Installing Oracle9*i* RAC on IBM @server xSeries running SuSE Linux Enterprise Server 7

Version 1.1

February 14, 2002

By:

Tim Spencer Stephen Poon



IBM / Oracle International Competency Center San Mateo, California

I BM

Contents

Introduction	3
Planning the installation	4
Hardware Cabling and Firmware	5
Hardware configuration	5
Firmware	
Operating System Setup	7
Operating System Patches	7
Network	
FAStT Host Adapter Driver	12
Configuring Shared Storage	14
Software installation	
Datafiles for Oracle9 <i>i</i> RAC	
Oracle9 <i>i</i> Installation	24
Preparing for Installation	
Install Oracle Cluster Manager	25
Start Oracle Cluster Manager	
Install Oracle9 <i>i</i> Database	
Post-Installation	
Install Oracle9 <i>i</i> Patch Set 1	
Update Startup Script	
Creating a Cluster Database	
Using Database Configuration Assistant	
Creating a Database Manually	
Update Oracle User Profile	
Configuring High Availability and Load Balancing	
listener configuration	
tnsnames configuration	
Administering Real Application Clusters Instances	
References	-
DISCLAIMER	63
TRADEMARKS	
SPECIAL NOTICE	63

INTRODUCTION

The objective of this document is to provide help to install Oracle9*i* Real Application Clusters (RAC) on IBM eServer x440 with FAStT500 running SuSE Linux Enterprise Server 7 (SLES7) through a description of the different steps necessary to install Oracle9*i* RAC. In this document, we take into account the specifics of the IBM xSeries hardware, and provide you the necessary information to successfully install Oracle9*i* RAC on IBM xSeries.

The information contained in this paper resulted from:

- Oracle and IBM documentation
- Installation runs of Oracle9*i* RAC
- Certification and other work done by the EMEA Oracle/IBM Joint Solutions Center
- Contributions from Oracle and IBM specialists.

Please also refer to Oracle documentations for more information. (http://docs.us.oracle.com).

- Oracle9*i* Installation Guide Release 9.2.0.1 for UNIX Systems
- Oracle9i Administrator's Reference 9.2.0.1 for UNIX Systems
- Oracle9*i* Release Notes Release 2 (9.2.0.1.0) for Linux Intel
- Oracle9i Online Generic Documentation CD-ROM Installation and Usage Notes
- Oracle9*i* Real Application Clusters Installation and Configuration
- Oracle Enterprise Manager Configuration Guide

We used the xSeries x440 and FAStT500 Storage Controller to perform this installation. While illustrations may be specific to these products, the methods described generally apply to other xSeries servers and FAStT Storage Controllers. Where appropriate, we will point out areas that are specific only to the x440.

Once the hardware is configured and the environment ready, the installation of the Oracle product is virtually identical on all Linux platforms. We have based this installation procedure on the document "Step-By-Step Installation of RAC on Linux" from Oracle Metalink and "Installing Oracle9*i* on IBM eServer x360 with FAStT700 running Red Hat AS 2.1" by the EMEA Oracle/IBM Joint Solutions Center. We have illustrated it with the screen shots from our lab.

Your feedback is important for us. We want our technical papers to be as helpful as possible. Please send your comments about this document to the IBM/Oracle International Competency Center (IOICC). The IOICC's email address is:

ibmoracl@us.ibm.com

Special thanks to the following for their assistance and contribution to this paper:

EMEA Oracle/IBM Joint Solutions Center, Montpellier, France

PLANNING THE INSTALLATION

Obtain the CDs for SuSE Linux Enterprise Server 7 (SLES7), SLES7 Patch CD2 and CD3.

Search and download the BIOS/drivers from http://www.pc.ibm.com:

- •IBM eServer xSeries 440 Flash BIOS Update version 1.06
- •IBM eServer xSeries 440 Diagnostic Flash Update version 1.03
- •Servers Fibre Channel Solutions: IBM FAStT Host Adapter BIOS version 1.76
- •Servers and Fibre Channel Solutions IBM FAStT Host Adapter failover device driver version 6.0 for Linux
- •Fibre Channel Solutions IBM FAStT Storage Manager version 8.21 Fibre Channel Controller firmware
- •Fibre Channel Solutions IBM FAStT Storage Manager version 8.21 for Red Hat Linux
- •Fibre Channel Solutions IBM FAStT MSJ Diagnostic and Configuration Utility version 2.0 release 33 for Linux

Search and download the Redbooks/Redpapers from http://www.redbooks.ibm.com:

- Implementing IBM eServer xSeries SANs, REDP0416
- Implementing Oracle9i RAC with Linux on IBM eServer xSeries servers, REDP0410

Obtain Oracle9i R2 Enterprise Edition CDs (Oracle9i can also be downloaded from http://technet.oracle.com).

HARDWARE CABLING AND FIRMWARE

HARDWARE CONFIGURATION

Figure 1 below shows our 2 node RAC cluster configuration, with xSeries 440's, IBM 2109-S16 SAN switch, FAStT500 Storage Controller and EXP500 Expansion Unit. Note that we had one SAN switch in our configuration. For higher availability, a second switch may be added. Refer to the "Implementing IBM eServer xSeries SANs" Redbook for more information on SAN configurations.



Figure 1. Oracle9i RAC configuration

FIRMWARE

The following are the minimum levels of firmware/BIOS for the different hardware parts (check the latest supported level on <u>http://www.pc.ibm.com</u>):

- XSeries 440 BIOS: 1.06
- ServeRaid BIOS: 4.84
- FAStT HBA BIOS: 1.76
- FAStT500 firmware: 8.21

Check the respective readme files from the downloaded files for the upgrade procedure. See the "PLANNING THE INSTALLATION" section for the downloads.

Also check the <u>Implementing IBM eServer xSeries SANs</u> Redbook for more information on the FAStT firmware upgrade.

OPERATING SYSTEM SETUP

This section will guide you through the steps for the post-installation of SLES7 to take in account the specifics of the IBM xSeries cluster.

After you have installed SLES7 on all the cluster nodes, follow these steps for each node in the cluster.

The oracle account (user ID) has been included in SLES7. In later sections, this account will be used to install, configure and run Oracle9i. You should change the password for the oracle user ID to secure your system. For the configuration steps described later, log in to X-Windows using this account. When necessary, we indicate the relevant steps for which you need to switch to the root user ID.

OPERATING SYSTEM PATCHES

Install SLES7 Patch CD2 and CD3.

- 1. Insert Patch CD2 into the CD drive. Open a terminal window. From oracle user's shell prompt, enter xhost + to allow connections to X-Windows.
- 2. Switch to root user, and check that the DISPLAY variable is set to "localhost:0.0". If not, set it, then enter yast2.
- 3. In the YaST2 Control Center window, click **Software** on the left hand panel, then **Patch CD Update** in the main panel as shown in Figure 2.

R -= YeST2 Control Center	ontrol Cen	ter	
Handware Misc Misc Network/Advanced Network/Basic Security8Users Schware Schware	System Update	Chine Update	
Help Search			

Figure 2. YaST2 Patch CD Update

Patches relevant to the installation will be automatically selected. With Patch CD2, you will install a YaST2 patch by itself first. Once this is done, exit and reload YaST2 in order to apply other patches.

4. Patch CD2 installs kernel 2.4.18, which contains Summit kernel patches for the x360 and x440. Be sure to select the Linux kernel source, patch-669, from CD2. Highlight the patch as shown in Figure 3 and

click **Apply** twice. You will see a "G", then the "X" appear in the status field, as shown in the figure. Click **Next** to install patches.

from SuSE patch CD which are		st of available	-		
not yet installed on your system.		Mode	Petch	Size	Description
Node "recommended" means	1	recommended		0.09 MB	Recommended update for package backhand Recommended update for package iserv
security'' is a security patch and is highly recommended to install 'YaST2' patches will be		recommended			Recommended update for package intx
		recommended			Recommended update for package mix
	l 🛛	recommended			Recommended update for Apache
					Recommended update for netatalk
atches will only be downloaded	112	security			Security update for Linux Kernel (k_1386)
and must be installed on a	Шx	security			Security update for Linux Kernel (k_smp)
second run.	1111	security			Security update for DHCP
Meaning of the status flags:		security			Security update for Linux Kernel (kernel-source)
C Patches concerning your		security	patch-673	13,19 MB	Security update for Linux Kernel (k_psmp)
nstallation are preselected. They		security	patch-678	12.79 MB	Security update for Linux Kernel (k_deft)
vill be downloaded and installed		recommended	patch-682	1.39 MB	Recommended update for FreeS/WAN
on your system. If you don't want		security			Security update for PHP4
a certain patch, double click on	Η×	habcommona	entch 688	0.96 140	Boonmanded unders for PAMRA
the line to unselect it (or select		Language and			
line and use CrtI A).	10	Apply			Show description
G: patch is available but not		China 1			The sea manufacture
relevant for your installation	C				

Figure 3. Install Linux kernel source

5. When completed, remove Patch CD2 from the CD drive and insert Patch CD3. Repeat the same procedure to install Patch-CD3. Exit yast2 when completed.

IMPORTANT: Be sure to execute mk_rdinit and lilo after installing patches from the Patch CDs. Do this from the root user's shell prompt.

NETWORK

In our example, the on-board Gigabit Ethernet device was used for the private LAN and an IBM 10/100 Ethernet Adapter 2 was used for the public LAN. The interfaces, IP addresses and hostnames are shown in Table 1.

