# Oracle Database 12c Release 2 (12.2) RAC On Oracle Linux 7 Using VirtualBox

This labs covers the installation of Oracle Database 12c Release 2 (12.2 64-bit) RAC on Linux (Oracle Linux 7 64-bit) using VirtualBox with no additional shared disk devices.

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Introduction

Using VirtualBox you can run multiple Virtual Machines (VMs) on a single server, allowing you to run both RAC nodes on a single machine. In addition, it allows you to set up shared virtual disks, overcoming the obstacle of expensive shared storage.
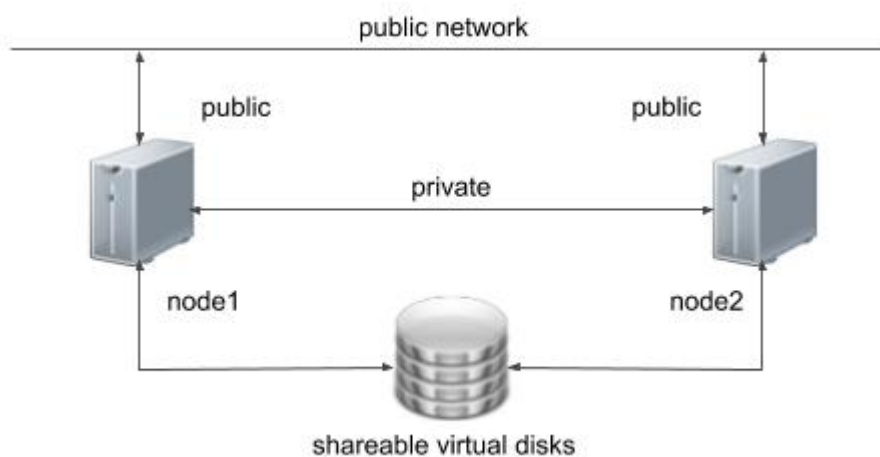
Before you launch into this installation, here are a few things to consider.

- The finished system includes the host operating system, two guest operating systems, two sets of Oracle Grid Infrastructure (Clusterware + ASM) and two Database instances all on a single server. As you can imagine, this requires a significant amount of disk space, CPU and memory.
- Following on from the last point, the VMs will each need at least 8G of RAM, preferably more if you don't want the VMs to swap like crazy.
- This procedure provides a bare bones installation to get the RAC working. There is no redundancy in the Grid Infrastructure installation or the ASM installation. To add this, simply create double the amount of shared disks and select the "Normal" redundancy option when it is offered. Of course, this will take more disk space.
- During the virtual disk creation, We can choose not to preallocate the disk space. This makes virtual disk access slower during the installation, but saves on wasted disk space. The shared disks must have their space preallocated.
- The Single Client Access Name (SCAN) should be defined in the DNS or GNS and round-robin between one of 3 addresses, which are on the same subnet as the public and virtual IPs. Prior to 11.2.0.2 it could be defined as a single IP address in the "/etc/hosts" file, which is wrong and will cause the cluster verification to fail, but it allowed you to complete the install without the presence of a DNS. This does not seem to work for 11.2.0.2 onward.
- The virtual machines can be limited to 2Gig of swap, which causes a prerequisite check failure, but doesn't prevent the installation working. If you want to avoid this, define 3+Gig of swap.
- This article uses the 64-bit versions of Oracle Linux and Oracle 12c Release 2.

This procedure should run successfully on a Linux and Windows host. Where applicable, I've included both the Linux and Windows commands to be run on the host, so pick the relevant ones.

** Although I have completed this installation with 4G VMs, it was chronically slow. I would suggest using as much memory as possible, without making the host OS swap.

Download Software

Download the following software.

- Oracle Linux 7.3
- VirtualBox (5.1.14)
- Oracle 12c Release 2 (12.2.0.1) Software (64 bit)

Depending on your version of VirtualBox and Oracle Linux, there may be some slight variation in how the screen shots look.

VirtualBox Installation

First, install the VirtualBox software. On RHEL and its clones you do this with the following type of command as the root user. On windows, just run the ".exe".

```
# rpm -Uvh VirtualBox*.rpm
```

The package name will vary depending on the host distribution you are using. Once complete, VirtualBox is started from the menu.

VirtualBox Network Setup

We need to make sure a host-only network is configured and check/modify the IP range for that network. This will be the public network for our RAC installation.

- Start VirtualBox from the menu.

- Select the "File > Preferences" menu option.

- Click "Network" in the left pane and click the "Host-only Networks" tab.

- Click the "Adds new host-only network" button on the right size of the screen. Depending on the host OS, a network called "vboxnet0" or "VirtualBox Host-Only Ethernet Adapter" will be created.
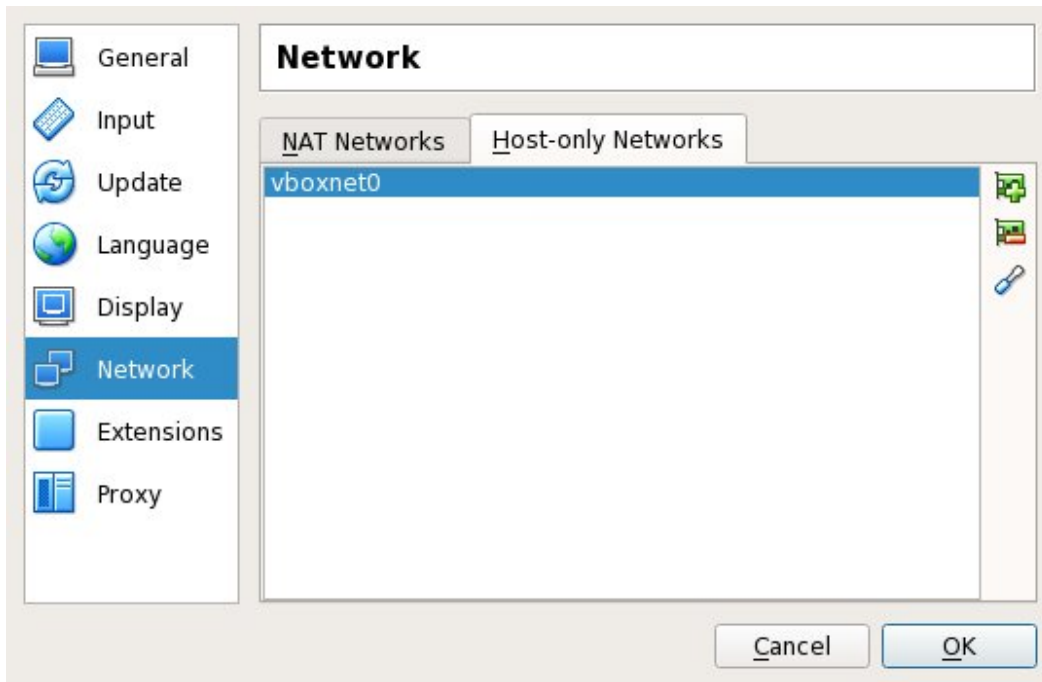
Click the "Edits selected host-only network." button on the right size of the screen.

- If you want to use a different subnet for your public addresses you can change the network details here. Just make sure the subnet you choose doesn't match any real subnets on your network. I've decided to stick with the default, which for me is "192.168.56.X".
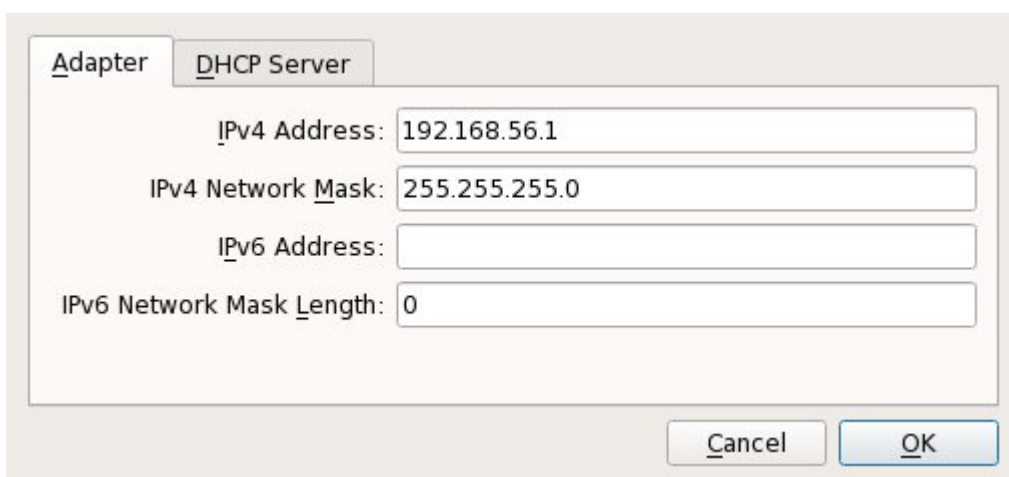
- Use the "OK" buttons to exit out of this screen.

- Click the "NAT Networks" tab. If you don't have a NAT network defined, click the "+" button. You shouldn't need to configure this.

- Click the "OK" button to close the preferences dialog.

Virtual Machine Setup

Now we must define the two virtual RAC nodes. We can save time by defining one VM, then cloning it when it is installed.

Start VirtualBox and click the "New" button on the toolbar. Enter the name "ol7-122-rac1", OS "Linux" and Version "Oracle (64 bit)", then click the "Next" button.

Enter "4096" as the base memory size, then click the "Next" button. Use more memory if you have enough physical memory on your machine as it will make the process much quicker!

Memory size

Select the amount of memory (RAM) in megabytes to be allocated to the virtual machine.

The recommended memory size is **1024** MB.

| | 4096 | MB |

4 MB   24576 MB

< Back   Next >   Cancel

Accept the default option to create a new virtual hard disk by clicking the "Create" button.

Hard disk

If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select one from the list or from another location using the folder icon.

If you need a more complex storage set-up you can skip this step and make the changes to the machine settings once the machine is created.

The recommended size of the hard disk is **12.00 GB**.

○ Do not add a virtual hard disk

● Create a virtual hard disk now

○ Use an existing virtual hard disk file

ol7.vdi (Normal, 100.00 GB)

< Back   Create   Cancel

Acccept the default hard drive file type by clicking the "Next" button.

Hard disk file type

Please choose the type of file that you would like to use for the new virtual hard disk. If you do not need to use it with other virtualization software you can leave this setting unchanged.

- ⦿ VDI (VirtualBox Disk Image)
- ○ VHD (Virtual Hard Disk)
- ○ VMDK (Virtual Machine Disk)

Expert Mode   < Back   Next >   Cancel

Acccept the "Dynamically allocated" option by clicking the "Next" button.

Storage on physical hard disk

Please choose whether the new virtual hard disk file should grow as it is used (dynamically allocated) or if it should be created at its maximum size (fixed size).

A **dynamically allocated** hard disk file will only use space on your physical hard disk as it fills up (up to a maximum **fixed size**), although it will not shrink again automatically when space on it is freed.

A **fixed size** hard disk file may take longer to create on some systems but is often faster to use.

- ⦿ Dynamically allocated
- ○ Fixed size

< Back   Next >   Cancel

Accept the default location and set the size to "50G", then click the "Create" button. If you can spread the virtual disks onto different physical disks, that will improve performance.

File location and size

Please type the name of the new virtual hard disk file into the box below or click on the folder icon to select a different folder to create the file in.
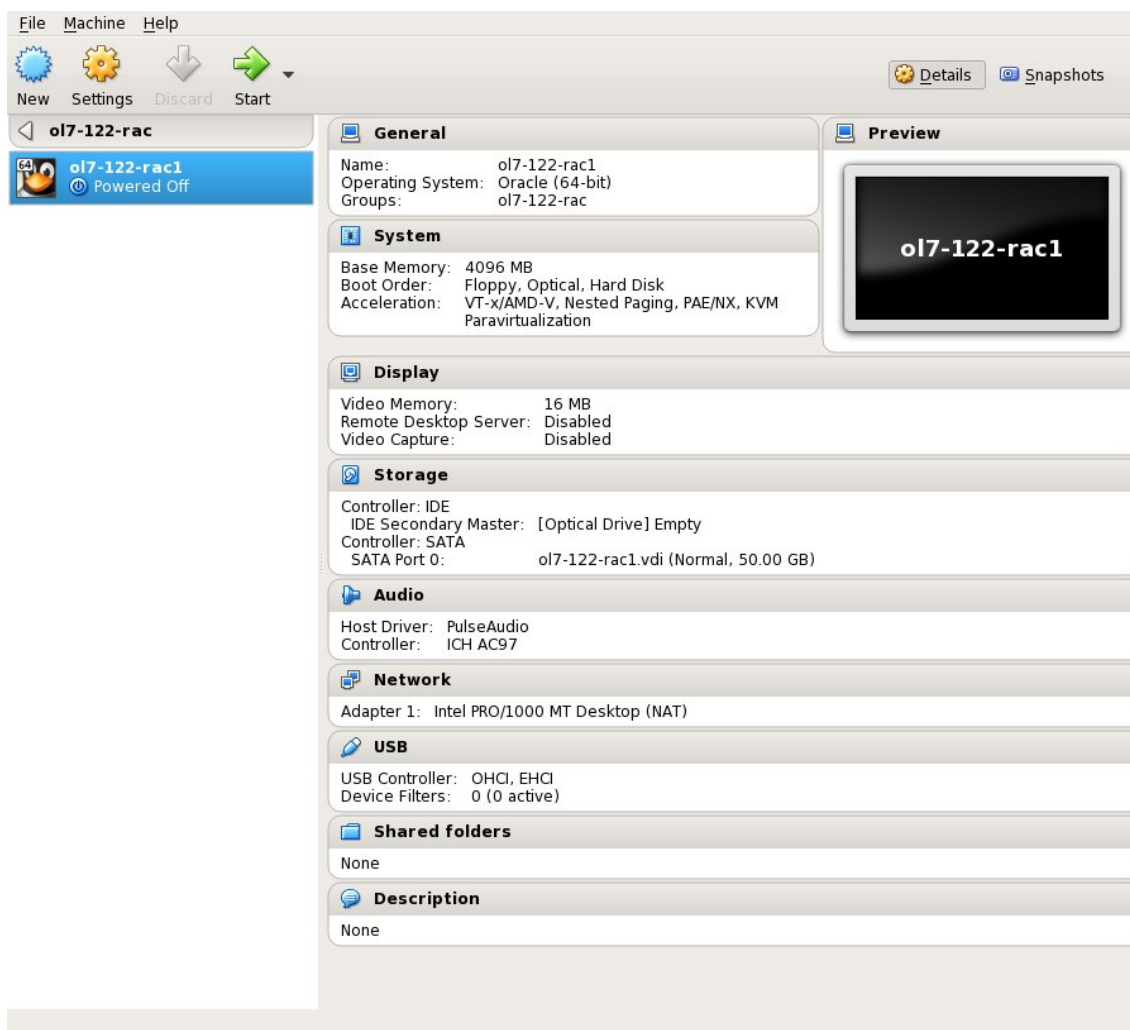
ol7-122-rac1

Select the size of the virtual hard disk in megabytes. This size is the limit on the amount of file data that a virtual machine will be able to store on the hard disk.

