



# **Oracle Clusterware Installation and Configuration**

# Objectives

**After completing this lesson, you should be able to:**

- **Describe the installation of Oracle RAC 11g**
- **Perform RAC preinstallation tasks**
- **Perform cluster setup tasks**
- **Install Oracle Clusterware**

# Oracle RAC 11g Installation

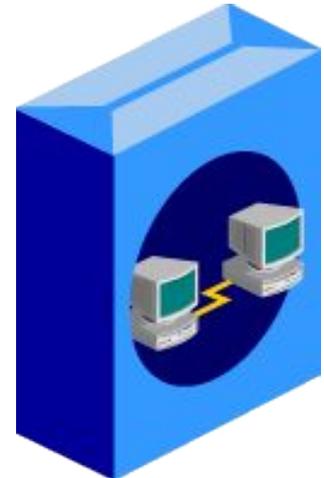
**Oracle RAC 11g incorporates a two-phase installation process:**

- **Phase one installs Oracle Clusterware.**
- **Phase two installs the Oracle Database 11g software with RAC.**



# Oracle RAC 11g Installation: Outline

- 1. Complete preinstallation tasks:**
  - Hardware requirements
  - Software requirements
  - Environment configuration, kernel parameters, and so on
- 2. Perform Oracle Clusterware installation.**
- 3. Perform ASM installation.**
- 4. Perform Oracle Database 11g software installation.**
- 5. Install EM agent on cluster nodes if using Grid Control.**
- 6. Perform cluster database creation.**
- 7. Complete postinstallation tasks.**



# Windows and UNIX Installation Differences

- **Startup and shutdown services**
- **Environment variables**
- **DBA account for database administrators**
- **Account for running OUI**



# Preinstallation Tasks

- ✓ **Check system requirements.**
- ✓ **Check software requirements.**
- ✓ **Check kernel parameters.**
- ✓ **Create groups and users.**
- ✓ **Perform cluster setup.**

# Hardware Requirements

- **At least 1 GB of physical memory is needed.**

```
# grep MemTotal /proc/meminfo
MemTotal:          1126400 kB
```

- **A minimum of 1 GB of swap space is required.**

```
# grep SwapTotal /proc/meminfo
SwapTotal:         1566328 kB
```

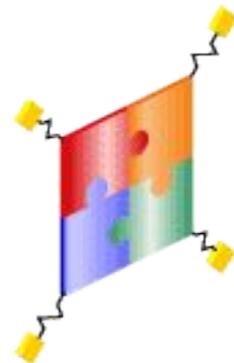
- **The /tmp directory should be at least 400 MB.**

```
# df -k /tmp
Filesystem      1K-blocks      Used Available Use%
/dev/sda6        6198556    3137920    2745756   54%
```

