Installing an Oracle 10g RAC database on Solaris 10 64-bit with an iSCSI SAN

Introduction:
This document is meant as a walk through for those looking to setup an Oracle 10gR2 RAC database on a Sun Solaris 10 system using an iSCSI interface to a SAN storage.

Note:
This document should be used in conjunction with the following documents:

1. Oracle Clusterware Installation and Real Application Clusters Installation Guide: 10gR2 (10.2)for Solaris Operating System (September 2006: part no. B14205-07)
2. Oracle Database Installation Guide for Solaris Operating System (SPARC 64-bit) part no. B15690

Software used:

1. Oracle 10g (10.2.0.1)
2. Sun Solaris 10

Hardware Used:

1. Sun T1000 Servers.
2. Equallogic PeerStorage Array
3. Riverstone Gigabit switches

Overview:

1. Setup iSCSI.
2. Create RAW device files for CRS
3. Prepare servers for Oracle CRS installation
4. Install Oracle CRS
5. Install Oracle ASM
6. Install Oracle 10g

The installation of the Oracle software can be on the server hard drives or placed on a volume on the SAN. To install the Oracle software onto the SAN, Cluster software will have to be used. Since I do not have a reliable cluster software I am going to do separate installations of the Oracle software on each server. I will then create raw partitions on the SAN. The Oracle Cluster Ready Service (CRS) will access the raw partitions directly. The raw partitions for the database will be controlled by Oracle's ASM. If the Oracle software is going to be placed on the SAN then a regular file system can be used instead of raw partitions.

Setup iSCSI:

Step 1: Verify that the iSCSI packages are installed

 # pkginfo SUNWiscsiu SUNWiscsir

Step 2: Configure the array

Create and add volume(s) for the Sun server(s). Include the proper access controls (IP Address, iSCSI name, etc.) when creating the volumes.

On the Sun server:
Display Initiator information

iscsiadm list initiator-node

Use the initiator node information as the initiator name for creating volume access

On the Equallogic iSCSI array:

EQ> create volume *volume1* **size 2048**

Volume is in MB. For gigabytes add GB. ex. 50GB

Volume select *volume_name* access create initiator *initiator_name* or
Volume select *volume_name* access create ipaddress *ip_address*

EQ> volume select *volume1* **access create initiator** *iqn.2000-05.com.sun.a2sd-4000.sn00044*

To determine the target name:

EQ> volume select *volume_name* show

The target name will be listed as ISCSI name: ex. iqn.2001-05.com.equallogic:6**….**

Note: It is best if there are no unsecured access volumes on the array. The Sun servers will see all volumes configured with their specific access (IP address, iSCSI name, etc.) as well as all unsecured volumes.

Step 3a: Configure Target discovery using ip address

iscsiadm add discovery-address 10.0.0.1:3260
Repeat above for all volumes

Step 3a.1: Enable Target discovery

iscsiadm modify discovery --sendtargets enable

Other commands:

Disable Target Discovery

iscsiadm modify discovery --sendtargets disable

Remove Target discovery

iscsiadm remove discovery-address 10.0.0.1:3260

Step 3b: Configure Target discovery using target name.

 # iscsiadm add static-config iqn.2001-05.com.equallogic:6…. **,** *ip_address*
Repeat above for all volumes

 # iscsiadm modify discovery --static enable

Other commands:

Disable Target Discovery

iscsiadm modify discovery --static disable

Remove Target discovery

iscsiadm remove static-config iqn.2001-05.com.equallogic:6….

Step 5: Create the iSCSI device links for the local system

devfsadm -i iscsi

Step 6. Check for iSCSI devices

 # iscsiadm list target –S

Basic iSCSI Monitoring

Display Initiator information

iscsiadm list initiator-node

Display Target information

iscsiadm list target –S

iscsiadm list discovery-address –v 10.0.0.3

iscsiadm list target-param -v iqn.2001-05.com.equallogic:6….

Create Raw Device Files for CRS

Step 1: Create partitions

Use the format utility:

format
AVAILABLE DISK SELECTIONS:
0. c0t1d0 <SUN72G cyl 14087 alt 2 hd 24 sec 424>
/pci@8,600000/SUNW,qlc@4/fp@0,0/ssd@w500000e010685cf1,0
1. c0t2d0 <SUN72G cyl 14087 alt 2 hd 24 sec 424>
/pci@8,600000/SUNW,qlc@4/fp@0,0/ssd@w500000e0106e3ba1,0
2. c2t0d0 <EQLOGIC-100E-00-2.2 cyl 546 alt 2 hd 16 sec 63>
/iscsi/disk@0000iqn.2001-05.com.equallogic%3A6-8a0900-deca50901-805ff036ff445ca2-volume2FFFF,0
3. c2t4d0 <EQLOGIC-100E-00-2.2 cyl 546 alt 2 hd 16 sec 63>
/iscsi/disk@0000iqn.2001-05.com.equallogic%3A6-8a0900-dcca50901-971ff036ff145ca2-volume1FFFF,0

```
Specify disk (enter its number): 2
selecting c2t0d0
[disk formatted]
format> partition
partition> print
partition> modify
Select partitioning base:
0. Current partition table (original)
1. All Free Hog
Choose base (enter number) [0]? 1
Part Tag Flag Cylinders Size Blocks
0 root wm 0 0 (0/0/0) 0
1 swap wu 0 0 (0/0/0) 0
2 backup wu 0 - 2035 1002.09MB (2036/0/0) 2052288
3 unassigned wm 0 0 (0/0/0) 0
4 unassigned wm 0 0 (0/0/0) 0
5 unassigned wm 0 0 (0/0/0) 0
6 usr wm 0 0 (0/0/0) 0
7 unassigned wm 0 0 (0/0/0) 0
Do you wish to continue creating a new partition
table based on above table[yes]? y
Free Hog partition[6]? 7
Enter size of partition '0' [0b, 0c, 0.00mb, 0.00gb]:1.00
Enter size of partition '1' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '3' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '4' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '5' [0b, 0c, 0.00mb, 0.00gb]:
Enter size of partition '6' [0b, 0c, 0.00mb, 0.00gb]:
Part Tag Flag Cylinders Size Blocks
0 root wm 0 0 (0/0/0) 0
1 swap wu 0 0 (0/0/0) 0
2 backup wu 0 - 2035 1002.09MB (2036/0/0) 2052288
3 unassigned wm 0 0 (0/0/0) 0
4 unassigned wm 0 0 (0/0/0) 0
5 unassigned wm 0 0 (0/0/0) 0
6 usr wm 0 0 (0/0/0) 0
7 unassigned wm 0 - 2035 1002.09MB (2036/0/0) 2052288
Okay to make this the current partition table[yes]? yes
Enter table name (remember quotes): "home"
Ready to label disk, continue? y
partition> q
format> verify
format> q
```

Step 2: Initialize the devices

dd if=/dev/zero of=/dev/rdsk/c2t0d0s7 bs=8192
dd if=/dev/zero of=/dev/rdsk/c2t4d0s7 bs=8192

Step 3: Change ownership and permissions

OCR disk device
chown root:dba /dev/rdsk/c2t0d0s*
chmod 660 /dev/rdsk/c2t0d0s*
Voting disk
chown oracle:dba /dev/rdsk/c2t4d0s*
chmod 660 /dev/rdsk/c2t4d0s*

Prepare Servers for CRS Installation

Note: See the latest Oracle Real Application Clusters Installation and Configuration Guide for the most current information. As of this writing it was Part No. 14205-07. It can be downloaded from http://www.oracle.com/technology/documentation/database10g.html . Along with ssh and

scp, rsh and rcp need to be installed. To install the Oracle cluster software using the GUI interface, you will need to have an X-windows server and client running and configured on your Desktop (ex. Cygwin).

Step 1: Create Users and Groups

Add the user groups dba, oper, oinstall to all nodes

 # /usr/sbin/groupadd –g 500 oinstall
 # /usr/sbin/groupadd –g 501 dba
 # /usr/sbin/groupadd –g 502 oper

Add the oracle user if it doesn't exist to all nodes

 # /usr/sbin/useradd -u 200 -g oinstall -G dba,oper –d /export/home/oracle –s /bin/ksh oracle –p *password*

To modify the user if it exists:

 # /usr/sbin/usermod

All equivalent users and groups must have the same GID (group) on all nodes

Update the file **.**profile and add the following:

```
umask 022
PATH=/bin:/usr/bin:/usr/local/bin:/usr/X11R6/bin
LD_LIBRARY_PATH=/usr/lib:/usr/X11R6/lib
ORA_CRS_HOME=/u01/crs/oracle/product/10.2.0.1/crs1
ORACLE_BASE=/u01/app/oracle
ORACLE_HOME=$ORACLE_BASE/product/10.2.0.1/db1
ORACLE_SID=orcl
LD_LIBRARY_PATH=$ORACLE_HOME/rdbms/lib:$ORACLE_HOME/lib:$ORACLE_HOME/jd
k/fre/lib/i386:$ORACLE_HOME/jdk/jre/lib/i386/server:$LD_LIBRARY_PATH:$CRS_HOME/lib:$
CRS_HOME/rdbms/lib
PATH=$ORACLE_HOME/bin:$PATH:$ORA_CRS_HOME/bin:/home/oracle
export PATH LD_LIBRARY_PATH
export ORACLE_BASE ORACLE_HOME ORACLE_SID ORA_CRS_HOME
unset USERNAME
```

Create Oracle user password if not already created:

 # passwd oracle

Step 2: Install and configure ssh, scp, rsh and rcp

1. Login as the oracle user
2. Create the directory .ssh

$ mkdir ~/.ssh
$ chmod 755 ~/.ssh

3. Generate an RSA key. At the prompts accept the default location and enter a pass phrase (not oracle password)
$ /usr/bin/ssh-keygen -t rsa

A public key is written to ~/.ssh/id_rsa.pub and a private key is written to the file ~/.ssh/id_rsa.

4. Generate a DSA key.
$ /usr/bin/ssh-keygen -t dsa

A public key is written to ~/.ssh/id_dsa.pub and a private key is written to the file ~/.ssh/id_dsa.

5. Copy the *contents* of the ~/.ssh/id_rsa.pub and ~/.ssh/id_dsa.pub files to the ~/.ssh/authorized_keys file on this node and to the same file on all other cluster nodes.

Note: The ~/.ssh/authorized_keys file on every node must contain the contents from all of the ~/.ssh/id_rsa.pub and ~/.ssh/id_dsa.pub files that you generated on all cluster nodes.

6. Change the permissions on the ~/.ssh/authorized_keys file on all cluster nodes:
$ chmod 644 ~/.ssh/authorized_keys

7. If you use ssh to log into or run a command on another node, you are prompted for the password that you specified when you created the DSA key. To enable the Installer to use the ssh and scp commands without being prompted for a password enter the following commands:

$ exec /usr/bin/ssh-agent $SHELL
$ /usr/bin/ssh-add

8. At the prompts, enter the pass phrase for each key that you generated. If you have configured SSH correctly, you can now use the ssh or scp commands without being prompted for a password.
To test the SSH configuration, enter the following commands:

$ ssh *nodename1* uname -n
$ ssh *nodename2* uname –n
$ scp test1 node2:test1

You should see the name of the server displayed without a request for a password. If any node prompts for a password, verify that the ~/.ssh/authorized_keys file on that node contains the correct public keys.

