oracle” user password and click “Test”/”Setup”.

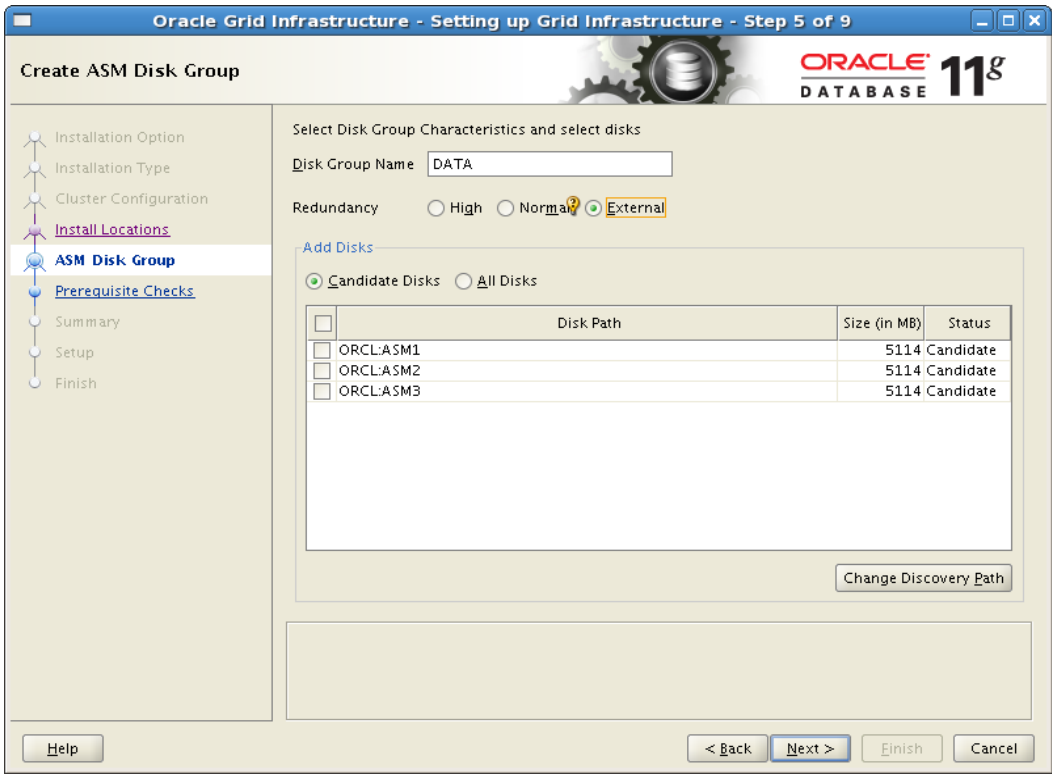


f) The “Install Location” wizard provides you to select the locations for “Oracle Base”, “Software Location” or grid home, “Cluster Registry Storage Type”, SYSASM Password and OSASM group. Select the appropriate values and click “Next”.
Note that the selection of correct OSASM group is required to list the ASM disks in the next wizards.



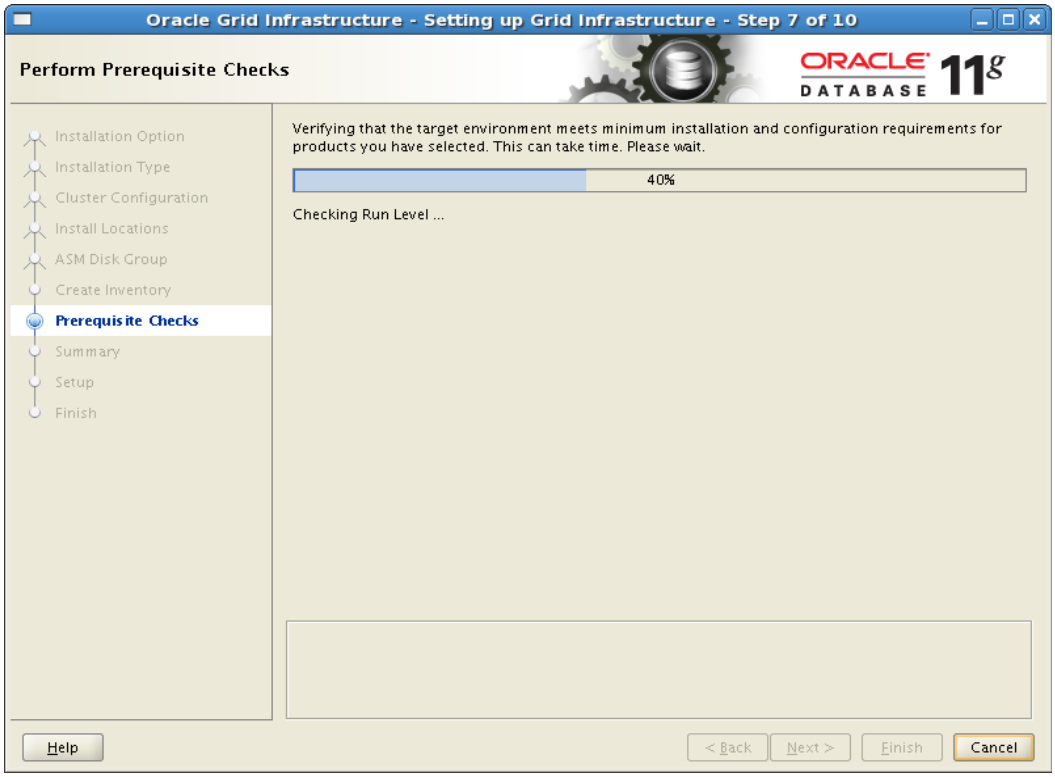
g) The “ASM Disk Group” wizard lists the configured ASM disks. “DATA” is the default Disk Group Name”. Select “External” redundancy to avoid mirroring of disks in the failure groups during demonstrations (though it is required in the production RAC setups). Check all the participating disks and click “Next”.

If the ASM disks are not getting listed, try to change the location by specifying correct location in “Change Discovery Path”.