Node		Public LA	N		Private LAN	
	Hostname	Interface	IP address	Hostname	Interface	IP address
1	xrac1	eth1	192.168.10.10	xrac1i	eth0	1.1.1.10
2	xrac2	eth1	192.168.10.20	xrac2i	eth0	1.1.1.20

Table 1. Network settings

During our installation, we encountered problems configuring the second network adapter. To circumvent this problem, we modified the configuration text files to define the interfaces and used YaST2 to activate and define other network parameters. These are the steps we used:

- 1. Open a terminal window and switch to root user
- 2. Edit /etc/modules.conf and modify the alias statements for eth0 and eth1 as shown in Example 1 below for node 1 (xrac1):

#
YaST2: Network card
#
alias eth0 bcm5700
alias eth1 e100
alias tr0 off
alias scsi_hostadapter off
alias fb0 off

Example 1. /etc/modules.conf

3. Edit /etc/rc.config. Modify the statements shown in bold highlighting in Example 2 for node 1.

```
# Number of network cards: "_0" for one, "_0 _1 _2 _3" for four cards
#
NETCONFIG="_0 _1"
#
# This variable contains all indices of active PCMCIA network devices
#
NETCONFIG_PCMCIA=""
#
# IP Adresses
#
IPADDR_0="1.1.1.10"
IPADDR_1="192.168.10.10"
IPADDR_2=""
IPADDR_3=""
#
# Network device names (e.g. "eth0")
#
NETDEV_0="eth0"
NETDEV_1="eth1"
NETDEV_2=" "
NETDEV_3=""
#
# Parameters for ifconfig, simply enter "bootp" or "dhcpclient" to use the
# respective service for configuration.
# Sample entry for ethernet:
# IFCONFIG_0="192.168.81.38 broadcast 192.168.81.63 netmask 255.255.255.224"
IFCONFIG_0="1.1.1.10 broadcast 1.1.1.255 netmask 255.255.255.0"
IFCONFIG_1="192.168.10.10 broadcast 192.168.10.255 netmask 255.255.255.0"
IFCONFIG_2=""
IFCONFIG_3=""
```

```
Example 2. /etc/rc.config
```

4. From the root user's shell prompt, enter yast2. Select **Network/Basic** in the left panel and then **Network card configuration** in the main panel. The Network basic configuration window, shown in Figure 4, is displayed:



Figure 4. Network basic configuration window

- 5. Verify that the network devices in your system are shown correctly. If so, click **Next** to continue. Otherwise, go back and make sure that the previous steps have been done correctly.
- 6. Enable network services through the inetd server. From YaST2 Control Center window (Figure 5), select **Network/Basic**, then **Stop/Start services (inetd)**.

Hardware	German T-DSL	Start/stop services (inetd)	
Network/Advanced	Madem configuration	Retwork card configuration	
Network/Basic	SCN configuration	S ADSL	
No Security8Users	Hostneme & DNS		
System			

Figure 5. Select Network/Basic window

7. From the Network services windows, select On with custom configuration and click Next.



Figure 6. Network services window

8. The **Enable/disable network services** window is displayed as shown in Figure 7. Verify that the services shown in Table 2 are activated:

the listbox you see all services	Enable/disa	able netwo	irk servi	ces			
reconfigured by SuSE	Status	Service	Туре	Proto	Flags	User	Server / Args
Il services marked with "#" are	4	ftp	stream	top	nowait	root	/usr/sbin/topd proftpd
inactive (locked), All services inarked with "Active!" are active	Active	ftp	stream	top	nowait.	raot	Jusi/sbin/topd in,ftpd
	Active	teinet	stream	tep	nowait	root	/usr/sbin/topd in.telnetd
nlocked).	¥.	nntp	stream	top	nowait	ICWS	/usr/sbin/topd /usr/sbin/teafn
inactive means, that these services are preconfigured in the		qtms	stream	top	nowat	raot	/usr/sbin/sendmail sendmail
	¢.	printer	stream	top	nowait	root	/usr/sbin/topd /usr/bin/lpd -i
onfiguration file of inetd	Active!	shell	stream	tcp	nowalt	raot	Jusn'sbin/topd in.rshd –L
etc/inetd.conf), but they are locked	#	shell	stream	top	nowait	root	/usr/sbin/topd in.rshd -aL
ith a click to this entry, and a	Active!	login	stream	top	nowat	root	/usr/sbin/topd in.rlogind
econd click on the button		login	stream	tcp	nowalt	root	Austr'sbin/topd in.rlogind -a
ctivate/inactivate you can unlock	*	exec	stream	tep	nowait	root	Just/sbin/topd in.rexecd
i inactive entry, or lock an active	Activel	talk	dgram	udp	wait	root	Austrisbinitopd in talkd
itry.	Active!	malk.	dgram	udp	wat	root	/usr/sbin/topd in.talkd
ith a click to an entry, and a		2000	stream		nowalt	root	Austrisbin/topd in pap2d

Figure 7. Enable/disable network services window

Service	Server / Args
ftp	/usr/sbin/tcpd in.ftpd
telnet	/usr/sbin/tcpd in.telnetd
shell	/usr/sbin/tcpd in.rshd -L
login	/usr/sbin/tcpd in.rlogind

Table 2. Network services

If **Active!** does not appear in the Status column for each of these services, select the service and click **Activate/inactivate**. Click **Finish** when done, then exit YaST2.

9. Add the host names to /etc/hosts.

1.1.1.20	xrac2i.local	xrac2i	
1.1.1.10	xracli.local	xracli	
192.168.10.20	xrac2.sanmateo.i	.bm.com	xrac2
192.168.10.10	xrac1.sanmateo.i	.bm.com	xrac1

Example 3. Entries for /etc/hosts

10. Configure host equivalence by adding the public and private hosts name to the /etc/hosts.equiv file, as shown in Example 4.

xracl	
xrac2	
xracli	
xrac2i	

Example 4. /etc/hosts.equiv

Test host equivalence by executing rsh, rcp and rlogin commands on both xrac1 and xrac2. Example 5 shows the output from these commands on xrac1:

```
oracle@xracl:~ > rsh xrac2 date
Mon Nov 27 17:29:05 PST 2002
oracle@xracl:~ > rcp /etc/hosts xrac2:/tmp
oracle@xracl:~ > rlogin xrac2
Last login: Wed Nov 27 16 17:29:03 from xrac1.sanmateo.ibm.com
Have a lot of fun...
oracle@xrac2:~ > ls /tmp/hosts
/tmp/hosts
oracle@xrac2:~ > exit
logout
rlogin: connection closed.
oracle@xrac1:~ >
```

Example 5. Testing host equivalence on xrac1

FASTT HOST ADAPTER DRIVER

Install the IBM FAStT Host Adapter driver. We downloaded the package consisting ot two files, 01r1093.tgz and 01r1093.txt, from the IBM Support site. Use the following steps to install the driver.

1. Rebuild the dependencies for the kernel. Enter the following command as root user:

```
cd /usr/src/linux-2.4.18.SuSE make dep
```

cd /root

2. Untar the IBM FAStT Host Adapter failover device driver version 6.0 for Linux.

tar xvfz 01r1093.tgz

The subdirectory named i2x00-v6.0 will be created.

3. Enter the following commands:

```
cd i2x00-v6.0
./libinstall
./drvsetup
make all OSVER=linux
```

4. Replace the existing drivers:

cp qla*.o /lib/modules/2.4.18-64GB-SMP/kernel/drivers/scsi/

5. Verify the order of the device modules:

Edit /etc/rc.config. Look for the line beginning with INITRD_MODULES. If your local disk drives are connected to the ServerRaid adapter, make sure that the ServerRaid adapter driver, ips, precedes the FAStT HBA driver (Example 6).

```
#
#
This variable contains the list of modules to be added to the initial
# ramdisk by calling the script "mk_initrd"
# (like drivers for scsi-controllers, for lvm or reiserfs)
#
INITRD_MODULES="aic7xxx ips qla2200"
Example 6. Extract from /etc/rc.config - INITRD_MODULES
```

6. Recreate the initial RAM disk:

mk_initrd lilo

- 7. Reboot the server.
- 8. After server reboot, log in as oracle. Switch to root user and verify that the FAStT HBA driver has loaded. Use the lsmod command to display the loaded kernel modules. You should see gla2200 in the displayed list of modules.

CONFIGURING SHARED STORAGE

SOFTWARE INSTALLATION

Install IBM FAStT Storage Manager version 8.21 for Red Hat Linux. This will allow you to configure the FAStT500 storage. To use this program, run as root: SMclient

Install IBM FAStT MSJ Diagnostic and Configuration Utility version 2.0 release 33. This will allow you to configure the FAStT Host Adapter failover driver and to monitor the FAStT adapters behavior. Install the agent and the GUI tool.

- To start the agent, run as root: glremote &.
- To use the GUI program, run as root: /opt/FAStT_MSJ/FAStT

DATAFILES FOR ORACLE9*i* RAC

Oracle9*i* RAC stores the datafiles in raw devices. On platforms supporting an Oracle-certified clustered file system, these datafiles may be stored on the clustered file system. At the time we wrote this paper, Oracle Clustered File System (OCFS) became available for Red Hat Advanced Server 2.1, but it was not yet available on SLES7.

In order to configure the storage and to create the raw devices, draw a table like the one shown in Table 3. This will help you to determine how to configure the shared storage device, how many logical devices you have to create, what size to give the logical devices, and it will help you to remember the purpose of each raw device.

The first column is the description of the database file that will be on the raw device, the second is the size of the database file in our example, the third and fourth are the volume groups and logical volumes created using LVM, and the fifth is the raw device which is mapped to the logical volume.

Database file	Size (MB)	Volume Group	Logical Volume	Raw device
quorum	110	controlvg	quorumlv	/dev/raw1
srvm	110	controlvg	srvmlv	/dev/raw2
spfile	5	controlvg	spfilelv	/dev/raw3
control file 1	110	controlvg	control1lv	/dev/raw4
control file 2	110	controlvg	control2lv	/dev/raw5
control file 3	110	controlvg	control3lv	/dev/raw6
system	400	datavg	systemlv	/dev/raw7
temp	110	datavg	templv	/dev/raw8
tools	12	datavg	toolslv	/dev/raw9
users	120	datavg	userslv	/dev/raw10
index	70	indexvg	indexlv	/dev/raw11
redo log thread 1 group 1	120	redovg	redo1_1lv	/dev/raw12
redo log thread 1 group 2	120	redovg	redo1_2lv	/dev/raw13
redo log thread 2 group 1	120	redovg	redo2_1lv	/dev/raw14
redo log thread 2 group 2	120	redovg	redo2_2lv	/dev/raw15
undo tablespace thread 1	312	undovg	undo1lv	/dev/raw16
undo tablespace thread 2	312	undovg	undo2lv	/dev/raw17

 Table 3. Database file correspondence and sizes

Configure the FAStT storage with the IBM Storage Manager client (SMclient), follow the instructions in the Implementing IBM eServer xSeries SANs Redbook. Once you have configured FAStT storage, reload the FAStT Host Adapter driver to force detection of the logical drives. Do this as root user on all server nodes, using the following commands:

rmmod qla2200 modprobe qla2200

To configure raw devices on SLES7, you may use the fdisk utility or Logical Volume Manager (LVM). LVM provides manageability and flexibility but is not required to implement Oracle9*i* RAC. For our installation, we used Logical Volume Manager.