50.00 GB
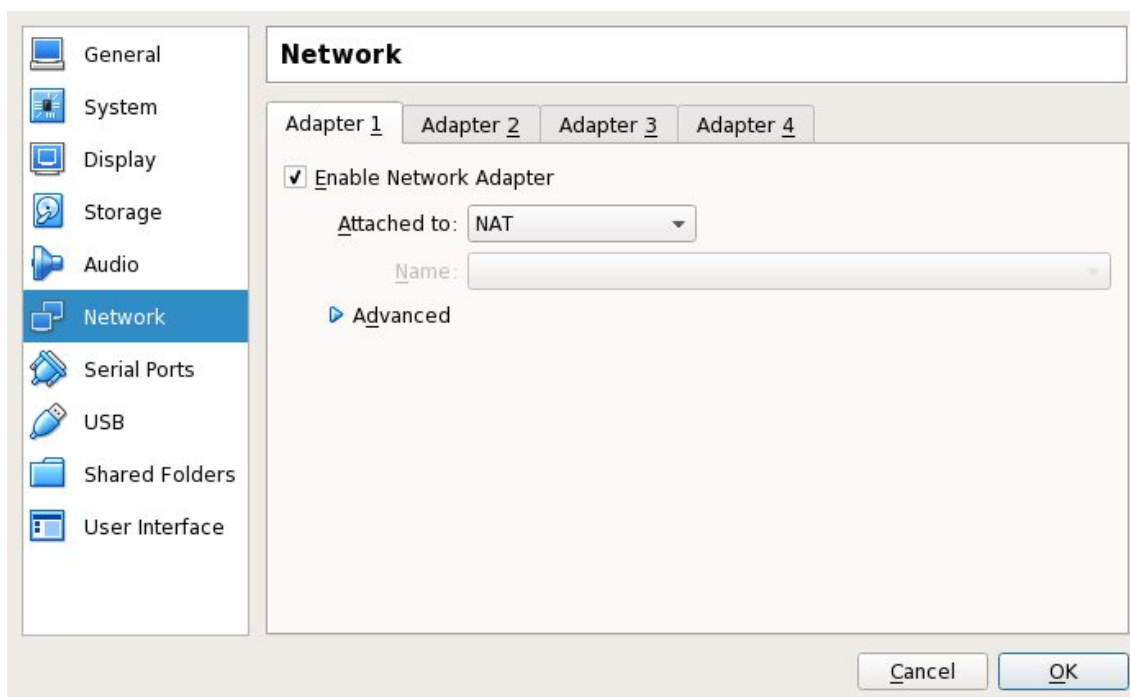
4.00 MB   2.00 TB

< Back   Create   Cancel

The "ol7-122-rac1" VM will appear on the left hand pane. Scroll down the details on the right and click on the "Network" link.
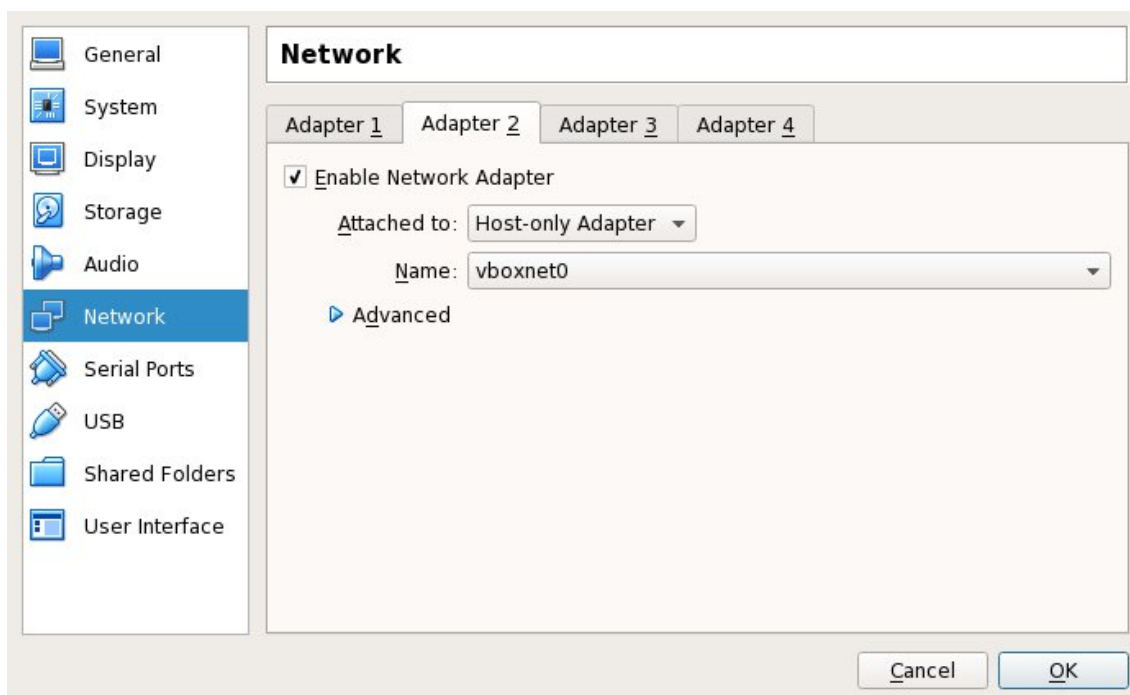
Make sure "Adapter 1" is enabled, set to "NAT", then click on the "Adapter 2" tab.
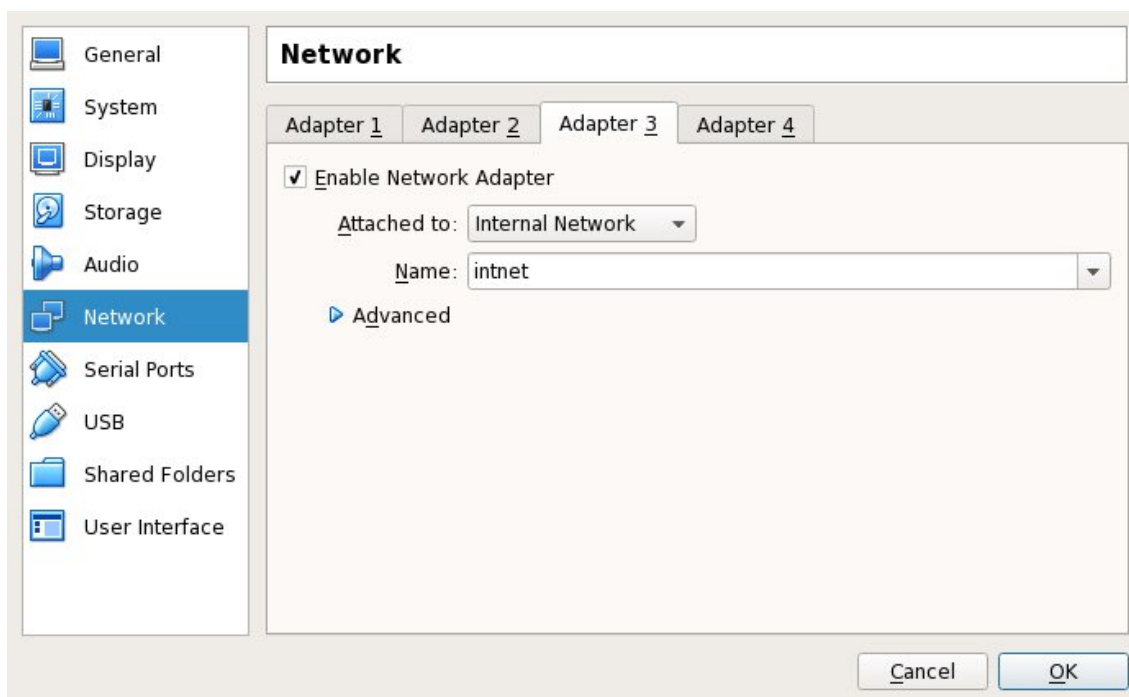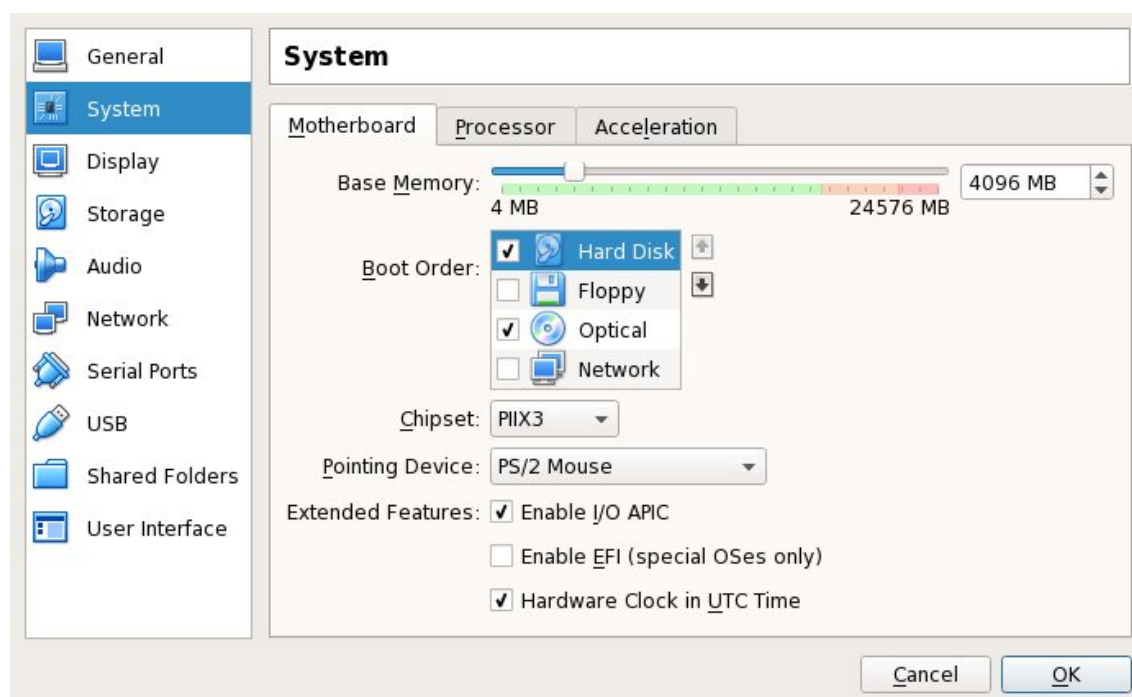
Make sure "Adapter 2" is enabled, set to "Host-only Adapter", then click on the "Adapter 3" tab.

Make sure "Adapter 3" is enabled, set to "Internal Network", then click on the "System" section.

Move "Hard Disk" to the top of the boot order and uncheck the "Floppy" option, then click the "OK" button.

The virtual machine is now configured so we can start the guest operating system installation.

Guest Operating System Installation

With the new VM highlighted, click the "Start" button on the toolbar. On the "Select start-up disk" screen, choose the relevant Oracle Linux ISO image and click the "Start" button.

If a "Select start-up disk" screen doesn't appear, use the "Devices > Optical Drives > Choose disk image..." menu option to select the relevant ISO image, then restart the VM using the "Machine > Reset" menu option.

The resulting console window will contain the Oracle Linux boot screen.

Continue through the Oracle Linux 7 installation as you would for a basic server. A general pictorial guide to the installation `oracle7_installation.pdf` . More specifically, it should be a server installation with a minimum of 4G+ swap, firewall disabled, SELinux set to permissive and the following package groups installed:

- Server with GUI
- Hardware Monitoring Utilities
- Large Systems Performance
- Network file system client
- Performance Tools
- Compatibility Libraries
- Development Tools

To be consistent with the rest of the article, the following information should be set during the installation.

