Installing Oracle RAC 11gR2 on the Oracle Solaris 11 OS by Using Oracle VM Server for SPARC

This paper describes how to install Oracle Real Application Clusters (RAC) on an Oracle Solaris 11 server by using the Oracle VM Server for SPARC software.
Introduction

*Oracle Real Application Clusters (RAC)* is a cluster database with a shared cache architecture that overcomes the limitations of traditional “shared-nothing” and “shared-disk” approaches to provide highly scalable and available database solutions for all your business applications.

The shared-nothing approach assumes that each node in a cluster has sole ownership of the data on that node. The shared-disk approach, also known as the “shared-everything” approach, assumes that one array of disks holds all of the data in that database. Each server or node in the cluster acts on that single collection of data in real time. The “shared-cache” approach is based on the shared-disk architecture. The overhead of sharing data by means of the disk, which is the slowest component in the system, introduces a significant performance penalty. The shared-cache approach uses a high-speed cache to share information between nodes, which is much faster than sharing by means of the disk.

Oracle VM Server for SPARC (previously called Sun Logical Domains) is Oracle's server virtualization and partitioning technology for Oracle's SPARC T-Series servers. Oracle VM Server for SPARC leverages the SPARC hypervisor to subdivide the resources (CPU, memory, I/O, and storage) of each supported platform by creating partitions called logical domains (or virtual machines). These logical domains can take advantage of the massive thread scale that is offered by SPARC T-Series servers and the Oracle Solaris 11 operating system.

Oracle RAC is always deployed in to a virtualized environment in the following ways:

- **Development environment.** Deploy multiple Oracle RAC nodes on the same physical server to reduce hardware costs.
- **Production environment.** Place each Oracle RAC node on a separate physical server for increased availability

This paper describes how to deploy four Oracle RAC 11g Release 2 (11gR2) nodes in a guest domain on separate SPARC T-Series servers to simulate a production environment. Both the control domains and the guest domains are installed with the Oracle Solaris 11 OS.

This paper covers the following topics:

- Configuring a logical domain on a SPARC T-Series System that runs the Oracle Solaris 11 OS
- Configuring the Oracle RAC 11g R2 software in a logical domain
Overview of the Test Environment

The test environment described in this paper uses four of Oracle's Sun SPARC Enterprise T5220 servers with two Sun StorageTek 6140 storage arrays. One guest domain on each T5220 system is used as an Oracle RAC node.

Figure 1 shows the network architecture of the test environment. All four of the network interfaces are imported into each logical domain to implement network redundancy. The first two interfaces are configured to be an IPMP group for public IP interfaces, and HAIP is automatically used for private IP interfaces in Oracle RAC 11gR2.

Two Oracle Sun StorageTek 6140 storage arrays are used in the test environment for redundancy. ASM disks, voting disks, and OCR disks are distributed between the two storage arrays. Each RAC node is connected to both array controllers (A and B) by using multipath I/O. This configuration ensures fault tolerance and enhances performance. See Figure 2.
How to Configure the Oracle VM Server for SPARC Environment For Oracle RAC

1. Install the Oracle VM Server for SPARC software.

The Oracle VM Server for SPARC package is installed as part of the Oracle Solaris 11 OS by default. The following command shows information about the ldomsmanager package:

```
# pkg info ldomsmanager
```

- **Name**: system/ldoms/ldomsmanager
- **Summary**: Logical Domains Manager
- **Description**: LDoms Manager - Virtualization for SPARC T-Series
- **Category**: System/Virtualization
- **State**: Installed
- **Publisher**: solaris
If this package is not installed, you can install it manually by using the `pkg install ldomsmanager` command.

2. Enable the Oracle VM Server for SPARC services.
   - Enable the Logical Domains Manager daemon (`ldmd`)
     
     ```
     # svcadm enable ldmd
     # svcsc ldmd
     online                Jan_11 svc:/ldoms/ldmd.default
     ```
   - Enable the Virtual Network Terminal Server daemon (`vntsd`)
     
     **Note:** Enable `vntsd` after network services have been added to the control domain.

3. Configure virtual device services the control domain.

   These virtual device services enable the control domain to act as a service domain and to provide virtual devices for guest domains:
   - Create the virtual console concentrator service (`vcc`).
     