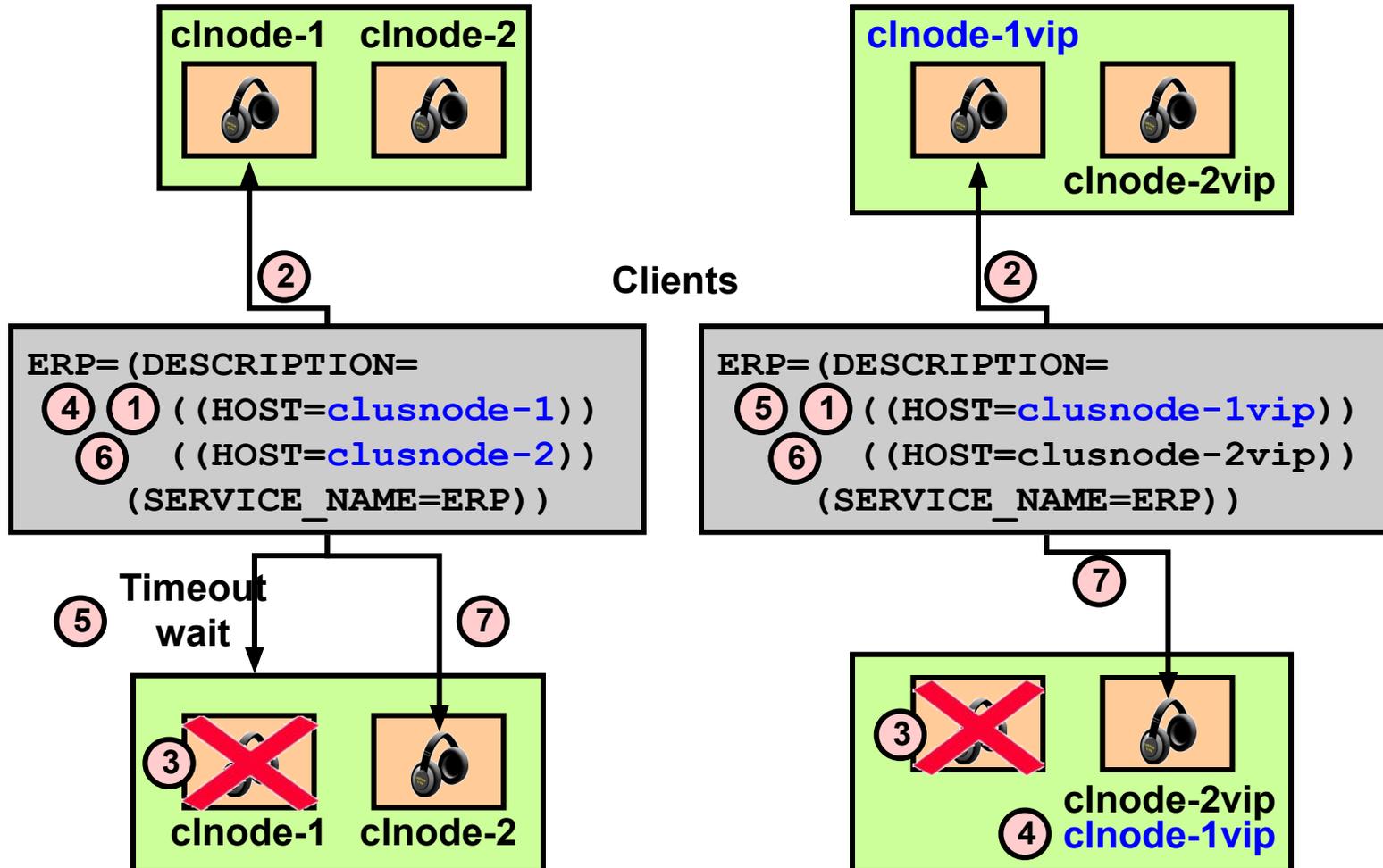
- **The Oracle Database 11g software requires up to 4 GB of disk space.**

# Network Requirements

- **Each node must have at least two network adapters.**
- **Each public network adapter must support TCP/IP.**
- **The interconnect adapter must support User Datagram Protocol (UDP).**
- **The host name and IP address associated with the public interface must be registered in the domain name service (DNS) or the `/etc/hosts` file.**

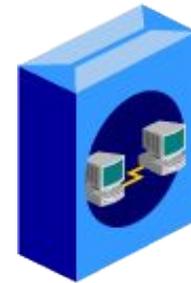


# Virtual IP Addresses and RAC



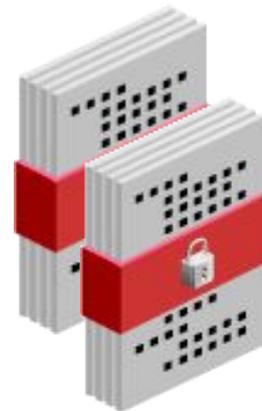
# RAC Network Software Requirements

- **Supported interconnect software protocols are required:**
  - TCP/IP
  - UDP
  - Reliable Data Gram
- **Token Ring is *not* supported on AIX platforms.**



# Package Requirements

- **Package versions are checked by the `cluvfy` utility.**
- **For example, required packages and versions for Red Hat 4.0 and Oracle Enterprise Linux 4 include:**
  - `glibc-2.3.4-2.25`
  - `glibc-common-2.3.4.2-25`
  - `glibc-devel-2.3.4.2-25`
  - `gcc-3.4.6-3`
  - `gcc-c++-3.4.6-3`
  - `libaio-0.3.105-2`
  - `libaio-devel-0.3.105-2`
  - `libstdc++-3.4.6-3.1`
  - `make-3.80-6`
  - `sysstat-5.0.5-11`



# Required UNIX Groups and Users

- **Create an oracle user, a dba, and an oinstall group on each node:**

```
# groupadd -g 500 oinstall
# groupadd -g 501 dba
# useradd -u 500 -d /home/oracle -g "oinstall" \
  -G "dba" -m -s /bin/bash oracle
```