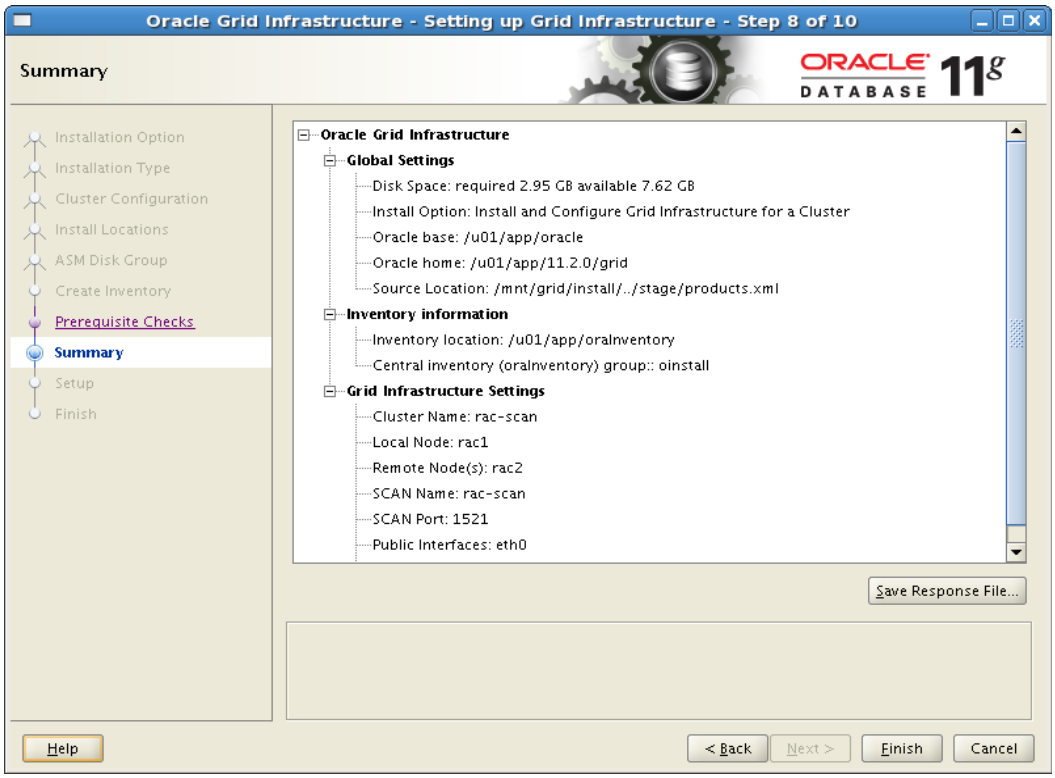


h) The next wizard “Create Inventory” specifies the default location for the storage of installation files. It is required for the first installation only.

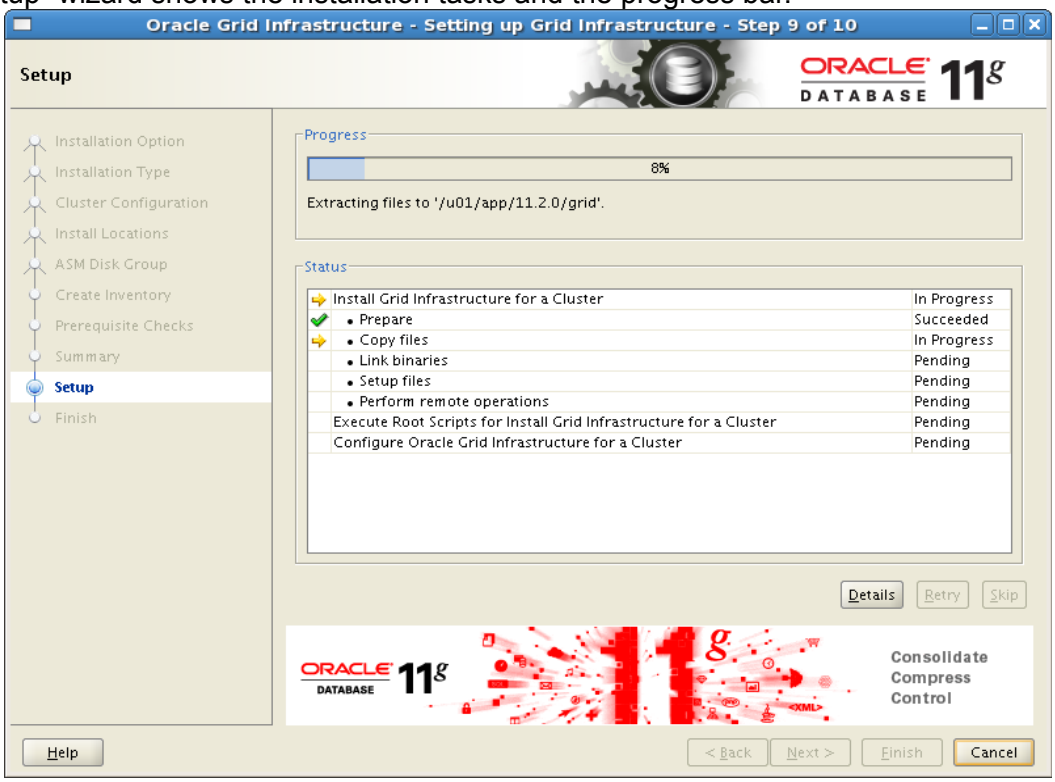
I) The next wizard “Prerequisite Checks” would check the system setup for the grid installation. The checks would be same as the one which we validated in the last section. After the verification, the wizard would be directed to “Summary” wizard.



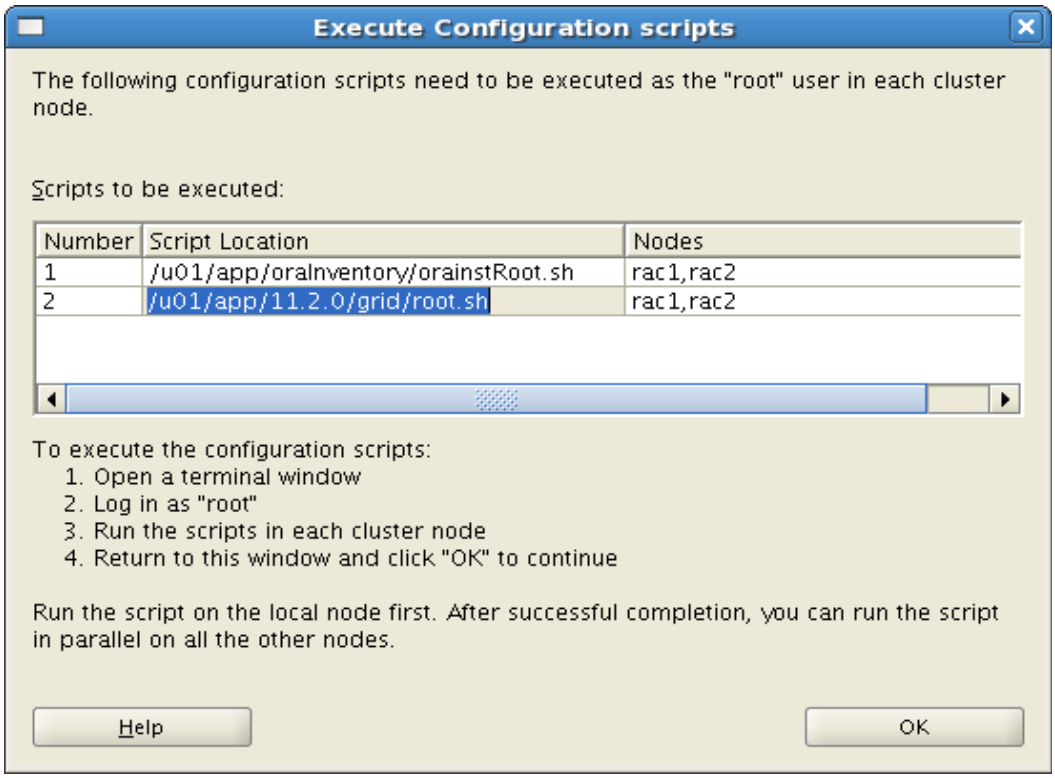
j) The “Summary” wizard will list the summary of the prerequisite check performed by the installer. If the check is successful, the below screen appears. If any of the checks are failed, the page lists the failed checks, fixable or not fixable recommendation, and ‘ignore’ option. If the failed checks can be fixed, it must be resolved before further proceedings. If the failed checks are ignorable, select the ‘ignore’ option. Click “Finish” to move ahead.