- hostname: ol7-122-rac1.localdomain
- enp0s3 (eth0): DHCP (Connect Automatically)
- enp0s8 (eth1): IP=192.168.56.101, Subnet=255.255.255.0, Gateway=192.168.56.1, DNS=192.168.56.1, Search=localdomain (Connect Automatically)
- enp0s9 (eth2): IP=192.168.1.101, Subnet=255.255.255.0, Gateway=<blank>, DNS=<blank>, Search= <blank> (Connect Automatically)

You are free to change the IP addresses to suit your network, but remember to stay consistent with those adjustments throughout the rest of the article. Likewise, in this article I will refer to the network adapters as enp0s3, enp0s8 and enp0s9, In previous Linux versions they would have been eth0, eth1 and eth2 respectively.

Oracle Installation Prerequisites

Perform either the Automatic Setup or the Manual Setup to complete the basic prerequisites. The Additional Setup is required for all installations.

Automatic Setup

If you plan to use the "oracle-database-server-12cR2-preinstall" package to perform all your prerequisite setup, issue the following command.

```
# yum install oracle-database-server-12cR2-preinstall -y
```

** Earlier versions of Oracle Linux required manual setup of the Yum repository by following the instructions at http://public-yum.oracle.com.

It is probably worth doing a full update as well, but this is not strictly speaking necessary.

```
# yum update -y
```

Manual Setup

If you have not used the "oracle-database-server-12cR2-preinstall" package to perform all prerequisites, you will need to manually perform the following setup tasks.

Add the following lines to the "/etc/sysctl.conf" file, or in a file called "/etc/sysctl.d/98-oracle.conf".

```
fs.file-max = 6815744
kernel.sem = 250 32000 100 128
kernel.shmmni = 4096
kernel.shmall = 1073741824
kernel.shmmax = 4398046511104
kernel.panic_on_oops = 1
net.core.rmem_default = 262144
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
net.core.wmem_max = 1048576
net.ipv4.conf.all.rp_filter = 2
net.ipv4.conf.default.rp_filter = 2
fs.aio-max-nr = 1048576
net.ipv4.ip_local_port_range = 9000 65500
```

Run one of the following commands to change the current kernel parameters, depending on which file you edited.

```
/sbin/sysctl -p
# Or
/sbin/sysctl -p /etc/sysctl.d/98-oracle.conf
```

Add the following lines to a file called "/etc/security/limits.d/oracle-database-server-12cR2-preinstall.conf" file.

```
oracle   soft   nofile    1024
oracle   hard   nofile    65536
oracle   soft   nproc    16384
oracle   hard   nproc    16384
oracle   soft   stack    10240
```

```
oracle    hard    stack     32768
oracle    hard    memlock   134217728
oracle    soft    memlock   134217728
```

In addition to the basic OS installation, the following packages must be installed whilst logged in as the root user. This includes the 64-bit and 32-bit versions of some packages.

```
# From Public Yum or ULN
yum install binutils -y
yum install compat-libstdc++-33 -y
yum install compat-libstdc++-33.i686 -y
yum install gcc -y
yum install gcc-c++ -y
yum install glibc -y
yum install glibc.i686 -y
yum install glibc-devel -y
yum install glibc-devel.i686 -y
yum install ksh -y
yum install libgcc -y
yum install libgcc.i686 -y
yum install libstdc++ -y
yum install libstdc++.i686 -y
yum install libstdc++-devel -y
yum install libstdc++-devel.i686 -y
yum install libaio -y
yum install libaio.i686 -y
yum install libaio-devel -y
yum install libaio-devel.i686 -y
yum install libXext -y
yum install libXext.i686 -y
yum install libXtst -y
yum install libXtst.i686 -y
yum install libX11 -y
yum install libX11.i686 -y
yum install libXau -y
yum install libXau.i686 -y
yum install libxcb -y
yum install libxcb.i686 -y
yum install libXi -y
yum install libXi.i686 -y
yum install make -y
yum install sysstat -y
yum install unixODBC -y
yum install unixODBC-devel -y
yum install zlib-devel -y
yum install zlib-devel.i686 -y
```

Create the new groups and users.

```
groupadd -g 54321 oinstall
groupadd -g 54322 dba
groupadd -g 54323 oper
#groupadd -g 54324 backupdba
```

```
#groupadd -g 54325 dgdba
#groupadd -g 54326 kmdba
#groupadd -g 54327 asmdba
#groupadd -g 54328 asmoper
#groupadd -g 54329 asmadmin
#groupadd -g 54330 racdba


useradd -u 54321 -g oinstall -G dba,oper oracle
```

You could define the additional groups and assign them to the "oracle" users. The would allow you to assign the individual groups during the installation. For this installation I've just used the "dba" group.

```
groupadd -g 54324 backupdba
groupadd -g 54325 dgdba
groupadd -g 54326 kmdba
groupadd -g 54327 asmdba
groupadd -g 54328 asmoper
groupadd -g 54329 asmadmin
groupadd -g 54330 racdba


useradd -u 54321 -g oinstall -G
dba,oper,backupdba,dgdba,kmdba,asmdba,asmoper,asmadmin,racdba oracle
```

Additional Setup

The following steps must be performed, whether you did the manual or automatic setup.

Perform the following steps whilst logged into the "ol7-122-rac1" virtual machine as the root user.

Set the password for the "oracle" user.

```
passwd oracle
```

Apart form the localhost address, the "/etc/hosts" file can be left blank, but I prefer to put the addresses in for reference.

```
127.0.0.1        localhost.localdomain    localhost
# Public
192.168.56.101   ol7-122-rac1.localdomain        ol7-122-rac1
192.168.56.102   ol7-122-rac2.localdomain        ol7-122-rac2
# Private
192.168.1.101   ol7-122-rac1-priv.localdomain   ol7-122-rac1-priv
192.168.1.102   ol7-122-rac2-priv.localdomain   ol7-122-rac2-priv
# Virtual
192.168.56.103   ol7-122-rac1-vip.localdomain    ol7-122-rac1-vip
192.168.56.104   ol7-122-rac2-vip.localdomain    ol7-122-rac2-vip
# SCAN
#192.168.56.105   ol7-122-scan.localdomain ol7-122-scan
#192.168.56.106   ol7-122-scan.localdomain ol7-122-scan
#192.168.56.107   ol7-122-scan.localdomain ol7-122-scan
```

** The SCAN address is commented out of the hosts file because it must be resolved using a DNS, so it can round-robin between 3 addresses on the same subnet as the public IPs. The DNS can be configured on the host machine using `BIND` or `Dnsmasq` , which is much simpler. Steps are mentioned in `Dnsmasq.pdf` . If you are using

Dnsmasq, put the RAC-specific entries in the hosts machines "/etc/hosts" file, with the SCAN entries uncommented, and restart Dnsmasq.

Make sure the "/etc/resolv.conf" file includes a nameserver entry that points to the correct nameserver. Also, if the "domain" and "search" entries are both present, comment out one of them. For this installation my "/etc/resolv.conf" looked like this.

```
#domain localdomain
search localdomain
nameserver 192.168.56.1
```

The changes to the "resolv.conf" will be overwritten by the network manager, due to the presence of the NAT interface. For this reason, this interface should now be disabled on startup. You can enable it manually if you need to access the internet from the VMs. Edit the "/etc/sysconfig/network-scripts/ifcfg-enp0s3" (eth0) file, making the following change. This will take effect after the next restart.

```
ONBOOT=no
```

There is no need to do the restart now. You can just run the following command. Remember to amend the adapter name if yours are named differently.

```
# ifdown enp0s3
# #ifdown eth0
```

At this point, the networking for the first node should look something like the following. Notice that enp0s3 (eth0) has no associated IP address because it is disabled.

```
# ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        ether 08:00:27:f6:88:78  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.101  netmask 255.255.255.0  broadcast 192.168.56.255
        inet6 fe80::cf8d:317d:534:17d9  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:82:06:32  txqueuelen 1000  (Ethernet)
        RX packets 574  bytes 54444 (53.1 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 547  bytes 71219 (69.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s9: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.101  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::9a9a:f249:61d1:5447  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:2e:2c:cf  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 29  bytes 4250 (4.1 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

```
lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 0  (Local Loopback)
        RX packets 68  bytes 5780 (5.6 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 68  bytes 5780 (5.6 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

virbr0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 192.168.122.1  netmask 255.255.255.0  broadcast 192.168.122.255
        ether 52:54:00:4a:12:2f  txqueuelen 0  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

#
```

With this in place and the DNS configured the SCAN address is being resolved to all three IP addresses.

```
# nslookup ol7-122-scan
Server:     192.168.56.1
Address:    192.168.56.1#53

Name:   ol7-122-scan.localdomain
Address: 192.168.56.105
Name:   ol7-122-scan.localdomain
Address: 192.168.56.106
Name:   ol7-122-scan.localdomain
Address: 192.168.56.107

#
```

Change the setting of SELinux to permissive by editing the "/etc/selinux/config" file, making sure the SELINUX flag is set as follows.

```
SELINUX=permissive
```

If you have the Linux firewall enabled, you will need to disable or configure it.

The following is an example of disabling the firewall.

```
# systemctl stop firewalld
# systemctl disable firewalld
```

Make sure NTP (Chrony on OL7/RHEL7) is enabled.

```
# systemctl enable chronyd
# systemctl restart chronyd
# chronyc -a 'burst 4/4'
# chronyc -a makestep
```

Create the directories in which the Oracle software will be installed.

```
mkdir -p /u01/app/12.2.0.1/grid
mkdir -p /u01/app/oracle/product/12.2.0.1/db_1
chown -R oracle:oinstall /u01
chmod -R 775 /u01/
```

Log in as the "oracle" user and add the following lines at the end of the "/home/oracle/.bash_profile" file.

```
# Oracle Settings
export TMP=/tmp
export TMPDIR=$TMP

export ORACLE_HOSTNAME=ol7-122-rac1.localdomain
export ORACLE_UNQNAME=CDBRAC
export ORACLE_BASE=/u01/app/oracle
export GRID_HOME=/u01/app/12.2.0.1/grid
export DB_HOME=$ORACLE_BASE/product/12.2.0.1/db_1
export ORACLE_HOME=$DB_HOME
export ORACLE_SID=cdbrac1
export ORACLE_TERM=xterm
export BASE_PATH=/usr/sbin:$PATH
export PATH=$ORACLE_HOME/bin:$BASE_PATH

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

alias grid_env='. /home/oracle/grid_env'
alias db_env='. /home/oracle/db_env'
```

Create a file called "/home/oracle/grid_env" with the following contents.

```
export ORACLE_SID=+ASM1
export ORACLE_HOME=$GRID_HOME
export PATH=$ORACLE_HOME/bin:$BASE_PATH

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

Create a file called "/home/oracle/db_env" with the following contents.

```
export ORACLE_SID=cdbrac1
export ORACLE_HOME=$DB_HOME
export PATH=$ORACLE_HOME/bin:$BASE_PATH

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

Once the "/home/oracle/.bash_profile" has been run, you will be able to switch between environments as follows.

```
$ grid_env
$ echo $ORACLE_HOME
/u01/app/12.2.0.1/grid
$ db_env
$ echo $ORACLE_HOME
```

```
/u01/app/oracle/product/12.2.0.1/db_1
$
```

We've made a lot of changes, so it's worth doing a reboot of the VM at this point to make sure all the changes have taken effect.

```
# shutdown -r now
```

Install Guest Additions

Click on the "Devices > Install Guest Additions" menu option at the top of the VM screen. If you get the option to auto-run take it. If not, then run the following commands.

```
cd /media/VBOXADDITIONS*
sh ./VBoxLinuxAdditions.run
```

Add the "oracle" user into the "vboxsf" group so it has access to shared drives.

```
# usermod -G oinstall,dba,vboxsf oracle
# id oracle
uid=54321(oracle) gid=54321(oinstall) groups=54321(oinstall),54322(dba),54323(vboxsf)
#
```

Unzip the database software (but not the grid software) on the host machine.

```
unzip linuxx64_12201_database.zip
```

Create a shared folder (Devices > Shared Folders) on the virtual machine, pointing to the directory on the host where the Oracle software was unzipped. Check the "Auto-mount" and "Make Permanent" options before clicking the "OK" button.
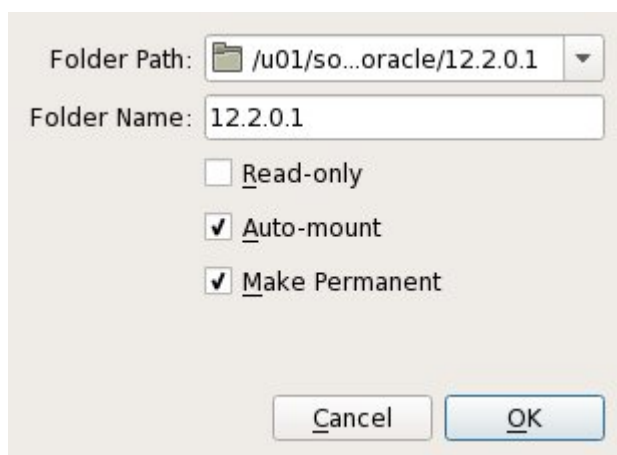
The VM will need to be restarted for the guest additions to be used properly. The next section requires a shutdown so no additional restart is needed at this time. Once the VM is restarted, the shared folder called "/media/sf_12.2.0.1" will be accessible by the "oracle" user.

Create Shared Disks

Shut down the "ol7-122-rac1" virtual machine using the following command.