     ```
     # ldm add-vcc port-range=5000-5100 primary-vcc0 primary
     ```
   - Create the virtual disk server (`vds`).
     
     ```
     # ldm add-vds primary-vds0 primary
     ```
   - Create the virtual switch service (`vsw`).
     
     The following command shows the physical links on the machine:
     
     ```
     # dladm show-phys
     ```
The following commands create a virtual switch on each interface. The `linkprop` property is set to `phys-state` for first two switches to implement redundancy for a link-based IPMP public network interface.

```bash
# ldm add-vsw net-dev=net0 linkprop=phys-state primary-vsw0 primary
# ldm add-vsw net-dev=net1 linkprop=phys-state primary-vsw1 primary
# ldm add-vsw net-dev=net2 primary-vsw2 primary
# ldm add-vsw net-dev=net3 primary-vsw3 primary
```

4. Configure the static IP address for the control domain.
First, disable NWAM, which is enabled by default on the Oracle Solaris 11 OS.

```
# svcadm disable svc:/network/physical:nwam
# svcadm enable svc:/network/physical:default
# ipadm create-ip net0
# ipadm create-addr -T static -a local=199.199.121.61/24 net0/v4static
```

5. Enable the Virtual Network Terminal server daemon (`vntsd`).

```
# svcadm enable vntsd
```

```
# svcs vntsd
STATE   STIME   FMRI
online   0:17:52 svc:/ldoms/vntsd:default
```

6. Configure the control domain (primary) with 16 CPUs and 16 Gbytes of memory.

Initially, all system resources are allocated to the control domain, so you must release some of these resources to permit the creation of other logical domains.

a) Initiate a delayed reconfiguration on the control domain.

```
# ldm start-reconf primary
```

b) Assign virtual CPUs to the control domain.

```
# ldm set-vcpu 16 primary
```

c) Assign memory to the control domain.

```
# ldm set-memory 16G primary
```

d) Save the configuration to the service processor (SP), and reboot.

Use `initial` as the configuration name.

```
# ldm add-spconfig initial
```

```
# ldm list-spconfig
factory-default
initial [next poweron]
```

```
# init 6
```
7. Configure the guest domain.

The test environment includes a guest domain on the server to act as the RAC node.

a) Add guest domain ldom01 with 32 CPUs with 40 Gbytes of memory.

```
# ldm add-domain ldom01
# ldm set-vcpu 32 ldom01
# ldm set-memory 40G ldom01
```

b) Configure the network on the guest domain.

```
# ldm add-vnet linkprop=phys-state vnet0 primary-vsw0 ldom01
# ldm add-vnet linkprop=phys-state vnet1 primary-vsw1 ldom01
# ldm add-vnet vnet2 primary-vsw2 ldom01
# ldm add-vnet vnet3 primary-vsw3 ldom01
```

c) Add disks to guest domain.

Use the local disk for the system disk.

```
# ldm add-vdsdev /dev/rdsk/c2t2d0s2 ldom01@primary-vds0
# ldm add-vdisk vdisk0 ldom01@primary-vds0 ldom01
```

8. Use an ISO disk image to install the guest domain.

The ISO disk image is added as a virtual device to the guest domain, and is set as the boot device.

```
# ldm add-vdsdev /share/sol-11-1111-text-sparc.iso cd-iso@primary-vds0
# ldm add-vdisk s11-cd cd-iso@primary-vds0 ldom01
# ldm set-var boot-device= s11-cd ldom01
# ldm set-var auto-boot\?=true ldom01
```

9. Bind all the resources to the guest domain, and boot it.

```
# ldm bind ldom01
# ldm start ldom01
```

10. Connect to the console to install the Oracle Solaris 11 OS in the guest domain.
# telnet localhost 5000

For information about the Oracle Solaris 11 installation from an ISO disk image, see “How to Export an ISO Image From the primary Domain to Install a Guest Domain” in Oracle VM Server for SPARC 2.2 Administration Guide.

