RAC Attack Lab Handbook

Jeremy Schneider
Chicago, Illinois, United States
http://www.ardentperf.com

Contributers
Dan Norris (dannorris.com)
Parto Jalili
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Overview

Sources:
- http://www.vmware.com/download/server/ (VMware Server 2.0.1)
- http://edelivery.oracle.com/linux (Enterprise Linux 5.6 [32-bit] - dvd)
- http://metalink.oracle.com/ (PSUs, one-off patches, tech notes)

For More Information:
- http://www.ioug.org/ (IOUG)
- http://www.oracleracsig.org/ (Oracle RAC Special Interest Group)

I referred to Tim Hall’s excellent articles at oracle-base.com about installing 11g RAC on VMware and installing Oracle Linux (in addition to manuals and metalink and such) when I first assembled this. He certainly deserves credit for posting such great step-by-step guides!

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Lab 1: Hardware and Windows Preparation
Lab 1.A: Hardware and Windows Minimum Requirements

This handbook will walk you through the process of creating a two-node Oracle RAC cluster on your own laptop or desktop computer.

A detailed explanation of virtualization is beyond the scope of this lab but the following diagram offers a simple overview of what we are building.

![Diagram](image)

Hardware Minimum Requirements

Most modern laptop and desktop computers should be powerful enough to run a two-node virtual RAC cluster. In a nutshell, these are the recommended minimums:

- Dual-core 2GHz 32-bit processor (it's been done with single-core)
- 4GB memory (it's been done with 3GB)
- Two physical hard disks - not partitions
  - External HD for laptops (it's been done with certain USB flash memory sticks)
  - 50 GB + 10.5 GB free space (it's been done with slightly less)
- Windows XP or Vista (linux & mac are not covered in these instructions)

If your laptop or desktop does not meet these minimum requirements then it is not recommended to try completing the RAC Attack labs. Although it is possible to complete these labs with smaller configurations, there are many potential problems.
Processor
1. From the **Start** menu, choose **RUN**. In the dialog box that appears, type `msinfo32`.

![Run dialog box](image1.png)

2. Select **System Summary** in the left pane. Scroll down to **Processor** in the right pane. Verify that you have at least 2 **cores**.

![System Information](image2.png)
Lab 1.A: Hardware and Windows Minimum Requirements

Memory
3. Scroll down to Memory in the right pane. Verify that Installed Physical Memory is at least 4GB. Also, verify that Available Memory is at least 1.4GB. You can terminate programs which run in the foreground and background to increase the Available Memory.

Hard Disks
4. In the left pane, choose Components → Storage → Disks. Count the number of Disk Drive entries and verify that there are at least two.
Second Hard Disk:

<table>
<thead>
<tr>
<th>Connection</th>
<th>Storage Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside Computer (SATA) -or- USB 3.0 -or- External Hard Disk with GigaBit Network Connection (not shared)</td>
<td>Hard Disk – not shared with anything else</td>
</tr>
<tr>
<td>USB 2.0</td>
<td>Flash Memory (Thumb Drive) advertised / reviewed / tested at least 50 MB/s</td>
</tr>
<tr>
<td>Share Drive on Network -or- External Hard Disk with 100 MegaBit Network Connection (not shared)</td>
<td>Flash Memory (Thumb Drive) advertised / reviewed / tested at least 15 MB/s</td>
</tr>
<tr>
<td></td>
<td>Hard Disk – shared with other programs</td>
</tr>
</tbody>
</table>

A single hard disk will typically get a maximum of around 45 MB/s. (This has been tested for RAC Attack on both laptops and enterprise RAID arrays.) Typical USB Flash Thumb Drives get very, very poor performance and should not be used. Some USB Flash Thumb Drives are marketed for performance; these typically get a maximum around 30 MB/s. In tests for RAC Attack, USB drives worked well for storing ISO images but somewhat poorly for storing virtual machine files.