```
# shutdown -h now
```

On the host server, create 4 sharable virtual disks and associate them as virtual media using the following commands. You can pick a different location, but make sure they are outside the existing VM directory.

```
$ mkdir -p /u04/VirtualBox/ol7-122-rac
$ cd /u04/VirtualBox/ol7-122-rac
$
$ # Create the disks and associate them with VirtualBox as virtual media.
$ VBoxManage createhd --filename asm1.vdi --size 20480 --format VDI --variant Fixed
$ VBoxManage createhd --filename asm2.vdi --size 20480 --format VDI --variant Fixed
$ VBoxManage createhd --filename asm3.vdi --size 20480 --format VDI --variant Fixed
$ VBoxManage createhd --filename asm4.vdi --size 20480 --format VDI --variant Fixed
$
$ # Connect them to the VM.
$ VBoxManage storageattach ol7-122-rac1 --storagectl "SATA" --port 1 --device 0 --type
hdd --medium asm1.vdi --mtype shareable
$ VBoxManage storageattach ol7-122-rac1 --storagectl "SATA" --port 2 --device 0 --type
hdd --medium asm2.vdi --mtype shareable
$ VBoxManage storageattach ol7-122-rac1 --storagectl "SATA" --port 3 --device 0 --type
hdd --medium asm3.vdi --mtype shareable
$ VBoxManage storageattach ol7-122-rac1 --storagectl "SATA" --port 4 --device 0 --type
hdd --medium asm4.vdi --mtype shareable
$
$ # Make shareable.
$ VBoxManage modifyhd asm1.vdi --type shareable
$ VBoxManage modifyhd asm2.vdi --type shareable
$ VBoxManage modifyhd asm3.vdi --type shareable
$ VBoxManage modifyhd asm4.vdi --type shareable
```

If you are using a Windows host, you will have to modify the paths, but the process is the same.

```
C:
mkdir C:\VirtualBox\ol7-122-rac
cd C:\VirtualBox\ol7-122-rac

"c:\Program Files\Oracle\VirtualBox\VBoxManage" createhd --filename asm1.vdi --size
20480 --format VDI --variant Fixed
"c:\Program Files\Oracle\VirtualBox\VBoxManage" createhd --filename asm2.vdi --size
20480 --format VDI --variant Fixed
"c:\Program Files\Oracle\VirtualBox\VBoxManage" createhd --filename asm3.vdi --size
20480 --format VDI --variant Fixed
"c:\Program Files\Oracle\VirtualBox\VBoxManage" createhd --filename asm4.vdi --size
20480 --format VDI --variant Fixed

"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac1 --
storagectl "SATA" --port 1 --device 0 --type hdd --medium asm1.vdi --mtype shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac1 --
storagectl "SATA" --port 2 --device 0 --type hdd --medium asm2.vdi --mtype shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac1 --
storagectl "SATA" --port 3 --device 0 --type hdd --medium asm3.vdi --mtype shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac1 --
```

```
storagectl "SATA" --port 4 --device 0 --type hdd --medium asm4.vdi --mtype shareable


"c:\Program Files\Oracle\VirtualBox\VBoxManage" modifyhd asm1.vdi --type shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" modifyhd asm2.vdi --type shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" modifyhd asm3.vdi --type shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" modifyhd asm4.vdi --type shareable
```

Start the "ol7-122-rac1" virtual machine by clicking the "Start" button on the toolbar. When the server has started, log in as the root user so you can configure the shared disks. The current disks can be seen by issuing the following commands.

```
# cd /dev
# ls sd*
sda   sda1   sda2   sdb   sdc   sdd   sde
#
```

Use the "fdisk" command to partition the disks sdb to sde. The following output shows the expected fdisk output for the sdb disk.

```
# fdisk /dev/sdb
Welcome to fdisk (util-linux 2.23.2).


Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.


Device does not contain a recognized partition table
Building a new DOS disklabel with disk identifier 0x14a4629c.


Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-41943039, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-41943039, default 41943039):
Using default value 41943039
Partition 1 of type Linux and of size 20 GiB is set


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


Calling ioctl() to re-read partition table.
Syncing disks.
#
```

In each case, the sequence of answers is "n", "p", "1", "Return", "Return" and "w".

Once all the disks are partitioned, the results can be seen by repeating the previous "ls" command.

```
# cd /dev
# ls sd*
```

```
sda   sda1   sda2   sdb   sdb1   sdc   sdc1   sdd   sdd1   sde   sde1
#
```

Add the following to the "/etc/scsi_id.config" file to configure SCSI devices as trusted. Create the file if it doesn't already exist.

```
options=-g
```

The SCSI ID of my disks are displayed below.

```
# /usr/lib/udev/scsi_id -g -u -d /dev/sdb1
1ATA_VBOX_HARDDISK_VB189c7a69-689f61b0
# /usr/lib/udev/scsi_id -g -u -d /dev/sdc1
1ATA_VBOX_HARDDISK_VBc4ae174e-fc756d12
# /usr/lib/udev/scsi_id -g -u -d /dev/sdd1
1ATA_VBOX_HARDDISK_VBa4e03079-ae751cbd
# /usr/lib/udev/scsi_id -g -u -d /dev/sde1
1ATA_VBOX_HARDDISK_VBf00747dc-10252f06
#
```

Using these values, edit the "/etc/udev/rules.d/99-oracle-asmdevices.rules" file adding the following 4 entries. All parameters for a single entry must be on the same line.

```
KERNEL=="sd?1", SUBSYSTEM=="block", PROGRAM=="/usr/lib/udev/scsi_id -g -u -d
/dev/$parent", RESULT=="1ATA_VBOX_HARDDISK_VB189c7a69-689f61b0",
SYMLINK+="oracleasm/asm-disk1", OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd?1", SUBSYSTEM=="block", PROGRAM=="/usr/lib/udev/scsi_id -g -u -d
/dev/$parent", RESULT=="1ATA_VBOX_HARDDISK_VBc4ae174e-fc756d12",
SYMLINK+="oracleasm/asm-disk2", OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd?1", SUBSYSTEM=="block", PROGRAM=="/usr/lib/udev/scsi_id -g -u -d
/dev/$parent", RESULT=="1ATA_VBOX_HARDDISK_VBa4e03079-ae751cbd",
SYMLINK+="oracleasm/asm-disk3", OWNER="oracle", GROUP="dba", MODE="0660"
KERNEL=="sd?1", SUBSYSTEM=="block", PROGRAM=="/usr/lib/udev/scsi_id -g -u -d
/dev/$parent", RESULT=="1ATA_VBOX_HARDDISK_VBf00747dc-10252f06",
SYMLINK+="oracleasm/asm-disk4", OWNER="oracle", GROUP="dba", MODE="0660"
```

Load updated block device partition tables.

```
# /sbin/partprobe /dev/sdb1
# /sbin/partprobe /dev/sdc1
# /sbin/partprobe /dev/sdd1
# /sbin/partprobe /dev/sde1
```

Test the rules are working as expected.

```
# /sbin/udevadm test /block/sdb/sdb1
```

Reload the UDEV rules.

```
# /sbin/udevadm control --reload-rules
```

The disks should now be visible and have the correct ownership using the following command. If they are not visible, your UDEV configuration is incorrect and must be fixed before you proceed.

```
# ls -al /dev/oracleasm/*
lrwxrwxrwx. 1 root root 7 Mar  6 17:41 /dev/oracleasm/asm-disk1 -> ../sdb1
lrwxrwxrwx. 1 root root 7 Mar  6 17:41 /dev/oracleasm/asm-disk2 -> ../sdc1
lrwxrwxrwx. 1 root root 7 Mar  6 17:41 /dev/oracleasm/asm-disk3 -> ../sdd1
lrwxrwxrwx. 1 root root 7 Mar  6 17:41 /dev/oracleasm/asm-disk4 -> ../sde1
#
```

The symbolic links are owned by root, but the devices they point to now have the correct ownership.

```
# ls -al /dev/sd*1
brw-rw----. 1 root   disk 8,  1 Apr 25 14:11 /dev/sda1
brw-rw----. 1 oracle dba  8, 17 Apr 25 14:11 /dev/sdb1
brw-rw----. 1 oracle dba  8, 33 Apr 25 14:11 /dev/sdc1
brw-rw----. 1 oracle dba  8, 49 Apr 25 14:11 /dev/sdd1
brw-rw----. 1 oracle dba  8, 65 Apr 25 14:11 /dev/sde1
#
```

The shared disks are now configured for the grid infrastructure.

Clone the Virtual Machine

Do not use VirtualBox to clone VM, as it will also attempt to clone the shared disks, which is not what we want. Instead we must manually clone the VM.

Shut down the "ol7-122-rac1" virtual machine using the following command.

```
# shutdown -h now
```

** You may get errors if you create the virtual disk in the default location VirtualBox will use to create the VM. If that happens, rename the folder holding the new virtual disk and go through the creation process of the new VM again.

Manually clone the "ol7-122-rac1.vdi" disk using the following commands on the host server.

```
$ # Linux
$ mkdir -p /u03/VirtualBox/ol7-122-rac2
$ VBoxManage clonehd /u01/VirtualBox/ol7-122-rac1/ol7-122-rac1.vdi
/u03/VirtualBox/ol7-122-rac2/ol7-122-rac2.vdi

Rem Windows
mkdir "C:\VirtualBox\ol7-122-rac2"
"c:\Program Files\Oracle\VirtualBox\VBoxManage" clonehd "C:\VirtualBox\ol7-122-
rac1\ol7-122-rac1.vdi" "C:\VirtualBox\ol7-122-rac2\ol7-122-rac2.vdi"
```

Create the "ol7-122-rac2" virtual machine in VirtualBox in the same way as you did for "ol7-122-rac1", with the exception of using an existing "ol7-122-rac2.vdi" virtual hard drive.

Hard disk

If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select one from the list or from another location using the folder icon.

If you need a more complex storage set-up you can skip this step and make the changes to the machine settings once the machine is created.

The recommended size of the hard disk is **12.00 GB**.

○ Do not add a virtual hard disk

○ Create a virtual hard disk now

⦿ Use an existing virtual hard disk file

ol7-122-rac2.vdi (Normal, 50.00 GB)

< Back   Create   Cancel

Remember to add the three network adaptor as you did on the "ol7-122-rac1" VM. When the VM is created, attach the shared disks to this VM.

```
$ # Linux : Switch to the shared storage location and attach them.
$ cd /u04/VirtualBox/ol7-122-rac
$
$ VBoxManage storageattach ol7-122-rac2 --storagectl "SATA" --port 1 --device 0 --type
hdd --medium asm1.vdi --mtype shareable
$ VBoxManage storageattach ol7-122-rac2 --storagectl "SATA" --port 2 --device 0 --type
hdd --medium asm2.vdi --mtype shareable
$ VBoxManage storageattach ol7-122-rac2 --storagectl "SATA" --port 3 --device 0 --type
hdd --medium asm3.vdi --mtype shareable
$ VBoxManage storageattach ol7-122-rac2 --storagectl "SATA" --port 4 --device 0 --type
hdd --medium asm4.vdi --mtype shareable


Rem Windows : Switch to the shared storage location and attach them.
C:
cd C:\VirtualBox\ol7-122-rac

"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac2 --
storagectl "SATA" --port 1 --device 0 --type hdd --medium asm1.vdi --mtype shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac2 --
storagectl "SATA" --port 2 --device 0 --type hdd --medium asm2.vdi --mtype shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac2 --
storagectl "SATA" --port 3 --device 0 --type hdd --medium asm3.vdi --mtype shareable
"c:\Program Files\Oracle\VirtualBox\VBoxManage" storageattach ol7-122-rac2 --
storagectl "SATA" --port 4 --device 0 --type hdd --medium asm4.vdi --mtype shareable
```

Start the "ol7-122-rac2" virtual machine by clicking the "Start" button on the toolbar. Ignore any network errors during the startup.

Log in to the "ol7-122-rac2" virtual machine as the "root" user so we can reconfigure the network settings to match the following.

- hostname: ol7-122-rac2.localdomain
- enp0s3 (eth0): DHCP (*Not* Connect Automatically)
- enp0s8 (eth1): IP=192.168.56.102, Subnet=255.255.255.0, Gateway=192.168.56.1, DNS=192.168.56.1, Search=localdomain (Connect Automatically)
- enp0s9 (eth2): IP=192.168.1.102, Subnet=255.255.255.0, Gateway=<blank>, DNS=<blank>, Search= <blank> (Connect Automatically)

Amend the hostname in the "/etc/hostname" file.

```
ol7-122-rac2.localdomain
```

Unlike previous Linux versions, we shouldn't have to edit the MAC address associated with the network adapters, but we will have to alter their IP addresses.

Edit the "/etc/sysconfig/network-scripts/ifcfg-enp0s8" (eth1), amending only the IPADDR settings as follows and deleting the UUID entry.

```
IPADDR=192.168.56.102
```

Edit the "/etc/sysconfig/network-scripts/ifcfg-enp0s9" (eth2), amending only the IPADDR settings as follows and deleting the UUID entry.

```
IPADDR=192.168.1.102
```

Restart the virtual machines.

```
# shutdown -r now
```

At this point, the networking for the second node should look something like the following. Notice that enp0s3 (eth0) has no associated IP address because it is disabled.