- 1. Start YaST as root on one node of the cluster by typing the command yast. From the main menu, select **Installation settings**, then **Configure the Logical Volume Manager**. You will be asked to confirm that you want to configure LVM. Select **Yes** to start LVM setup.
- 2. We are going to create the Volume Group, representing one or more hard drives. First, we have to partition the logical drive we have created to make it usable by LVM. The window entitled ADMINISTRATION OF LVM VOLUME GROUPS is displayed as shown in Figure 8.



Figure 8. LVM Administration

- a. Press F6 for Partitioning. You will be asked for confirmation. Press Enter to continue.
- b. Select the device to be partitioned. In our case, it is /dev/sdb (see Figure 9):

—	Terminal 📃 🗖	×
File Sessior	ns Settings Help	
	<pre>K Continue ></pre>	
F2=New F6=Partit	cioning F7=Show all PVs F8=Show all LVs F10=Leave screen	4 5

Figure 9. Select hard drive

- c. Select **Partitioning** and press Enter.
- d. Press F5 to create a new partition.
- e. In the Partition Type window (see Figure 10), select **Primary partition**, then select **Continue** and press Enter.

	Terminal		- 🗆 ×
File Sessions Se	ttings Help		
Disk /dev/s One cylinde Here you ca Device con OSF diskla Building a until you Current par Device na	following partition types is possible. Please choose one. Primary partition Extended partition Continue > Continue >	SGI or ly, vious	
F1=Help -F	3=Change type - F4=Delete - <mark>F5=Create -</mark> F6 <u>Continue ></u>	=View error	s a
	rminal No 1		

Figure 10. Partition type selection

f. In the Primary Partition window (Figure 11), select the first line (/dev/sdb1 in our system), then select **Continue** and press Enter.

	Terminal		- 🗆 🗙
File Sessions Settings	Help		
Disk /dev/sdb 25 One cylinder has Here you can see Device contains OSF disklabel Building a new until you decid Current partitio Device name	The following primary partitions are still available in your partition table. Please choose the one you want. /dev/sdb1 /dev/sdb2 /dev/sdb4 /dev/sdb1 /dev/sdb3 /dev/sdb4	Sun, SGI or ry only, e previous	
	ge type - F4=Delete - <mark>F5=Create</mark> Continue > < Abort	-F6=View error	8
New Terminal N	lo 1		

Figure 11. Partition number selection

g. In the Location of the Partition window (Figure 12), accept the default entries to create a single partition for the whole logical device. Select **Continue** and press Enter.

Terminal 📃 🗖	×
File Sessions Settings Help	
EDITING THE PARTITION TABLE Fdisk detected the following hard drive geometry: Disk /dev/sdb 255 Heads 63 Sectors 8840 Cylinders. LOCATION OF THE PARTITION Now enter the location of the new partition on your hard disk. Please enter the starting cylinder number of the partition. After that, either specify an ending cylinder number or an offset from the first cylinder (e.g +66). It is also possible to specify the size of the partition directly (e.g. +100M or +20000K). Starting cylinder: :1 End of partition: :8840 EDITING THE PARTITION TABLE EDITING THE PARTITION HE PAR	•
<pre></pre>	
F1=Help -F3=Chanze type - F4=Delete - F5=Create - F6=View errors Continue >	4 P
New Terminal No 1	

Figure 12. Location of the partition

- h. The partition is now created. Press F3 to change its type.
- i. In the Enter the Partition Type window (Figure 13), select **LVM Partition**, then select **Continue** and press Enter.

Terminal 🛛	- 🗆 🗙
File Sessions Settings Help	
EDITING THE PARTITION TABLE Fdisk detected the following hand drive geometry: Disk /dev/sdb 255 Heads 63 Sectors 8840 Cylinders. One cylinder has 8225280 Bytes. Here you can see The number of c The number of c There is nothin and could in ce Current partition Device name /dev/sdb1 F1=Help F3=Change type F4=Delete F5=Create F6=View errors	
Continue >	
New Terminal No 1	

Figure 13. Partition type

j. The changes made are now reflected in the partition table shown in Figure 14.

🔳 🛃 📕	
File Sessions Settings Help	
EDITING THE PARTITION TABLE Fdisk detected the following hard drive geometry: Disk /dev/sdb 255 Heads 63 Sectors 8840 Cylinders, One cylinder has 8225280 Bytes. Here you can see the error messages of the fdisk program:	
The number of cylinders for this disk is set to 8840. There is nothing wrong with that, but this is larger than 1024, and could in certain setups cause problems with: Current partition table of the selected hard disk: Device name From To Blocks Partition type	-
/dev/sdb1 1 8840 71007268 8e Linux LVM	
F1=Help F3=Change type F4=Delete F5=Create F6=View errors - Continue > < Abort >	4 1
New_ Terminal No 1	

Figure 14. Partition table

k. Select Continue and press Enter. Press ESC to return to the LVM main window (see Figure 15).

I			Terminal					×
File Sessions	Settings Hel	p						- 14.0
managers. V: of a Volume Volume Group	log, you ca ia F2 and F Group, F4 0, F7 and F	DMINISTRATION an see the ex F3 you can ch activates and F8 give an ove llows existing	isting Vol ange the F d de-activ erall view	ume Groups Hysical and Vates Volume Vof all exi	of the Lo I/or Logic Groups. sting Phy	al volume F5 delete sical and	sa sa	4
Name	Size Tot	tal/Free (MB)	Active	Number of	PVs/LVs	PE Size (м	
		(Create)	new Volume	: Group>				
F2=New F6=Partition		=Change LVs =Show all PVs		activate Dw all LVs	F5=Dele F10=Lea	te VG ve screen		4
	Terminal No 1]						

Figure 15. LVM main window

- I. Press F2 to create a new Volume Group.
- m. In the field Name of the Volume Group, enter the volume group name. Figure 17 shows the volume group redovg being created. Change or accept The size of a Physical extent, then highlight the appropriate device (/dev/sdc1) and select it by pressing the Spacebar. Select Create Volume group and press Enter.

🔲 🔳 🛛 Te	rminal	- 🗆 🗙
File Sessions Settings Help		
PHYSICAL V In this dialog you can create a new V both the name and the size of a Physi any number of Physical Volumes which Group. Selecting and unselecting a Ph pressing the space bar. The new volum dialog. Name of the Volume Group	ical extent. After this, y do not yet belong to anot nysical Volume is made in	ou may select her Volume each case by
The size of a Physical extent	: B : Size Total/Free (MB) Pa	rtition ID
[]/dev/sda1 []/dev/sda2 []/dev/sda3	23 / 23 1034 / 1034 33648 / 33648	83 82 83
[X]/dev/sdb1 redovg 	69343 / 69343	8E
New Terminal No 1		

Figure 16. Physical Volume window

n. Repeat steps a - m to create the remaining volume groups. Once this is done, all the volume groups are shown in the Administration of LVM Volume Groups window (Figure 17).

±	Т	erminal		
e Sessions Settir	ngs Help			
hanagers. Via F of a Volume Gro Volume Group. F	ADMINISTRATION 0 you can see the exis 2 and F3 you can chan up. F4 activates and 7 and F8 give an over . F6 allows existing	ting Volume Gr ge the Physica de-activates V all view of al	roups of the al and/or Log /olume Groups ll existing Pl	ical volumes . F5 deletes a nysical and
Name S	ize Total/Free (MB)	Active Numbe	er of PVs/LVs	PE Size (M
redovg datavg controlvg indexvg undovg	69336 / 69336 69336 / 69336 34632 / 34632 34632 / 34632 34632 / 34632 34632 / 34632 (Create ne	[X] [X] [X] [X] [X] w Volume Group	1 / 0 1 / 0 1 / 0 1 / 0 1 / 0	8 8 4 4 4
2=Change PVs 6=Partitioning	F3=Change LVs F7=Show all PVs	F4=Deactivat F8=Show all		lete VG eave screen
New New	inal No 1			

Figure 17. LVM main window

- 3. The next phase of the process is to create the logical volumes within the volume groups. The following steps illustrate the procedure for the redo1_1lv logical volume.
 - a. Select a volume group (for example, redovg) in the LVM window. Press F3 to Change Logical Volumes. The Logical Volume window is displayed (Figure 18).

—		Terminal			- 🗆 🗙
File Sessions Settings H	Help				
In this dialog, you create new ones and	can both cha			s, as well	as
Free space in MB st	ill available	in the VG: 6933	6		
Name	Vg Name	Mount Point	Size in MB	Stripes	
	<create< td=""><td>new Logical Vol</td><td>.ume></td><td></td><td></td></create<>	new Logical Vol	.ume>		
- F2=Change size	— F3	=Delete LV	- F10=Leave	screen	
		Continue >			
New Terminal N	o 1				

Figure 18. Logical Volume window

- b. Select Create new Logical Volume and press Enter.
- c. In the Create a New Logical Volume window (Figure 19), fill in the fields as follows:
 - Logical Volume name: redo1_1lv
 - Logical Volume size: 120M (per Table 3)
 - Number of stripes: 1



Figure 19. Create a new Logical Volume window

- d. Select Continue and press Enter.
- e. Repeat steps b d to create the other logical volumes in the redovg volume group. When done, the Logical Volume window will list the logical volumes in the redovg volume group (Figure 20).