- **Verify the existence of the nobody nonprivileged user:**

```
# grep nobody /etc/passwd
Nobody:x:99:99:Nobody:/:/sbin/nobody
```

# oracle User Environment

- **Set umask to 022.**
- **Set the DISPLAY environment variable.**
- **Set the ORACLE\_BASE environment variable.**
- **Set the TMP and TMPDIR variables, if needed.**

```
$ cd
$ vi .bash_profile
umask 022
ORACLE_BASE=/u01/app/oracle; export ORACLE_BASE
TMP=/u01/mytmp; export TMP
TMPDIR=$TMP; export TMPDIR
```

# User Shell Limits

- Add the following lines to the `/etc/security/limits.conf` file:

```
*      soft  nproc    2047
*      hard  nproc    16384
*      soft  nofile   1024
*      hard  nofile   65536
```

- Add the following line to the `/etc/pam.d/login` file:

```
session      required
/lib/security/pam_limits.so
```

# Configuring for Remote Installation

To configure Secure Shell:

1. Create the public and private keys on all nodes:

```
[vx0044]$ /usr/bin/ssh-keygen -t dsa  
[vx0045]$ /usr/bin/ssh-keygen -t dsa
```

2. Concatenate `id_dsa.pub` from all nodes into the `authorized_keys` file on the first node:

```
[vx0044]$ ssh vx0044 "cat ~/.ssh/id_dsa.pub" >> \  
~/.ssh/authorized_keys  
[vx0044]$ ssh vx0045 "cat ~/.ssh/id_dsa.pub" >> \  
~/.ssh/authorized_keys
```

3. Copy the `authorized_keys` file to the other nodes:

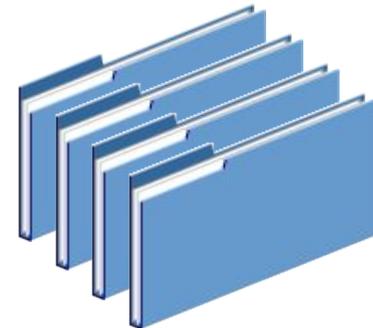
```
[vx0044]$ scp ~/.ssh/authorized_keys vx0045:/home/oracle/.ssh/
```



# Required Directories for the Oracle Database Software

You must identify five directories for the Oracle database software:

- Oracle base directory
- Oracle inventory directory
- Oracle Clusterware home directory
- Oracle home directory for the database
- Oracle home directory for ASM





# Linux Operating System Parameters

Parameter	Value	File
semmsl	250	/proc/sys/kernel/sem
semmns	32000	/proc/sys/kernel/sem
semopm	100	/proc/sys/kernel/sem
semmni	128	/proc/sys/kernel/sem
shmall	2097152	/proc/sys/kernel/shmall
shmmax	½ physical memory	/proc/sys/kernel/shmmax
shmmni	4096	/proc/sys/kernel/shmmni
file-max	65536	/proc/sys/fs/file-max
rmem_max	4194304	/proc/sys/net/core/rmem_max
rmem_default	4194304	/proc/sys/net/core/rmem_default
wmem_max	262144	/proc/sys/net/core/wmem_max
wmem_default	262144	/proc/sys/net/core/wmem_default



# Cluster Setup Tasks

- 1. View the Certifications by Product section at <http://metalink.oracle.com/>.**
- 2. Verify your high-speed interconnects.**
- 3. Determine the shared storage (disk) option for your system:**
  - OCFS or other shared file system solution**
  - Raw devices**
  - ASM**

***ASM cannot be used for the OCR and Voting Disk files!***
- 4. Install the necessary operating system patches.**

# Verifying Cluster Setup with cluvfy

- Install the `cvuqdisk` rpm required for `cluvfy`:

```
# su root
# cd /stage/db/rpm
# export CVUQDISK_GRP=dba
# rpm -iv cvuqdisk-1.0.1-1.rpm
```

- Run the `cluvfy` utility as `oracle` as shown below:

```
# cd /stage/db
./runcluvfy.sh stage -post hwos -n all -verbose
```