Configure a local repository for more packages and install the node in large-server mode.

11. Configure a local repository on the remote machine.
    a) Configure a local repository for more packages and install the node in large-server mode.

        # lofiadm -a /oracle-sw/solaris11/sol-11-1111-repo-full.iso
        # mount -F hsfs /dev/lofi/1 /ips
        # share /ips

    b) Add the local repository to the remote machine from the RAC nodes, and install the packages from the local repository.

        # pkg set-publisher -g file:///net/node01-ctl/ips/repo/solaris

    c) After the installation, remove the virtual CD.

        # ldm rm-vdisk s11-cd ldom01
        # ldm rm-vdsdev cd-iso@primary-vds0

---

**How to Configure Networking for Oracle RAC in a Guest Domain**

At least two network adapters or network interface cards (NICs) are required per Oracle RAC node:

- One for the public network interface
- One for the private network interface (the inter-connect)

In the test environment, all four NICs are configured for network redundancy, and have the following addresses configured:
• **Public IP address**—Is a public host name address for each node. Two virtual NICs (net0, net1) are bound in an IPMP group to ensure network redundancy.

• **Private IP address**—Is a private IP address for each node to serve as the private interconnect address. From Oracle Database 11g Release 2 (11.2.0.2), the Oracle Clusterware creates one to four highly available IP addresses (HAIP) for the private network. Oracle RAC and Oracle ASM instances use these interface addresses to ensure highly available, load-balanced interface communications between nodes. The two virtual NICs (net2, net3) have been chosen for HAIP.

• **Virtual IP address**—Is a public internet protocol (IP) address for each node, which is used as the virtual IP address (VIP) for client connections. If a node fails, Oracle Clusterware fails over the VIP address to an available node. Ensure that the VIP is not in use at the time of the installation because it is an IP address that is managed by Oracle Clusterware.

• **Single client access name (SCAN)**—Is a domain name that resolves to all the addresses that are allocated for the SCAN. Allocate three addresses to the SCAN.

**Note:** The public IP addresses, VIP addresses, and SCAN addresses are on the same subnet.

<table>
<thead>
<tr>
<th>NODE NAME</th>
<th>DOMAIN</th>
<th>HOST NAME</th>
<th>INTERFACE</th>
<th>IP ADDRESS</th>
<th>USED IN RAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>node1</td>
<td>Control</td>
<td>node1-ctl</td>
<td>net0</td>
<td>199.199.121.61</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guest</td>
<td>node1</td>
<td>Ipmp0 (net0, net1)</td>
<td>199.199.121.1</td>
<td>Public IP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>net2</td>
<td></td>
<td>HAIP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>net3</td>
<td></td>
<td>HAIP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>node1-vip</td>
<td></td>
<td>199.199.121.221</td>
<td>Virtual IP</td>
</tr>
<tr>
<td>node2</td>
<td>Control</td>
<td>node2-ctl</td>
<td>net0</td>
<td>199.199.121.62</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guest</td>
<td>node2</td>
<td>Ipmp0 (net0, net1)</td>
<td>199.199.121.2</td>
<td>Public IP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>net2</td>
<td></td>
<td>HAIP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>net3</td>
<td></td>
<td>HAIP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>node2-vip</td>
<td></td>
<td>199.199.121.222</td>
<td>Virtual IP</td>
</tr>
<tr>
<td>node3</td>
<td>Control</td>
<td>node3-ctl</td>
<td>net0</td>
<td>199.199.121.63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guest</td>
<td>node3</td>
<td>Ipmp0 (net0, net1)</td>
<td>199.199.121.3</td>
<td>Public IP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>net2</td>
<td></td>
<td>HAIP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>net3</td>
<td></td>
<td>HAIP</td>
</tr>
</tbody>
</table>
Three Static IP addresses are configured on the domain name server (DNS) prior to installation so that the three IP addresses are associated with the name provided as the SCAN. Also, all three addresses are returned in random order by the DNS to the requestor.

```
11gr2s11-scan .sample.com 199.199.121.131
199.199.121.132
199.199.121.133
```
a) Update the `/etc/hosts` file.