For a detailed comparison of different connection types, refer to: [http://www.pixelbeat.org/speeds.html](http://www.pixelbeat.org/speeds.html)

Free Space Requirements:

RAC Attack is carefully designed to use three directories and spread out I/O for the best possible responsiveness during labs. You can choose how to spread the directories across your hard disks, and the best configuration may vary depending on your connection and storage type.

<table>
<thead>
<tr>
<th>Directory Name</th>
<th>Description</th>
<th>Free Space</th>
<th>Suggested Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAC11g</td>
<td>Operating System</td>
<td>50 GB</td>
<td>Second Hard Disk (not flash)</td>
</tr>
<tr>
<td></td>
<td>Oracle RAC Software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAC11g-shared</td>
<td>Oracle RAC Data</td>
<td>7.5 GB</td>
<td>Windows Hard Disk*</td>
</tr>
<tr>
<td>RAC11g-iso</td>
<td>OEL installation DVD (read-only)</td>
<td>3 GB</td>
<td>Windows Hard Disk*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>page file is usually here</td>
</tr>
</tbody>
</table>

Note: do not create the RAC11g directory (with OS and Oracle Software) on a Flash Thumb Drive.

We worked hard to reduce the footprint of RAC Attack, however with 11gR2 it’s very difficult to reduce it beyond this.
Windows Preparation

RAC Attack requires a **local windows user account** with a **password** and with **administrative privileges**. You may login using a network or password-free account only if the login account has admin privileges and you know the password for a local account which also has admin privileges (and not an empty password).

If your account is not local, or if your account does not have local admin privileges then you can create an admin account by following the directions here.

*Creating a Local Admin Account:*

5. From the **Start** menu, choose **RUN**. In the dialog box that appears, type `cmd` to launch a command prompt. At the command prompt, run the following two commands (as an admin user):

```
net user admin racattack /add
net localgroup administrators admin /add
```

Login: admin  
Password: racattack

*Verifying the Login Account:*

6. Type **net user %username%** (if you’re using a network or password-free login account then replace `%username%` with the local password-ed admin account).

VERIFY the **username**, VERIFY that **password required** is yes, and VERIFY that local group memberships include **Administrators**.
Lab 1.B: Install VMware Server

1. These labs have been tested with version 2.0.1 of VMware Server. Go to the VMware Server website at http://www.vmware.com/go/getserver

2. Register for an account if you don’t have one already. Write down your license number and download VMware Server. (These labs have been tested with version 2.0.1 of VMware Server.)
3. Run the VMware Installer

![VMware Product Installation]

4. Accept the license agreement and all default options during the installation process.

![Destination Folder]

(C) Copyright © 2011
5. Reboot your computer if you are asked by the VMware installer.
Lab 1.C: Setup Virtual Networks

1. Choose **Manage Virtual Networks** from the start menu.

![Image of Manage Virtual Networks](image1)

2. Click the **Host Virtual Network Mapping** Tab and then click the Right Arrow Button next to **VMnet1**. Choose **Subnet** from the submenu.

![Image of Host Virtual Network Mapping](image2)
3. Set the IP address to **172.16.100.0** and click **OK**.

![Virtual Network Editor](image1)

4. Click the Right Arrow Button next to **Vmnet8** and choose **Subnet** from the submenu.

![Virtual Network Editor](image2)

5. Set the IP address to **192.168.78.0** and click **OK**.

![Virtual Network Editor](image3)
6. Return to the **Summary** tab and VALIDATE:
   - **VMnet1** has subnet 172.16.100.0
   - **VMnet8** has subnet 192.168.78.0

![Virtual Network Editor](image1)

7. Go to the **NAT** tab and VALIDATE that the VMnet host is **VMnet8** and Gateway IP is **192.168.78.2**

![Virtual Network Editor](image2)
Lab 1.D: Setup Virtual Storage

1. As was previously discussed, RAC Attack is carefully designed to use three directories and spread out I/O for the best possible responsiveness during labs. Create these three directories in the destinations that you chose during the previous exercise, taking the guidelines into consideration.

   mkdir C:\RAC11g
   mkdir D:\RAC11g-shared
   mkdir D:\RAC11g-iso

   In the **RAC11g** directory, create two subdirectories called collabn1 and collabn2.

   mkdir C:\RAC11g\collabn1
   mkdir C:\RAC11g\collabn2

2. Launch **VMware Server Home Page** from the start menu.
3. Depending on what web browser you use, you might receive security-related warnings. Proceed through all of these warnings and choose to view the web page.
4. Login to the VMware console with the local windows admin account username and password.