```
# ifconfig
enp0s3 : flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        ether 08:00:27:dc:7c:74  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.102  netmask 255.255.255.0  broadcast 192.168.56.255
        inet6 fe80::a00:27ff:fed9:c89a  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:d9:c8:9a  txqueuelen 1000  (Ethernet)
        RX packets 197  bytes 19460 (19.0 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 178  bytes 27171 (26.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s9: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
```

```
        inet 192.168.1.102  netmask 255.255.255.0  broadcast 192.168.1.255
        inet6 fe80::a00:27ff:feb4:6bf  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:b4:06:bf  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 30  bytes 4112 (4.0 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 0  (Local Loopback)
        RX packets 4  bytes 420 (420.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 4  bytes 420 (420.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

 #
```

Edit the "/home/oracle/.bash_profile" file on the "ol7-122-rac2" node to correct the ORACLE_SID and ORACLE_HOSTNAME values.

```
export ORACLE_SID=cdbrac2
export ORACLE_HOSTNAME=ol7-122-rac2.localdomain
```

Also, amend the ORACLE_SID setting in the "/home/oracle/db_env" and "/home/oracle/grid_env" files.

Restart the "ol7-122-rac2" virtual machine and start the "ol7-122-rac1" virtual machine. When both nodes have started, check they can both ping all the public and private IP addresses using the following commands.

```
ping -c 3 ol7-122-rac1
ping -c 3 ol7-122-rac1-priv
ping -c 3 ol7-122-rac2
ping -c 3 ol7-122-rac2-priv
```

Check the SCAN address is still being resolved properly on both nodes.

```
# nslookup ol7-122-scan
Server:     192.168.56.1
Address:    192.168.56.1#53

Name:   ol7-122-scan.localdomain
Address: 192.168.56.105
Name:   ol7-122-scan.localdomain
Address: 192.168.56.106
Name:   ol7-122-scan.localdomain
Address: 192.168.56.107

 #
```

At this point the virtual IP addresses defined in the "/etc/hosts" file will not work, so don't bother testing them.

Check the UDEV rules are working on both machines.

```
# ls -al /dev/oracleasm/*
lrwxrwxrwx. 1 root root 7 Sep 18 08:19 /dev/oracleasm/asm-disk1 -> ../sdb1
lrwxrwxrwx. 1 root root 7 Sep 18 08:19 /dev/oracleasm/asm-disk2 -> ../sdc1
lrwxrwxrwx. 1 root root 7 Sep 18 08:19 /dev/oracleasm/asm-disk3 -> ../sdd1
lrwxrwxrwx. 1 root root 7 Sep 18 08:19 /dev/oracleasm/asm-disk4 -> ../sde1
#
```

If you get any failures be sure to correct them before proceeding.

The virtual machine setup is now complete.

Before moving forward you should probably shut down your VMs and take snapshots of them. If any failures happen beyond this point it is probably better to switch back to those snapshots, clean up the shared drives as mentioned in `failed_grid_installation.pdf` and start the grid installation again. An alternative to cleaning up the shared disks is to back them up now using zip and just replace them in the event of a failure.

```
$ # Linux
$ cd /u04/VirtualBox/ol7-122-rac
$ zip PreGrid.zip *.vdi

Rem Windows
C:
cd C:\VirtualBox\ol7-122-rac
zip PreGrid.zip *.vdi
```

Install the Grid Infrastructure

Make sure both virtual machines are started. The GI is now an image installation, so perform the following on the first node as the "oracle" user.

```
export SOFTWARE_LOCATION=/media/sf_database-setup/
cd /u01/app/12.2.0.1/grid
unzip -q $SOFTWARE_LOCATION/linuxx64_12201_grid_home.zip
```

Install the following package from the grid home as the "root" user on all nodes.

```
su -
# Local node.
cd /u01/app/12.2.0.1/grid/cv/rpm
rpm -Uvh cvuqdisk*

# Remote node.
scp ./cvuqdisk* root@ol7-122-rac2:/tmp
ssh root@ol7-122-rac2 rpm -Uvh /tmp/cvuqdisk*
exit
```

If you were planning on using the AFD Driver (the new ASMLib) you would configure the shared disks using the `asmcmd` command as shown below. We are using UDEV, so this is not necessary.

```
# !!!! I did not do this! !!!!
su -

# Set environment.
```

```
export ORACLE_HOME=/u01/app/12.2.0.1/grid
export ORACLE_BASE=/tmp

# Mark disks.
$ORACLE_HOME/bin/asmcmd afd_label DISK1 /dev/oracleasm/asm-disk1 --init
$ORACLE_HOME/bin/asmcmd afd_label DISK2 /dev/oracleasm/asm-disk2 --init
$ORACLE_HOME/bin/asmcmd afd_label DISK3 /dev/oracleasm/asm-disk3 --init
$ORACLE_HOME/bin/asmcmd afd_label DISK4 /dev/oracleasm/asm-disk4 --init

# Test Disks.
$ORACLE_HOME//bin/asmcmd afd_lslbl /dev/oracleasm/asm-disk1
$ORACLE_HOME//bin/asmcmd afd_lslbl /dev/oracleasm/asm-disk2
$ORACLE_HOME//bin/asmcmd afd_lslbl /dev/oracleasm/asm-disk3
$ORACLE_HOME//bin/asmcmd afd_lslbl /dev/oracleasm/asm-disk4

# unset environment.
unset ORACLE_BASE

exit
```

Configure the Grid Infrastructure by running the following as the "oracle" user.

```
su - oracle
```

We could have run the configuration in silent mode using this edited response file `grid\_config.rsp` with the following command.

```
cd /u01/app/12.2.0.1/grid
./gridSetup.sh -silent -responseFile /tmp/grid_config.rsp
```

Instead, here's the interactive configuration.

```
cd /u01/app/12.2.0.1/grid
./gridSetup.sh
```

Select the "Configure Oracle Grid Infrastructure for a New Cluster" option, then click the "Next" button.

Accept the "Configure an Oracle Standalone Cluster" option by clicking the "Next" button.

Enter the cluster name "ol7-122-cluster", SCAN name "ol7-122-scan" and SCAN port "1521", then click the "Next" button.

On the "Cluster Node Information" screen, click the "Add" button.

Enter the details of the second node in the cluster, then click the "OK" button.

Click the "SSH connectivity..." button and enter the password for the "oracle" user. Click the "Setup" button to configure SSH connectivity, and the "Test" button to test it once it is complete. Once the test is complete, click the "Next" button.

Check the public and private networks are specified correctly. If the NAT interface is displayed, remember to mark it as "Do Not Use". Click the "Next" button.

Specify Network Interface Usage

Configuration Option
Cluster Configuration
Grid Plug and Play
Cluster Node Information
Network Interface Usage
Storage Option
Grid Infrastructure Managem
Create ASM Disk Group
ASM Password
Operating System Groups
Installation Location
Root script execution
Prerequisite Checks
Summary
Install Product
Finish

Private interfaces are used by Oracle Grid Infrastructure for internode traffic.

Interface Name	Subnet	Use for
enp0s8	192.168.56.0	Public ▼
enp0s9	192.168.1.0	ASM & Private ▼
virbr0	192.168.122.0	Do Not Use ▼

Help   < Back   Next >   Install   Cancel

Accept the "Configure ASM using block devices" option by clicking the "Next" button.

Storage Option Information

Configuration Option
Cluster Configuration
Grid Plug and Play
Cluster Node Information
Network Interface Usage
Storage Option
Grid Infrastructure Managem
Create ASM Disk Group
ASM Password
Operating System Groups
Installation Location
Root script execution
Prerequisite Checks
Summary
Install Product
Finish

Oracle Cluster Registry (OCR) files, voting disk files and other clusterware data will be configured with Oracle ASM. You can choose to configure Oracle ASM on block devices or on a NFS location.

◉ Configure ASM using block devices

○ Configure ASM on NFS

Help   < Back   Next >   Install   Cancel

Select the "No" option, as we don't want to create a separate disk group for the GIMR in this case. Click the "Next" button.

Set the redundancy to "External", click the "Change Discovery Path" button and set the path to "/dev/oracleasm/*". Return to the main screen and select all 4 disks. Uncheck the "Configure Oracle ASM Filter Driver" option, then click the "Next" button.

Create ASM Disk Group

OCR and Voting disk data will be stored in the following ASM Disk group. Select disks and characteristics of this Disk group.

Disk group name   DATA

Redundancy   ○ Flex ○ High ○ Normal ● External

Allocation Unit Size 4 ▼ MB

Select Disks   Show Candidate/Provisioned Dis... ▼

☑	Disk Path	Size (in MB)	Status
☑	/dev/oracleasm/asm-disk1	20479	Candidate
☑	/dev/oracleasm/asm-disk2	20479	Candidate
☑	/dev/oracleasm/asm-disk3	20479	Candidate
☑	/dev/oracleasm/asm-disk4	20479	Candidate

[Change Discovery Path...]

☐ Configure Oracle ASM Filter Driver

Select this option to configure ASM Filter Driver(AFD) to simplify configuration and management of disk devices by Oracle ASM.

[Help]   [< Back] [Next >] [Install] [Cancel]

Enter the credentials and click the "Next" button.

Specify ASM Password

The new Oracle Automatic Storage Management (Oracle ASM) instance requires its own SYS user with SYSASM privileges for administration. Oracle recommends that you create a less privileged ASMSNMP user with SYSDBA privileges to monitor the ASM instance.

Specify the password for these user accounts.

○ Use different passwords for these accounts

	Password	Confirm Password
SYS		
ASMSNMP		

● Use same passwords for these accounts

Specify Password: ....   Confirm Password: ....

[Help]   [< Back] [Next >] [Install] [Cancel]

Accept the default IPMI option by clicking the "Next" button.

Don't register with EM. Click the "Next" button.

We are using a single user and group manage both ASM add the database, so set the groups to "dba" and click the "Next" button. Accept the warnings on the subsequent dialog by clicking the "Yes" button.
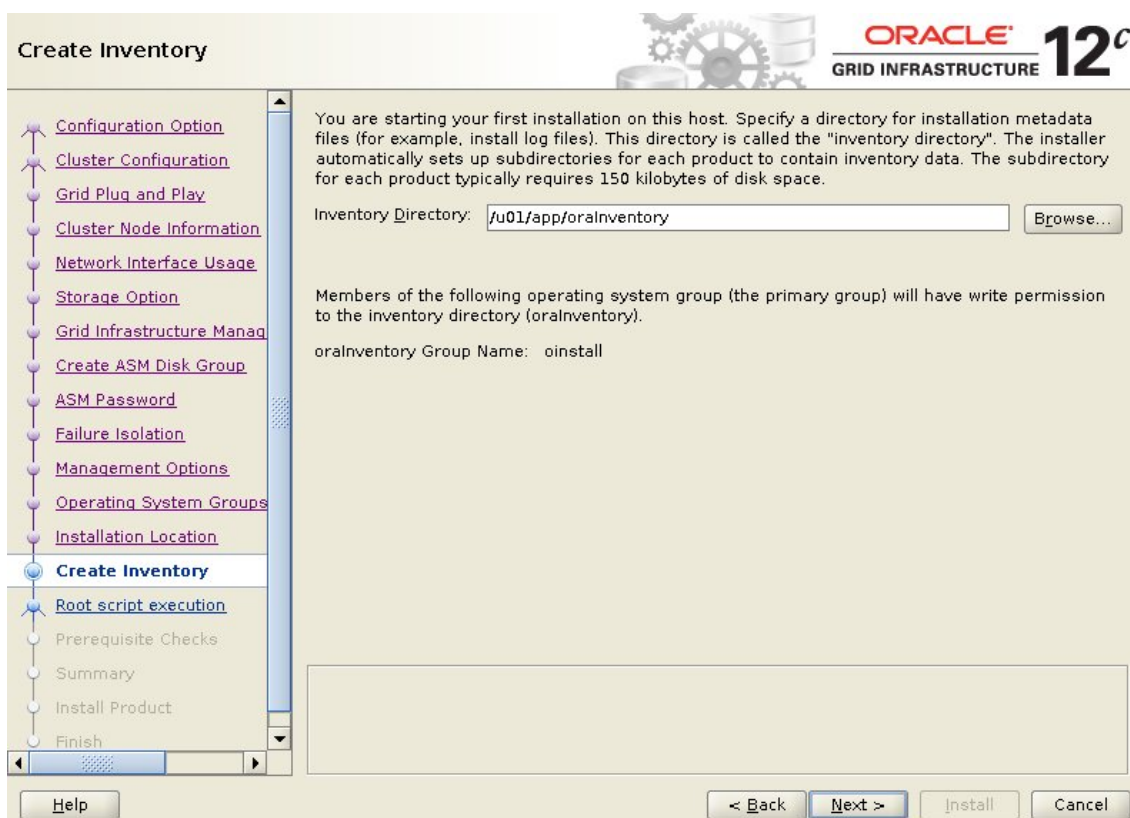
Enter the Oracle Base location "/u01/app/oracle" and click the "Next" button. We have already pre-created directories for the later database installation, so ignore the subsequent warning about the Oracle Base not being empty by clicking the "Yes" button.

Specify Installation Location

ORACLE 12c
GRID INFRASTRUCTURE

- Configuration Option
- Cluster Configuration
- Grid Plug and Play
- Cluster Node Information
- Network Interface Usage
- Storage Option
- Grid Infrastructure Managem
- Create ASM Disk Group
- ASM Password
- Failure Isolation
- Management Options
- Operating System Groups
- **Installation Location**
- Root script execution
- Prerequisite Checks
- Summary
- Install Product
- Finish

Specify the Oracle Grid Infrastructure for a Cluster Oracle base. By default, Oracle Grid Infrastructure is installed in a path indicating the Oracle Grid Infrastructure release and grid infrastructure software owner.

Oracle base: /u01/app/oracle   [Browse...]

This software directory is the Oracle Grid Infrastructure home directory.

Software location: /u01/app/12.2.0.1/grid

[Help]   [< Back] [Next >] [Install] [Cancel]

Accept the default inventory directory by clicking the "Next" button.

Create Inventory

ORACLE 12c
GRID INFRASTRUCTURE
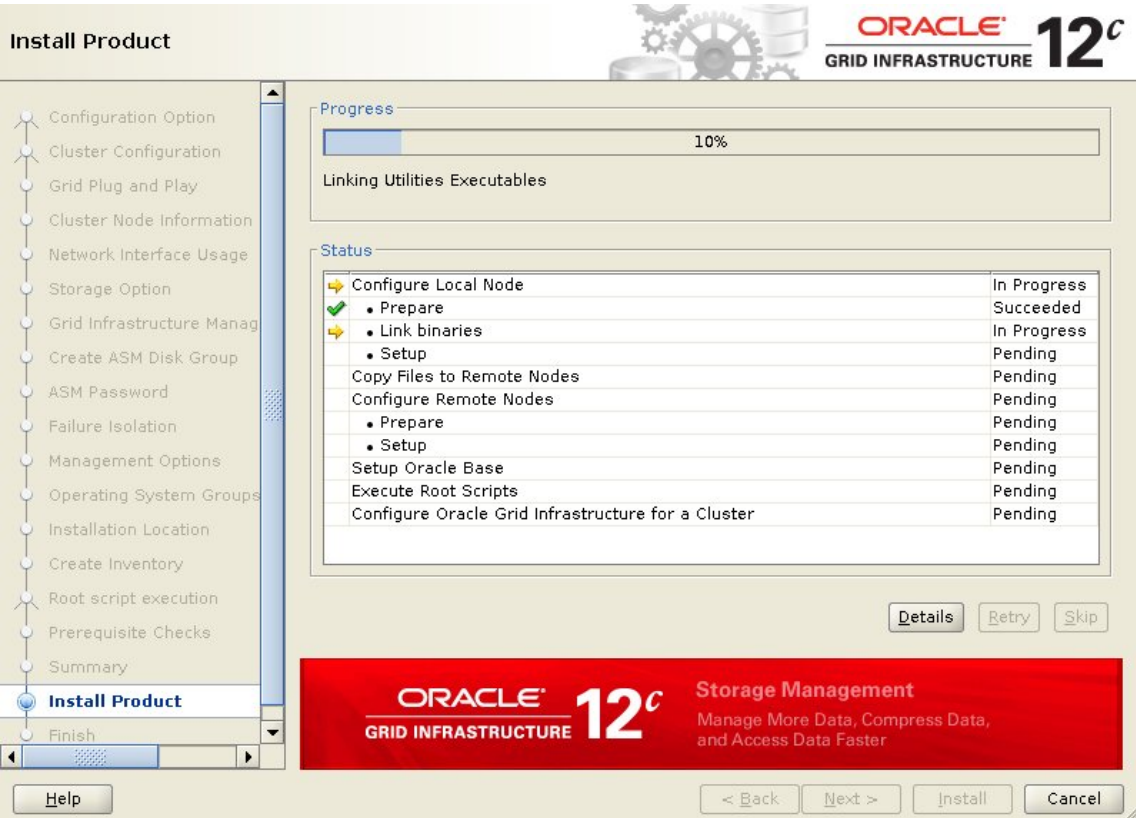
- Configuration Option
- Cluster Configuration
- Grid Plug and Play
- Cluster Node Information
- Network Interface Usage
- Storage Option
- Grid Infrastructure Manag
- Create ASM Disk Group
- ASM Password
- Failure Isolation
- Management Options
- Operating System Groups
- Installation Location
- **Create Inventory**
- Root script execution
- Prerequisite Checks
- Summary
- Install Product
- Finish

You are starting your first installation on this host. Specify a directory for installation metadata files (for example, install log files). This directory is called the "inventory directory". The installer automatically sets up subdirectories for each product to contain inventory data. The subdirectory for each product typically requires 150 kilobytes of disk space.

Inventory Directory: /u01/app/oraInventory   [Browse...]

Members of the following operating system group (the primary group) will have write permission to the inventory directory (oraInventory).

oraInventory Group Name: oinstall

[Help]   [< Back] [Next >] [Install] [Cancel]

Run the root scripts manually. Click the "Next" button.

Wait while the prerequisite checks complete. If you have any issues use the "Fix & Check Again" button. Once possible fixes are complete, check the "Ignore All" checkbox and click the "Next" button. It is likely the "Physical Memory" and "Network Time Protocol (NTP)" tests will fail for this type of installation. This is OK.

If you are happy with the summary information, click the "Install" button.

Wait while the installation takes place.

When prompted, run the configuration scripts on each node.

The output from the "orainstRoot.sh" file should look something like that listed below.