Use the information in Table 1 to update the `/etc/hosts` file for node1, and the other Oracle RAC nodes.

```
# vi /etc/hosts
::1 node1 localhost
127.0.0.1 node1 localhost

# public ip
199.199.121.1 node1 loghost
199.199.121.2 node2
199.199.121.3 node3
199.199.121.4 node4

#--------- VIP ---------
```
b) Configure the public IPs and private IPs for the Oracle RAC nodes.

a) Check the physical links on the RAC node.

```
# dladm show-phys

<table>
<thead>
<tr>
<th>LINK</th>
<th>MEDIA</th>
<th>STATE</th>
<th>SPEED</th>
<th>DUPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>net0</td>
<td>Ethernet</td>
<td>up</td>
<td>0</td>
<td>unknown</td>
</tr>
<tr>
<td>vnet0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>net1</td>
<td>Ethernet</td>
<td>up</td>
<td>0</td>
<td>unknown</td>
</tr>
<tr>
<td>vnet1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>net2</td>
<td>Ethernet</td>
<td>up</td>
<td>0</td>
<td>unknown</td>
</tr>
<tr>
<td>vnet2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>net3</td>
<td>Ethernet</td>
<td>up</td>
<td>0</td>
<td>unknown</td>
</tr>
<tr>
<td>vnet3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

b) Create IPMP for public IP on the first two NICs.

First, disable NWAM on the logical domain.

```
# svcadm disable svc:/network/physical:nwam
# svcadm enable svc:/network/physical:default

# ipadm create-ip net0
# ipadm create-ip net1

# ipadm create-ipmp -i net0,net1 ipmp0
# ipadm create-addr -T static -a local=199.199.121.1/24 ipmp0/v4static
```

c) Check the IPMP setting.

```
# ipadm show-addr ipmp0/v4static

<table>
<thead>
<tr>
<th>ADDROBJ</th>
<th>TYPE</th>
<th>STATE</th>
<th>ADDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>ipmp0/v4static</td>
<td>static</td>
<td>ok</td>
<td>199.199.121.21/24</td>
</tr>
</tbody>
</table>
```
After this configuration, configure the three remaining nodes in the same way. The following sets net2 during the OS installation. To ease network access, add both net0 and net1 to IPMP. HAIP is set up during the RAC installation.

d) Configure Scan IP by DNS.

a) Configure the DNS server on another machine called node10.

```
# ifconfig -a

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 10.129.192.84 netmask ffffff00 broadcast 10.129.192.255

    ether 0:14:4f:2:74:84

e1000g1: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500 index 3

    inet 199.199.121.10 netmask ffffff00 broadcast 199.199.121.255

    ether 0:14:4f:2:74:85
```

b) Enable the dns/server service on node10 (10.129.192.84).

```
# svcs -a |grep dns
```
c) Configure DNS for the new sample.com domain for the Oracle RAC information.
The /etc/named.conf file is the default configuration file for the DNS server.

```
# vi /etc/named.conf
...
zone "sample.com" in {
    type master ;
    file "domain.sample.com";
};

zone "in-addr.arpa" in {
    type master ;
    file "rdomain.sample.com";
};
...
```

d) Configure the three static Oracle RAC scan IP addresses in the configuration files called /var/named/domain.sample.com and /var/named/rdomain.sample.com.

```
# vi /var/named/domain.sample.com
; Forward map for sample.com
$TTL 1h
@ in soa node10.sample.com.
root.node10.sample.com. (20110925
43200
...)
vi /var/named/rdomain.sample.com

; Reverse map for in-addr.arpa.
$TTL 1h
@ in soa node10.sample.com.
root.node10.sample.com. (20110925 43200)
In the Oracle Solaris 11 OS, the `/etc/resolv.conf` is automatically populated by the `svc:/network/dns/client` service. So do not make manual edits to this file or they will be lost when the `svc:/network/dns/client` service is started or restarted.