# Installing Oracle Clusterware

## Select a Product to Install

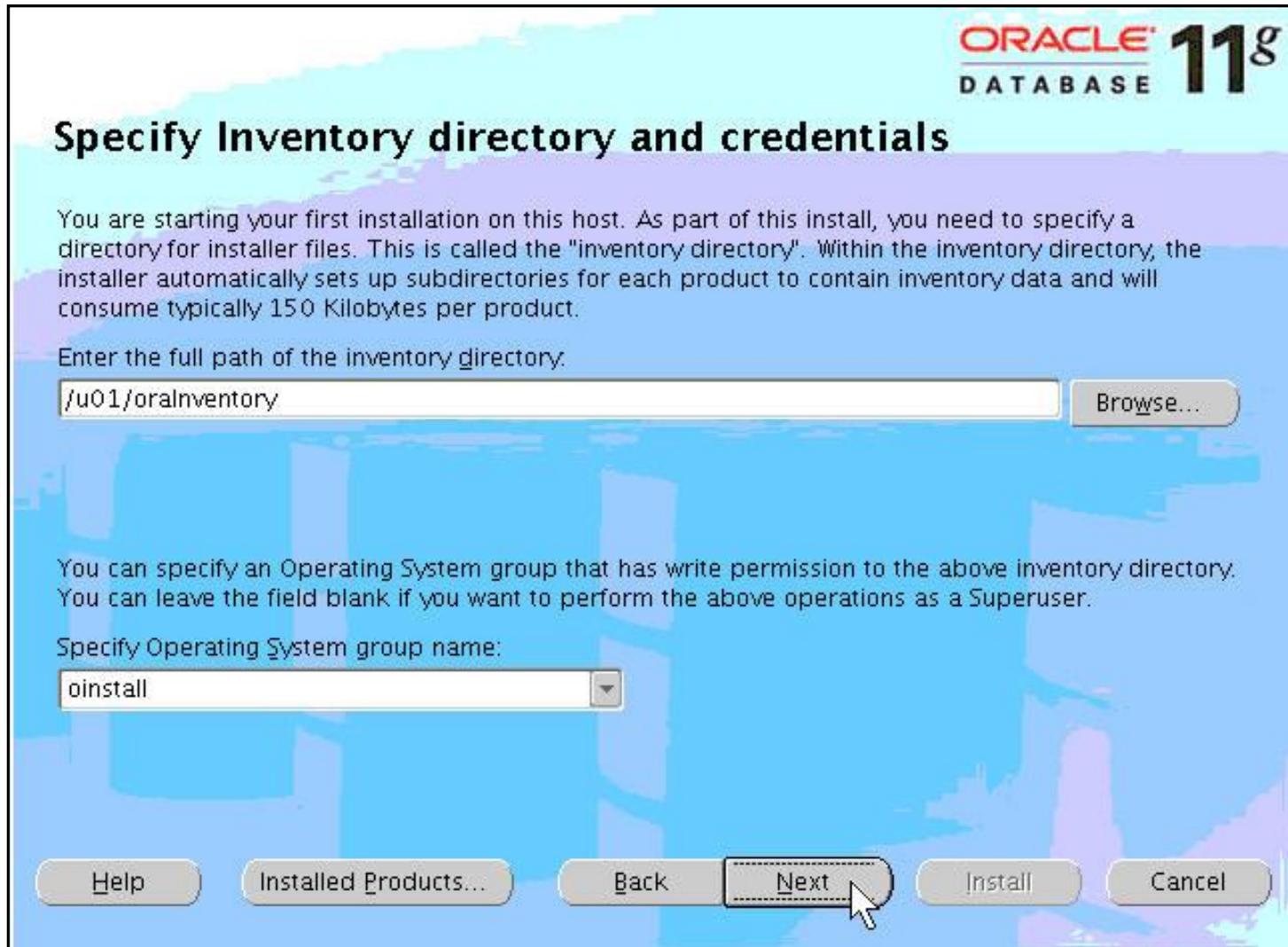


- Oracle Database 11g**  
Installs an optional preconfigured starter database, product options, management tools, networking services, utilities, and basic client software for an Oracle Database server. This option also supports Automatic Storage Management database configuration.
- Oracle Client**  
Installs enterprise management tools, networking services, utilities, development tools and precompilers, and basic client software.
- Oracle Clusterware**  
Installs the Oracle Clusterware components that provide the required infrastructure for Oracle Real Application Clusters. Oracle Clusterware also enables the management of Oracle Database and other applications within the cluster.

```
$ export ORACLE_BASE=/u01/app/oracle
$ /stage/db/runInstaller
```

Help Back Next Install Cancel

# Specifying the Inventory Directory



**ORACLE 11<sup>g</sup>**  
DATABASE

## Specify Inventory directory and credentials

You are starting your first installation on this host. As part of this install, you need to specify a directory for installer files. This is called the "inventory directory". Within the inventory directory, the installer automatically sets up subdirectories for each product to contain inventory data and will consume typically 150 Kilobytes per product.