![Login Screen](image1)

5. On the main screen (Summary tab), find the Commands box and choose Add Datastore.

![Commands Screen](image2)

6. Repeat this step three times. Set the datastore names to RAC11g, RAC11g-shared and RAC11g-iso. Choose Local Datastore and use the directory path which you previously chose and created.

![Add Datastore Screen](image3)
7. VERIFY that the three new datastores exist in the Summary screen – named “RAC11g” and “RAC11g-iso” and “RAC11g-shared”. Also VERIFY that the two networks “vmnet1” and “vmnet8” are available as “HostOnly” and “NAT” respectively.

### Datastores

<table>
<thead>
<tr>
<th>Name</th>
<th>Capacity</th>
<th>Free Space</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAC11g</td>
<td>232.82 GB</td>
<td>220.35 GB</td>
<td>C:\RAC11g</td>
</tr>
<tr>
<td>RAC11g-iso</td>
<td>279.45 GB</td>
<td>269.14 GB</td>
<td>D:\RAC11g-iso</td>
</tr>
<tr>
<td>RAC11g-shared</td>
<td>279.45 GB</td>
<td>269.56 GB</td>
<td>D:\RAC11g-shared</td>
</tr>
<tr>
<td>standard</td>
<td>232.82 GB</td>
<td>220.35 GB</td>
<td>C:\Virtual Machines\</td>
</tr>
</tbody>
</table>

### Networks

<table>
<thead>
<tr>
<th>Name</th>
<th>VMnet</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridged</td>
<td>vmnet0</td>
<td>bridged</td>
</tr>
<tr>
<td>HostOnly</td>
<td>vmnet1</td>
<td>hostonly</td>
</tr>
<tr>
<td>NAT</td>
<td>vmnet8</td>
<td>nat</td>
</tr>
</tbody>
</table>
Lab 1.E: Download Oracle Enterprise Linux


2. Enter your Name, Company, Email and Country and review/accept the license and export restrictions before clicking Continue. If you have visited Oracle EDelivery before then make sure to enter your information exactly the same.

If this is the first time you've downloaded software from Oracle, then you might have to wait a few days until you receive an email from Oracle granting you permission to continue.
3. Search for **Oracle Linux** on the **x86-32-bit** platform. Choose Oracle Linux **Release 5 Update 6**.

4. Download the file for **x86 (32 bit)** – not the source.

5. This zip file will contain a single file named **Enterprise-R5-U6-Server-i386-dvd.iso** – extract this file into the **RAC11g-iso** folder and then delete the original zip file.
Lab 2: Linux Install
Lab 2.A: Create VM

1. From the SUMMARY screen, choose Create Virtual Machine. Name the new machine collabn1 and select the RAC11g datastore.

3. Allocate **760M** of memory for the virtual machine and choose **1 processor**.

4. Choose to Create a New Virtual Disk.
5. Set the disk size to **30G** and name the file `collabn1/system.vmdk` – leave all other options at their defaults and click **Next**.

6. Choose to **Add a Network Adapter**.
7. Choose to create a **NAT** network connection.

8. Choose **Don’t Add a CD/DVD Drive**.
9. Choose Don’t Add a Floppy Drive.

10. Choose Don’t Add a USB Controller.
11. Review the configuration and click **Finish**. Do not power on the virtual machine yet.
**Lab 2.B: Prep for OS Installation**

**VIRTUAL CD CONFIGURATION:**

| IDE 0:0 | (RAC11g-iso) Enterprise-R5-U6-Server-i386-dvd.iso |

1. In the **Inventory** tab at the left, select **collabn1** (the virtual machine we just created).

2. From the **Commands** box, click **Add Hardware**. In the window that appears, click **CD/DVD Drive**.
3. Choose to **Use an ISO Image**.