Note: The first time you use SSH to connect to a node from a particular system, you might see a message stating that the authenticity of the host could not be established. Enter yes at the prompt to continue. The node is now added to the ~/.ssh/authorized_hosts file. Connect to each node using the node names and IP addresses so that this prompt will not occur during installation.

9. To ensure that X11 forwarding will not cause the installation to fail, create the ~oracle/.ssh/config file. Put the following text into the file:
Host *
ForwardX11 no

10. The installer can now be run from this session. If it isn't repeat step 7 before starting the Installer.

11. Configure rsh and rcp.
a. Create a .rhosts (or /etc/hosts.equiv) file in the oracle home directory of each node. Add node information:

Node1 oracle
10.4.1.511 oracle
Node2 oracle
10.4.1.521 oracle

b. If the rsh service is not active, activate it. As root:

 # svcadm enable svc:/network/shell:default

c. Verify functionality of rsh and rcp by using the same methods as before for ssh and scp

Step 3: Update /etc/system

set semsys:seminfo_semmns=1024
set semsys:seminfo_semvmx=32767
set shmsys:shminfo_shmmax=6442450944
set semsys:seminfo_semmni=256
set semsys:seminfo_semmsl=256
set shmsys:shminfo_shmmni=100

Step 4: Verify OS version.

 # /bin/isainfo –kv

ie. i386 or SPARC, and 32-bit or 64-bit.

Step 5. Check that OS software patches are installed.

 # /usr/sbin/patchadd -p | grep *patch_number*

Step 6. Setup */etc/hosts* file.

```
# Do not remove the following line, or various programs
# that require network functionality will fail.
127.0.0.1       localhost.localdomain localhost
10.2.1.211      titanium
10.2.1.201      copper
# Private IP addresses for the rac nodes
10.5.1.61       rac2-priv1
10.5.1.51       rac1-priv1
# Virtual IP addresses for the rac nodes
10.2.1.202      rac1-vip
10.2.1.212      rac2-vip
```

Step 7: Create CRS and Database Home directories

CRS Home Directory: /u01/crs/oracle/product/10.2.0.1/crs1
Oracle Home Directory: /u01/app/oracle/product/10.2.0.1/db1

Create a shared folder for the CRS Voting Disk. ex. /u02/crsdata

Create a shared folder for the Oracle database data. ex. /u03/oradata
A folder can also be created for archive logs or flash-back files. ex. /u04/archive

Step 8: Verify servers meet hardware and software requirements: check the Guide.

Run the cluvfy (cluster verification utility) utility, which will perform various system checks that will confirm that your system is configured for Oracle Clusterware and Oracle RAC.

$ ./runcluvfy.sh stage -pre crsinst -n *node1,node2 -verbose*

To check for required OS packages listed in Guide.
 # pkginfo –i SUNWarc SUNWbtool SUNWhea SUNWlibm SUNWlibms

Install Oracle CRS

Step1: Start Installer

1. a. make sure you run the following from Step 3:

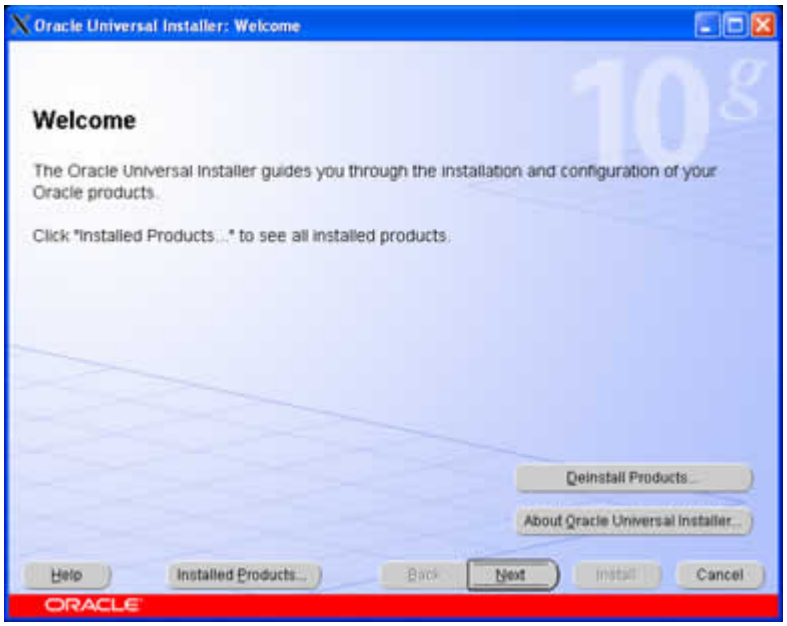
$ exec /usr/bin/ssh-agent $SHELL
$ /usr/bin/ssh-add

b.set ORACLE_HOME=/u01/crs/oracle/product/10.2.0.1/crs1

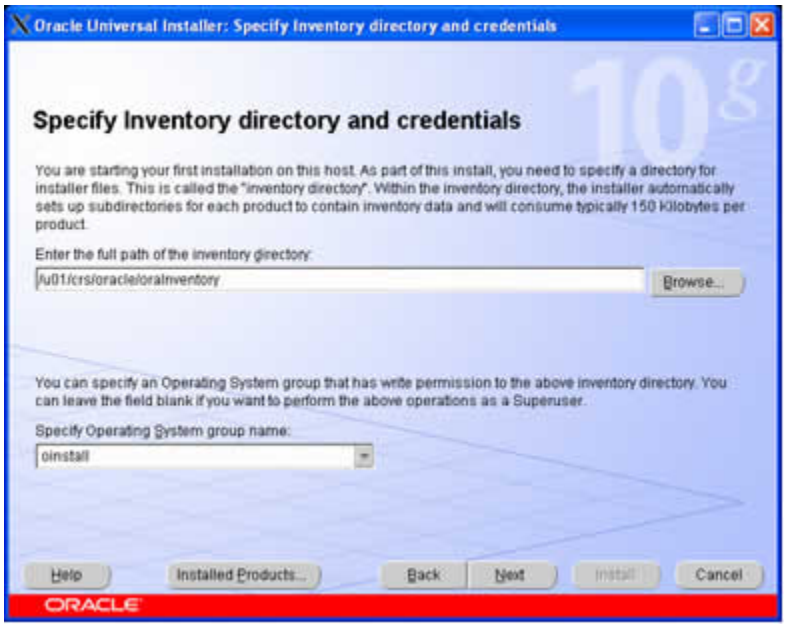
2. Start the installer

$ ~/runinstaller &

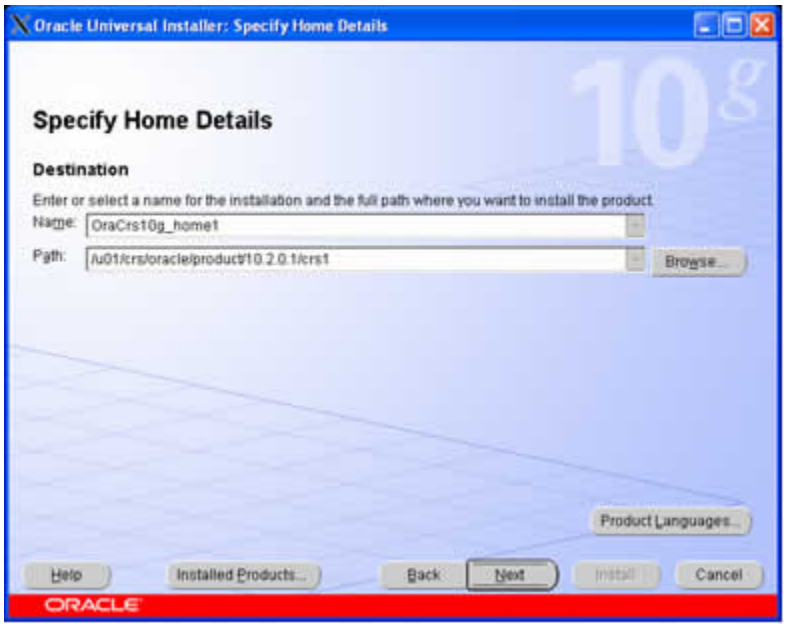
3. The GUI should appear after a short delay and look similar to this:



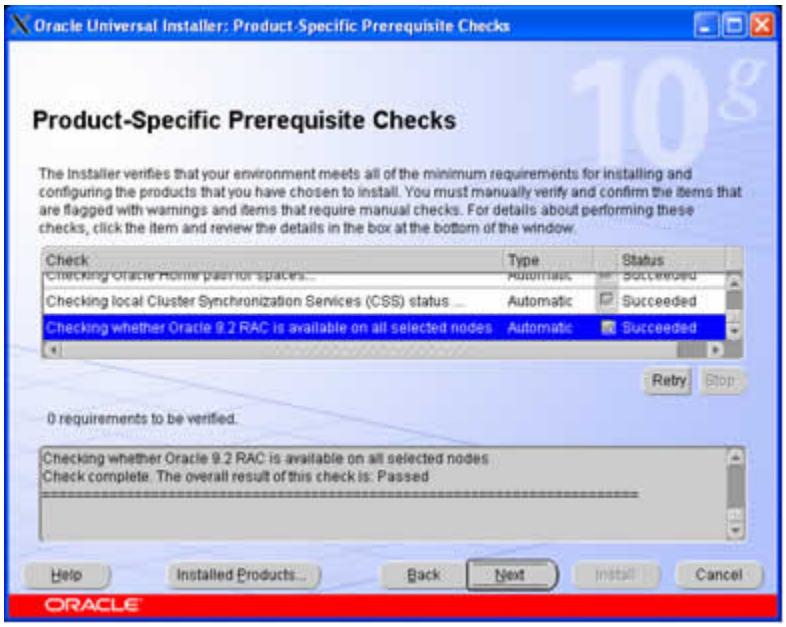
4. inventory location



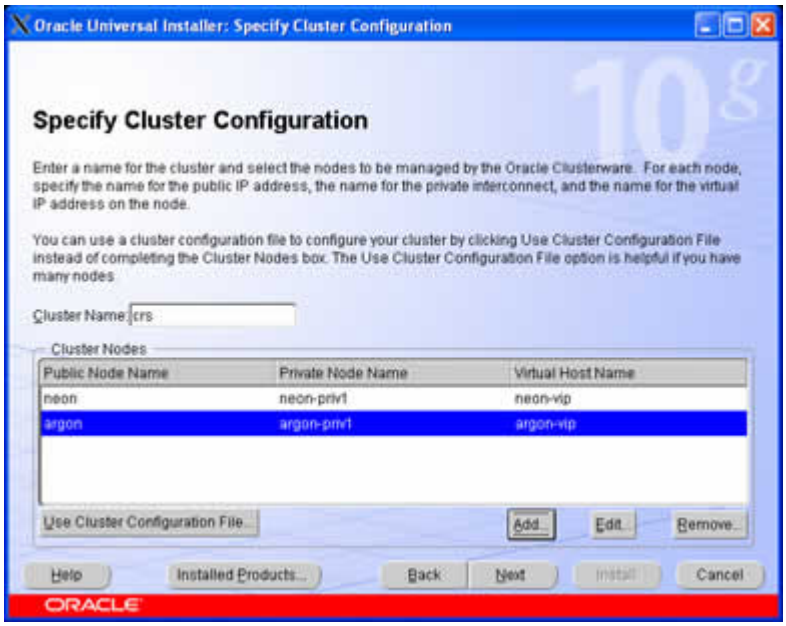
5. Choose a location for the CRS home



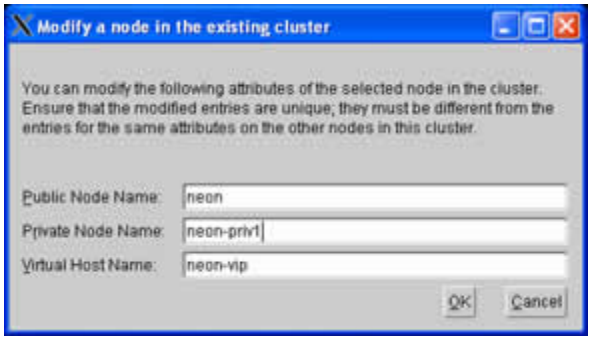
6. Pre-requisite checks



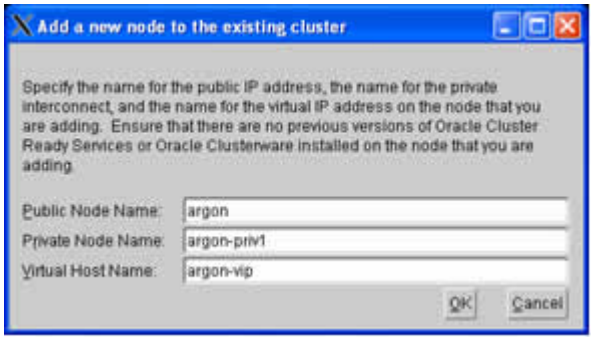
7. Add the public (server name) and private node names. Recommend doing only one private node name now.