Enter the full path of the inventory directory:

You can specify an Operating System group that has write permission to the above inventory directory. You can leave the field blank if you want to perform the above operations as a Superuser.

Specify Operating System group name:

# Specify Home Details

**ORACLE** 11<sup>g</sup>  
DATABASE

## Specify Home Details

**Destination**  
Enter or select a name for the installation and the full path where you want to install the product.

Name:

Path:

# Product-Specific Prerequisite Checks

ORACLE<sup>®</sup> 11g  
DATABASE

## Product-Specific Prerequisite Checks

The Installer verifies that your environment meets all of the minimum requirements for installing and configuring the products that you have chosen to install. You must manually verify and confirm the items that are flagged with warnings and items that require manual checks. For details about performing these checks, click the item and review the details in the box at the bottom of the window.

Check	Type	Status
Checking local Cluster Synchronization Services (CSS) status ...	Automatic	<input checked="" type="checkbox"/> Succeeded
Checking whether Oracle 9.2 RAC is available on all selected node	Automatic	<input checked="" type="checkbox"/> Succeeded
Checking Oracle 9i OCR partition size ...	Automatic	<input checked="" type="checkbox"/> Succeeded

Retry Stop

0 requirements to be verified.

-----

Help

Installed Products...

Back

Next

Install

Cancel

ORACLE<sup>®</sup>

# Cluster Configuration

**ORACLE 11g DATABASE**

## Specify Cluster Configuration

Enter a name for the cluster and select the nodes to be managed by the Oracle Clusterware. For each node, specify the name for the public IP address, the name for the private interconnect, and the name for the virtual IP address on the node that you are adding. Ensure that there are no previous Cluster Ready Services or Oracle Clusterware instances on the node that you are adding.

You can use a cluster configuration file to configure your cluster by clicking Use Cluster Configuration File instead of completing the Cluster Nodes box. The Use Cluster Configuration File option is helpful if you have many nodes.

Cluster Name: vx\_cluster02

Public Node Name: vx0313.us.oracle.com

Private Node Name: vx0313-priv.us.oracle.com

Virtual Host Name: vx0313-vip.us.oracle.com

Use Cluster Configuration File...

Help Installed Products... Back

**ORACLE 11g DATABASE**

## Specify Cluster Configuration

Enter a name for the cluster and select the nodes to be managed by the Oracle Clusterware. For each node, specify the name for the public IP address, the name for the private interconnect, and the name for the virtual IP address on the node.

You can use a cluster configuration file to configure your cluster by clicking Use Cluster Configuration File instead of completing the Cluster Nodes box. The Use Cluster Configuration File option is helpful if you have many nodes.