4. Click **Browse** and locate the file **[RAC11g-iso] Enterprise-R5-U6-Server-i386-dvd.iso**.
5. **DO NOT SKIP THIS:** open the section called **Virtual Device Node** and choose **IDE 0:0**. Then click **Next**.

6. Click **Finish** to add the device. Don't power on the virtual machine yet.
7. If you are doing this lab as part of a class, then the instructor may have provided a second VIRTUAL CD which contains all additional needed software. In this case, repeat this entire lab with the configuration details here:

INSTRUCTOR-LED CLASS ONLY: REPEAT ALL STEPS FOR THIS VIRTUAL CD CONFIGURATION:

| IDE 0:1 | [RAC11g.iso] RAC11gR2.iso |

8. After you have repeated this lab for all ISO files, scroll down to the Hardware box and confirm the Virtual Machine settings. They should match this picture (except that the second CD is optional):

![Hardware Configuration screenshot]
Lab 2.C: OS Installation

1. Click the **Console** tab. You might see a message saying that the Remote Console Plug-in is not installed. If you see this message then click **Install plug-in** and follow the directions before continuing (you might have to restart your computer).

2. When the plugin is installed, you should see a large “play” button in the center of the console. Click on the play button to start the VM.
3. When you see the square boxes, click anywhere to open a console window.

4. **CLICK ON THE NEW CONSOLE WINDOW** to let it capture your keyboard and mouse and then press **ENTER** (or just wait and don't press anything) to enter the graphical installer.

**AT ANY TIME PRESS CTRL-ALT TO REGAIN CONTROL OF YOUR KEYBOARD AND MOUSE.**
5. Choose to **SKIP** the media test.

6. Choose **NEXT** when the first installer screen comes up.
7. Accept the default **English** and choose **Next**

8. **US English** and **Next**
9. Select **YES** to initialize the drive.

10. Accept the default layout (with no encryption) and choose **NEXT**
11. Choose **YES** to remove all partitions.

12. Set the hostname to **collabn1.vm.ardentperf.com** and leave DHCP enabled before choosing **NEXT**
13. Choose the timezone where you are located! Let the system clock run on UTC though.

14. Set the root password to racattack
15. Choose **Customize Now** – but don’t choose any “additional tasks”. Then click **NEXT**

16. Choose these package groups:

<table>
<thead>
<tr>
<th>Desktop Environments</th>
<th>GNOME Desktop Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications</td>
<td>Editors</td>
</tr>
<tr>
<td></td>
<td>Graphical Internet</td>
</tr>
<tr>
<td></td>
<td>Text-based Internet</td>
</tr>
<tr>
<td>Development</td>
<td>Development Libraries</td>
</tr>
<tr>
<td></td>
<td>Development Tools</td>
</tr>
<tr>
<td>Servers</td>
<td>Server Configuration Tools</td>
</tr>
<tr>
<td>Base System</td>
<td>Administration Tools</td>
</tr>
<tr>
<td></td>
<td>Base</td>
</tr>
<tr>
<td></td>
<td>System Tools</td>
</tr>
<tr>
<td></td>
<td>X Window System</td>
</tr>
</tbody>
</table>

**DO NOT** CHOOSE *CLUSTER STORAGE OR CLUSTERING.*
17. Choose **NEXT** to start the installation.
18. Choose **REBOOT**
19. After the machine reboots – when you see the Welcome screen – choose **FORWARD**.

20. **ACCEPT** the license and choose **FORWARD**.
21. **DISABLE** the firewall and choose **FORWARD**. Confirm by clicking **YES**.

22. **DISABLE** SELinux before choosing **FORWARD**. Confirm with **YES**.
23. Leave Kdump disabled and choose **FORWARD**.