k) The “Setup” wizard shows the installation tasks and the progress bar.



l) In between of the installation (stage “Execute Root Scripts for Install Grid Infrastructure for a Cluster”), below dialog box pops-up and prompts for the execution of two scripts on all the nodes in the cluster. The scripts starts the Oracle High Availability Services, cluster processes and configures oracle grid infrastructure for the cluster. In addition, it also creates (and starts) ASM service and diskgroup DATA.



Execute both the scripts on the master node RAC1 first. Upon the successful execution of the scripts, execute the scripts on the remaining nodes. Sample output of the script execution is as below

```
[root@rac1 ~]# /u01/app/oraInventory/orainstRoot.sh
Changing permissions of /u01/app/oraInventory.
Adding read,write permissions for group.
Removing read,write,execute permissions for world.

Changing groupname of /u01/app/oraInventory to oinstall.
The execution of the script is complete.
[root@rac1 ~]# /u01/app/11.2.0/grid/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
    ORACLE_OWNER= oracle
    ORACLE_HOME=  /u01/app/11.2.0/grid

Enter the full pathname of the local bin directory: [/usr/local/bin]:
   Copying dbhome to /usr/local/bin ...
   Copying oraenv to /usr/local/bin ...
   Copying coraenv to /usr/local/bin ...


Creating /etc/oratab file...
```

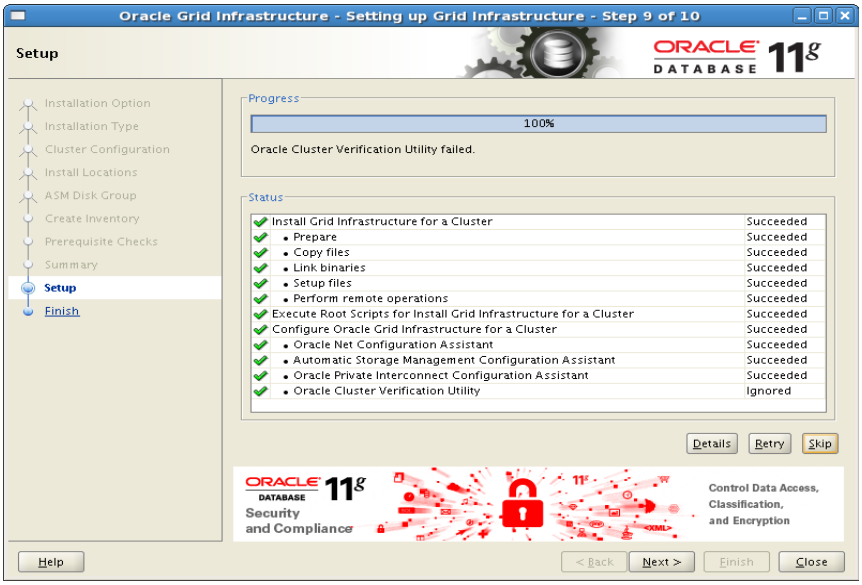
```
Entries will be added to the /etc/oratab file as needed by
Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
2012-09-23 18:06:35: Parsing the host name
2012-09-23 18:06:35: Checking for super user privileges
2012-09-23 18:06:35: User has super user privileges
Using configuration parameter file:
/u01/app/11.2.0/grid/crs/install/crsconfig_params
Creating trace directory
LOCAL ADD MODE
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
  root wallet
  root wallet cert
  root cert export
  peer wallet
  profile reader wallet
  pa wallet
  peer wallet keys
  pa wallet keys
  peer cert request
  pa cert request
  peer cert
  pa cert
  peer root cert TP
  profile reader root cert TP
  pa root cert TP
  peer pa cert TP
  pa peer cert TP
  profile reader pa cert TP
  profile reader peer cert TP
  peer user cert
  pa user cert
Adding daemon to inittab
CRS-4123: Oracle High Availability Services has been started.
ohasd is starting
acfsroot: ACFS-9301: ADVM/ACFS installation can not proceed:

acfsroot: ACFS-9302: No installation files found at
/u01/app/11.2.0/grid/install/usm/EL5/x86_64/2.6.18-8/2.6.18-8.el5uek-x86_64/bin.

CRS-2672: Attempting to start 'ora.gipcd' on 'rac1'
CRS-2672: Attempting to start 'ora.mdnsd' on 'rac1'
CRS-2676: Start of 'ora.gipcd' on 'rac1' succeeded
CRS-2676: Start of 'ora.mdnsd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.gpnpd' on 'rac1'
CRS-2676: Start of 'ora.gpnpd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.cssdmonitor' on 'rac1'
CRS-2676: Start of 'ora.cssdmonitor' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.cssd' on 'rac1'
CRS-2672: Attempting to start 'ora.diskmon' on 'rac1'
CRS-2676: Start of 'ora.diskmon' on 'rac1' succeeded
CRS-2676: Start of 'ora.cssd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.ctssd' on 'rac1'
CRS-2676: Start of 'ora.ctssd' on 'rac1' succeeded

ASM created and started successfully.
```

```
DiskGroup DATA created successfully.

clscfg: -install mode specified
Successfully accumulated necessary OCR keys.
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
CRS-2672: Attempting to start 'ora.crsd' on 'rac1'
CRS-2676: Start of 'ora.crsd' on 'rac1' succeeded
CRS-4256: Updating the profile
Successful addition of voting disk 35ab9a01644a4fa1bfd2c1b1c28cfb32.
Successfully replaced voting disk group with +DATA.
CRS-4256: Updating the profile
CRS-4266: Voting file(s) successfully replaced
##  STATE    File Universal Id                File Name Disk group
--  -----    -----------------                --------- ---------
 1. ONLINE   35ab9a01644a4fa1bfd2c1b1c28cfb32 (ORCL:ASM1) [DATA]
Located 1 voting disk(s).
CRS-2673: Attempting to stop 'ora.crsd' on 'rac1'
CRS-2677: Stop of 'ora.crsd' on 'rac1' succeeded
CRS-2673: Attempting to stop 'ora.asm' on 'rac1'
CRS-2677: Stop of 'ora.asm' on 'rac1' succeeded
CRS-2673: Attempting to stop 'ora.ctssd' on 'rac1'
CRS-2677: Stop of 'ora.ctssd' on 'rac1' succeeded
CRS-2673: Attempting to stop 'ora.cssdmonitor' on 'rac1'
CRS-2677: Stop of 'ora.cssdmonitor' on 'rac1' succeeded
CRS-2673: Attempting to stop 'ora.cssd' on 'rac1'
CRS-2677: Stop of 'ora.cssd' on 'rac1' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd' on 'rac1'
CRS-2677: Stop of 'ora.gpnpd' on 'rac1' succeeded
CRS-2673: Attempting to stop 'ora.gipcd' on 'rac1'
CRS-2677: Stop of 'ora.gipcd' on 'rac1' succeeded
CRS-2673: Attempting to stop 'ora.mdnsd' on 'rac1'
CRS-2677: Stop of 'ora.mdnsd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.mdnsd' on 'rac1'
CRS-2676: Start of 'ora.mdnsd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.gipcd' on 'rac1'
CRS-2676: Start of 'ora.gipcd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.gpnpd' on 'rac1'
CRS-2676: Start of 'ora.gpnpd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.cssdmonitor' on 'rac1'
CRS-2676: Start of 'ora.cssdmonitor' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.cssd' on 'rac1'
CRS-2672: Attempting to start 'ora.diskmon' on 'rac1'
CRS-2676: Start of 'ora.diskmon' on 'rac1' succeeded
CRS-2676: Start of 'ora.cssd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.ctssd' on 'rac1'
CRS-2676: Start of 'ora.ctssd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'rac1'
CRS-2676: Start of 'ora.asm' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.crsd' on 'rac1'
CRS-2676: Start of 'ora.crsd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.evmd' on 'rac1'
CRS-2676: Start of 'ora.evmd' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'rac1'
CRS-2676: Start of 'ora.asm' on 'rac1' succeeded
CRS-2672: Attempting to start 'ora.DATA.dg' on 'rac1'
CRS-2676: Start of 'ora.DATA.dg' on 'rac1' succeeded

rac1     2012/09/23 18:12:00
```