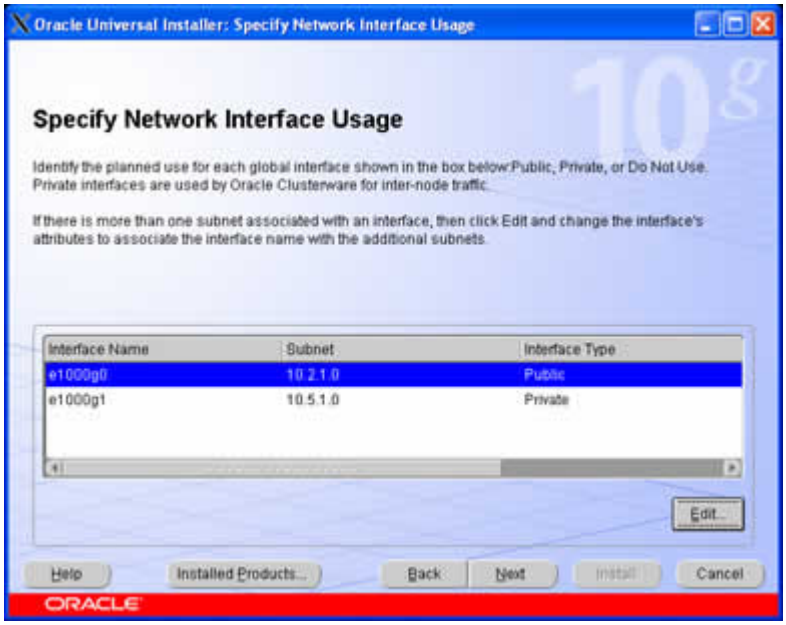
7b. secondary window for entering private and virtual node names.



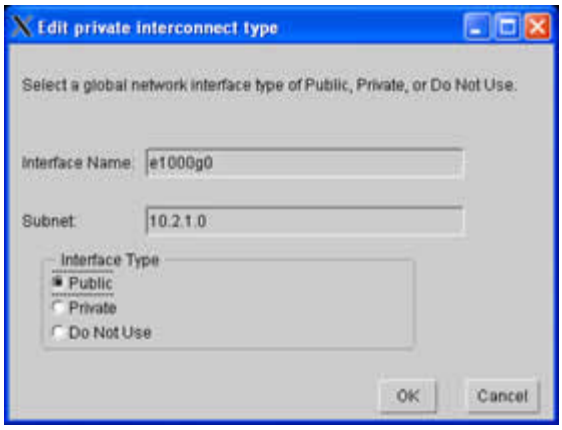
7c. secondary window to add other nodes.



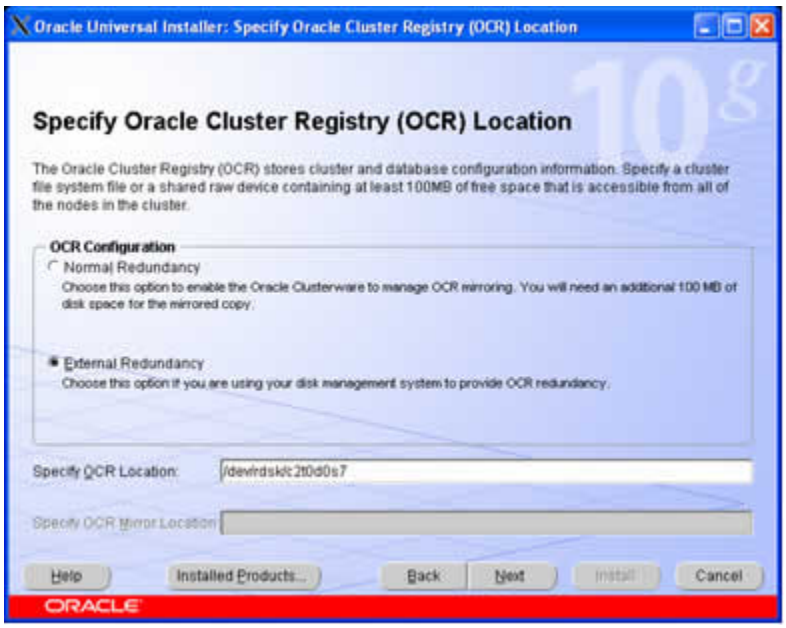
8. Choose the Interface type (Public. Private, Do not use) for each network interface.



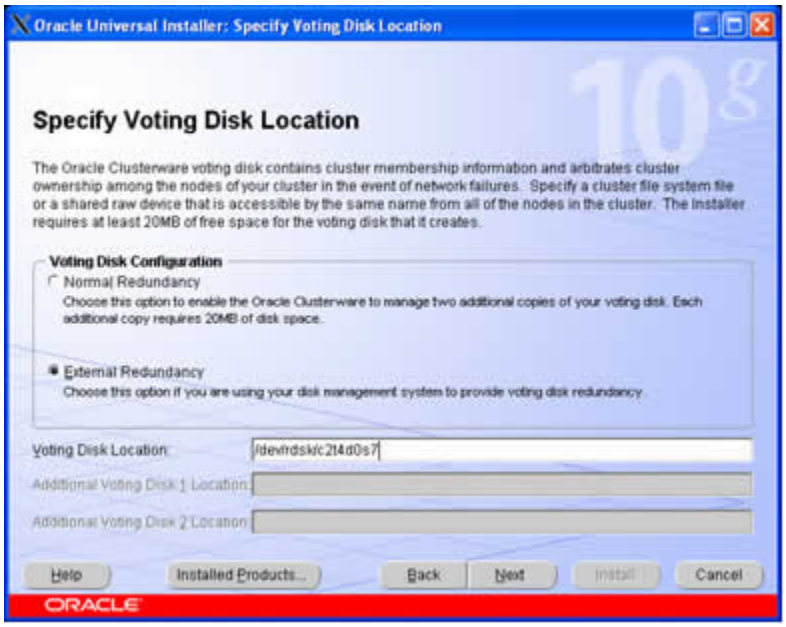
9b. Choose the interface type shown in secondary window.



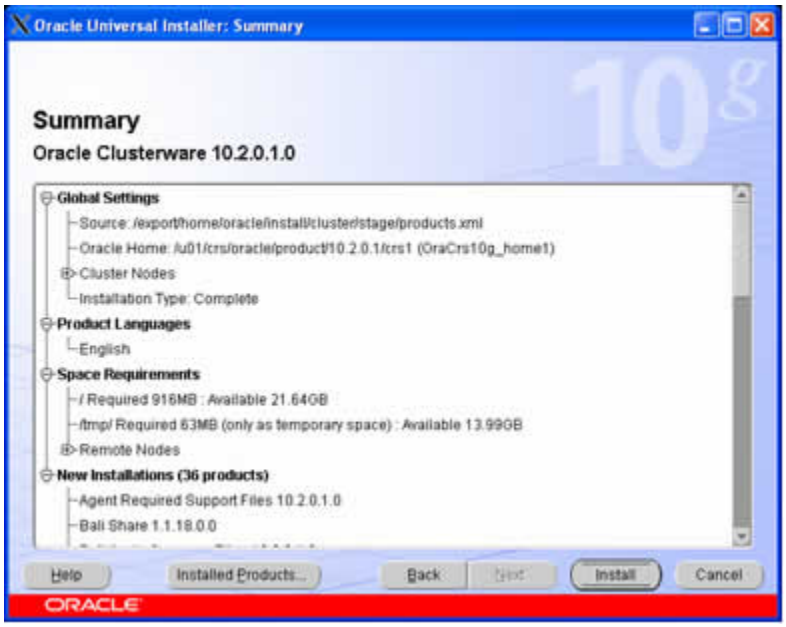
10. Specify the shared file where the Oracle Cluster Registry (OCR) data will be stored. Enter the raw device name of the iSCSI volume.



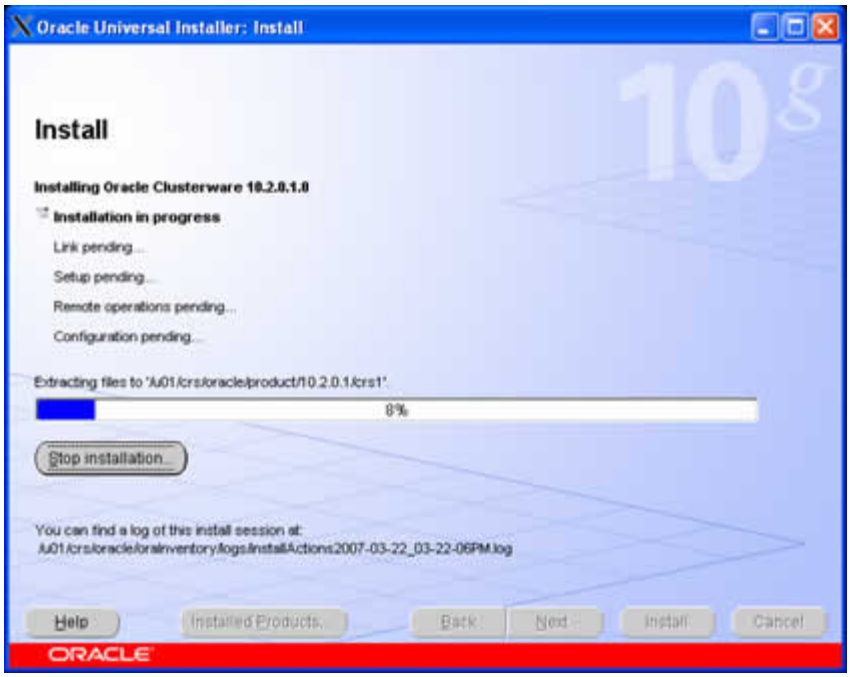
11. Enter the Voting Disk file location.