Cluster Name: vx\_cluster02

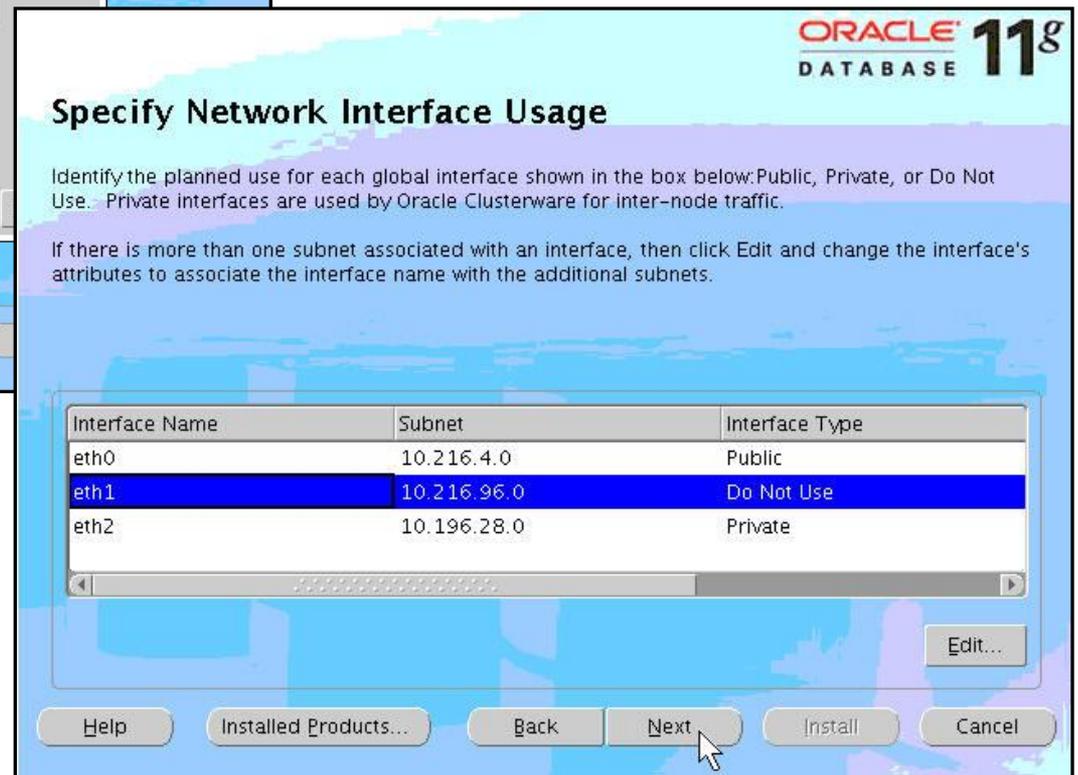
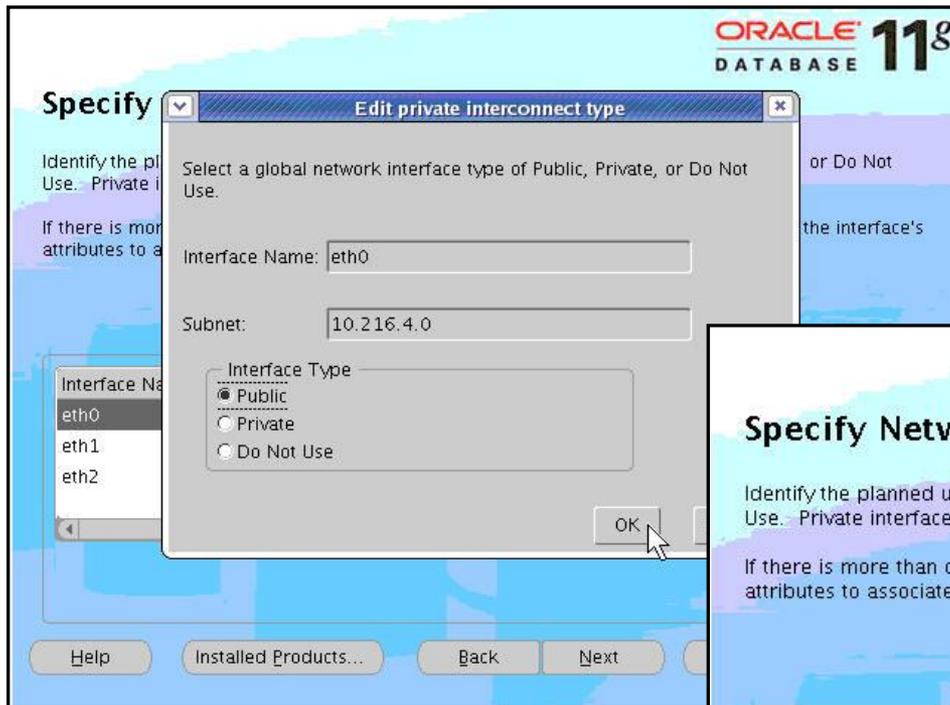
Cluster Nodes

Public Node Name	Private Node Name	Virtual Host Name
vx0306.us.oracle.com	vx0306-priv.us.oracle.com	vx0306-vip.us.oracle.com
vx0313.us.oracle.com	vx0313-priv.us.oracle.com	vx0313-vip.us.oracle.com

Use Cluster Configuration File... Add... Edit... Remove...

Help Installed Products... Back Next Install Cancel

# Private Interconnect Enforcement



# Oracle Cluster Registry File

ORACLE 11g  
DATABASE

## Specify Oracle Cluster Registry (OCR) Location

The Oracle Cluster Registry (OCR) stores cluster and database configuration information. Specify a cluster file system file or a shared raw device containing at least 256 MB of free space that is accessible from all of the nodes in the cluster.

### OCR Configuration

Normal Redundancy

Choose this option to enable the Oracle Clusterware to manage OCR mirroring. You will need an additional 256 MB of disk space for the mirrored copy.