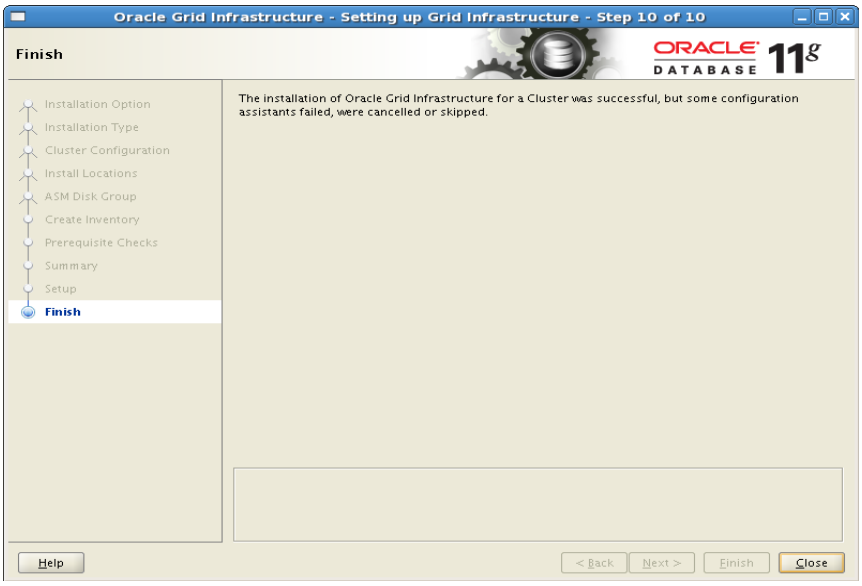
```
/u01/app/11.2.0/grid/cdata/rac1/backup_20120923_181200.olr
Configure Oracle Grid Infrastructure for a Cluster ... succeeded
Updating inventory properties for clusterware
Starting Oracle Universal Installer...

Checking swap space: must be greater than 500 MB.   Actual 3928 MB    Passed
The inventory pointer is located at /etc/oraInst.loc
The inventory is located at /u01/app/oraInventory
'UpdateNodeList' was successful.
```

Similar output can be observed while executing the scripts on the other nodes also. The message `'UpdateNodeList' was successful` confirms the successful execution of the script.

m) The installation is complete. Click “Next” to move to the “Finish” wizard



n) The “Finish” wizard confirms the successful installation of the Oracle Grid Infrastructure software



Oracle Database Software Installation

Once the oracle grid infrastructure is installed successfully, oracle database software installation can be initiated. The step by step listing and related description is as follows.

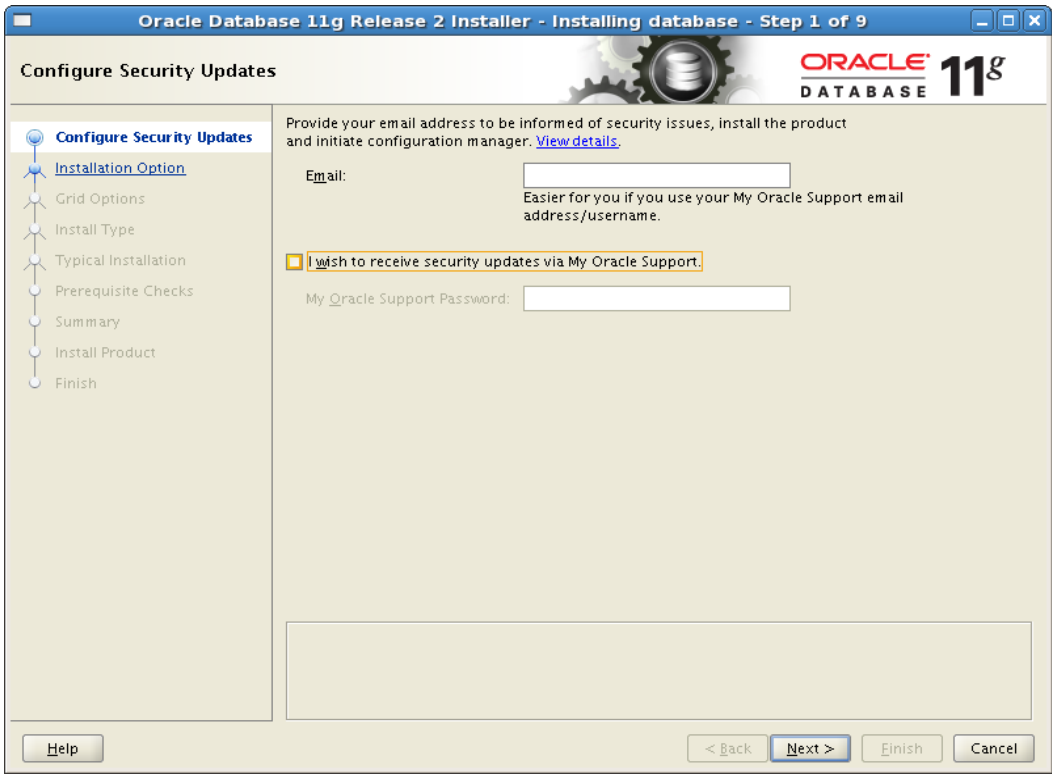
a) Unzip the database software zipped files as “root” user. Modify the owner and group details of the “database” folder.

```
[root@rac1 install]# unzip linux.x64_11gR2_database_2of2.zip
[root@rac1 install]# unzip linux.x64_11gR2_database_2of2.zip
[root@rac1 install]# cd ./database
[root@rac1 database]# chown -R oracle:oinstall *
```