```
# /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.
#
```

The output of the "root.sh" will vary a little depending on the node it is run on. Example output can be seen here (Node1, Node2).

Note: It can take upto 20 minutes to complete **root.sh** script on Node1.

Once the scripts have completed, return to the "Execute Configuration Scripts" screen on "ol7-122-rac1" and click the "OK" button.

Wait for the configuration assistants to complete.
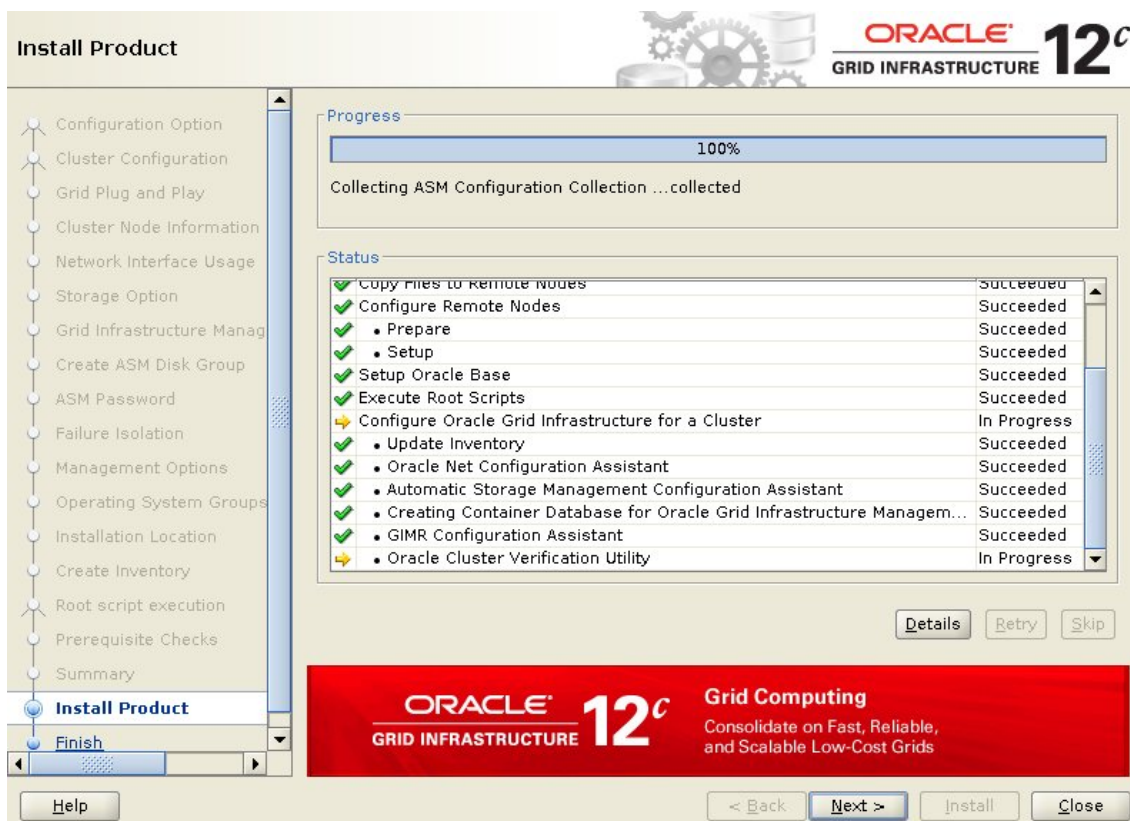
If any of the configuration steps fail you should check the specified log to see if the error is a show-stopper or not. The only error I received was for time sychronization (PRVG-13606. .

```
PRVG-13606 : chrony daemon is not synchronized with any external time source on node
...
```

Provided you don't have any show-stoppers, it is safe to ignore the errors by clicking "Next" button.

Click the "Close" button to exit the installer.

Finish

The configuration of Oracle Grid Infrastructure for a Cluster was successful, but some configuration assistants failed, were cancelled or skipped.

- Configuration Option
- Cluster Configuration
- Grid Plug and Play
- Cluster Node Information
- Network Interface Usage
- Storage Option
- Grid Infrastructure Manag
- Create ASM Disk Group
- ASM Password
- Failure Isolation
- Management Options
- Operating System Groups
- Installation Location
- Create Inventory
- Root script execution
- Prerequisite Checks
- Summary
- Install Product
- **Finish**

Help   < Back   Next >   Install   Close

Note: It can take upto 120-150 minutes to complete grid infrastructure installation.

The grid infrastructure installation is now complete. We can check the status of the installation using the following commands.

```
$ grid_env
$ crsctl stat res -t
--------------------------------------------------------------------------------
Name           Target  State     Server                   State details
--------------------------------------------------------------------------------
Local Resources
--------------------------------------------------------------------------------
ora.ASMNET1LSNR_ASM.lsnr
               ONLINE  ONLINE    ol7-122-rac1             STABLE
               ONLINE  ONLINE    ol7-122-rac2             STABLE
ora.DATA.dg
               ONLINE  ONLINE    ol7-122-rac1             STABLE
               ONLINE  ONLINE    ol7-122-rac2             STABLE
ora.LISTENER.lsnr
               ONLINE  ONLINE    ol7-122-rac1             STABLE
               ONLINE  ONLINE    ol7-122-rac2             STABLE
ora.chad
               ONLINE  ONLINE    ol7-122-rac1             STABLE
               ONLINE  ONLINE    ol7-122-rac2             STABLE
ora.net1.network
               ONLINE  ONLINE    ol7-122-rac1             STABLE
               ONLINE  ONLINE    ol7-122-rac2             STABLE
```

```
ora.ons
                ONLINE  ONLINE       ol7-122-rac1              STABLE
                ONLINE  ONLINE       ol7-122-rac2              STABLE
ora.proxy_advm
                OFFLINE OFFLINE      ol7-122-rac1              STABLE
                OFFLINE OFFLINE      ol7-122-rac2              STABLE
--------------------------------------------------------------------------------
Cluster Resources
--------------------------------------------------------------------------------
ora.LISTENER_SCAN1.lsnr
      1         ONLINE  ONLINE       ol7-122-rac2              STABLE
ora.LISTENER_SCAN2.lsnr
      1         ONLINE  ONLINE       ol7-122-rac2              STABLE
ora.LISTENER_SCAN3.lsnr
      1         ONLINE  ONLINE       ol7-122-rac2              STABLE
ora.MGMTLSNR
      1         ONLINE  ONLINE       ol7-122-rac2              169.254.137.110 192.
                                                              168.1.102,STABLE
ora.asm
      1         ONLINE  ONLINE       ol7-122-rac1              Started,STABLE
      2         ONLINE  ONLINE       ol7-122-rac2              Started,STABLE
      3         OFFLINE OFFLINE                                STABLE
ora.cvu
      1         ONLINE  ONLINE       ol7-122-rac1              STABLE
ora.mgmtdb
      1         ONLINE  ONLINE       ol7-122-rac2              Open,STABLE
ora.ol7-122-rac1.vip
      1         ONLINE  ONLINE       ol7-122-rac1              STABLE
ora.ol7-122-rac2.vip
      1         ONLINE  ONLINE       ol7-122-rac2              STABLE
ora.qosmserver
      1         ONLINE  ONLINE       ol7-122-rac1              STABLE
ora.scan1.vip
      1         ONLINE  ONLINE       ol7-122-rac2              STABLE
ora.scan2.vip
      1         ONLINE  ONLINE       ol7-122-rac2              STABLE
ora.scan3.vip
      1         ONLINE  ONLINE       ol7-122-rac2              STABLE
--------------------------------------------------------------------------------
$
```

At this point it is probably a good idea to shutdown both VMs and take snapshots. Remember to make a fresh zip of the ASM disks on the host machine, which you will need to restore if you revert to the post-grid snapshots.

```
$ cd /u04/VirtualBox/ol7-122-rac
$ zip PostGrid.zip *.vdi
```

Install the Database Software

Make sure the "ol7-122-rac1" and "ol7-122-rac2" virtual machines are started, then login to "ol7-122-rac1" as the oracle user and start the Oracle installer. Check that all services are up using "crsctl stat res -t", as described before.

We could have run the OUI in silent mode using this edited response file db_install.rsp with the following command.

```
$ db_env
$ cd /media/sf_database-setup/database
$ ./runInstaller -silent -ignoreSysPrereqs -showProgress -responseFile
/tmp/db_install.rsp
```

Instead, here's the interactive view.