a) Set properties for the DNS client service.

```
# svccfg -s dns/client
```

```
svc:/network/dns/client> setprop config/nameserver = (10.129.192.84)
svc:/network/dns/client> setprop config/domain = "sample.com"
```

```
svc:/network/dns/client> listprop config
config application
config/value_authorization astring solaris.smf.value.name-service.dns.client
```
config/domain astring sample.com
config/nameserver net_address 10.129.192.84

svc:/network/dns/client> exit

# svcs -a |grep dns
disabled 0:22:24 svc:/network/dns/multicast:default
disabled 0:22:31 svc:/network/dns/server:default
online 0:22:50 svc:/network/dns/client:default

# svcadm refresh dns/client
# svcadm restart dns/client

Then, the service generates a file, /etc/resolv.conf, which looks similar to the following file:

# Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
#
# _AUTOGENERATED_FROM_SMF_V1_
#
# WARNING: THIS FILE GENERATED FROM SMF DATA.
# DO NOT EDIT THIS FILE. EDITS WILL BE LOST.
# See resolv.conf(4) for details.

domain sample.com
nameserver 10.129.192.84

b) Specify the dns keyword in the name service switch.

This enables you to use DNS to analyze the host name if local files are not configured.

# svccfg -s name-service/switch
svc:/system/name-service/switch> setprop config/host = astring: "files dns"

svc:/system/name-service/switch> listprop config

<table>
<thead>
<tr>
<th>configuration</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>config/application</td>
<td>application</td>
</tr>
<tr>
<td>config/value_authorization</td>
<td>astring</td>
</tr>
<tr>
<td>config/default</td>
<td>astring</td>
</tr>
<tr>
<td>config/printer</td>
<td>astring</td>
</tr>
<tr>
<td>config/host</td>
<td>astring</td>
</tr>
</tbody>
</table>

svc:/system/name-service/switch> exit

# svcadm refresh name-service/switch
# svcadm restart name-service/switch

c) Check the Scan IP address.

# nslookup 11gr2s11-scan

Server: 10.129.192.84
Address: 10.129.192.84#53

Name: 11gr2s11-scan.sample.com
Address: 199.199.121.131
Name: 11gr2s11-scan.sample.com
Address: 199.199.121.132
Name: 11gr2s11-scan.sample.com
Address: 199.199.121.133

How to Configure Storage for Oracle RAC in a Guest Domain
Use the Oracle Automatic Storage Management (ASM) disk group to install Oracle Clusterware files. The following table shows how the `votedg` and `asmdg` disk groups are configured between the 6140-1a and 6140-1b storage arrays.

<table>
<thead>
<tr>
<th>STORAGE</th>
<th>VOTEDG (INCLUDE OCR AND VOTING FILES)</th>
<th>ASMDG (DATABASE FILES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6140-1a</td>
<td>voting1a (2 Gbytes)</td>
<td>asm1a (400 Gbytes)</td>
</tr>
<tr>
<td></td>
<td>voting2a (2 Gbytes)</td>
<td></td>
</tr>
<tr>
<td>6140-1b</td>
<td>voting1b (2 Gbytes)</td>
<td>asm1b (400 Gbytes)</td>
</tr>
</tbody>
</table>

Table 2--Storage and Disk Group

1. Create two disk groups for the test environment:
   
   `votedg` is for the OCR and voting disk files and `asmdg` is for the database files.
   
   You can either use the same disk group for them, or you can choose to place files in different disk groups. The `votedg` and the `asmdg` disk groups are spread between two storage arrays for redundancy. See Table 2. Solaris I/O multipathing, formally known as Sun MPxIO, is used for controller redundancy.

2. Configure I/O multipathing in the control domain for the storage arrays that are linked by Fibre Channel.
   
   Determine whether I/O multipathing is configured on the system.
   
   ```
   # stmsboot -L
   ```
   
   If not, set the storage arrays that are linked to by Fibre Channel to use multipathing.
   