LOGICAL VOLUME DIALOG In this dialog, you can both change the size of Logical Volumes, as well as create new ones and delete existing ones. Free space in MB still available in the VG: 68856 Name Vg Name Mount Point Size in MB Stripes /dev/redovg/redo1_11v redovg /dev/redovg/redo1_21v redovg /dev/redovg/redo2_11v redovg /dev/redovg/redo2_21v redovg <t< th=""><th>∎ ≖ File Sessions Settin</th><th>• .</th><th>Terminal</th><th>· · · · · · · · · · · · · · · · · · ·</th><th></th></t<>	∎ ≖ File Sessions Settin	• .	Terminal	· · · · · · · · · · · · · · · · · · ·	
/dev/redovg/redo1_11v redovg 120 1 /dev/redovg/redo1_21v redovg 120 1 /dev/redovg/redo2_11v redovg 120 1 /dev/redovg/redo2_21v redovg 1 1	create new ones	you can both cha and delete exist	inge the size of ing ones.	Logical Volumes	s, as well as
/dev/redovg/redo1_21v redovg 120 1 /dev/redovg/redo2_11v redovg 120 1 /dev/redovg/redo2_21v redovg 120 1 <create logical="" new="" volume=""> F2=Change size F3=Delete LV F10=Leave screen</create>	Name	Vg Name	Mount Point	Size in MB	Stripes
	/dev/redovg/re /dev/redovg/re	edo1_21v redovg edo2_11v redovg edo2_21v redovg	∶new Logical Vo	120 120 120	1
	F2=Change s.	ize FZ		F10=Leave	screen

Figure 20. Logical Volume window – redovg volume group

- f. Press F10 to return to the LVM main window. Repeat steps a e to create logical volumes for the other volume groups datavg, controlvg, indexvg, and undovg.
- g. Press F10 to exit LVM.
- h. Press Esc twice to exit YaST.

Note: Check the directories /dev/redovg, /dev/datavg, /dev/controlvg, /dev/indexvg, /dev/undovg. These directories represent the volume groups created. Within these directories, you will find files representing the logical volumes created.

- 4. At this point, only the sever node used to run LVM sees the LVM configuration. Activate the LVM configuration on the other nodes with the vgscan command as root user.
- 5. Map the logical volumes to raw devices. Perform the following steps on each server node:
 - a. Create the script oracle_raw_devices in /etc/rc.d as shown in Example 7. This script must be owned by root and have execute permission.

```
# bind raw devices
/usr/sbin/raw /dev/raw1 /dev/controlvg/quorumlv
/usr/sbin/raw /dev/raw2 /dev/controlvg/srvmlv
/usr/sbin/raw /dev/raw3 /dev/controlvg/spfilelv
/usr/sbin/raw /dev/raw4 /dev/controlvg/controlllv
/usr/sbin/raw /dev/raw5 /dev/controlvg/control2lv
/usr/sbin/raw /dev/raw6 /dev/controlvg/control3lv
/usr/sbin/raw /dev/raw7 /dev/datavg/systemlv
/usr/sbin/raw /dev/raw8 /dev/datavg/templv
/usr/sbin/raw /dev/raw9 /dev/datavg/toolslv
/usr/sbin/raw /dev/raw10 /dev/datavg/userslv
/usr/sbin/raw /dev/raw11 /dev/indexvg/indexlv
/usr/sbin/raw /dev/raw12 /dev/redovg/redo1_11v
/usr/sbin/raw /dev/raw13 /dev/redovg/redo1_21v
/usr/sbin/raw /dev/raw14 /dev/redovg/redo2_11v
/usr/sbin/raw /dev/raw15 /dev/redovg/redo2_21v
/usr/sbin/raw /dev/raw16 /dev/undovg/undollv
/usr/sbin/raw /dev/raw17 /dev/undovg/undo2lv
Example 7. oracle_raw_devices
```

 b. To map the raw devices at server boot time, we configured the system to run the script at runlevel 5. To do this, create a symbolic link to the script file in /etc/rc.d/rc5.d. We used the 25th position in the startup sequence, using the following commands as root user:

```
cd /etc/rc.d/rc5.d
ln -s ../oracle_raw_devices S25raw_devices
```

Note: The file named /etc/raw, together with a script named /etc/rc.d/raw and the symbolic link /etc/rc.d/rc5.d/S10raw provide a facility for mapping raw devices during startup. However, we did not use this facility because code within /etc/rc.d/raw prevents execution when invoked using S10raw.

c. The raw devices have to be accessed by the oracle user id, so set permissions so that all the raw devices are owned by root and the group oinstall. Give the owner and group read/write access. This is done by executing the following commands as root user:

```
chown root:oinstall /dev/raw*
```

chmod 660 /dev/raw*

- d. Execute the /etc/rc.d/oracle_raw_devices as root. Verify the raw device bindings with the raw -qa command.
- Create symbolic links to the raw devices. Do this in each server node as oracle user. In our example, we
 placed these symbolic links in \$ORACLE_HOME/oradata/XRAC, where XRAC is our database name.
 You may do this using the following script:

```
# symbolic links to raw devices for database XRAC
mkdir $ORACLE_HOME/oradata
mkdir $ORACLE_HOME/oradata/XRAC
ln -s /dev/raw3 $ORACLE_HOME/oradata/XRAC/spfile
ln -s /dev/raw4 $ORACLE_HOME/oradata/XRAC/control01.ctl
ln -s /dev/raw5 $ORACLE_HOME/oradata/XRAC/control02.ctl
ln -s /dev/raw6 $ORACLE_HOME/oradata/XRAC/control03.ctl
ln -s /dev/raw7 $ORACLE_HOME/oradata/XRAC/system01.dbf
ln -s /dev/raw8 $ORACLE_HOME/oradata/XRAC/temp01.dbf
ln -s /dev/raw9 $ORACLE_HOME/oradata/XRAC/tools01.dbf
ln -s /dev/raw10 $ORACLE_HOME/oradata/XRAC/users01.dbf
ln -s /dev/raw11 $ORACLE_HOME/oradata/XRAC/indx01.dbf
ln -s /dev/raw12 $ORACLE_HOME/oradata/XRAC/redo1_1.log
ln -s /dev/raw13 $ORACLE_HOME/oradata/XRAC/redo1_2.log
ln -s /dev/raw14 $ORACLE_HOME/oradata/XRAC/redo2_1.log
ln -s /dev/raw15 $ORACLE_HOME/oradata/XRAC/redo2_2.log
ln -s /dev/raw16 $ORACLE_HOME/oradata/XRAC/undotbs1.log
ln -s /dev/raw17 $ORACLE_HOME/oradata/XRAC/undotbs2.log
Example 8. Create symbolic links for datafiles
```

Adding datafiles

If you create a new logical device on the SAN storage and add a logical volume (using LVM) or a partition (using fdisk), you have to reload the FAStT adapter driver. This means you lose the disk access for some time, and therefore the database instance running on the server has to be shut down.

To maximize database availability, it is recommended that spare partitions be created for use in the future as new datafiles.

When you run out of spare partitions, for each node in the cluster, you will have to shut down the instance, reload the FAStT adapter driver and restart the instance. This has to be done one node after another, in order to have the database always online.

ORACLE91 INSTALLATION

PREPARING FOR INSTALLATION

Oracle 9 Release 2 is supplied on three CDs, so it is necessary to switch product CDs during installation. Oracle Universal Installer (OUI) will manage the switching between CDs and ask you for the CD location when necessary.

In our installation, we copied the Oracle9*i* product CDs to the hard disk. The three product CDs were copied to three directories on the server named xrac1. These directories were named /opt/oracle/prod92/disk1, /opt/oracle/prod92/disk2 and /opt/oracle/prod92/disk3.

If you chose to install from the CDs, do not run OUI while the CD is the current directory, or you will not be able to switch CDs when prompted.

The following pre-installation tasks have to be performed on all nodes.

- 1. Modify the kernel parameters that affect resources used by Oracle9*i*. This must be performed as root user.
 - a. Review kernel parameter recommendations in Oracle9i Release Notes Release 2 (9.2.0.1.0) for Linux Intel (32-bit) and Installation Guide, Release 2 (9.2.0.1.0) for UNIX Systems: AIX-Based Systems, Compaq Tru64 UNIX, HP 9000 Series HP-UX, Linux Intel, and Sun Solaris
 - b. In our example, we increased SEMMNS to 1024 while retaining the minimum settings for SEMMSL, SEMOPM and SEMMNI. Example 9 shows a shell script containing the commands used to modify the kernel parameters.

```
export SEMMSL=100
export SEMMNS=1024
export SEMOPM=100
export SEMMNI=100
echo $SEMMSL $SEMONN $SEMONN > /proc/sys/kernel/sem
export SHMMAX=2147483648
echo $SHMMAX > /proc/sys/kernel/shmmax
```

Example 9. Kernel parameters modification script

These kernel parameters need to be initialized during system startup, so we named the script oracle_rac and stored it in /etc/rc.d.

c. Add execute permission to this script and set it up to run at runlevel 5. Do this with the following commands:

```
chmod u+x /etc/rc.d/oracle_rac
cd /etc/rc.d/rc5.d
ln -s ../oracle_rac S26oracle_rac
```

- d. Execute /etc/rc.d/oracle_rac to modify the current kernel settings.
- A number of environmental variables have to be set up for the oracle user ID. Do this as oracle user.
 a. Modify .bash_profile in oracle's home directory, adding the statements shown in Example 10.



```
# .bash_profile
xhost + > /dev/null 2>&1
export DISPLAY=localhost:0.0
export ORACLE_BASE=/oracle
export ORACLE_HOME=$ORACLE_BASE
export OH=$ORACLE_HOME=$ORACLE_BASE
export OH=$ORACLE_HOME
export ORACLE_TERM=xterm
export ORACLE_TERM=xterm
export TNS_ADMIN=$ORACLE_HOME/network/admin
export NLS_LANG=AMERICAN_AMERICA.US7ASCII
export ORA_NL33=$ORACLE_HOME/ocommon/nls/admin/data
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:$ORACLE_HOME/lib:$ORACLE_HOME/oracm/lib
export
CLASSPATH=$ORACLE_HOME/jre:$ORACLE_HOME/jlib:$ORACLE_HOME/rdbms/jlib:$ORACLE_HOME/netw
ork/jlib
export THREADS_FLAG=native
```

```
export PATH=$ORACLE_HOME/bin:$HOME/bin:$PATH
Example 10. Setting environmental variables in .bash_profile
```

b. Verify that the environmental variables are set correctly by loggin in using the oracle user ID and echoing a variable to the console. Here is an example:

```
oracle@xrac1:~ > echo $ORACLE_HOME
/oracle
oracle@xrac1:~ >
```

INSTALL ORACLE CLUSTER MANAGER

The first step in implementing Oracle9*i* RAC is to install and start Oracle Cluster Manager, which will let you install Oracle Database on every node on your cluster from a single node. Oracle Cluster Manager is installed using the Oracle Universal Installer (OUI).