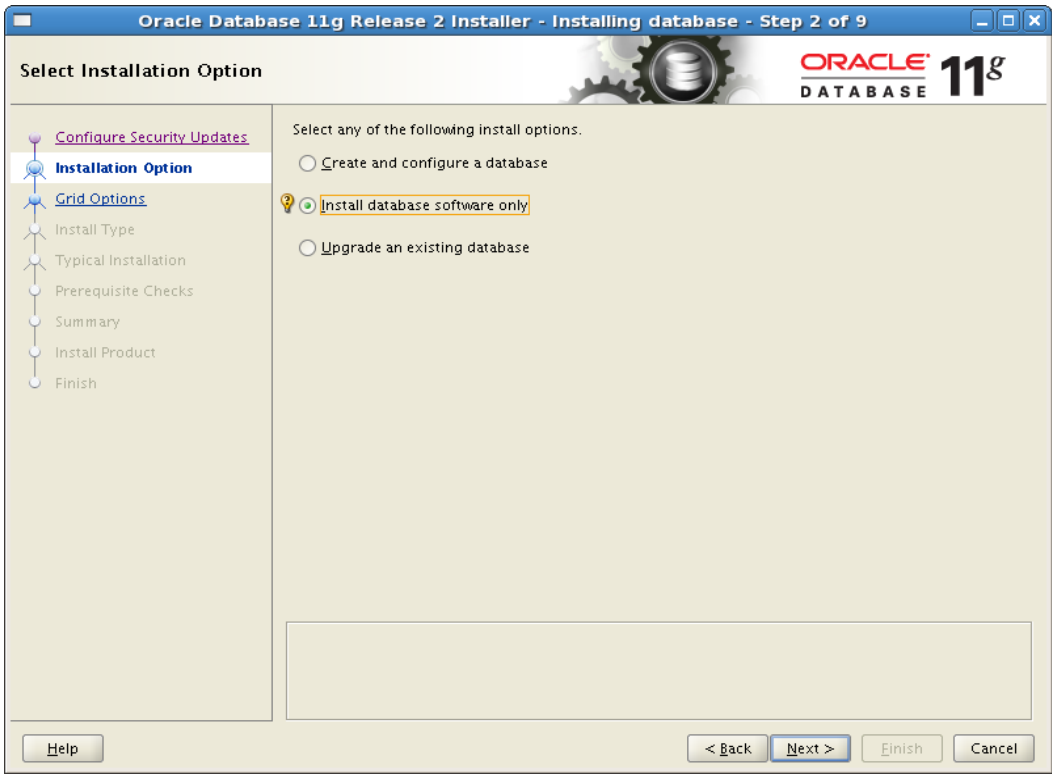
b) Execute “xhost +” as root to configure xwindows. Run the Installer utility

```
[root@rac1 database]# xhost +
access control disabled, clients can connect from any host
[root@rac1 database]# su oracle
[oracle@rac1 database]$ sh runInstaller
Starting Oracle Universal Installer...

Checking Temp space: must be greater than 120 MB.   Actual 4870 MB    Passed
Checking swap space: must be greater than 150 MB.   Actual 3999 MB    Passed
Checking monitor: must be configured to display at least 256 colors.    Actual
16777216    Passed
Preparing to launch Oracle Universal Installer from /tmp/OraInstall2012-09-24_05-
28-58AM. Please wait ...
```

c) The “Configure Security Updates” asks for the email contact to sync in the security updates to the user. Since its not mandatory, uncheck the option and click “Next”.

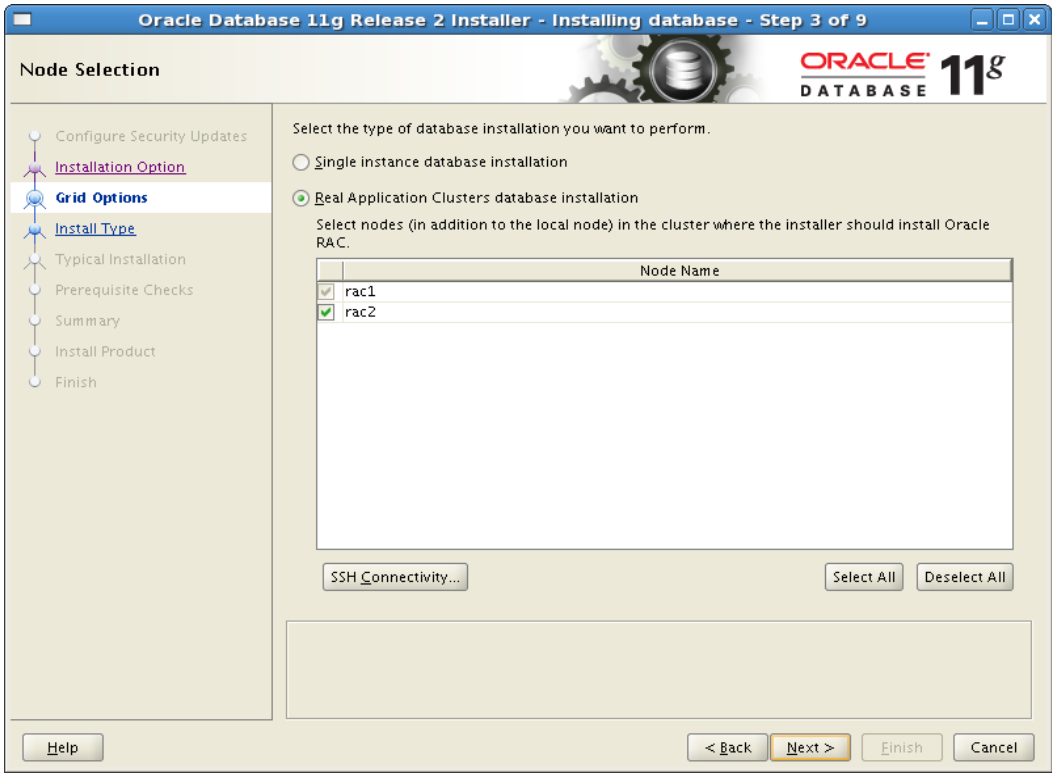


d) In the wizard “Installation Option”, select the option “Install database software only” and click “Next”. It implies that we shall create the database separately using the “dbca” utility.