24. Leave the clock alone (with the wrong time) and click **FORWARD**.
25. Don't create a user; click **FORWARD**. Choose **CONTINUE** to confirm.

26. Choose **FORWARD** to skip sound card config.
27. Choose **FINISH** to close the installer. Click **OK** to reboot.

28. After reboot you will see a login screen.
Lab 2.D: Wrap-up OS Installation

Tip: If you are familiar with the unix command-line, then we recommend connecting through SSH rather than using the VMware console. You can then copy-and-paste the commands from this handbook! Until we configure networking, VMware will assign the address 192.168.78.128.

1. Login as root with password racattack.

2. GNOME is the graphical window environment installed by default in OEL. First, disable GNOME CD automount. Go to the menu System >> Preferences >> Removable Drives and Media.
3. Uncheck all of the options under **Removable Storage** and click **Close**.

![Removable Drives and Media Preferences](image)

4. Open a terminal window.

![Terminal Window](image)
5. From the menus, open **Edit >> Current Profile**.

6. In the **Title and Command** tab, check the box for **Run command as a login shell**, then close the dialog.
7. The editor “gedit” is a simple graphical editor – similar to notepad – and it can be used to edit files on Linux. If you are going to use gedit, then it is helpful if you open Edit > Preferences to disable text wrapping and enable line numbers.

![](image)

8. In a terminal window as the root user, shutdown and disable the automounter.

```
[root@collabn1 ~]# service autofs stop
Stopping automount:          [  OK  ]
[root@collabn1 ~]# umount /media/*
[root@collabn1 ~]# chkconfig autofs off
[root@collabn1 ~]# chkconfig --list autofs
autofs    0:off  1:off  2:off  3:off  4:off  5:off  6:off
```

9. If any of the small CD images in the status bar do not have a green dot, then click on the CD image and choose “Connect to [RAC11g] iso/... on Server”. If a window opens showing the CD contents then make sure to close the window.

![](image)
10. Create two CDROM directories.

[root@collabn1 ~]# cd /mnt
[root@collabn1 mnt]# mkdir cdrom
[root@collabn1 mnt]# mkdir cdrom5

11. Add entries to /etc/fstab for all CD's and then mount them. If you are in a class then you will probably have two CD's. If you are not in a class then you will probably have only one.

[root@collabn1 ~]# ls /dev/cdrom-*
/dev/cdrom-hda     /dev/cdrom-hdb

[root@collabn1 ~]# gedit /etc/fstab
/dev/cdrom-hda     /mnt/cdrom      iso9660 defaults 0 0
/dev/cdrom-hdb     /mnt/cdrom5     iso9660 defaults 0 0

[root@collabn1 mnt]# mount cdrom
[root@collabn1 mnt]# mount cdrom5

12. Install the additional required RPM's

cd /mnt
# From Enterprise Linux 5 CDROM 2
rpm -Uvh */*/compat-libstdc++-33*
rpm -Uvh */*/libaio-devel-0.*
rpm -Uvh */*/unixODBC-2.*
rpm -Uvh */*/unixODBC-devel-2.*
# From Enterprise Linux 5 CDROM 3
rpm -Uvh */*/sysstat-7.*

# Additional required packages which are already installed:
# From Enterprise Linux 5 CDROM 1
rpm -Uvh */*/binutils-2.*
rpm -Uvh */*/elfutils-libelf-0.*
rpm -Uvh */*/glibc-2.*i686*
rpm -Uvh */*/glibc-common-2.*
rpm -Uvh */*/libaio-0.*
rpm -Uvh */*/libgcc-4.*
rpm -Uvh */*/libstdc++-4.*
rpm -Uvh */*/make-3.*
# From Enterprise Linux 5 CDROM 2
rpm -Uvh */*/elfutils-libelf-devel-*
rpm -Uvh */*/glibc-headers*
rpm -Uvh */*/glibc-devel-2.*
rpm -Uvh */*/libgomp*
rpm -Uvh */*/gcc-4.*
rpm -Uvh */*/gcc-c++-4.*
rpm -Uvh */*/libstdc++-devel-4.*

13. Eject the cdrom

[root@collabn1 mnt]# eject /mnt/cdrom
14. Return to the **Summary** tab in the VMware console. From the **Status** box, choose to **Install VMware Tools**. Click the **Install** button to begin.