Follow this procedure to install Oracle Cluster Manager and the Real Application Clusters software...

1. Log in as oracle on xrac1 and invoke the Oracle9*i* Universal Installer as follows:

```
cd /opt/oracle/prod92/disk1
./runInstaller
```

The Welcome screen is display as shown in The Oracle Universal Installer loads the Java Runtime Environment (you may receive some messages on your terminal window regarding the fonts but this is normal, because if the Java Runtime Environment does not find all the fonts it needs, then it substitutes them with others).



Figure 21. OUI Welcome screen

Click **Next** to go to the Inventory Location window shown in Figure 22. You will be prompted for the Inventory Location if this is the first time that you have started the Oracle Universal Installer on your system. The Inventory Location is the base directory into which Oracle Universal Installer will place the files needed to keep your Oracle installations centralized and up to date. The Oracle Inventory definition can be found in the file /etc/oraInst.loc. Accept the default values and then click **OK** to continue. If you choose another file location, keep in mind you should be consistent about this location in the future.



Figure 22. Inventory Location window

2. The next window (Figure 23) will prompt you for the UNIX group that the oracle user will use during the installation. This value should be "dba" or "oinstall" if you followed this document to install Oracle 9i RAC, or if you use the Step by Step procedure from Oracle that is available at Metalink's site. Enter "oinstall" and click **Next** to continue.

🛛 🖬 📃 Oracle Universal Installer: UNIX Group Name 📃	×
UNIX Group Name	
You can specify a UNIX group name which will have permission to update Oracle software on this system.	
If you want only root to have permission, leave the field blank and press "Next" to continue th <mark>e</mark> install.	
UNIX Group Name: oinstall	
1 0 1	
	ζ
Exit Help Installed Products Previous Next	Ś
ORACLE	

Figure 23. UNIX Group Name window

3. You will be then prompted to execute a shell script as root user (Figure 24). This script is located at "/tmp/oraInst.sh" and you must execute it in order for the installer to work properly. Open a terminal window, switch to root user and execute the script as directed.



Figure 24. Pop-up window - Execute orainstRoot.sh

4. Once the shell script is executed, click **Continue** and the File Locations window appears (Figure 25). This window asks you for the source and destination paths for your installation. Do not change the source location. For the destination location, verify that the value shown is the ORACLE_HOME variable previously set in .bash_profile. If the values are correct, click **Next** to continue.



Figure 25. File Locations window

5. The Available Products window (Figure 26) shows the different products you can install from the CDs. Select "Oracle Cluster Manager" and click **Next** to start installation of the Cluster Manager.



Figure 26. Available Products window

6. Oracle Universal Installer needs to know the public names or public IP addresses of the nodes of your cluster. The Public Node Information window will let you specify the node names. These nodes must be available from each other for the Oracle Universal Installer to configure the Real Application Clusters properly. In our case, our two xSeries 440s are named xrac1 and xrac2 (Figure 27).

		-			
Public No	ode Info	ormation			
Please enter the	public node	names in the ne	etwork		
Public Node 1:	xrac1				
Public Node 2:	xrac2				
Public Node 3:					
Public Node 4:		-			
Public Node 5:		1			
Public Node 6:					
Public Node 7:				1 1 1	
				100 Tak	No X
Exit	Help	Installed Pr	oducts	Previous	Next

Figure 27. Public Node Information window

7. The Private Node Information window configures the Private Node addresses that will be used for the interconnect between the different nodes of your RAC cluster. In our example, the hostnames for the private interconnect are xrac1i and xrac2i. Enter the information as shown and click **Next** to continue.

Private N	ode Inf	formatio	n			
lease enter the p	orivate node	names in the i	network			
Private Node 1:	xracli					
Private Node 2:						
Private Node 3:	xrac2i					
Private Node 4:						
Private Node 5:		12				
Private Node 5:						
Private Node 7:	I					
	1				100	
					~ /	
				N/		
Exit	Help	Installed F	roducts	Previou	5	Next

Figure 28. Private Node Information window

8. The Watchdog parameter window (Figure 29) asks you for the watchdog parameters. Simply accept the default value (60000) and click **Next** to continue.



Figure 29. WatchDog Parameter Information window

 The Quorum Disk Information window displays next. Enter the full name of the raw device you have created for the node monitor for the Quorum disk information. In this case, our quorum device will be /dev/raw1. Enter /dev/raw1 and click Next to continue.

oracle Universal Installer: Quorum Disk Information Disk Information	- X
Quorum Disk Information	
Enter the Quorum Disk Information	
Quorum Disk Information [/dev/raw1	
	\sim
Exit Help Installed Products Previous	Next

Figure 30. Quorum Disk Information window

10. The Summary window is displayed (Figure 31). Click Install to continue.



Figure 31. Summary window

11. An installation progress window (Figure 32) displays. Wait until the End of Installation window (Figure 33) displays.

a 🔳	Oracle Universal Installer: Install	<u> </u>
Install		
🕾 Installation in progre	855	
Link pending		
Counting angefor she		
Copying cmcfg.sbs	8	
Cancel		
You can find a log of this	s install session at: gs/installActions2002-12-09_06-59-38PM.log	
/bracie/branitencory,rog		
Exit Help	Installed Products Previous	Next

Figure 32. Install progress window

🛥 Oracle Universal Installer: End of Installation 📃 🗙
End of Installation
The installation of Oracle Cluster Manager was successful.
the second s
Exit Help Installed Products Previous Next Install

Figure 33. End of Installation window

12. Once the End of Installation window is displayed, click **Exit** and confirm by clicking **Yes**.

START ORACLE CLUSTER MANAGER

The next step is to start the Cluster Manager. This service has to run on each node of the cluster in order to install RAC.

- 1. Log in to one of the cluster nodes as oracle user and open a terminal window.
- Before starting Oracle Cluster Manager, go to each cluster node and verify that the \$ORACLE_HOME/oracm/log directory exists. If not, create the directory as oracle user. Do this with the following command:

mkdir \$ORACLE_HOME/oracm/log

3. Switch to root on each node and execute the following commands:

```
export ORACLE_HOME=/oracle
$ORACLE_HOME/oracm/bin/ocmstart.sh
```

4. This will start the watchdogd daemon and the oracm process, which make up Oracle Cluster Manager. Verify you have started it on each node with the ps -ef command and check the oracm log: \$ORACLE_HOME/oracm/log/cm.log

INSTALL ORACLE9/ DATABASE

 Start the Oracle Universal Installer again. Click Next on the Welcome screen and you will be prompted for the cluster nodes on which you would like to install the Database. This is because the Oracle Universal Installer detects the Cluster Manager. The Cluster Node Selection window is shown in Figure 34.



Figure 34. Cluster Node Selection window

Select all the nodes in your cluster and click **Next** to continue. The next window will be the File Location Screen that we have already seen in Figure 25. Click **Next** to continue.

2. Select **Oracle9***i* **Database 9.2.0.1.0** from the Available Products window (Figure 35) and click **Next** to continue.



Figure 35. Available Products window

3. The next window displayed is the Installation Types window (Figure 36). Select **Custom** in order to have full control over the components you will install. Click **Next** to continue.



Figure 36. Installation Types window

4. The Available Product Components window is displayed (Figure 37). In this window, you can select components to be installed. For a Real Application Cluster configuration, be sure to install at least the Oracle Database, Real Application Clusters, Partitioning and Netlistener components. If you need additional components for your database, select them on this screen. Once you have selected all desired components, click **Next** to continue.

Pracle9i Database he following are components that you can install as par lese components do you want to install?	t of Oracle9i Database. W	/hich of
Components	Install Status	
∋ 🗹 Oracle9i Database 9.2.0.1.0	New Install	
⊮ Oracle9i 9.2.0.1.0	New Install	
⊕ 🖬 Enterprise Edition Options 9.2.0.1.0	New Install	
⊕ 🗹 Oracle Net Services 9.2.0.1.0	New Install	
⊕ Oracle Enterprise Manager Products 9.2.0.1.0	Not Installed	
⊕□ Oracle9i Development Kit 9.2.0.1.0	Not Installed	
□ Oracle9i for UNIX Documentation 9.2.0.1.0	Not Installed	
⊕ Oracle HTTP Server 9.2.0.1.0	Not Installed	
⊕ [] iSQL*Plus 9.2.0.1.0	Not Installed	
□Oracle JDBC/OCI Interfaces 9.2.0.1.0	Not Installed	
Show all components including required dependencies		
Show all components including required dependencies		

Figure 37. Available Product Components window

5. The Components Location window is displayed (Figure 38). Do not modify the values, click **Next** to continue.



Figure 38. Component Locations window

6. You will also be prompted for the raw device where you will have the shared configuration of your cluster. Enter /dev/raw2 as shown in Figure 39. Click **Next** to continue.



Figure 39. Shared Configuration File Name window

7. On the Privileged Operating System Groups window (Figure 40) select the group(s) for your database operator and administrator. Normally, these values are set to dba. Enter the appropriate information and click **Next** to continue.
| 🖌 🔳 Oracle Universal Installe | er: Privileged Operating System Groups 📃 🗙 |
|---|--|
| Privileged Operating S | ystem Groups |
| authentication. These are granted throug
OSOPER, respectively, and the dba group | red to create a database using operating system (OS)
h membership in the UNIX groups OSDBA and
is usually used for this purpose. If you would like
the UNIX groups of which you are a member, to be |
| Database Administrator (OSDBA) Group | dba |
| Database Operator (OSOPER) Group | dba |
| Exit Help Installe | d Products Previous Next |
| ORACLE | |

Figure 40. Privileged Operation System Groups window

8. You will then be prompted for database creation (Figure 41). We will not create it right now, so select **No** and then click **Next** to continue. If you wish to create a database during the installation, you should select "Yes" and follow the configuration steps. We will create the database later.

📓 🖬 🛛 🚽 Oracle Universal Installer: Create Database 🖉 🖃 🔀
Create Database
If you want to create a new database, Oracle recommends using the Oracle Database Configuration Assistant. This tool provides a simple, graphical method for creating a database, and can be automatically launched at the end of installation. Do you want to create a new database by using this tool?
CYes
@ No
Exit Help Installed Products Previous Next
ORACLE
Sizure 11. Oraște Detebase windew

Figure 41. Create Database window

- 9. A Summary window shows you the product component selections you have made. Verify it and if you need to add something else, go back by clicking on **Back**. If everything is OK, click **Install** to start the installation procedure.
- 10. During the installation process, you will see an installation progress window such as shown in Figure 42.