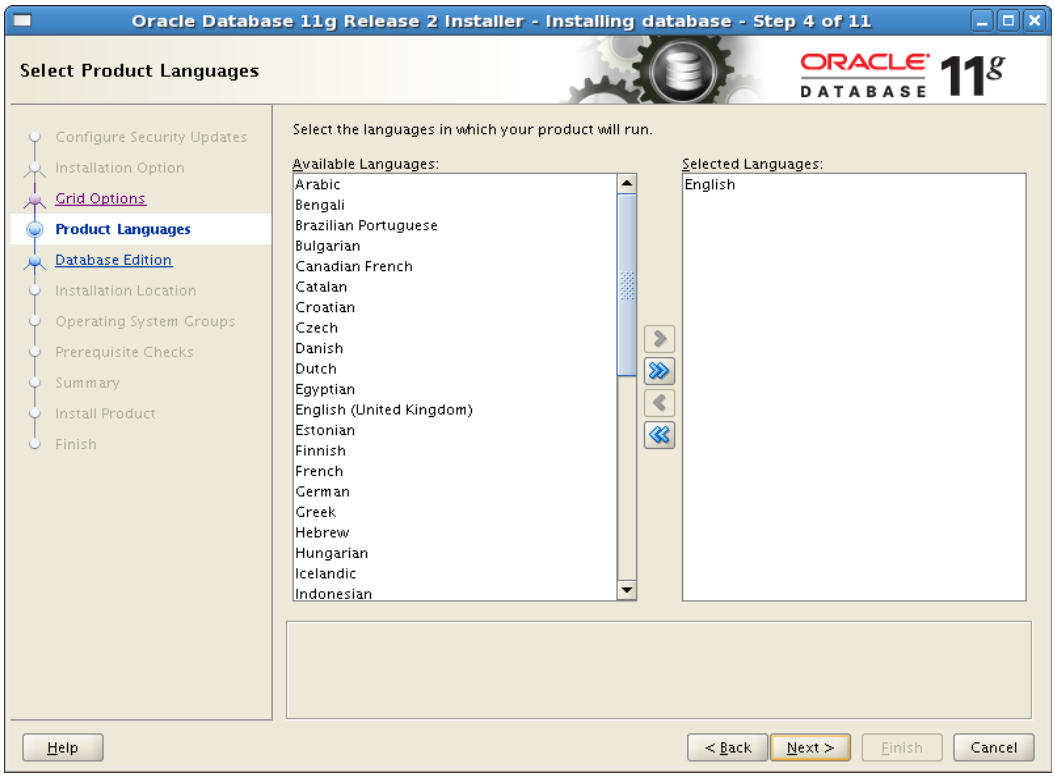


e) Under the “Grid Options” wizard, the “Real Application Clusters database installation” is selected by default due to detection of the clusterware by the installer. Note that both the nodes i.e. RAC1 and RAC2 are listed and check by default.

However, “Single instance database installation” option allows to create a conventional database with a single instance connecting to a single database.

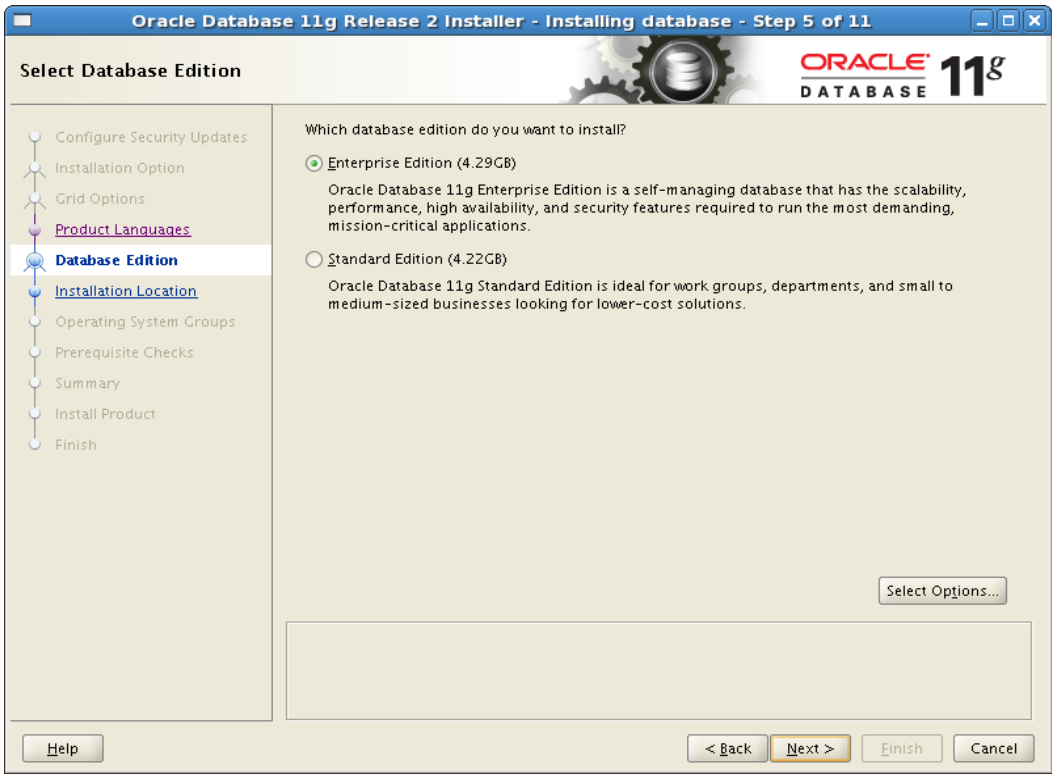


f) The “Product Languages” wizard allows you to select the language supported by the database product.