![VMware Tools Installation Screen]

15. Install VMware client tools and run configuration tool.

   *Tip: you must perform this step in VMware; do not use PuTTY.*

```
[root@collabn1 mnt]# mount /mnt/cdrom
mount: block device /dev/cdrom-hda is write-protected, mounting read-only

[root@collabn1 mnt]# rpm -ivh /mnt/cdrom/VMwareTools-7.7.5-156745.i386.rpm
Preparing...                ########################################### [100%]
1:VMwareTools                ########################################### [100%]
```

The installation of VMware Tools 7.7.5 for Linux completed successfully. You can decide to remove this software from your system at any time by invoking the following command: "rpm -e VMwareTools".

Before running VMware Tools for the first time, you need to configure it for your running kernel by invoking the following command: "/usr/bin/vmware-config-tools.pl".

Enjoy,

   --the VMware team

```
[root@collabn1 cdrom]# vmware-config-tools.pl
```

...  
Choose **NO** to skip the VMware FileSystem Sync Driver (vmsync)  
Choose display size [12] – 1024x768  
Mounting HGFS shares will probably FAIL, but this is ok.
16. Run the network commands. (You can cut and paste the commands into the terminal.) Next, run `vmware-toolbox` and enable clock synchronization.
17. Logout from your session.
Lab 2.E: Create RAC Attack DVD

If you are doing this lab as part of a class, then the instructor may have provided a second VIRTUAL CD which contains all additional needed software. In a class, **SKIP THIS LAB**.

At home: follow these instructions to create the RAC Attack Virtual DVD.

1. Download the latest release of the RAC Attack supporting code (GPL).
   
   ```bash
   [root@collabn1 ~]#
   curl -L github.com/ardentperf/racattack/tarball/master | tar xz
   ```

2. You can view the master list of downloads here:
   

   If you have already downloaded any of these files, you may optionally copy them to the /tmp directory in your virtual machine. When you create the DVD, any remaining files will be automatically downloaded.

3. Create the DVD by running the automatic build script. You will be prompted for your Oracle SSO login and password.

   **Note: If your account is not authorized for Oracle Support then patch downloads will fail.**

   ```bash
   [root@collabn1 ~]# sh ardentperf-racattack-*/makeDVD/auto.sh /mnt/cdrom5
   'oracle-profile' -> '/mnt/cdrom5/oracle-profile'
   root/
   root/fix_cssd/
   root/fix_cssd/fix_cssd.sh
   Oracle SSO Username: <your-username>
   Oracle SSO Password: <your-password>
   LOGGING IN TO ORACLE SSO
   % Total    % Received % Xferd Average Speed   Time    Time     Time
   Current  Dload  Upload  Total  Spent    Left  Speed
   414  733  414  2977    0     0   1621      0 --:--:--  0:00:01 --:--:-- 22383
   DOWNLOADING: /tmp/oracleasmlib-2.0.4-1.el5.i386.rpm
   % Total    % Received % Xferd Average Speed   Time    Time     Time
   Current  Dload  Upload  Total  Spent    Left  Speed
   100 13929 100 13929    0     0  23118      0 --:--:-- --:--:-- 2720k
   '/tmp/oracleasmlib-2.0.4-1.el5.i386.rpm' -> './oracleasmlib-2.0.4-1.el5.i386.rpm'
   DOWNLOADING: /tmp/linux_11gR2_database_1of2.zip
   ( ... )
   FINISHED BUILDING RAC ATTACK DVD
   ```
Lab 2.F: Prep for Oracle

1. Edit /etc/sysctl.conf

   [root@collabn1 ~]# gedit /etc/sysctl.conf
   kernel.shmmni = 4096
   # semaphores: semmsl, semmns, semopm, semmni
   kernel.sem = 250 32000 100 128
   net.ipv4.ip_local_port_range = 1024 65000
   net.core.rmem_default=4194304
   net.core.rmem_max=4194304
   net.core.wmem_default=262144
   net.core.wmem_max=262144