External Redundancy

Choose this option if you are using your disk management system to provide OCR redundancy.

Specify OCR Location:

Specify OCR Mirror Location:

Help

Installed Products...

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Next

Install

Cancel

# Voting Disk File

ORACLE<sup>®</sup> 11<sup>g</sup>  
DATABASE

## Specify Voting Disk Location

The Oracle Clusterware voting disk contains cluster membership information and arbitrates cluster ownership among the nodes of your cluster in the event of network failures. Specify a cluster file system file or a shared raw device that is accessible by the same name from all of the nodes in the cluster. The Installer requires at least 256 MB of free space for the voting disk that it creates.

### Voting Disk Configuration

Normal Redundancy

Choose this option to enable the Oracle Clusterware to manage two additional copies of your voting disk. Each additional copy requires 256 MB of disk space.

External Redundancy

Choose this option if you are using your disk management system to provide voting disk redundancy.

Voting Disk Location:

Additional Voting Disk 1 Location:

Additional Voting Disk 2 Location:

Help

Installed Products...

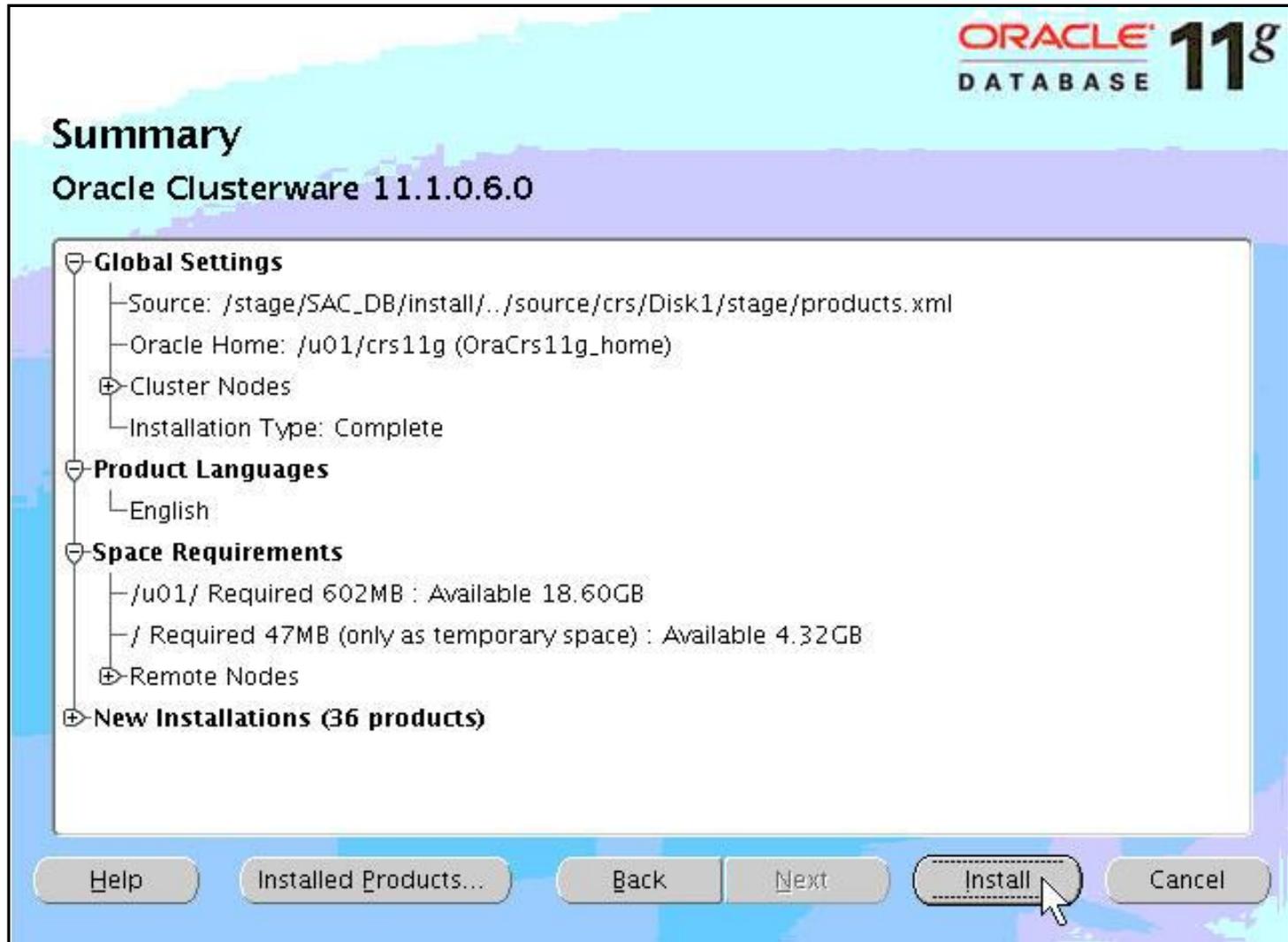
Back

Next

Install

Cancel

# Summary and Install



The image shows the Oracle Database 11g Summary and Install window. The title bar reads "ORACLE DATABASE 11g". The main heading is "Summary" for "Oracle Clusterware 11.1.0.6.0". The summary is organized into a tree view with the following sections:

- Global Settings**
  - Source: /stage/SAC\_DB/install/./source/crs/Disk1/stage/products.xml
  - Oracle Home: /u01/crs11g (OraCrs11g\_home)
- Cluster Nodes**
  - Installation Type: Complete
- Product Languages**
  - English
- Space Requirements**
  - /u01/ Required 602MB : Available 18.60GB
  - / Required 47MB (only as temporary space) : Available 4.32GB
- Remote Nodes**
- New Installations (36 products)**

At the bottom of the window, there are several buttons: "Help", "Installed Products...", "Back", "Next", "Install", and "Cancel". A mouse cursor is pointing at the "Install" button.

# Run Configuration Scripts on All Nodes

The following configuration scripts need to be executed as the "root" user in each node.

Scripts to be executed:

Number	Script Location	Nodes
1	/u01/app/orainventory/orainstRoot.sh	vx0306,vx0313
2	/u01/crs11g/root.sh	vx0306,vx0313