   ```
   # stmsboot -e -D fp
   # init 6
   ```

3. Import all the disks into the guest domain.
   
   Consider writing a script to perform the following steps on all of the nodes:
   
   ```
   # ldm add-vdsdev /dev/rdsk/c0t600A0B800011FC3E00000E074BBE32EAd0s2 disk1@primary-vds0
   # ldm add-vdisk vdisk1 disk1@primary-vds0 ldom01
   ```
# ldm add-vdsdev /dev/rdsk/c0t600A0B800011FC3E00000E194B8E3514d0s2
disk5@primary-vds0
# ldm add-vdisk vdisk5 disk5@primary-vds0 ldom01
# ldm list-bindings ldom01

4. Add notes to the disks in the guest domain to make them recognizable.
   
   # format

   AVAILABLE DISK SELECTIONS:

   0. c2d0 <SUN146G cyl 14087 alt 2 hd 24 sec 848>
      /virtual-devices@100/channel-devices@200/disk@0
   1. c2d1 <SUN-CSM200_R-0660 cyl 1022 alt 2 hd 64 sec 64> asmla
      /virtual-devices@100/channel-devices@200/disk@1
   2. c2d2 <SUN-CSM200_R-0660 cyl 1022 alt 2 hd 64 sec 64> asmlb
      /virtual-devices@100/channel-devices@200/disk@2
   3. c2d3 <SUN-CSM200_R-0660 cyl 1022 alt 2 hd 64 sec 64> vot1a
      /virtual-devices@100/channel-devices@200/disk@3
   4. c2d4 <SUN-CSM200_R-0660 cyl 1022 alt 2 hd 64 sec 64> vot1b
      /virtual-devices@100/channel-devices@200/disk@4
   5. c2d5 <SUN-CSM200_R-0660 cyl 1022 alt 2 hd 64 sec 64> vot2a
      /virtual-devices@100/channel-devices@200/disk@5

5. Set the owner, group, and permissions on the character raw device file for each disk slice that you want to add to the disk group.

Run these commands on every Oracle RAC node:

   # chown oracle:oinstall /dev/rdsk/c2dns*
   # chmod 660 /dev/rdsk/c2dns*

---

**How to Configure the System Prior to Installing Oracle RAC**

1. Add users and groups to all the Oracle RAC nodes.
Create the Oracle Inventory group (oinstall) and dba as the OSDBA and OSASM for the Oracle ASM groups. Create the Oracle Grid infrastructure software owner (grid) and the Oracle Database owner (oracle).

```
# groupadd -g 1000 oinstall
# groupadd -g 1001 dba
# useradd -u 1100 -g oinstall -G dba -d /export/grid -m grid
# useradd -u 1101 -g oinstall -G dba -d /export/oracle -m oracle
```

2. Set the passwords of the grid and oracle user, who own the Oracle Grid Infrastructure.

```
# passwd grid
# passwd oracle
```

3. Manually create the Oracle Grid Infrastructure Grid home and Oracle base home directories.

```
# mkdir -p /u01/app/oracle/product/11.2.0.3/base
# mkdir -p /u01/app/oracle/product/11.2.0.3/grid
# mkdir -p /u01/app/oracle/product/11.2.0.3/db_1
# chown -R grid:oinstall /u01
# chmod -R 775 /u01/
# chown oracle:oinstall /u01/app/oracle/product/11.2.0.3/db_1
```

4. Update the profile for the grid user.

```
# vi /export/grid/.profile
export ORACLE_BASE=/u01/app/oracle/product/11.2.0.3/base
export ORACLE_HOME=/u01/app/oracle/product/11.2.0.3/grid
export ORACLE_SID=+ASM1
export
PATH=$PATH:/usr/sbin:/usr/X11/bin:/usr/dt/bin:/usr/openwin/bin:/usr/sfw/bin:/usr/sfw/sbin:/usr/ccs/bin:/usr/local/bin:/usr/local/sbin:$ORACLE_HOME /bin:.
```
export LD_LIBRARY_PATH=$ORACLE_HOME/lib:/usr/dt/lib:
$ORACLE_HOME/oracm/lib
export CLASSPATH=$(CLASSPATH):$ORACLE_HOME/jlib:
$ORACLE_HOME/rdbms/jlib:$ORACLE_HOME/network/jlib
export TEMP=/tmp
export TMPDIR=/tmp
ulimit -n 65536