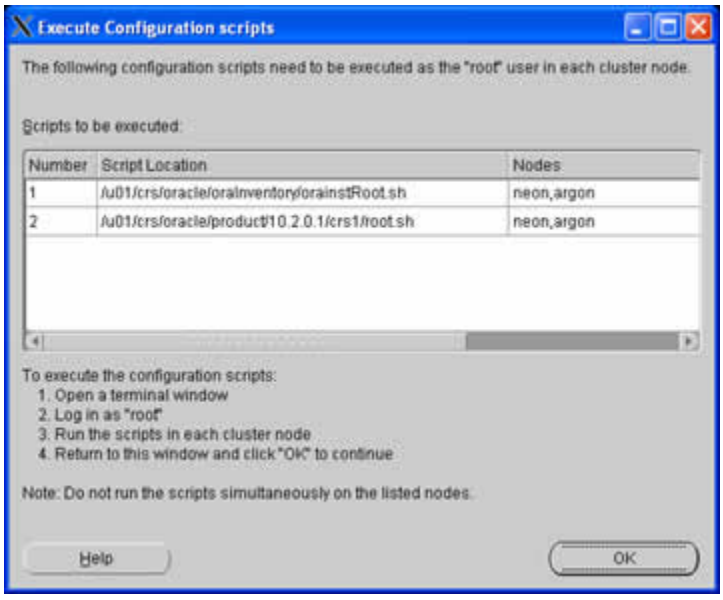
12. The OUI will now show a summary page before installation.



13. The installation begins.



14. The OUI will now display a request to run *root.sh*

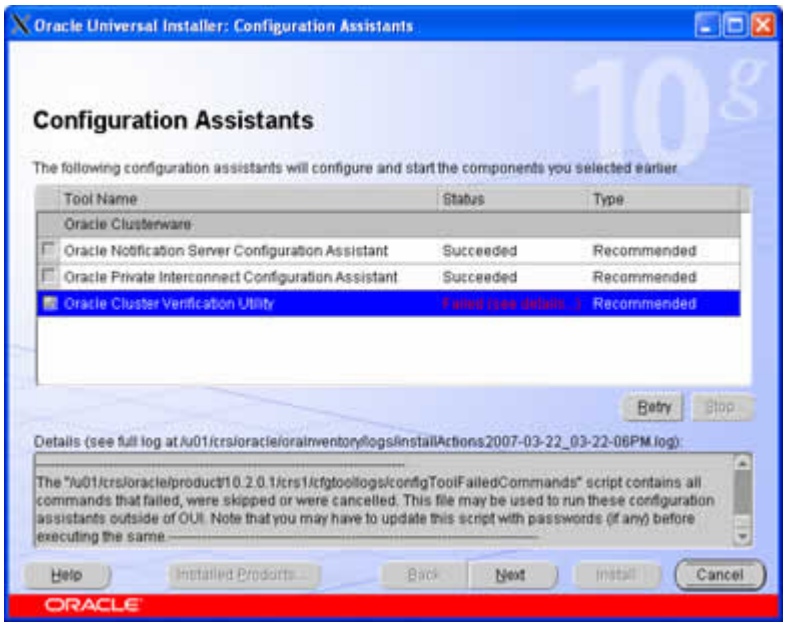


15. Run the root.sh scripts on each node (as root). On the first node the output will look similar to the picture below.

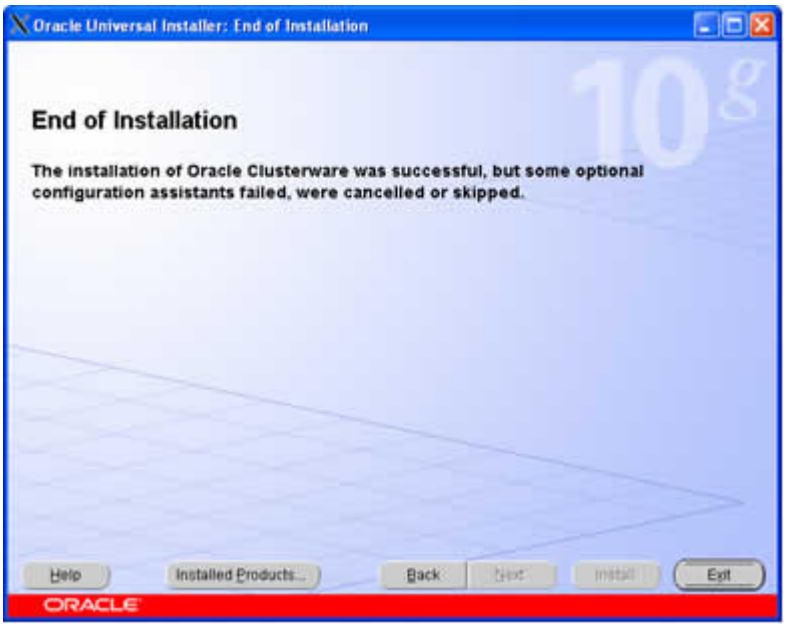
 # ./root.sh
WARNING: directory '/u01/crs/oracle/product/10.2.0.1' is not owned by root
WARNING: directory '/u01/crs/oracle/product' is not owned by root
WARNING: directory '/u01/crs/oracle' is not owned by root
WARNING: directory '/u01/crs' is not owned by root
WARNING: directory '/u01' is not owned by root
Checking to see if Oracle CRS stack is already configured

Setting the permissions on OCR backup directory
Setting up NS directories
Oracle Cluster Registry configuration upgraded successfully
WARNING: directory '/u01/crs/oracle/product/10.2.0.1' is not owned by root
WARNING: directory '/u01/crs/oracle/product' is not owned by root
WARNING: directory '/u01/crs/oracle' is not owned by root
WARNING: directory '/u01/crs' is not owned by root
WARNING: directory '/u01' is not owned by root
Successfully accumulated necessary OCR keys.
Using ports: CSS=49895 CRS=49896 EVMC=49898 and EVMR=49897.
node <nodenumber>: <nodename> <private interconnect name> <hostname>
node 1: neon neon-priv1 neon
node 2: argon argon-priv1 argon
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
Now formatting voting device: /dev/rdsk/c2t4d0s7
Format of 1 voting devices complete.
Startup will be queued to init within 30 seconds.
Adding daemons to inittab
Expecting the CRS daemons to be up within 600 seconds.
CSS is active on these nodes.
neon
CSS is inactive on these nodes.
argon
Local node checking complete.
Run root.sh on remaining nodes to start CRS daemons.

16. The OUI now shows a screen that indicates the starting of the CRS services.



17. The installation is now complete.



Note: The cluvfy utility had difficulty with raw partitions and was not able to successfully verify all parameters.

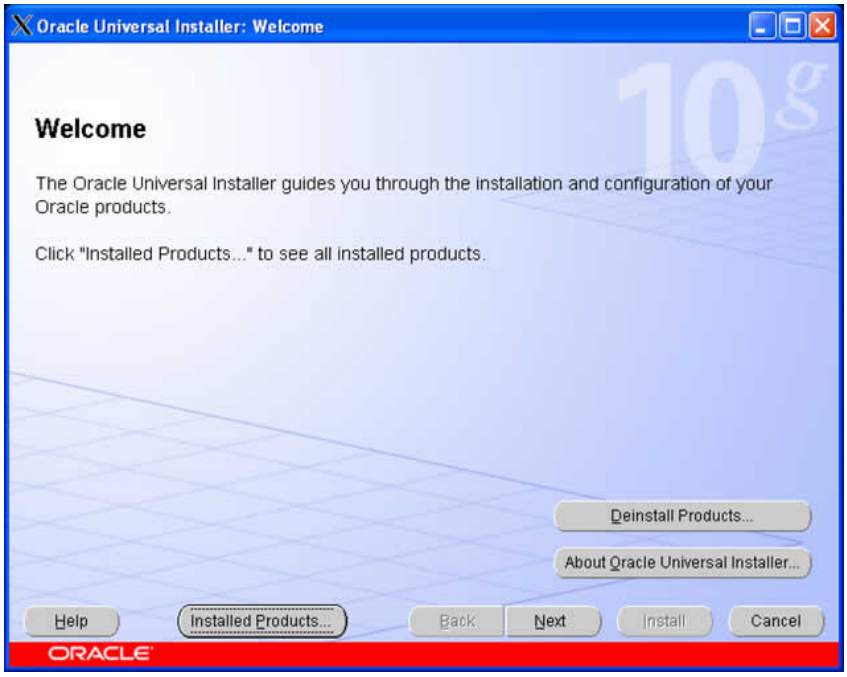
Install Oracle ASM

Create ASM Disks for Oracle

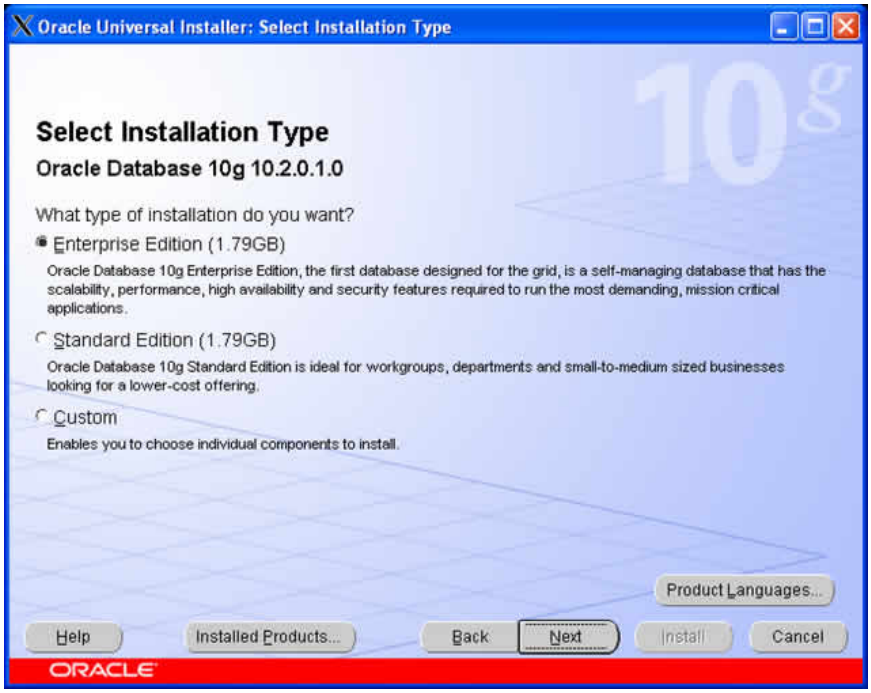
1. Setup the array volumes and iSCSI targets, as mentioned in Setup iSCSI.