		Oracle Universal I	nstaller: Install			
Install						
Installing Ja 1.3.1.0.0	ava Runtime En	vironment				
Link pending						
Copying psfont	j2d.properties					
I.	1%					
Cancel						
You can find a /oracle/orainv	log of this insta entory/logs/ins	ll session at: tallActions2002-11-20,	_04-42-22PM.10	og		
Exit	Help	Installed Product	:5	Previous	Next	
RACLE						
ure 42. Inst	all window					

11. After a few minutes, a pop-up window entitled Disk Location displays (Figure 43). If you have copied the CDs to the disk, modify the path to indicate where the second CD's contents can be found. If you used a scheme like ours, change disk1 to disk2 and click **OK** to continue. If you are installing from the CDs, open another window, umount the CD, remove it, and insert the CD requested.

× •	Disk Location	- ×
	e insert orcl920 disk 2 into yo Fy an alternative location.	ur disk drive or
Path:	/opt/oracle/prod92/disk1/	Browse)
Help	D	OK Cancel

Figure 43. Disk Location window

- 12. After another few minutes, another Disk Location pop-up window is displayed to ask for the location of CD 3's contents. Modify the path as necessary and click OK to continue the installation.
- 13. Once all the CD's are installed on the first node, the Oracle Universal Installer will install the software on each node on your cluster. A pop-up window entitled Setup Privileges will ask you to execute root.sh (Figure 44).



Figure 44. Setup Privileges window

14. Before executing root.sh, create the directory /var/opt/oracle and make oracle its owner on <u>both</u> nodes. Execute the following commands from the root shell prompt:

```
mkdir /var/opt/oracle
chown oracle:oinstall /var/opt/oracle
```

15. Oracle Universal Installer will automatically configure the cluster and then ask you to configure the network. We will configure the listeners later, so click **Cancel** on the Oracle Net Configuration Assistant: Welcome window and confirm by clicking **Yes** (Figure 45).



Figure 45. Oracle Net Configuration Assistant window

16. An Error window (Figure 46) is displayed because we cancelled the network configuration. Accept the error by clicking **OK** and **Next** to finish the installation.



Figure 46. Error window

17. The Oracle Universal Installer displays the End of Installation (Figure 47) window and warns you that you have got some components that were not configured. Since we cancelled network configuration, this is expected, so exit the installer by clicking **Exit**.



Figure 47. End of Installation window

- 18. Some of the log directories may not have been created on all nodes during the installation. Make sure then that the following directories exist on each node:
 - \$ORACLE_HOME/rdbms/audit
 - \$ORACLE_HOME/rdbms/log
 - \$ORACLE_HOME/network/log
 - \$ORACLE_HOME/network/trace

If they do not exist, please create them in order to have full logs on your system.

19. Start the Global Services Daemon. You should also add it to your Oracle start-up script in order to have it running each time you start your machine. As oracle user, type "gsdctl start" on each node of your cluster to start the Global Services Daemon.

POST-INSTALLATION

Listeners configuration

- Before the database creation we will create the listeners that we will use later and which will let us configure our database without problems. Make sure your "LANG" variable is not set by typing "unset LANG". Then you can start the Network Configuration Assistant. This tool is the one we stopped during the installation procedure. To start NCA, type "netca".
- 2. The TOPSWelcome window shown in Figure 48 is displayed. Select **Cluster Configuration** and click **Next**.

Ora	acle Net Configuration Assistant: TOPSWelcome 📃 🗙
	Select the type of Oracle Net Services configuration:
y and a second s	Cluster configuration
	C Single node configuration
Cancel Help	Back Next >>

Figure 48. Net Configuration Assistant TOPSWelcome window

3. The TOPSNodes window is displayed (Figure 49). Select all the nodes on the cluster as shown and click **Next**.

	Oracle Net Configuration Assistant: TOPSNodes
	Select the nodes to configure Nodes(s): xrac1 xrac2
	Select all nodes Deselect all nodes
Cancel Hel	p (< <u>B</u> ack <u>Next ≫</u>)

Figure 49. Net Configuration Assistant TOPSNodes window

4. The Welcome window is displayed (Figure 50). Select Listener Configuration and click Next.

-	Oracle Net Configuration Assistant: Welcome 📃 🗙
	Welcome to the Oracle Net Configuration Assistant. This tool takes you through the following common configuration steps: Choose the configuration you would like to do: © Listener configuration © Naming Methods configuration © Local Net Service Name configuration © Directory Usage Configuration
Cancel Help	Back

Figure 50. Net Configuration Assistant Welcome window

5. The Listener Configuration window displays (Figure 51. Select Add and click Next to continue.



Figure 51. Listener Configuration window

6. Accept the default Listener name shown on the **Listener Name** window (Figure 52). Click **Next** to continue.

■ ■ Oracle Net Configuration /	Assistant: Listener Configuration, Listener Name 📃 🗙
	For remote connections to be made to your Oracle database you must have at least one Oracle Net listener. Enter the name of the listener you want to create:
	Listener name: LISTENER
Cancel Help	Back

Figure 52. Listener Name window

 The next window (Figure 53) will let you select network protocols to configure for the listener. TCP/IP should already be selected, but we will also add IPC support. Select IPC and click ">". Click Next to continue.



Figure 53. Select Protocols window

8. The next window (Figure 54) will prompt for the TCP/IP port number to be used by the listener. Accept the default port value (set to 1521) and go to the next window by clicking **Next**.

💻 🔳 🛛 Oracle Net Configu	ration Assistant: Listener Configura	ation, TCP/IP Protocol 📃 📕
	Which TCP/IP port number sho port number selected should no software on this computer.	ot be used by any other
	Use the standard port numbe	r of 1521
	© Use another port number:	1521
Cancel Help	🤇 Back	Next >>

Figure 54. Listener TCP/IP port number window

9. The next window (Figure 55) will ask for the IPC key to be used. Enter your database name as key and then click **Next**. In our example, we used "DB".



Figure 55. IPC protocol window

10. This should complete listener configuration. Oracle Universal Installer will then ask if you want to create another listener (Figure 56). Select **No** and click **Next**.

🖃 🖼 🧰 Oracle Net Configuration A	ssistant: Listener Configuration, More Listeners? 📖 🗖 🗙
	Would you like to configure another listener? No C Yes
Cancel Help	

Figure 56. New Listeners window

11. The Listener Configuration is now complete. Click Next to exit the Network Configuration Assistant.



Figure 57. Listener Configuration Done window

INSTALL ORACLE9/ PATCH SET 1

Prior to the end of our project, Oracle released Oracle9i Release 2 Database Server Patch Set 1 with Cluster Manager Patch for Linux-32. This patch set is not a complete software distribution and requires an existing Oracle9i Release 2 Oracle Server installation.

Patch Set 1 includes patches to the Oracle Cluster Manager on Linux. The watchdogd implementation has been removed and replaced by a Linux kernel module named hangcheck-timer. At the time we wrote this paper, the hangcheck-timer module was only available for Red Hat Advanced Server 2.1. We obtained a development version of the hangcheck-timer module from Oracle for our tests. Oracle recommends loading the hangcheck-timer, however, the oracm process is not prevented from running if the hangcheck-timer is not loaded.

IMPORTANT as of December 16, 2002: If you are installing Oracle9*i* RAC on xSeries 440s with more than 4 CPUs, contact the IBM/Oracle International Competency Center for latest information regarding open issues and latest patches. The IBM/Oracle International Competency Center can be reached by email at: ibmoracl@us.ibm.com.

- 1. Download Patch Set 1 from Oracle MetaLink. The patch set number is 2632931 and the download file is named p2632931_9202_LINUX.zip.
- 2. Check MetaLink to see if the hangcheck-time for SLES7 is available for download. The patch number for the Red Hat Advanced Server module is 2594820. If not, contact Oracle Support for assistance.
- 3. Review the README.html file shipped with Patch Set 1 for notes that apply to your implementation. Follow the detailed procedure for installing Patch Set 1 in the README file.

UPDATE STARTUP SCRIPT

After Patch Set 1 is installed, we can now complete the startup script that was started in Example 9 on page 24. The script shown in Example 11 now initializes kernel parameters, loads the hangcheck timer, starts Oracle Cluster Manager, and Global Services Daemon.

```
#! /bin/sh
#
. /opt/oracle/.bash_profile
case "$1" in
  start)
#
     echo "Modifying kernel parameters"
     export SEMMSL=100
     export SEMMNS=1024
     export SEMOPM=100
     export SEMMNI=100
     echo $SEMMSL $SEMMNS $SEMOPM $ SEMMNI > /proc/sys/kernel/sem
     export SHMMAX=2147483648
     echo $SHMMAX > /proc/sys/kernel/shmmax
     echo "Loading hangcheck-timer module"
     /sbin/insmod hangcheck-timer hangcheck_tick=30 hangcheck_margin=180
     echo "Starting Oracle Cluster Manager"
     if [ -f /oracle/oracm/log/ocmstart.ts ]; then
        rm /oracle/oracm/log/ocmstart.ts
     fi
     /oracle/oracm/bin/ocmstart.sh
     echo "Starting Global Services Daemon"
     su - oracle -c "gsdctl start"
     ;;
  stop)
     echo "Stopping Global Services Daemon"
     su - oracle -c "gsdctl stop"
     echo "Stopping Oracle Cluster Manager"
     killall oracm
     /sbin/rmmod hangcheck-timer
     ;;
  restart)
     $0 stop
     $0 start
     ;;
  *)
     echo "Usage: $0 {start|stop|restart}"
     exit 1
     ;;
esac
```

Example 11. Oracle startup script - /etc/rc.d/oracle_rac

CREATING A CLUSTER DATABASE

USING DATABASE CONFIGURATION ASSISTANT

For the database creation, we will use the Database Configuration Assistant (DBCA) tool. DBCA is a graphical tool that makes the database creation easier. It uses the Optimal Flexible Architecture (OFA). This means that DBCA creates the database files, including the default server parameter file, using standard file naming and file placement practices. In order to run DBCA, you must have the GSD daemon started. If not, please be sure you run it before starting database creation.