5. Update the profile for the oracle user.

    # vi /export/oracle/.profile
    export ORACLE_BASE=/u01/app/oracle/product/11.2.0.3/base1
    export ORACLE_HOME=/u01/app/oracle/product/11.2.0.3/db_1
    export ORACLE_SID=db1
    export
    PATH=/usr/sbin:/bin:/usr/X11/bin:/usr/dt/bin:/usr/openwin/bin:/usr/ccs/bin:/usr/local/bin:$ORACLE_HOME/bin:/usr/local/bin:/home/oracle:.
    export LD_LIBRARY_PATH=$ORACLE_HOME/lib:$ORACLE_HOME/oracm/lib
    export CLASSPATH=$ORACLE_HOME/jdbc:$ORACLE_HOME/jlib:
    $ORACLE_HOME/rdbms/jlib:$ORACLE_HOME/network/jlib
    export TEMP=/tmp
    export TMPDIR=/tmp
    ulimit -n 65536

6. Update the kernel properties on all the Oracle RAC nodes.

    # projadd -c "oracle" 'user.oracle'
    # projadd -c "grid" 'user.grid'

    Check the current resource control values.

    $ id -p
    uid=1101(oracle) gid=1000(oinstall) projid=100(user.oracle)

    $ prctl $$
7. Change the resource control values, if necessary.

The value for the maximum shared memory depends on the SGA requirements and should be set to a value greater than the SGA size.

```
# projmod -sK "project.max-shm-memory=(privileged,32G,deny)" user.oracle
# projmod -sK "process.max-sem-nsems=(priv,4096,deny)" user.oracle
# projmod -sK "project.max-shm-ids=(priv,1024,deny)" user.oracle
# projmod -sK "project.max-sem-ids=(priv,1024,deny)" user.oracle
```

8. Do the same for the grid user, and we can check by using the following command.

```
# projects -l
```

9. Configure the UDP and TCP kernel properties on all the Oracle RAC nodes.

```
# vi /etc/rc3.d
#!bin/sh
/usr/sbin/ndd -set /dev/tcp tcp_smallest_anon_port 9000
/usr/sbin/ndd -set /dev/tcp tcp_largest_anon_port 65500
/usr/sbin/ndd -set /dev/udp udp_smallest_anon_port 9000
/usr/sbin/ndd -set /dev/udp udp_largest_anon_port 65500
```

10. Create a passwordless SSH configuration.

   a) Enable the ssh service on all the Oracle RAC nodes.

```
# svcs ssh
STATE STIME FMRI
disabled Mar_21 svc:/network/ssh:default
# svcadm enable ssh
```

   b) Run the sshUserSetup.sh script and follow the prompted directions.

   The passwordless SSH configuration is a mandatory installation requirement. It removes the repetitive steps to set up SSH user equivalence while installing a RAC cluster. Oracle 11gR2 RAC now includes automatic SSH setup.
# ./sshUserSetup.sh -hosts " node1 node2 node3 node4" -user oracle -advanced -noPromptPassphrase

# ./sshUserSetup.sh -hosts " node1 node2 node3 node4" -user grid -advanced -noPromptPassphrase

c) Check the cluster configuration before the installation and generation of a fixup script.

Perform the required operating system changes before starting the installation.

# ./runcluvfy.sh stage -pre crsinst -n node1,node2,node3,node4 -fixup -verbose

11. Prepare to install the Grid and the Oracle Database software after the pre-checks have been successfully completed.

Using the text based install media to install the server over a console with Oracle Solaris 11 might be missing the `compatibility/packages/SUNWxwplt` package, which enables you to use remote displays.

# pkg info -r compatibility/packages/SUNWxwplt

# pkg install -r compatibility/packages/SUNWxwplt

12. Add a motif package for running the Oracle RAC installation GUI, if necessary.

The `libXm.so.4` library might be missing otherwise. Proceed to check the status of the package as shown in the previous example.

# pkg info -r motif

# pkg install motif

Now, you can use the interactive Oracle GUI installer to install Oracle RAC.