```
$ db_env
$ cd /media/sf_database-setup/database
$ ./runInstaller
```

Uncheck the security updates checkbox and click the "Next" button and "Yes" on the subsequent warning dialog.

Select the "Install database software only" option, then click the "Next" button.
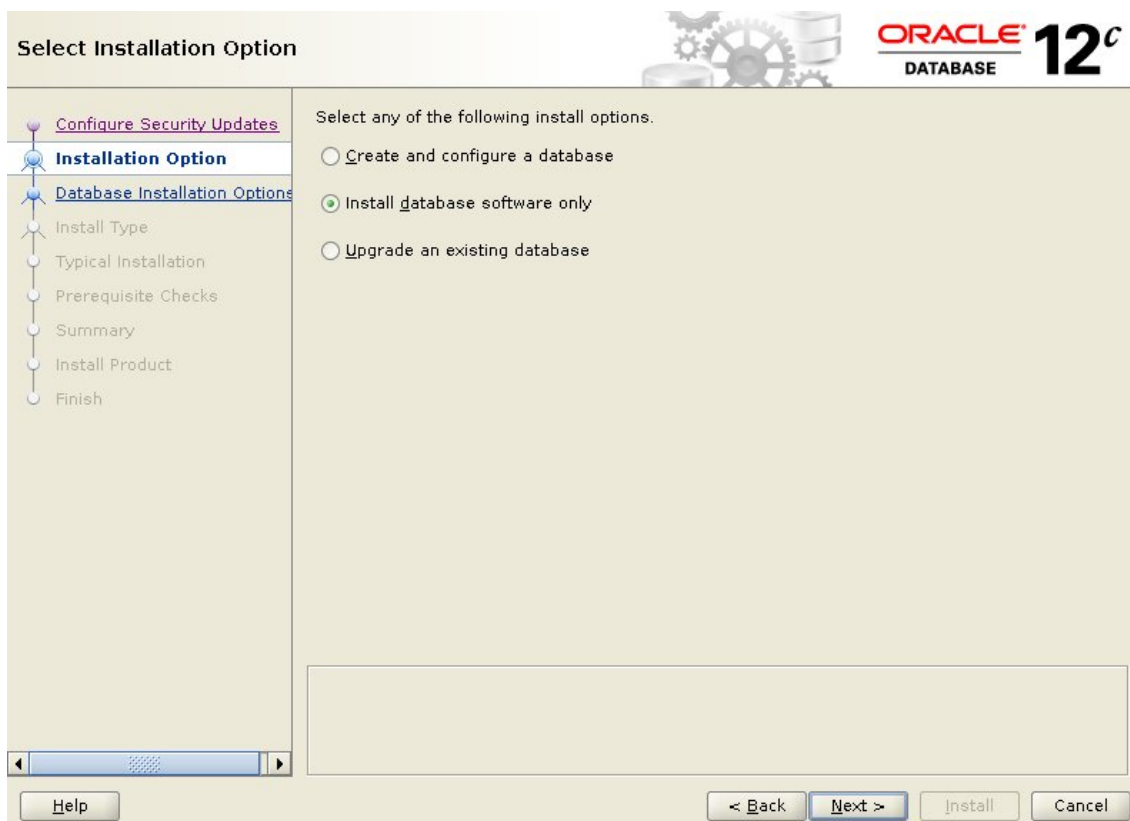
Accept the "Oracle Real Application Clusters database installation" option by clicking the "Next" button.
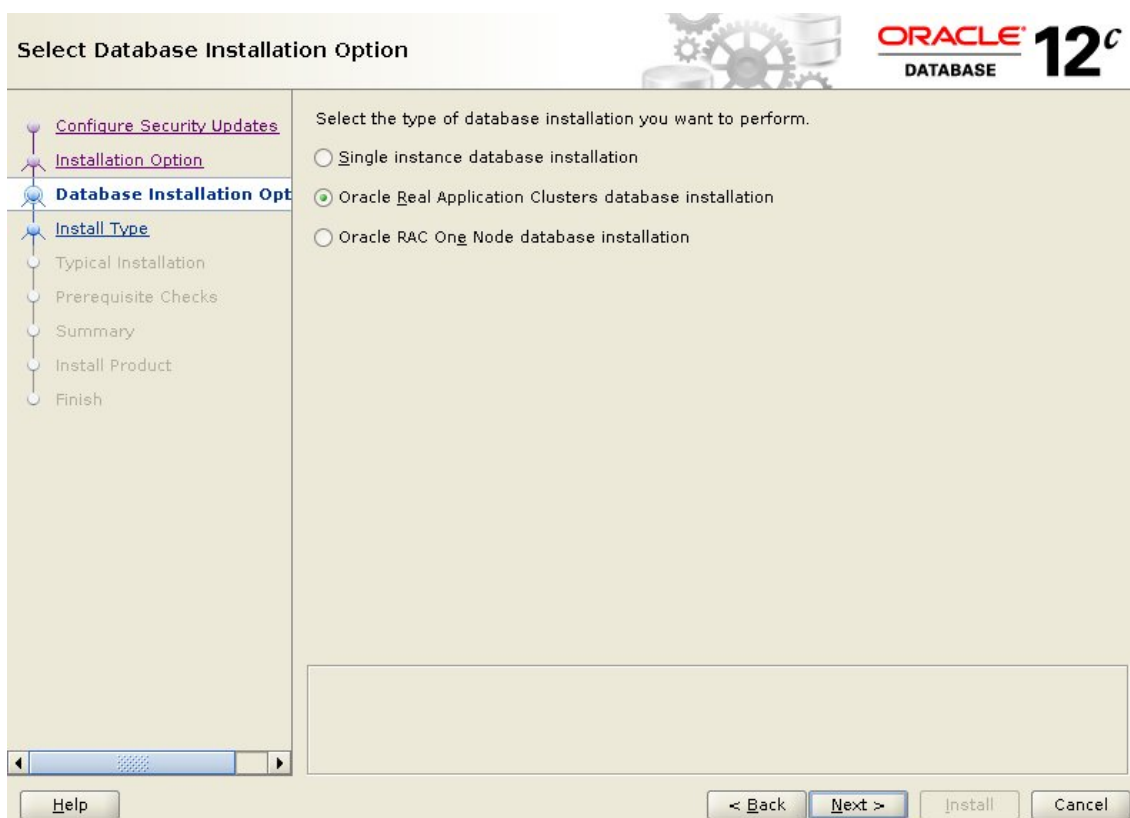
Make sure both nodes are selected, then click the "Next" button.

Select the "Enterprise Edition" option, then click the "Next" button.

Enter "/u01/app/oracle" as the Oracle base and "/u01/app/oracle/product/12.2.0.1/db_1" as the software location, then click the "Next" button.

Select the desired operating system groups, then click the "Next" button. In this case we are only using the "dba" group.

Privileged Operating System groups

SYS privileges are required to create a database using operating system (OS) authentication. Membership in OS Groups grants the corresponding SYS privilege, eg. membership in OSDBA grants the SYSDBA privilege.

Configure Security Updates
Installation Option
Database Installation Options
Nodes Selection
Database Edition
Installation Location
Operating System Groups
Prerequisite Checks
Summary
Install Product
Finish

Database Administrator (OSDBA) group: `dba`

Database Operator (OSOPER) group (Optional): ` `

Database Backup and Recovery (OSBACKUPDBA) group: `dba`

Data Guard administrative (OSDGDBA) group: `dba`

Encryption Key Management administrative (OSKMDBA) group: `dba`

Real Application Cluster administrative (OSRACDBA) group: `dba`
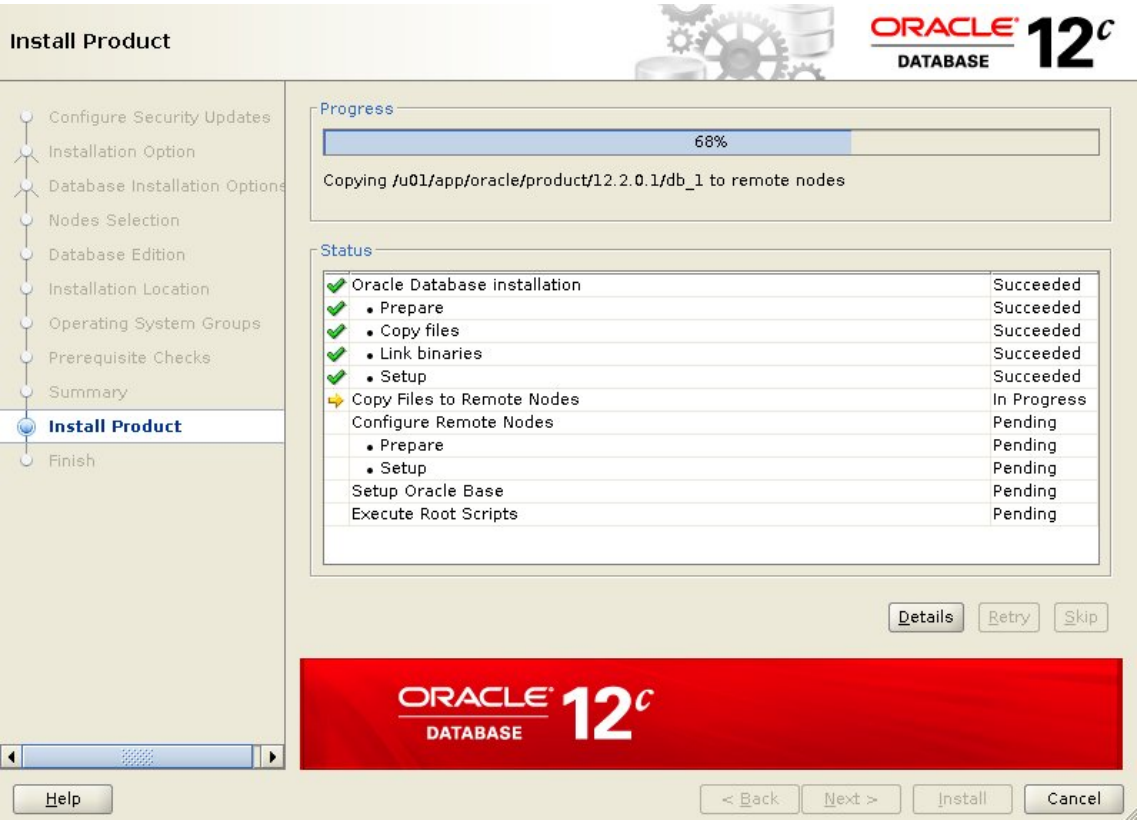
Help   < Back   Next >   Install   Cancel

Wait for the prerequisite check to complete. If there are any problems either click the "Fix & Check Again" button, or check the "Ignore All" checkbox and click the "Next" button.
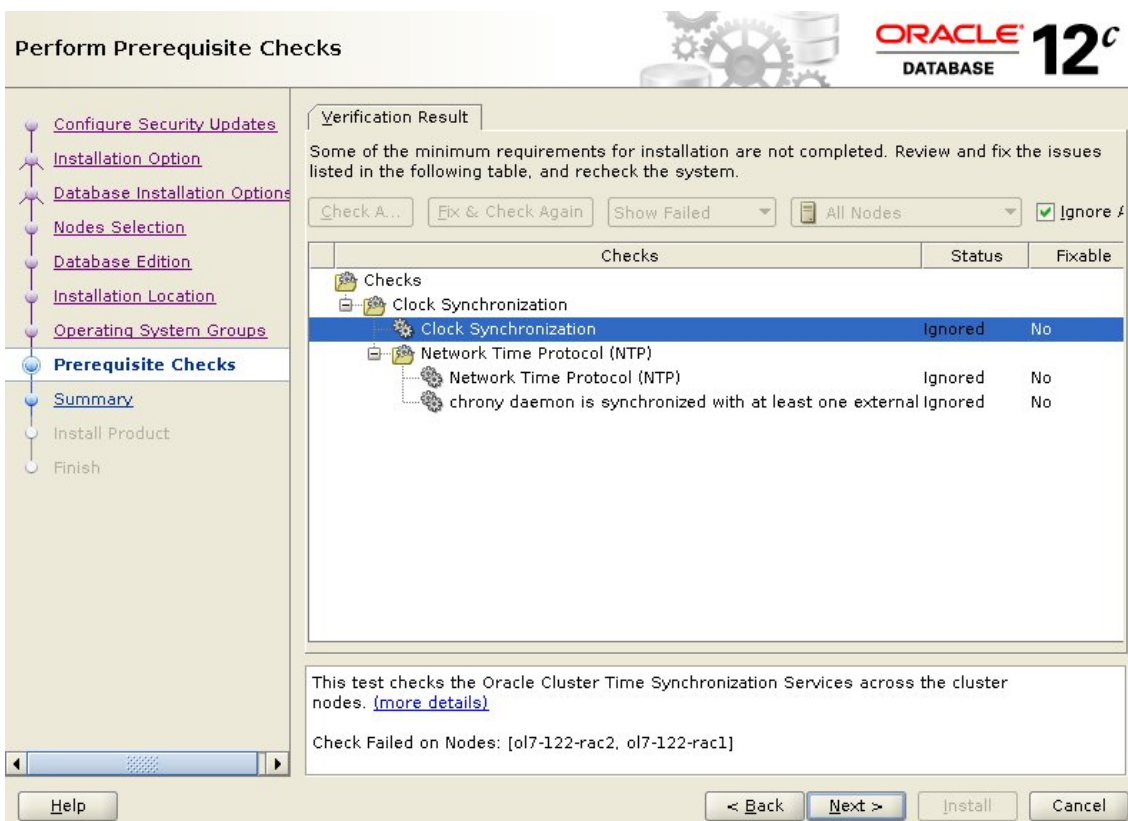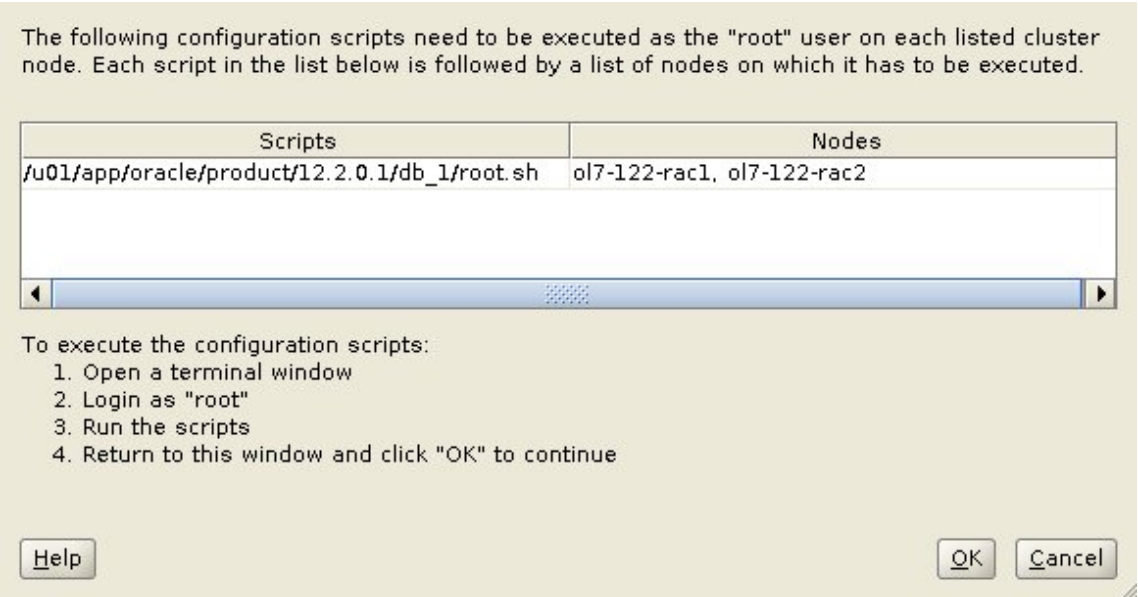
If you are happy with the summary information, click the "Install" button.
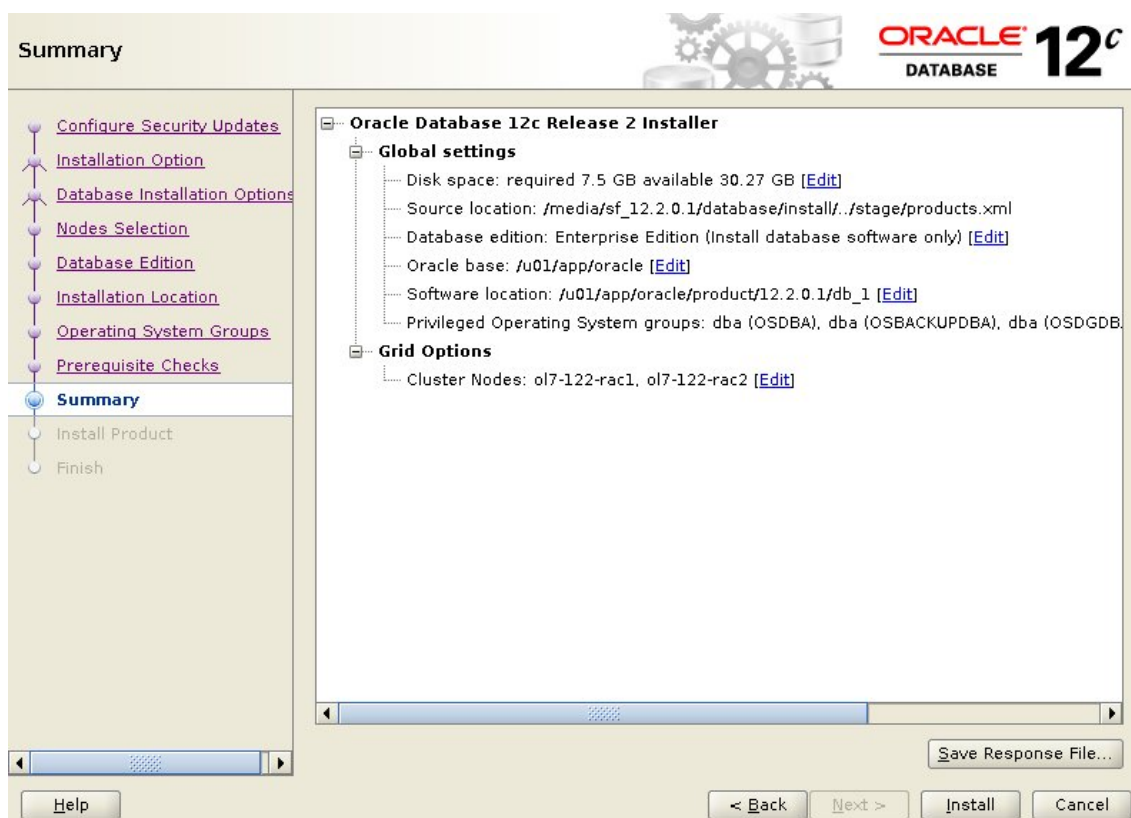
Wait while the installation takes place.

When prompted, run the configuration script on each node. When the scripts have been run on each node, click the "OK" button.

Click the "Close" button to exit the installer.

Finish

The installation of Oracle Database was successful.

Configure Security Updates
Installation Option
Database Installation Options
Nodes Selection
Database Edition
Installation Location
Operating System Groups
Prerequisite Checks
Summary
Install Product
Finish

Help   < Back   Next >   Install   Close

Note: It can take upto 60-75 minutes to complete database software installation.

Shutdown both VMs and take snapshots. Remember to make a fresh zip of the ASM disks on the host machine, which you will need to restore if you revert to the post-db snapshots.