Note: If reusing volumes previously used for ASM , the first 10 blocks need to be reformatted.
ex. dd if=/dev/zero of=/dev/rdsk/c2t0d0s7 bs=1024 count=10

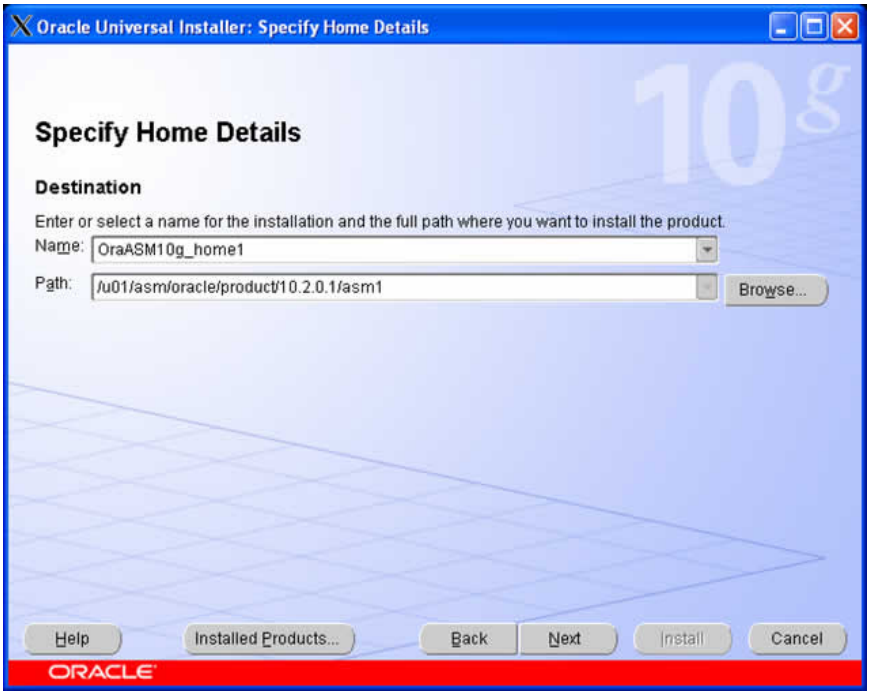
2. Start the Database Configuration Assistant (DBCA)
$. $ORACLE_HOME/bin/dbca &



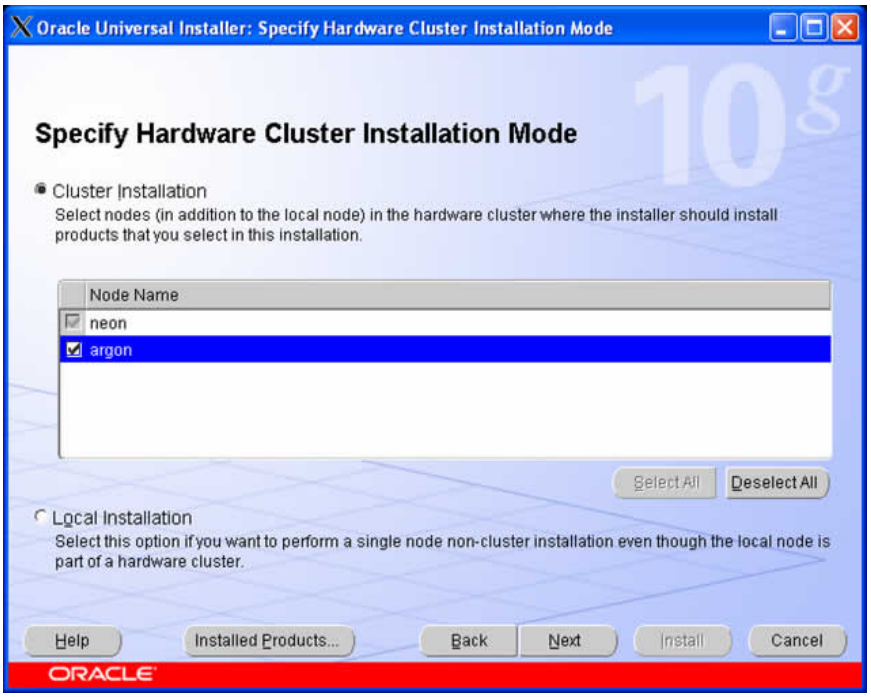
3. Same page as the database install



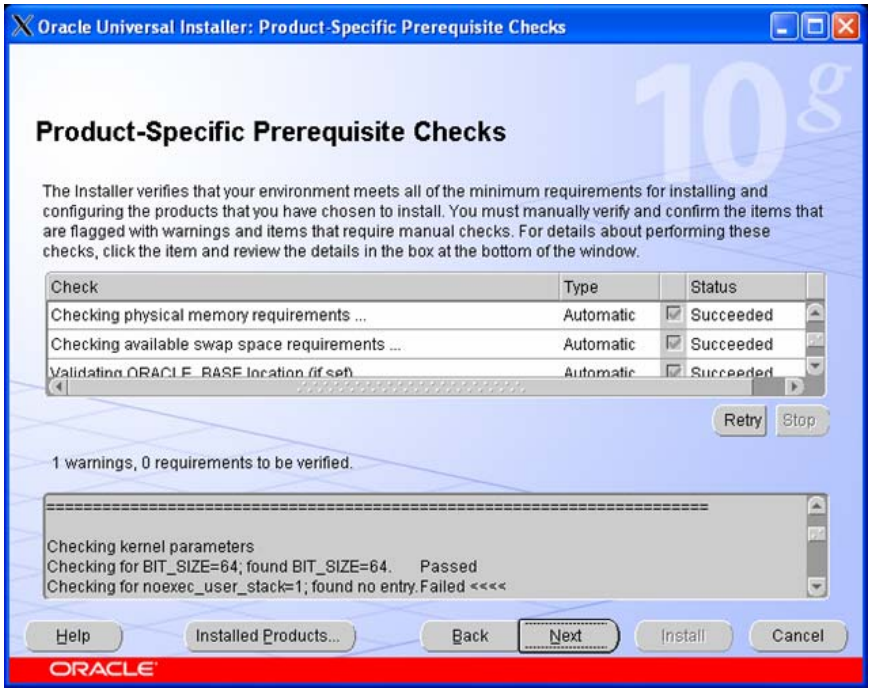
4. Choose a separate install location for the ASM software.



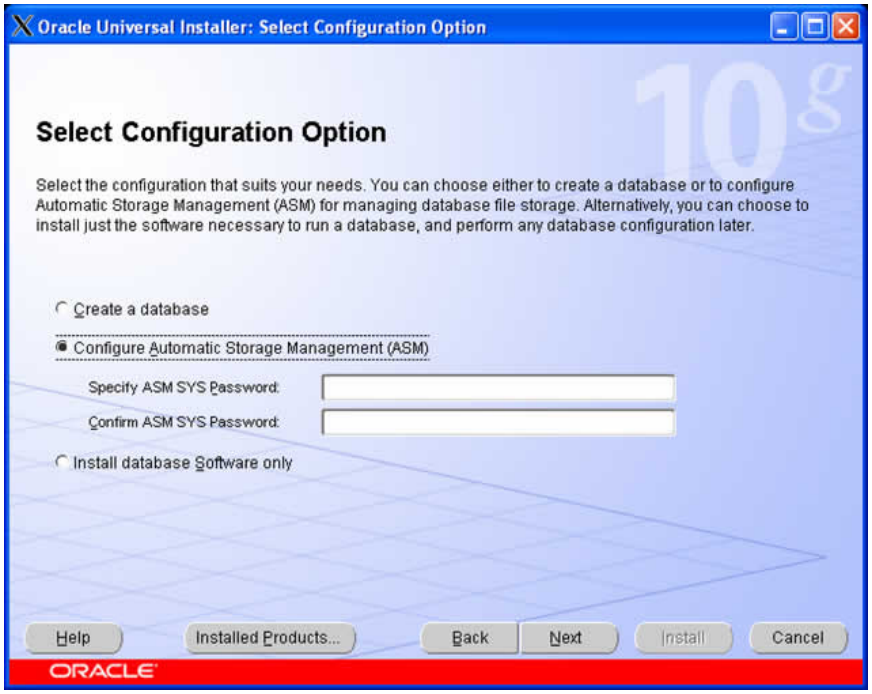
5. Choose the cluster nodes



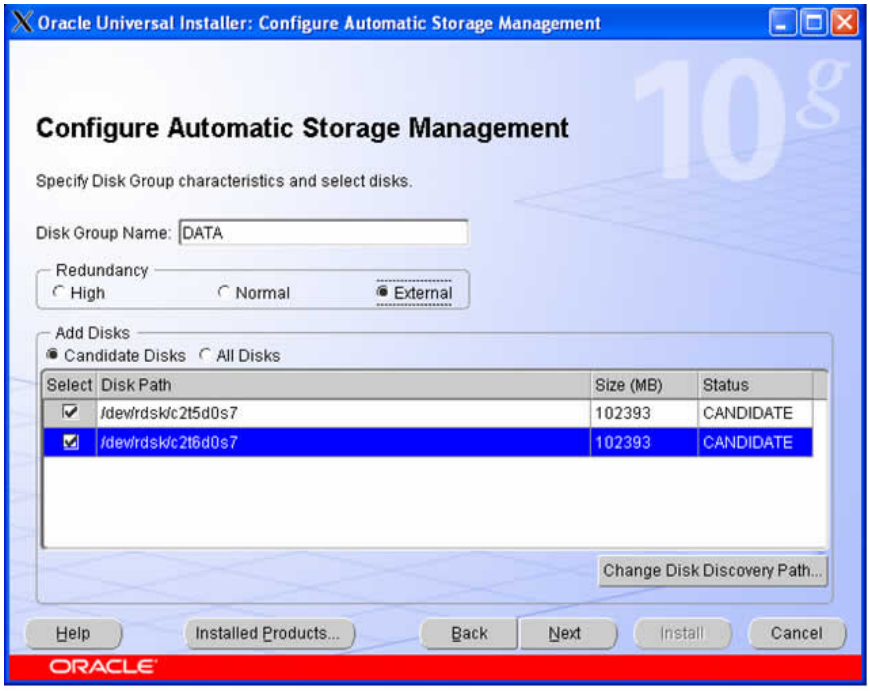
6. Same prerequisite checks for the database