Verify that you have correctly configured all the shared disks for each tablespace (for non-cluster file system platforms) and then you can start database creation.

Oracle Corporation recommends that you use the DBCA to create your database. This is because the DBCA preconfigured databases optimize your environment to take advantage of Oracle9*i* features such as the server parameter file and automatic undo management. The DBCA also enables you to define your own tablespaces as part of the database creation process. So even if you have datafile requirements that differ from those offered in one of the DBCA templates, use the DBCA. You can also execute user-specified scripts as part of the database creation process.

The Database Configuration Assistant (DBCA) makes use of a file that maps database tablespaces to datafiles. Create this file to suit your own tablespaces and make sure it is owned by the oracle user. See Example 12 below for a listing of the file we used in our example, which we named mappingDBCA.cfg.

```
# DBCA mappings for XRAC
spfile=/oracle/oradata/XRAC/spfile
control1=/oracle/oradata/XRAC/control01.ctl
control2=/oracle/oradata/XRAC/control02.ctl
control3=/oracle/oradata/XRAC/control03.ctl
system=/oracle/oradata/XRAC/system01.dbf
temp=/oracle/oradata/XRAC/temp01.dbf
tools=/oracle/oradata/XRAC/tools01.dbf
users=/oracle/oradata/XRAC/users01.dbf
indx=/oracle/oradata/XRAC/indx01.dbf
redo1_1=/oracle/oradata/XRAC/redo1_1.log
redo1_2=/oracle/oradata/XRAC/redo1_2.log
redo2_1=/oracle/oradata/XRAC/redo2_1.log
redo2_2=/oracle/oradata/XRAC/redo2_2.log
undotbs1=/oracle/oradata/XRAC/undotbs1.log
undotbs2=/oracle/oradata/XRAC/undotbs2.log
Example 12. DBCA mapping file – mappingDBCA.cfg
```

1. The name of this file is passed to DBCA by the variable DBCA_RAW_CONFIG. As oracle user, set this variable by entering:

```
export DBCA_RAW_CONFIG=~/mappingDBCA.cfg
```

2. Start DBCA with the dbca command. A Welcome screen is displayed as shown in Figure 58. Select Oracle Cluster Database and click Next.

11 💻	Database Contiguration Assistant : Welcome	
	Welcome to Database Configuration Assistant for Oracle Real Application Clusters	
	The Database Configuration Assistant enables you to create, configure or delete a database and manage database templates. It also enables you to add, delete or m cluster database instances.	odity
	What type of database would you like to create or administer?	
	🛎 Oracle duster database	
	C Oracle single instance database	
~		
Control Unite		
Cancel Help	Back Best D	

Figure 58.DBCA Welcome window

3. The Operations window (Figure 59) is displayed. Select Create Database and click Next.

	Database Configuration Assistant, Step 1 of 9 : Operations	FOX
	Select the operation you want to perform	
	🕷 Create a database	
	Configure database options in a database	
	/C Delete al database	
	🗆 Manage Templates	
	🗹 🖉 Instance Management	
(_Cancel_) H	elp)	

Figure 59. Operations window

4. The Node Selection window is displayed (Figure 60). Select all the nodes that apply and click **Next** to continue. In our example, we selected both xrac1 and xrac2 as shown.



Figure 60. Node Selection window

If some of your nodes are missing, there is a cluster diagnostic tool called lsnodes which will let you know what nodes are currently active. Resolve the problem and try again the process from the beginning. In our tests, we used two nodes: "xrac1" and "xrac2", and "Isnodes" shows both of them (Example 13).

```
oracle@xrac1:~ > lsnodes
xrac1
xrac2
oracle@xrac1:~ >
```

Example 13. Isnodes command

5. The next window is the Database Templates window (Figure 61). All of the templates, other than New Database, include datafiles. Select **New Database** and click **Next**.

	Select	Template Name	Includes Datafil.
	0	Data Warehouse	Yes
	0	General Purpose	Yes
		Transaction Processing	Yes
	8	New Database	No
Hand of the second seco			

Figure 61. Database Templates window

6. This next window is the Database Identification window (Figure 62). You should enter the Global Database Name (typically on the name.domain form) and the Oracle System Identifier (SID). The SID will identify an instance and DBCA will suggest you use the same name that you entered on the Database Name field. The SID identifier will be used on RAC databases as a prefix for the instance number. In our example, we used XRAC for the Global Database Name and took the suggested SID Prefix. Click Next to continue.

1 🔳 📃 Dat	abase Configuration Assista	ant, Step 4 of 9 : Database Identification 📃 🗖 🗙
	Specify the following da	atabase information.
	An Oracle9 i database is form "name.domain".	uniquely identified by a Global Database Name, typically of the
	Global Database Name:	KRAC
	Instance is uniquely ide database instance, the s number for each instan-	d by an OracleSI instance on each cluster database node. Each ntified by an Oracle System Identifier ISID). For each cluster SD is comprised of a common prefix for the database and a ce that is automatically generated. A suggested SID prefix has hich you can accept or change to a value you prefix.
	SID Prefix:	[KPAC
(_Cancel_) Help)	💰 Back 🛛 Next 🔊

Figure 62. Database Identification window

7. The Database Features window displays (Figure 63). Select the appropriate database features. In our example, we deselected every feature.

T	В	M

	Database Features Custom Scripts
	Select the features you want to configure for use in your database;
_	🗖 Oracio Smatia i
.	🗖 Gracie Ultra Saarch
	Cracle Label Security
	E Oracle Data Mining
	F Oracle OTAP
	Example Schemas
2	🗖 Human Resources
	🗖 Order Entry
1	E Product Media
	E Sales History E Shipping
	4. 200 p. 110
	Standard database feature
	<u></u>

Figure 63. Database Features window

8. Click on **Standard database features** to add or remove some standard options. The Standard database features window shown in Figure 64 displays. In our example, we deselected every standard option as shown. Click **OK** to continue.

use in your o	andard database features you want to configure for database. Oracle Corporation recommends that you .Il these features in your database.
🗆 Oracle J	VM
🗆 Oracle I	ntermedia
🗆 Oracle 🗆	Гехt
□ Oracle >	KML DB Customize)

Figure 64. Standard Database Features window

9. The Database Connection Options window displays (Figure 65). Select **Dedicated Server Mode** and click **Next** to continue.



Figure 65. Database Connection Options window

10. The next window will let you configure the Initialization Parameters. On this window you will see multiple page tabs. The first tab is the Memory page, shown in Figure 66. Modify the memory setting if desired.

	Memory	Character Sets	D8 Sizing	File L	ocations	Archive
	C Typical					
- -	Percentag	e of physical memo	ry (2020 MB) f	or Oracle	70	
ALL DE LEASE	Database	Туре:			Dete Wa	rehousing
	show di	stribution of Memor	y)			
	Custom					
	Shared Po	iol: B0	68	-	M Bytes	*
-	Buffer Ca	che: 24		-	M Bytes	-
	Java Pool:	33	554432	4	Bytes	-
	Large Poo	l: 8		- 1	M Bytes	+
	PCA	24		1	M Bytes	*
7 -	To	nory for Oracle: 201 tal memory include: empty parameters	40MB of Orac	le Proces	s Size and	the default
	All Initializat	ion Parameters)			File 1o	cation Var

Figure 66. Initialization Parameters window - Memory tab

11. Click the **File Locations** tab. The File Locations page is displayed in Figure 67. Select the "File Locations" tab. The option "Create Persistent Initialization" is selected by default. Server Parameters Filename should point to the correct datafile. If not, either DBCA_RAW_CONFIG is not set correctly or the file contains errors.

Click on the othe tabs and verify all the configuration options according to your requirements. When this is done, click **Next** to continue.

	Memory	Character Sets	DB Sizing	File Locations	Archive
	Initialization #	Parameters Filen:	ame: {ORACLE_	BASE}/admin/{OB_	NANE}/pfile/
🧼 🛒 –	- 🖓 Create se	rver parameters	file (sptile)		
	parameters These param	set in the init.ord	on the database	like traditional RD R 5Y5TEN or ALTER server side, in a b ing a database.	ESSION.
	Server Par	ameters Filenam	e: [/oracle/orad	ata/XRAC/spfile	
	- Trace File D	irectories			
	For User Pro		ACLE_BASE}/ad	min/\$DB_NAME}/ut	d um p
	For Backgrou	and Process: 10	ACLE_BASE!/ad	min/SDB_NAME3/br	d um p
	For Core Du	mps: [[0	RACLE_BASE//a.d	min/@DB_NAME3/ <d< td=""><td>lump</td></d<>	lump
	All Initializatio	n Parameters)		File	Location Varia
	rin minianzario	relative to s /		FILE	cocation sa n

Figure 67. Initialization Parameters window – File Locations tab

12. DBCA now shows you the Database Storage Window (Figure 68). The tablespaces and datafiles should be as specified in the mapping file (mappingDBCA in Example 12). Verify the settings and click **Next** when you're finished.

Controlfile Contr	Database Storage page, you can specify storage parameters for the database creation. This page displays a tree listing and summary view (multi-column lists) to ellow you to change and view the following object: • Controlfiles • Database Storage page, you can specify storage parameters for the database creation. This page displays a tree listing and summary view (multi-column lists) to ellow you to change and view the following object: • Controlfiles • Datafiles • Datafiles • Bollback Segments • Redo Log Groups Tormer any object type folder, dick Add to create a new object. To delete an object select the specific object from within the object type folder and click Remove. Important: if you select a seed database template, you will be able to add or remove datafiles tablespaces or ollback segments. Selecting a seed template allows you to only change the following: • The name of the database • Destination of the datafiles • Controlfiles or log groups.
Add Bernove)	File Location Variables.

Figure 68. Database Storage window

13. The Database Creation Options window is displayed. Ensure that the option **Create Database** is checked and click **Finish**.

- E Save as a D Name Description:	vatabase Template	
	atabase Creation Scripts /oracle/admin/XRAC/scripts	Browse.

Figure 69. Creation Options window

14. The DBCA Summary window (Figure 70) is displayed. Using the scroll bar, review all information and then click **OK** to continue.