To execute the configuration scripts:

1. Open a terminal window
2. Log in as "root"
3. Run the scripts in each cluster node
4. Return to this window and click "OK" to continue

Note: Do not run the scripts simultaneously on the listed nodes.

Help

```

bash-3.00$ sudo /u01/app/orainventory/orainstRoot.sh
Changing permissions of /u01/app/orainventory to 770.
Changing groupname of /u01/app/orainventory to oinstall.
The execution of the script is complete
bash-3.00$ ssh vx0313
Last login: Mon Nov  5 11:16:26 2007 from vx0306.us.oracle.com
[oracle@vx0313 ~]$ sudo /u01/app/orainventory/orainstRoot.sh
Changing permissions of /u01/app/orainventory to 770.
Changing groupname of /u01/app/orainventory to oinstall.
The execution of the script is complete
[oracle@vx0313 ~]$ █

bash-3.00$ sudo /u01/crs11g/root.sh
Checking to see if Oracle CRS stack is already configured
/etc/oracle does not exist. Creating it now.

Setting the permissions on OCR backup directory
Setting up Network socket directories
Oracle Cluster Registry configuration upgraded successfully
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: vx0306 vx0306-priv vx0306
node 2: vx0313 vx0313-priv vx0313
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
Now formatting voting device: /dev/sdb5
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.
Cluster Synchronization Services is active on these nodes.
    vx0306
Cluster Synchronization Services is inactive on these nodes.
    vx0313
Local node checking complete. Run root.sh on remaining nodes to start CRS daemons.
bash-3.00$
    
```

# End of Installation



# Verifying the Oracle Clusterware Installation

- Check for Oracle Clusterware processes with the `ps` command.
- Check the Oracle Clusterware startup entries in the `/etc/inittab` file.

```
# cat /etc/inittab
# Run xdm in runlevel 5
x:5:respawn:/etc/X11/prefdm -nodaemon
h1:35:respawn:/etc/init.d/init.evmd run >/dev/null
2>&1 </dev/null
h2:35:respawn:/etc/init.d/init.cssd fatal >/dev/null
2>&1 </dev/null
h3:35:respawn:/etc/init.d/init.crsd run >/dev/null
2>&1 </dev/null
```



# Summary

**In this lesson, you should have learned how to:**

- **Describe the installation of Oracle RAC 11g**
- **Perform RAC preinstallation tasks**
- **Perform cluster setup tasks**
- **Install Oracle Clusterware**

# Practice 1: Overview

**This practice covers the following topics:**

- **Performing initial cluster configuration**
- **Installing Oracle Clusterware**