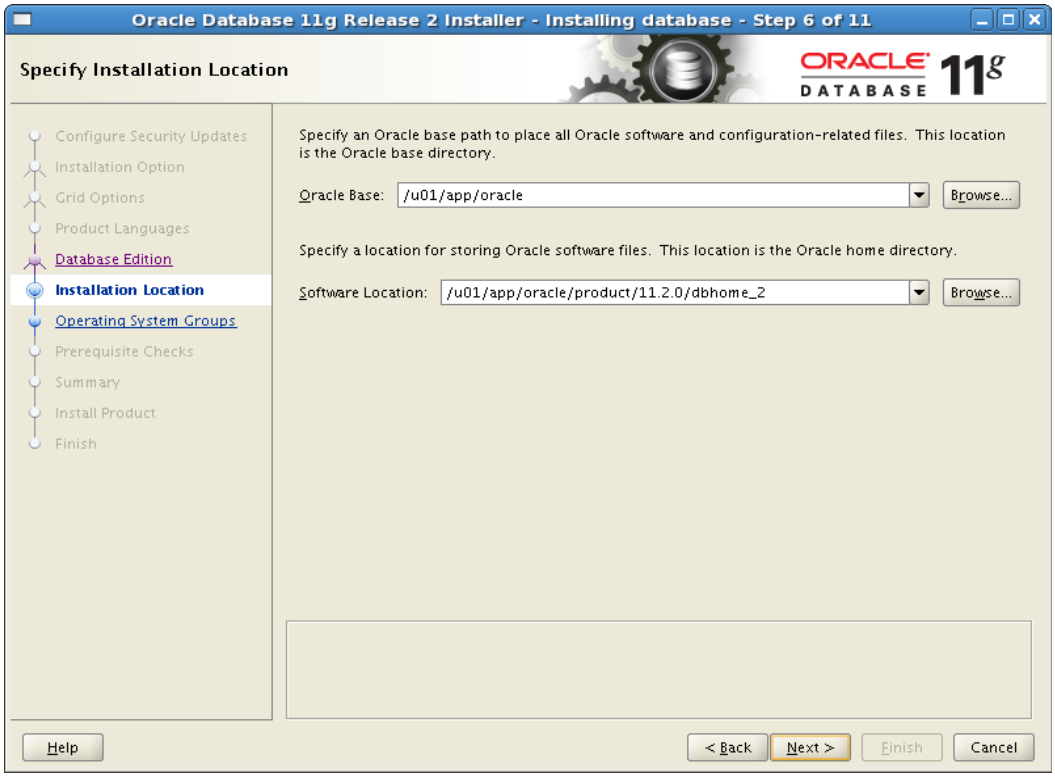


g) The “Database Edition” wizard allows you to select the appropriate edition to be installed. For

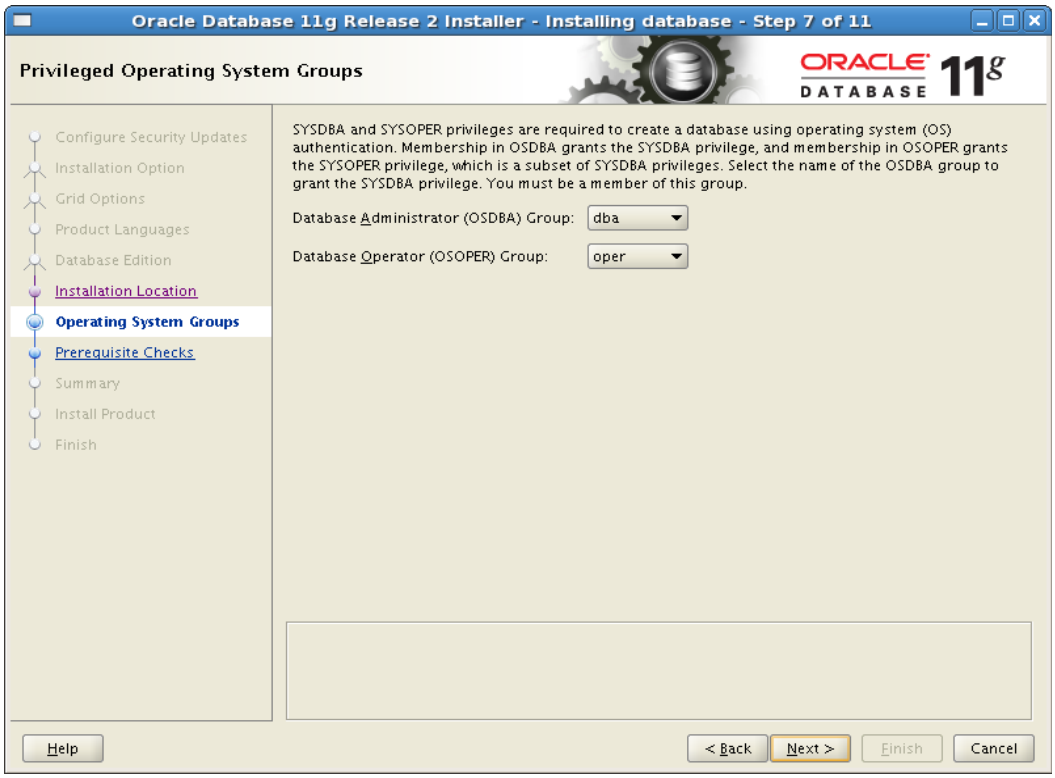
demonstration purposes, we select “Enterprise Edition” and click “Next” to move further.



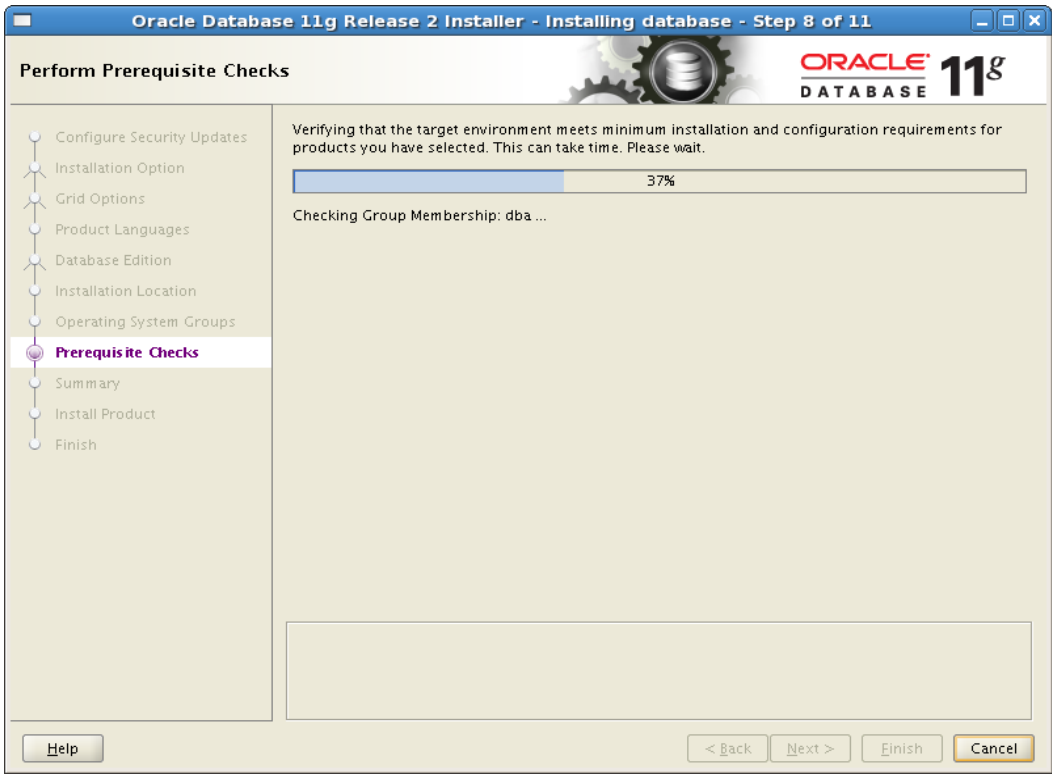
h) The “Installation Location” wizard allows the user to select the “Oracle Base” and “Software Location” on the server.