	USERS	PERM	IANENT L	DCAL		AC/scripts".
Data	File	s				_
Status		Na	ıme	Tablespace	Size(M)	
ONLINE	/oracle/	oradata/>	RAC/indx01.dbf	INDX	25	
ONLINE	/oracle/	oradata/X	RAC/system01.db	f SYSTEM	250	
ONLINE	/oracle/	oradata/>	RAC/temp01.dbf	TEMP	40	
ONLINE	/oracle/	oradata/X	RAC/tools01.dbf	TOOLS	10	
ONLINE	/oracle/	oradata/>	RAC/undotbs1.log	UNDOTBS1	200	
ONLINE	/oracle/	oradata/>	RAC/undotbs2.log	UNDOTBS2	200	
ONLINE	/oracle/	oradata/X	RAC/users01.dbf	USERS	25	
		-				
	Size(K)	Groi	ups File M	ame		
	_		-		9	
Group	Size(K)	Thread	- File M	RAC/redo1_1.lo	-	
<mark>Group</mark> 1	<mark>Size(K)</mark> 102400	Thread 1	- File M /oracle/oradata/>	RAC/redo1_1.lo RAC/redo1_2.lo	g	
<mark>Group</mark> 1 2	Size(K) 102400 102400 102400	<mark>Thread</mark> 1 1	File M /oracle/oradata/> /oracle/oradata/>	RAC/redo1_1.ld RAC/redo1_2.ld RAC/redo2_1.ld	9	

Figure 70. DBCA Summary window

15. DBCA begins to create the database. Since we selected Generate Database Creation Scripts (Figure 69), a pop-up window will display to indicate successful script generation (Figure 71).



Figure 71. Pop-up window - successful script generation

16. DBCA starts the database creation. A progress window is displayed (Figure 72).

🔟 🔳	Database Configuration Assistant 📃 🔀
	 Creating and starting Oracle instance Creating database files Creating data dictionary views Creating cluster database views Completing Database Creation Database creation in progress
	5%
	Stop

Figure 72. DB creation progress window

17. When DBCA has finished database creation, the completion window shown in Figure 73 is displayed. DBCA prompts you to change the passwords for SYS and SYSTEM database users. Enter the desired passwords and click **Exit**.

Database creation complete. Ch details.	eck the logfiles at /oracle/admin/XRAC/create for
Database Information: Global Database Name: System Identifier(SID) Prefix: Server Parameters Filename:	XRAC XRAC /oracle/oradata/XRAC/spfile
- Change Passwords	
For security reasons, you mus accounts in the new database	t specify a password for the SYS and SYSTEM
SYS Password:	****
Confirm SYS Password:	****
SYSTEM Password:	****
Confirm SYSTEM Password:	****
Confirm SYSTEM Password: Note: All database accounts e: locked. Select the Password M locked accounts or to manage Management window, unlock	

Figure 73. Database creation complete window

18. Once this step finished, you have successfully created the clustered database. It can now be accessed by Oracle SQL*PLUS or other applications designed to work with an Oracle RAC database. You should make sure to execute start-up scripts during system startup as root and other scripts or commands as oracle user as described earlier in this document.

CREATING A DATABASE MANUALLY

You can also create the databases manually. To do so, follow the next steps:

- on one node : srvctl add db -p <db_name> -o <oracle_home>
- for each instance of the database :

srvctl add instance -p <db_name> -i <SID> -n <node_name>

(it is advised to set the SID to db_name plus instance_number)

- on each node, check the configuration : srvctl config -p <db_name>
- on each node, create (or update) oratab file (in /etc directory) with the following line :

<db_name>:<\$ORACLE_HOME>:N

- create the udump, cdump and bdump directories.
- set the SID in .profile of oracle user

- create the init.ora file for each node. It is possible to prefix parameter which are local to the instance with the instance name. For example, thread, instance_name, rollback_segments...
 It is possible to create a spfile with "create spfile='/dev/rawspfile' from pfile=/.../init.ora".
- create the database creation script. You can use \$ORACLE_HOME/srvm/clustdb.sql script as sample. The script must be adapted to your environment. Be careful, there are some errors in this file.
- you can create a password file. Under \$ORACLE_HOME execute orapwd file=orapw password=###.
- as sysdba, execute the script.

For further information, refer to Step-by-step Installation of RAC on Linux, Oracle Metalink Note184821.1.

UPDATE ORACLE USER PROFILE

The database has been created and each node has its own instance. Update each node's .bash_profile (created in Example 10 on page 25) for the oracle user with the correct ORACLE_SID value. The instance name for a node is the SID prefix concatenated with the instance number. For example, the instance on xrac1 will be XRAC1 and the instance on xrac2 will be XRAC2.

For example, in xrac1, we added the line

export ORACLE_SID=XRAC1

to oracle user's .bash_profile on xrac1. Source the new .bash_profile in your current shell by issuing the command:

. ~/.bash_profile

CONFIGURING HIGH AVAILABILITY AND LOAD BALANCING

LISTENER CONFIGURATION

The listener should be properly configured by **net ca** and **dbca** but it is worth checking that the contents of \$ORACLE_HOME/network/admin/listener.ora are similar to those in the following listener.ora for the first instance:

```
LISTENER =
(DESCRIPTION_LIST =
   (DESCRIPTION =
      (ADDRESS_LIST =
         (ADDRESS =(PROTOCOL =TCP)(HOST =xracl)(PORT =1521))
      )
   )
)
SID_LIST_LISTENER =
(SID_LIST =
   (SID_DESC =
      (SID_NAME =PLSExtProc)
      (ORACLE_HOME =/oracle)
      (PROGRAM =extproc)
   )
   (SID_DESC =
      (ORACLE_HOME =/oracle)
      (SID_NAME = XRAC1)
   )
```

Example 14. listener.ora for the first instance

TNSNAMES CONFIGURATION

```
LISTENERS_XRAC =
   (DESCRIPTION =
       (ADDRESS_LIST =
          (ADDRESS = (PROTOCOL = TCP) (HOST = xrac1) (PORT = 1521))
          (ADDRESS =(PROTOCOL =TCP)(HOST =xrac2)(PORT =1521))
       )
   )
XRAC =
   (DESCRIPTION =
       (ADDRESS_LIST =
          (ADDRESS =(PROTOCOL =TCP)(HOST =xrac1)(PORT =1521))
          (ADDRESS = (PROTOCOL = TCP) (HOST = xrac2) (PORT = 1521))
       )
       (FAILOVER =yes)
       (LOAD_BALANCE =yes)
       (CONNECT_DATA =
          (SERVICE_NAME =XRAC)
          (FAILOVER_MODE=
          (TYPE=SELECT)
          (METHOD=BASIC)
          (RETRIES=30)
          (DELAY=1)
       )
   )
)
XRAC1 =
   (DESCRIPTION =
       (ADDRESS_LIST =
          (ADDRESS =(PROTOCOL =TCP)(HOST =xrac1)(PORT =1521))
       )
       (CONNECT_DATA =
          (SERVICE_NAME =XRAC)
          (INSTANCE_NAME =XRAC1)
       )
   )
XRAC2 =
   (DESCRIPTION =
       (ADDRESS_LIST =
          (ADDRESS = (PROTOCOL = TCP) (HOST = xrac2) (PORT = 1521))
       )
       (CONNECT_DATA =
          (SERVICE_NAME =XRAC)
          (INSTANCE_NAME =XRAC2)
       )
   )
```

```
Example 15. Extract from tnsnames.ora
```

ADMINISTERING REAL APPLICATION CLUSTERS INSTANCES

Oracle Corporation recommends that you use SRVCTL to administer your Real Application Clusters Database environment. SRVCTL manages configuration information that is used by several Oracle tools.

Before using SRVCTL, ensure that your Global Services Daemon (GSD) is running. To use SRVCTL, you must have already created the configuration information for the database that you want to administer.

You must have done this either by using the Oracle Database Configuration Assistant (DBCA), or by using the srvctl add command. If you have followed the instructions in this document, dbca will have added your database and instances.

```
$ srvctl config database -d XRAC
xrac1 XRAC1 /oracle
xrac2 XRAC2 /oracle
```

Examples of starting and stopping RAC follow:-

```
$ srvctl start database -d XRAC
$ srvctl status database -d XRAC
Instance XRAC1 is running on xrac1
Instance XRAC2 is running on xrac2
```

\$ srvctl stop database -d XRAC \$ srvctl status database -d XRAC Instance XRAC1 is not running on xrac1 Instance XRAC2 is not running on xrac2

```
$ srvctl start instance -d XRAC -i XRAC1
$ srvctl status instance -d XRAC -i XRAC1
Instance XRAC1 is running on xrac1
```

```
$ srvctl status database -d XRAC
Instance XRAC1 is running on xrac1
Instance XRAC2 is not running on xrac2
```

```
$ srvctl stop instance -d XRAC -i XRAC1
```

For further information on srvctl see the Oracle9*i* Real Application Clusters Administration Release 1 (9.0.1) manual.

REFERENCES

- Oracle9i Installation Guide Release 2 for UNIX Systems: AIX-Based Systems, Compaq Tru64 UNIX, HP 9000 Series HP-UX, Linux Intel, and Sun Solaris, Part No. A96167-01
- Oracle9i Release Notes Release 2 (9.2.0.1.0) for Linux Intel (32-bit), Part No. A97349-02
- Oracle9*i* Real Application Clusters Setup and Configuration Release 2 (9.2), March 2002, Part No. A96600-01
- Step-by-step Installation of RAC on Linux, Oracle Metalink Note184821.1.
- Installing Oracle9i RAC on IBM x360 with FAStT700 running RedHat AS 2.1, Version 1.0, September 2002, EMEA Oracle/IBM Joint Solutions Center

DISCLAIMER

This document reflects the IBM / Oracle International Competency Center's understanding about Oracle products running on IBM hardware servers and storage. It was produced and reviewed by the members of the IBM organization called the IBM / Oracle International Competency Center and others.

This document is presented "As-Is" and IBM does not assume responsibility for the statements expressed herein. It reflects the experiences of the IBM / Oracle International Competency Center. If you have questions about the contents of this document, please direct them to the IBM / Oracle International Competency Center (ibmoracl@us.ibm.com).

TRADEMARKS

All brand names are the trademarks of their respective owners.

SPECIAL NOTICE

The material in this document was produced by a joint effort of IBM and Oracle specialists. The material herein is copyrighted by both IBM and Oracle.