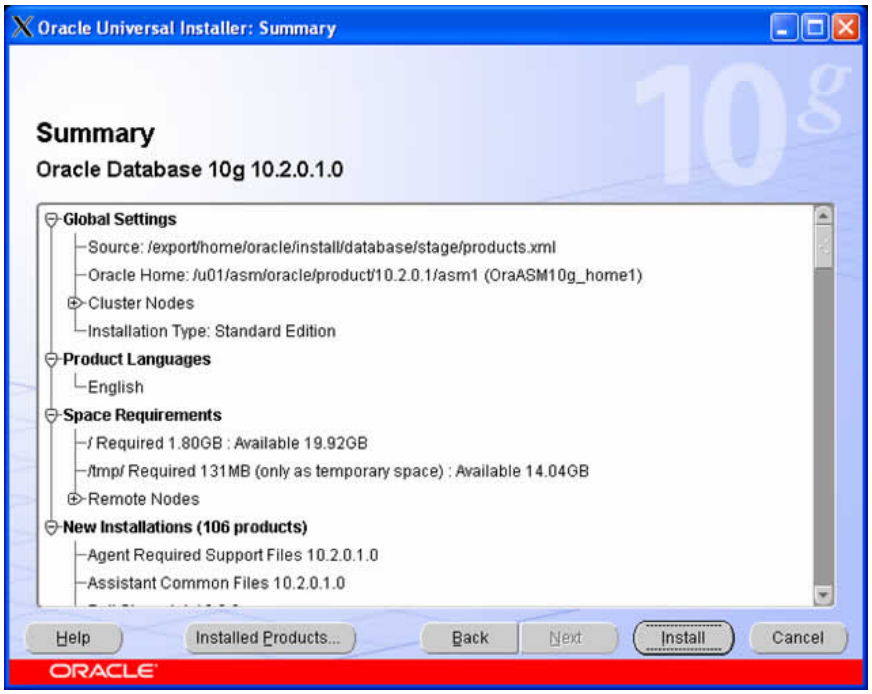
7. Choose the ASM install



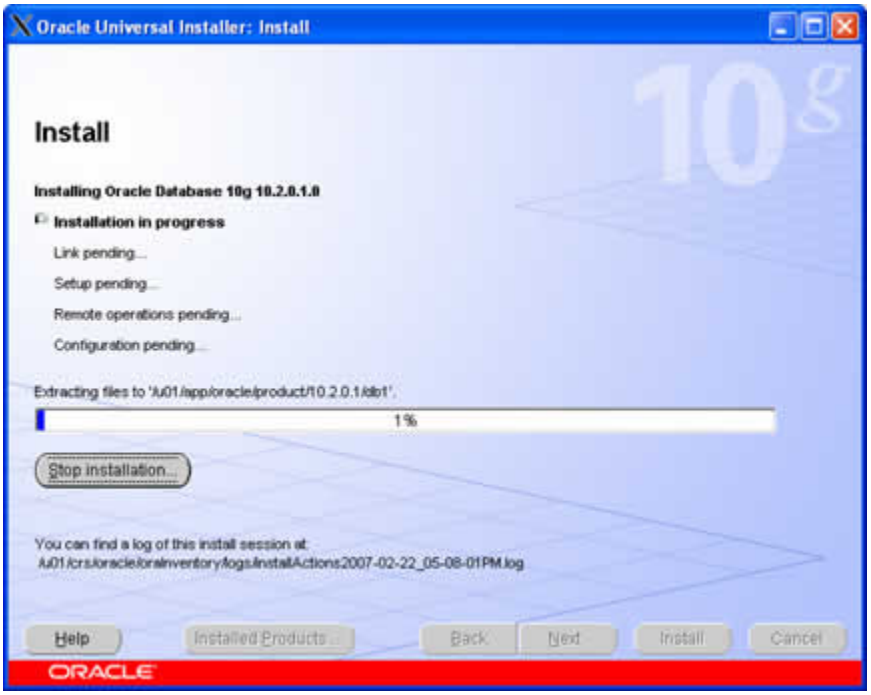
8. Available unused raw disks will be shown. Choose the ones to be included.