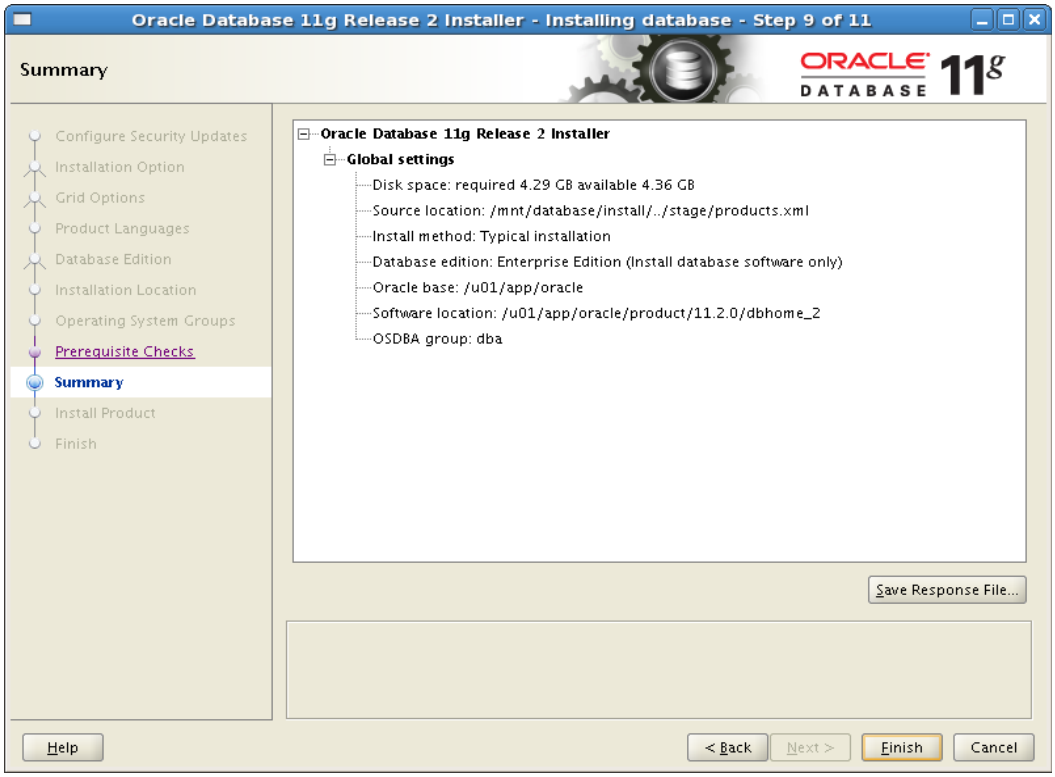
I) The wizard “Operating System Groups” select the OSDBA abd OSOPER groups.



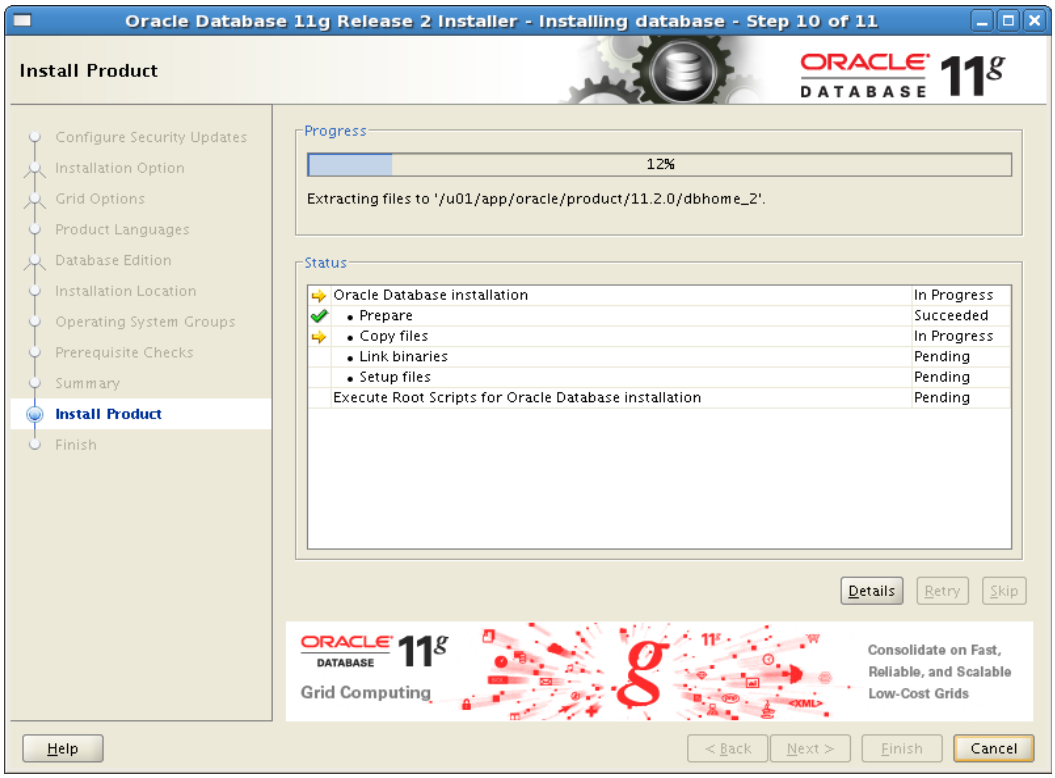
j) In the “Prerequisite Checks” wizard, the installer performs the prerequisite checks.



k) Once the prerequisite checks are performed, the “Summary” wizard lists the summary of validations and verifications. Click “Finish’ to kick off the installation.



l) The “Install Product” wizard shows the stepwise installation and progress bar



m) Similar to grid installation, a dialog pops up to prompt the execution of Root scripts for Database Installation. Execute the scripts on both the nodes RAC1 and RAC2 respectively

```
[root@rac1 /]# /u01/app/oracle/product/11.2.0/dbhome_2/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
    ORACLE_OWNER= oracle
    ORACLE_HOME=  /u01/app/oracle/product/11.2.0/dbhome_2

Enter the full pathname of the local bin directory: [/usr/local/bin]:
The file "dbhome" already exists in /usr/local/bin.  Overwrite it? (y/n)
[n]: y
   Copying dbhome to /usr/local/bin ...
The file "oraenv" already exists in /usr/local/bin.  Overwrite it? (y/n)
[n]: y
   Copying oraenv to /usr/local/bin ...
The file "coraenv" already exists in /usr/local/bin.  Overwrite it? (y/n)
[n]: y
   Copying coraenv to /usr/local/bin ...

Entries will be added to the /etc/oratab file as needed by
Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
Finished product-specific root actions.
```

n) The “Finish” wizard confirms the successful installation of Oracle database software.