```
$ cd /u04/VirtualBox/ol7-122-rac
$ zip PostDB.zip *.vdi
```

Create a Database

Make sure the "ol7-122-rac1" and "ol7-122-rac2" virtual machines are started, then login to "ol7-122-rac1" as the oracle user and start the Database Creation Asistant (DBCA).

We could have run the DBCA in silent mode using this edited response file `dbca.rsp` with the following command.

```
db_env
dbca -silent -responseFile /tmp/dbca.rsp
```

Instead, here's the interactive view.

```
$ db_env
$ dbca
```

Select the "Create Database" option and click the "Next" button.

Select the "Typical configuration" option. Enter the container database name (cdbrac), pluggable database name (pdb1) and administrator password. Click the "Next" button.

Wait for the prerequisite checks to complete. If there are any problems either fix them, or check the "Ignore All" checkbox and click the "Next" button. If there are no problems you will go directly to the summary screen.

If you are happy with the summary information, click the "Finish" button.

Summary

Database Configuration Assistant
- **Global Settings**
  - Global database name: cdbrac
  - Node List: ol7-122-rac1,ol7-122-rac2
  - Configuration type: Oracle Real Application Cluster (RAC) database - Admin Managed
  - SID: cdbrac
  - Create as Container database: Yes
  - Pluggable Database Name: pdb1
  - Number of Pluggable Databases: 1
  - Database Files Storage Type: Automatic Storage Management (ASM)
  - Memory Configuration Type: Automatic Shared Memory Management
  - Template name: General Purpose
- **Initialization Parameters**
  - audit_file_dest: {ORACLE_BASE}/admin/{DB_UNIQUE_NAME}/adump
  - audit_trail: db
  - cluster_database: true
  - compatible: 12.2.0
  - db_block_size: 8 KB
  - db_create_file_dest: +DATA/{DB_UNIQUE_NAME}/
  - db_name: cdbrac
  - db_recovery_file_dest: +DATA
  - db_recovery_file_dest_size: 8016 MB

Save Response File...

Help | < Back | Next > | Finish | Cancel

Wait while the database creation takes place.

Progress Page

Progress

Clone database "cdbrac" creation in progress...

27%

Steps	Status
✔ Copying database files	Finished
🕐 Creating and starting Oracle instance	In Progress
Creating cluster database views	
Completing Database Creation	
Creating Pluggable Databases	
Executing Post Configuration Actions	

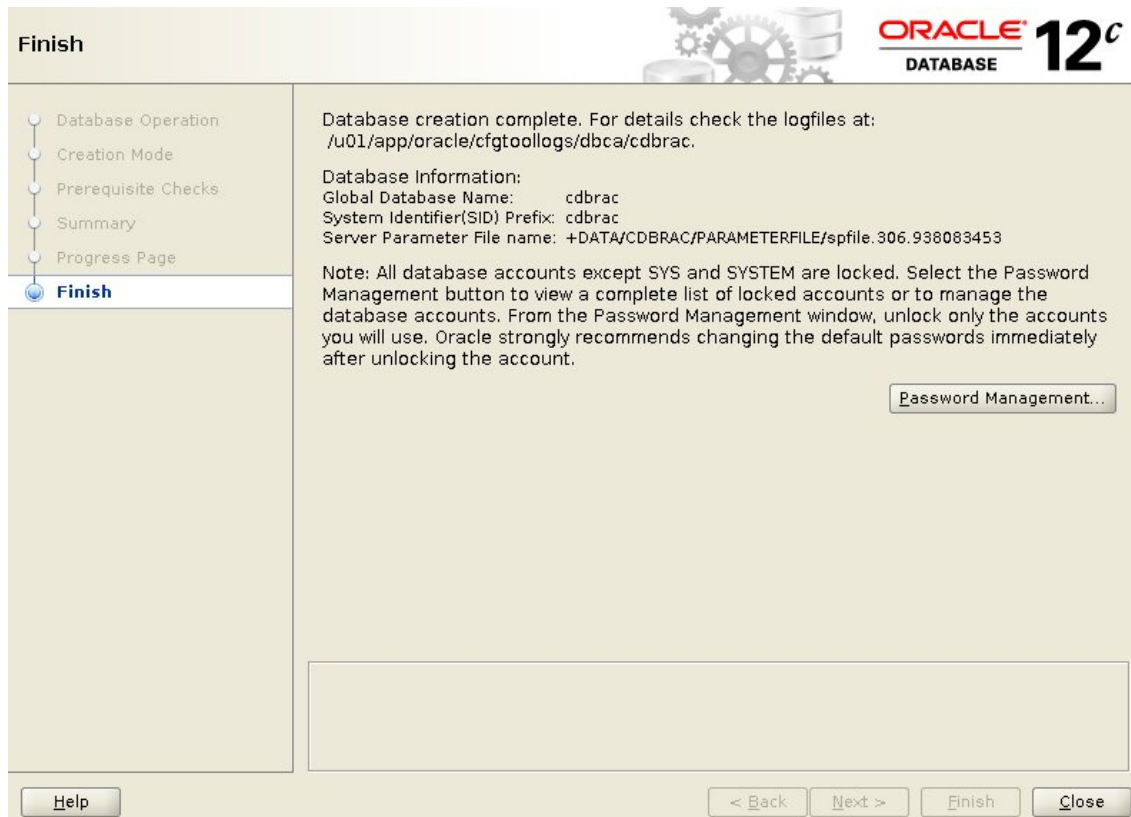DBCA Log Location:/u01/app/oracle/cfgtoollogs/dbca/cdbrac/trace.log_2017-03-08_10-13-57-AM
Alert Log Location:/u01/app/oracle/diag/rdbms/cdbrac/cdbrac1/trace/alert_cdbrac1.log

Help | < Back | Next > | Finish | Cancel

If you want to modify passwords, click the "Password Management" button. When finished, click the "Close" button.

Note: It can take upto 40-50 minutes to complete database creation.

The RAC database creation is now complete.

Check the Status of the RAC

There are several ways to check the status of the RAC. The `srvctl` utility shows the current configuration and status of the RAC database.

```
$ srvctl config database -d cdbrac
Database unique name: cdbrac
Database name: cdbrac
Oracle home: /u01/app/oracle/product/12.2.0.1/db_1
Oracle user: oracle
Spfile: +DATA/CDBRAC/PARAMETERFILE/spfile.306.938083453
Password file: +DATA/CDBRAC/PASSWORD/pwdcdbrac.285.938081999
Domain:
Start options: open
Stop options: immediate
Database role: PRIMARY
Management policy: AUTOMATIC
Server pools:
Disk Groups: DATA
Mount point paths:
Services:
```

```
Type: RAC
Start concurrency:
Stop concurrency:
OSDBA group: dba
OSOPER group:
Database instances: cdbrac1,cdbrac2
Configured nodes: ol7-122-rac1,ol7-122-rac2
CSS critical: no
CPU count: 0
Memory target: 0
Maximum memory: 0
Default network number for database services:
Database is administrator managed
$

$ srvctl status database -d cdbrac
Instance cdbrac1 is running on node ol7-122-rac1
Instance cdbrac2 is running on node ol7-122-rac2
$
```

The `V$ACTIVE_INSTANCES` view can also display the current status of the instances.

```
$ sqlplus / as sysdba

SQL*Plus: Release 12.2.0.1.0 Production on Wed Mar 8 11:04:42 2017

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Connected to:
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production

SQL> SELECT inst_name FROM v$active_instances;


INST_NAME
--------------------------------------------------------------------------------
ol7-122-rac1.localdomain:cdbrac1
ol7-122-rac2.localdomain:cdbrac2

SQL>
```