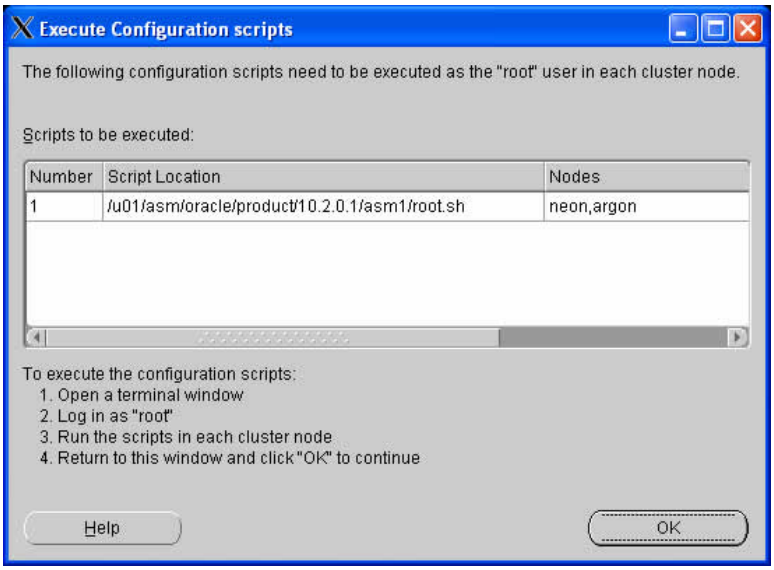
9. Install summary page



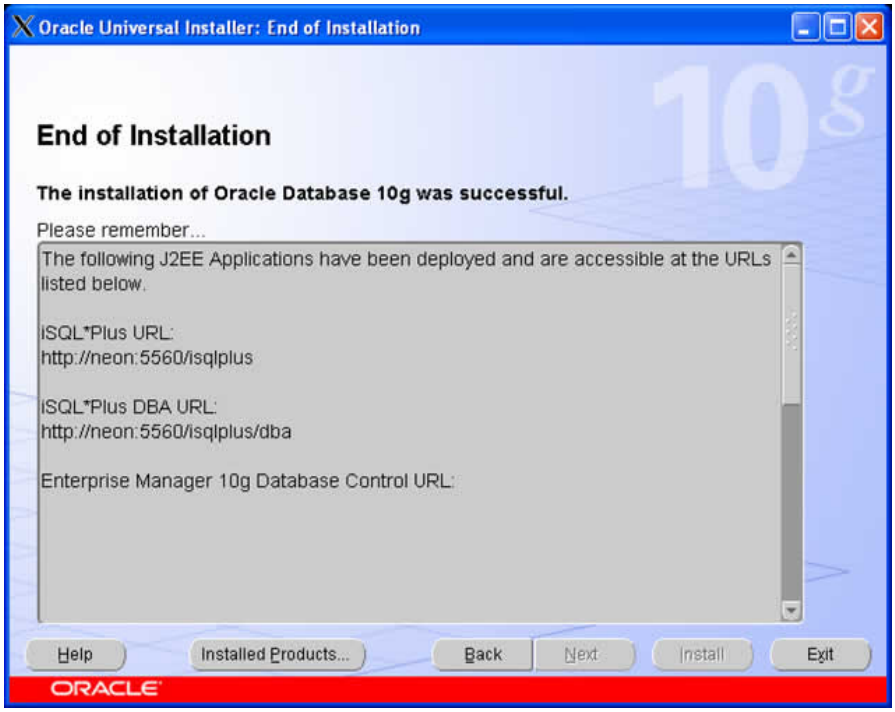
10. Install



11. Window to prompt you to run the root.sh scripts

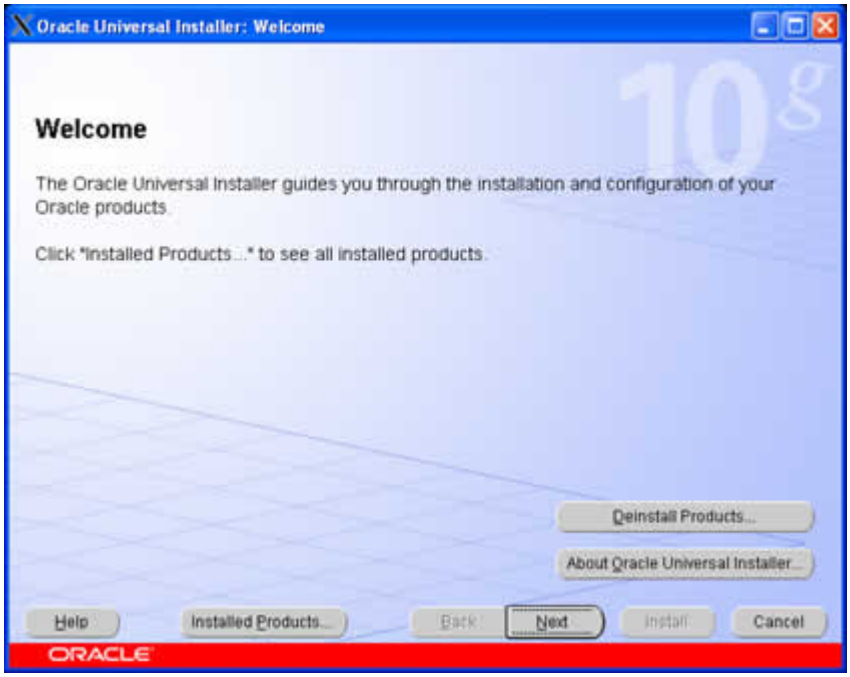


12. Install summary

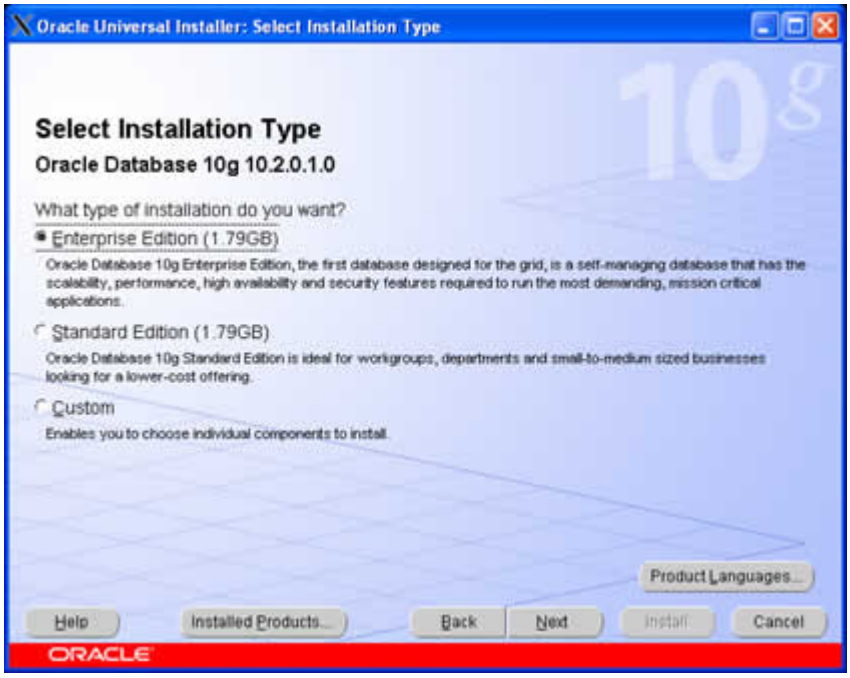


Install Oracle 10g Software

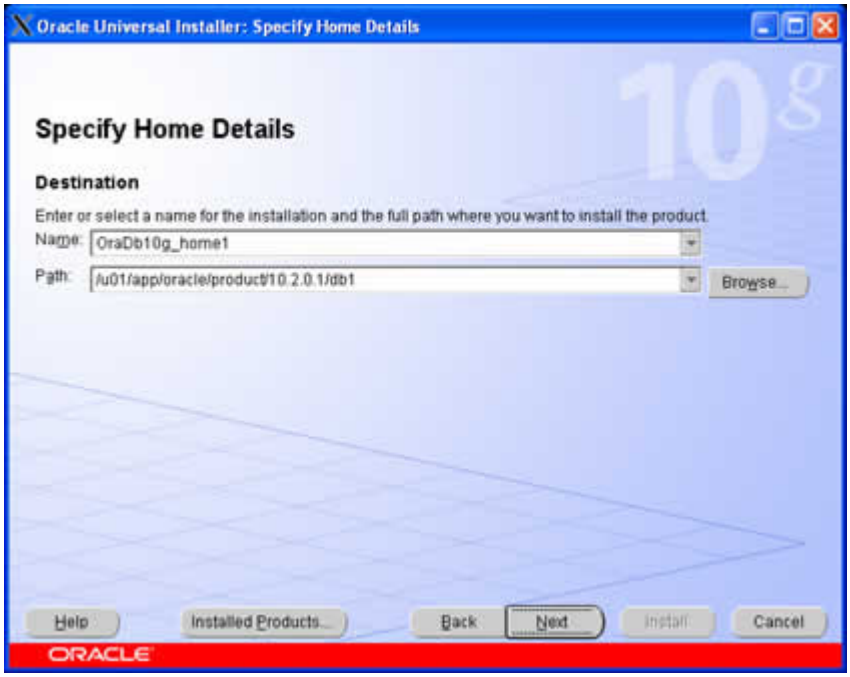
1. Start page



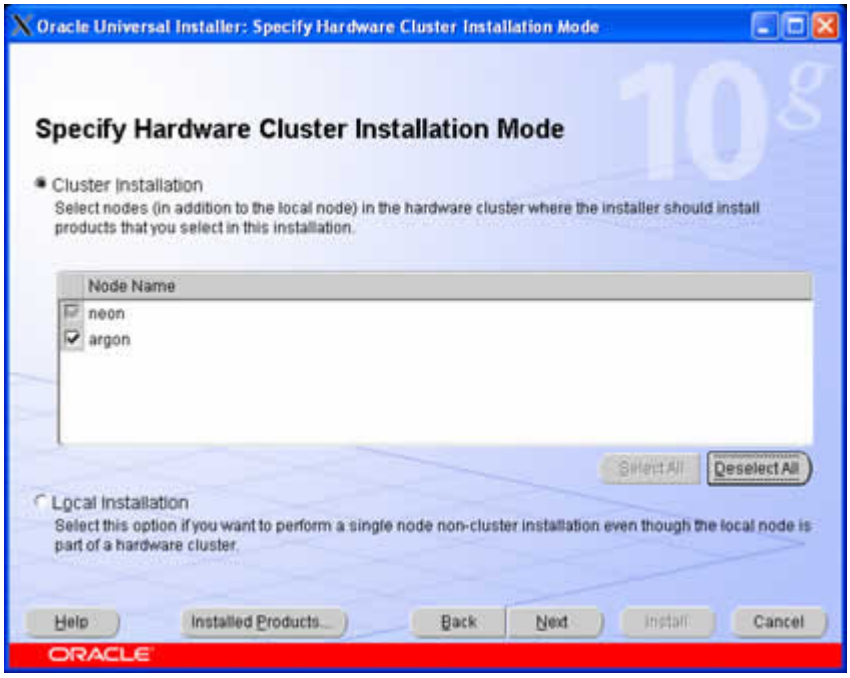
2. Choose Oracle version



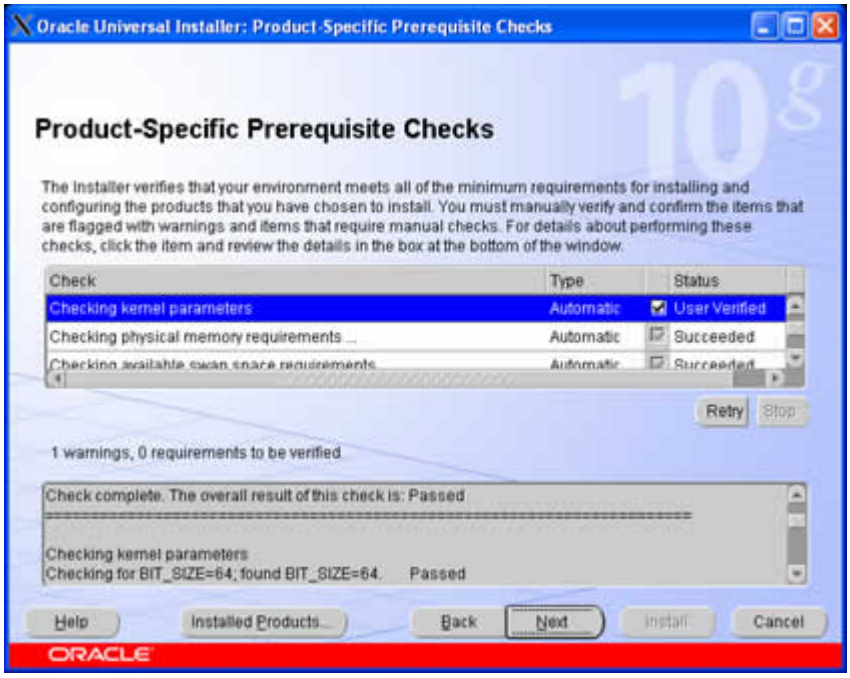
3. Enter Oracle database home



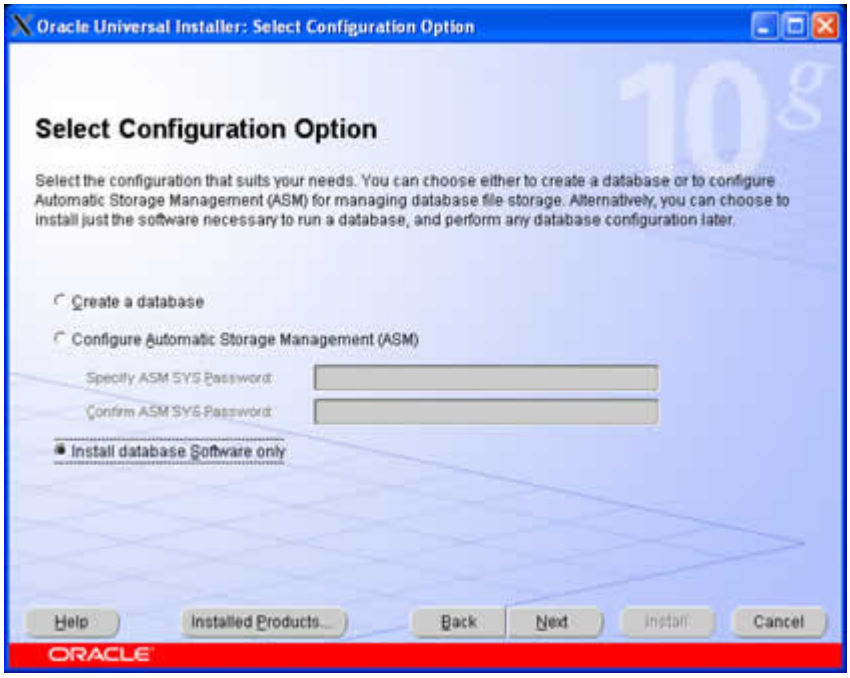
4. choose nodes



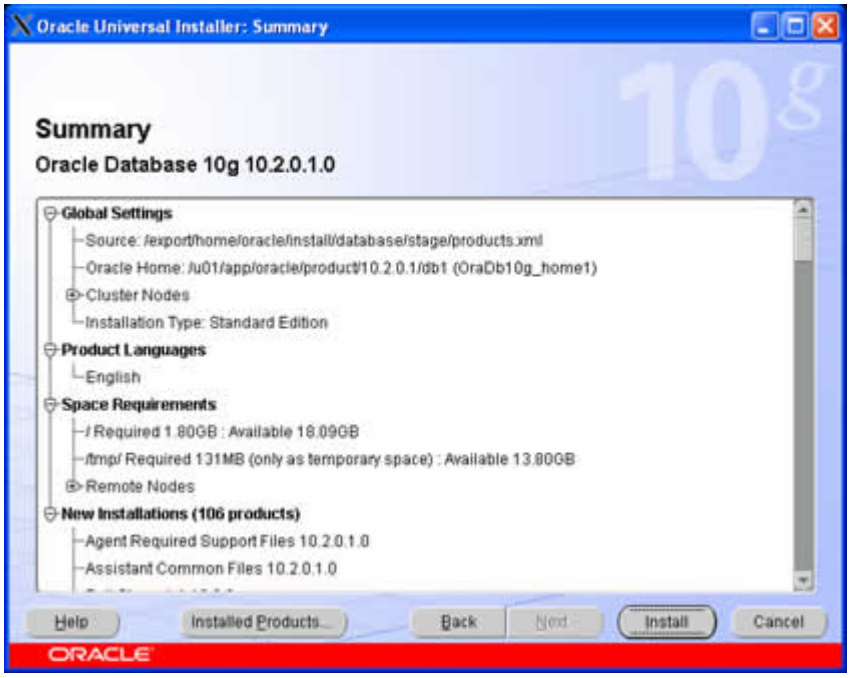
5. System variable checks



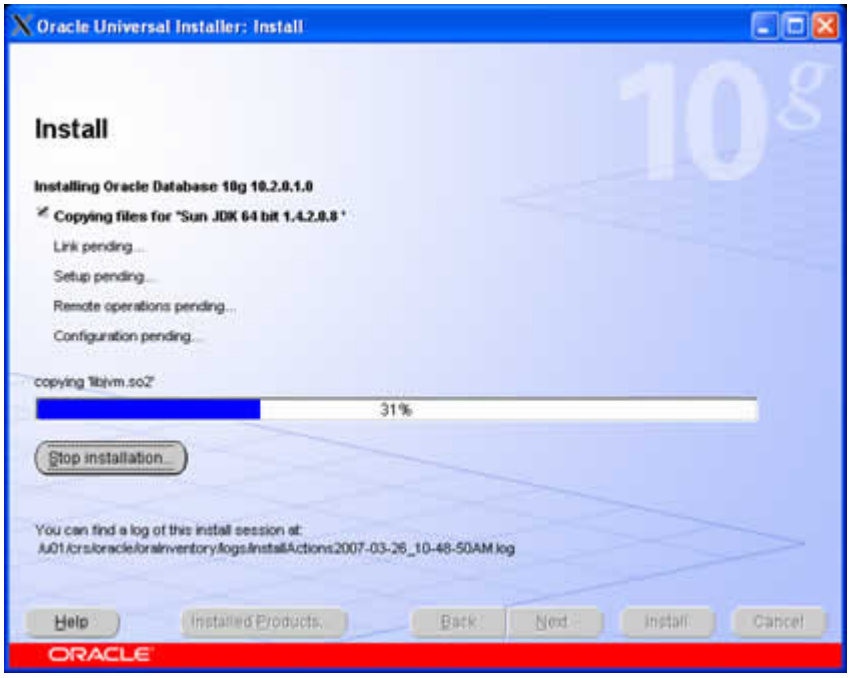
6. Choose type of install



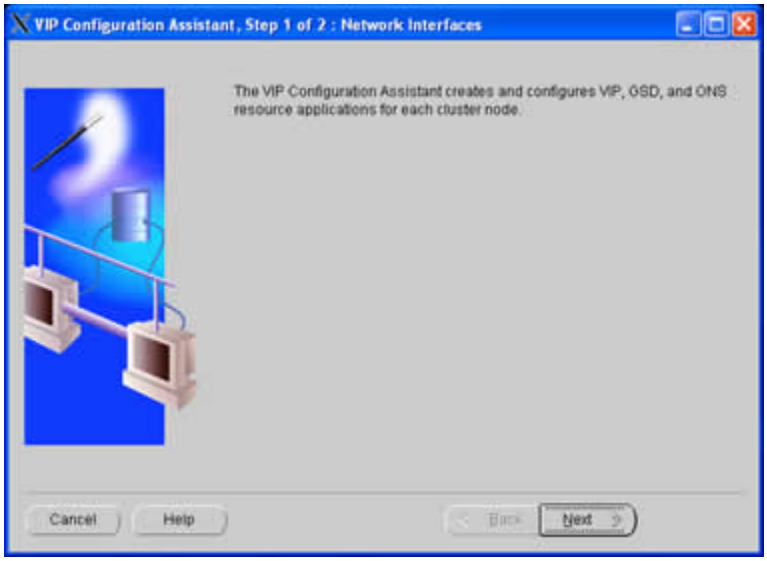
7. Summary page of install components.



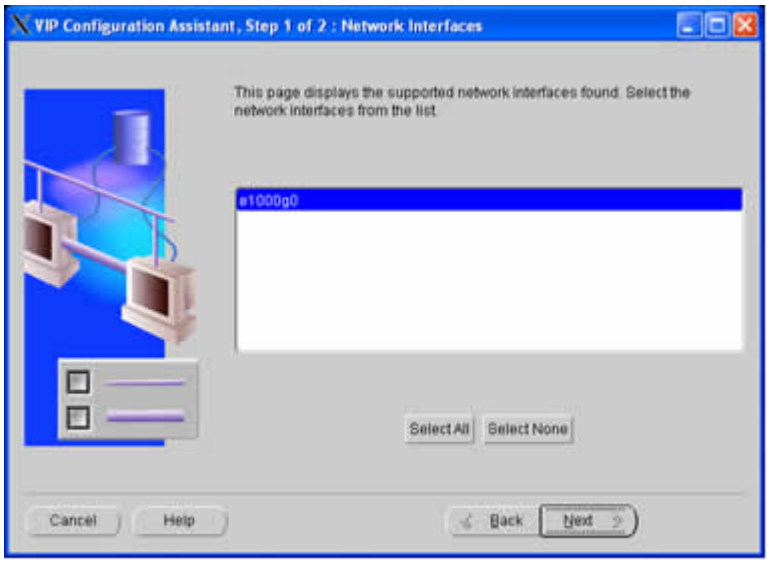
8. Install monitor



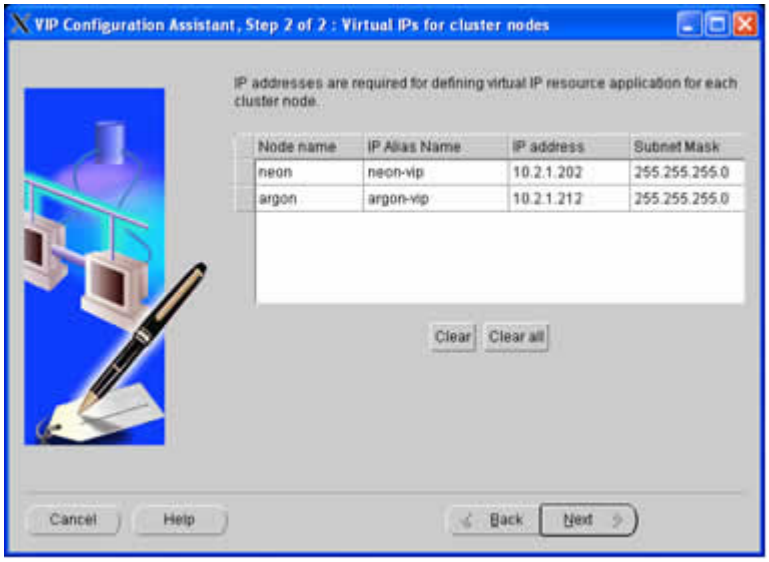
9. Create VIP
 a. The VIPCA utility should start automatically once the install has completed.



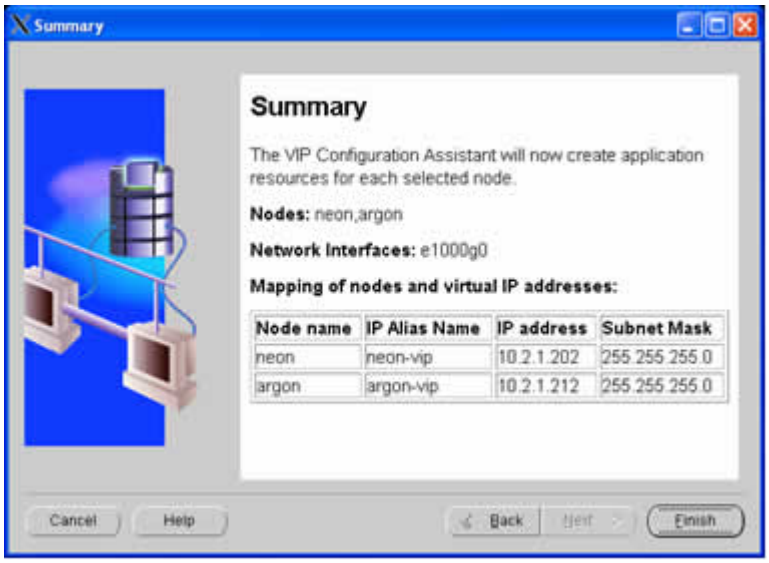
b. The network interfaces will be shown.



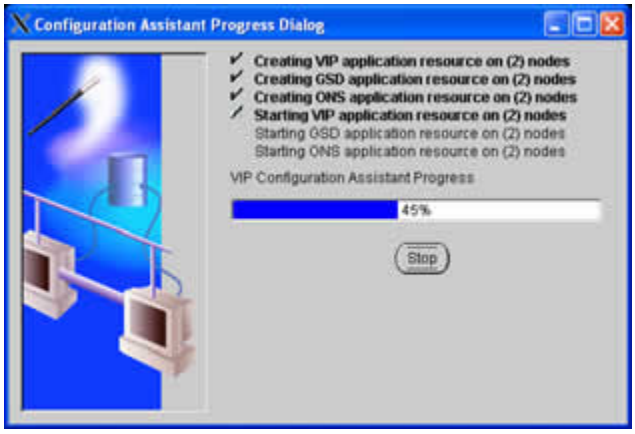
c. Enter the desired virtual IP addresses



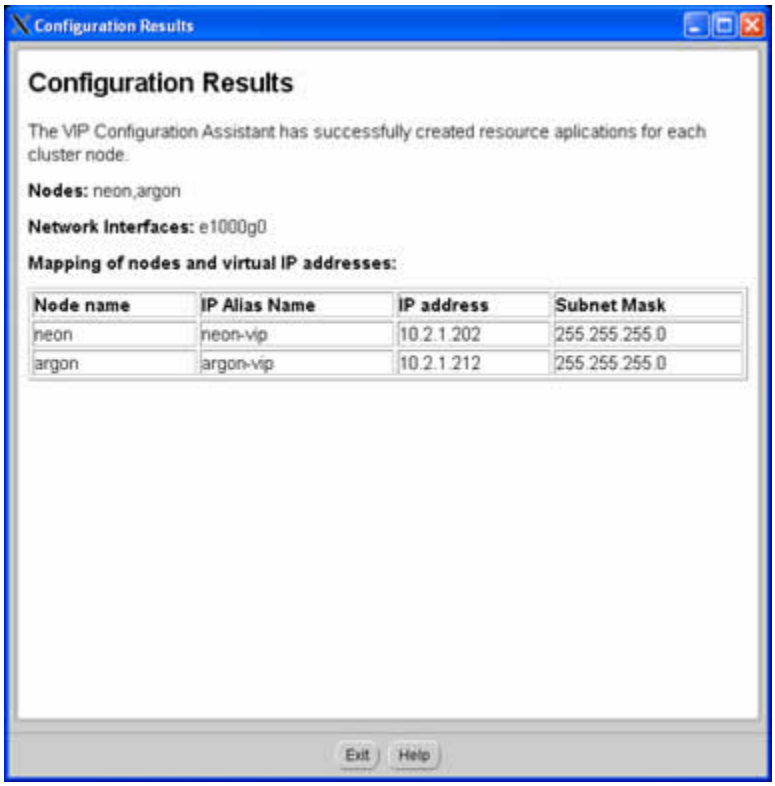
d. A summary page of your input will be shown before the process starts.



e. VIPCA will create vip addresses.



f. If the VIP creation is successful a summary page will be shown.



Check that the VIP address has been created. On Solaris use ifconfig.

ifconfig –a

You should see results similar to this:

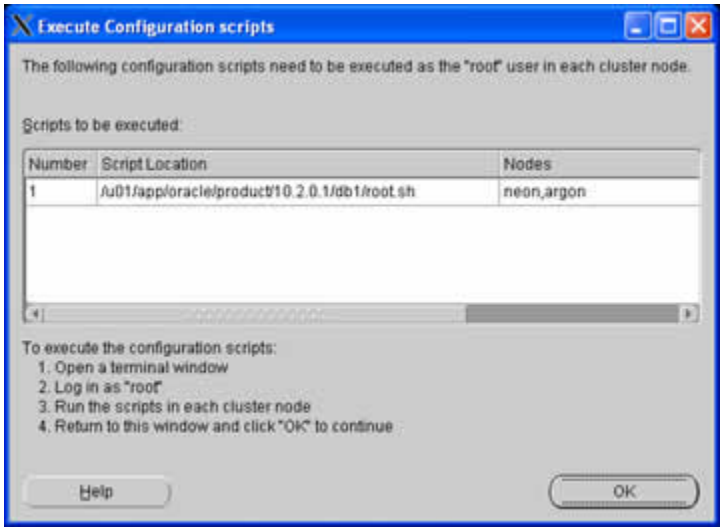
lo0: flags=2001000849<UP,LOOPBACK,RUNNING,MULTICAST,IPv4,VIRTUAL> mtu 8232 index 1
inet 127.0.0.1 netmask ff000000
e1000g0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500 index 2
inet 10.2.1.201 netmask ffffff00 broadcast 10.2.1.255
ether 0:14:4f:2c:f6:d4
e1000g0:1: flags=1040843<UP,BROADCAST,RUNNING,MULTICAST,DEPRECATED,IPv4> mtu 1500 index 2
inet 10.2.1.202 netmask ffffff00 broadcast 10.2.1.255

The public node is e1000g0 and the VIP is multiplexed (e1000g0:1) with the public node.

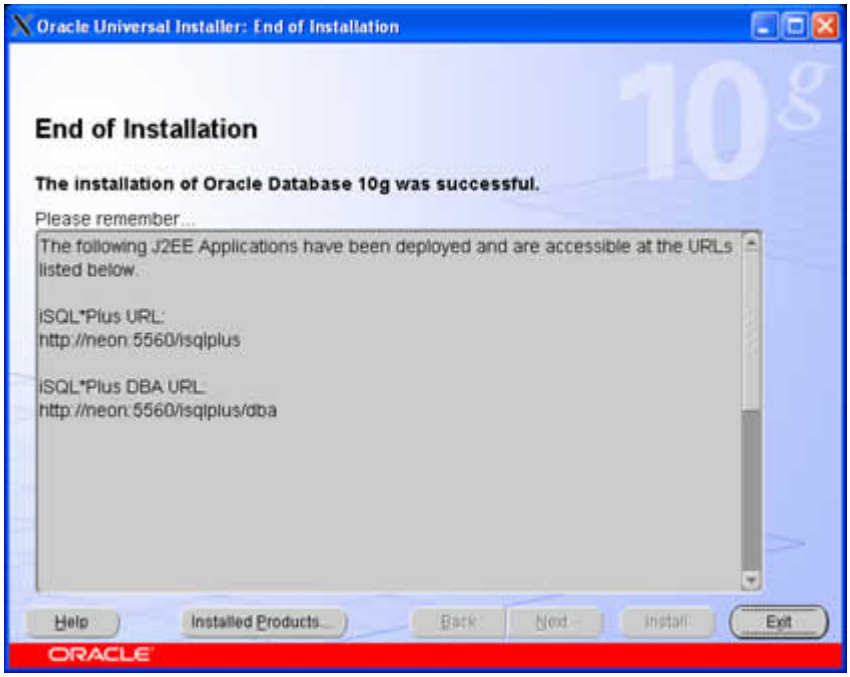
If VIP was not setup automatically by the Database Install then go ahead and use the $ORA_CRS_HOME/bin/vipca utility to create the vip.

$ORA_CRS_HOME/bin/vipca &

10. Window to request the running of root.sh script



11. End of Install window



Note: **Make a copy of this page since the location of this information is not included on the window. However, the portnumber information is available at $ORACLE_HOME/install/portlist.ini**