   [root@collabn1 ~]# sysctl -p

2. Edit /etc/security/limits.conf

   oracle       soft    nproc   2047
   oracle       hard    nproc   16384
   oracle       soft    nofile  1024
   oracle       hard    nofile  65536

3. Edit /etc/pam.d/login and insert the following lines BEFORE the "selinux open" line.

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

4. Create groups and users. Make the oracle password racattack

   [root@collabn1 ~]# groupadd oinstall
   [root@collabn1 ~]# groupadd dba
   [root@collabn1 ~]# groupadd oper
   [root@collabn1 ~]# groupadd asmdba
   [root@collabn1 ~]# groupadd asmoper
   [root@collabn1 ~]# groupadd asmadmin
   [root@collabn1 ~]# useradd -u 500 -g oinstall -G dba,oper,asmdba,asmoper,asmadmin oracle
   [root@collabn1 ~]# passwd oracle
   Changing password for user oracle.
   New UNIX password: racattack
   BAD PASSWORD: it is based on a dictionary word
   Retype new UNIX password: racattack
   passwd: all authentication tokens updated successfully.

5. Create directories.

   [root@collabn1 ~]# mkdir -p /u01/grid/oracle/product/11.2.0/grid_1
   [root@collabn1 ~]# mkdir -p /u01/app/oracle/product/11.2.0/db_1
   [root@collabn1 ~]# chown -R oracle:oinstall /u01
6. Logout of your session and login as the oracle user.

7. Disable GNOME CD automount for the oracle user. Go to the menu System >> Preferences >> Removable Drives and Media.
8. Uncheck all of the options under Removable Storage and click Close.

9. Open a terminal window.
10. From the menus, open **Edit >> Current Profile**.

11. In the **Title and Command** tab, check the box for **Run command as a login shell**, then close the dialog.
12. If you are using gedit, then open **Edit > Preferences** to **disable** text wrapping and **enable** line numbers.

![Gedit Preferences](image)

13. Setup ssh equivalence for oracle user.

```
[oracle@collabn1 ~]$ ssh localhost
The authenticity of host 'localhost (127.0.0.1)' can't be established. RSA key fingerprint is 3f:65:e6:77:af:11:84:56:a4:0f:8b:41:b4:2f:8a. Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'localhost (RSA)' to the list of known hosts.
```

```
[oracle@collabn1 ~]$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/oracle/.ssh/id_rsa): ^C
```

```
[oracle@collabn1 ~]$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/oracle/.ssh/id_rsa): ^M [default]
Enter passphrase (empty for no passphrase): ^M [no password]
Enter same passphrase again: ^M [no password]
Your identification has been saved in /home/oracle/.ssh/id_rsa.
Your public key has been saved in /home/oracle/.ssh/id_rsa.pub.
The key fingerprint is:
oracle@collabn1.vm.ardentperf.com
```

```
[oracle@collabn1 ~]$ cat /home/oracle/.ssh/id_rsa.pub >> /home/oracle/.ssh/authorized_keys
```

```
[oracle@collabn1 ~] $ su - root
[oracle@collabn1 ~] # gedit /etc/oratab
grid:/u01/grid/oracle/product/11.2.0/grid_1:N
[oracle@collabn1 ~] # chown oracle:dba /etc/oratab

[oracle@collabn1 ~] # gedit /root/.bashrc
ORAENV_ASK=NO
ORACLE_SID=grid
. oraenv >/dev/null
unset ORAENV_ASK

[oracle@collabn1 ~] # su - oracle
[oracle@collabn1 ~] $ cd /mnt
[oracle@collabn1 ~] $ cat */oracle-profile >>/home/oracle/.bash_profile
export ORACLE_BASE=/u01/app/oracle
export ADMIN_TOP=$ORACLE_BASE/admin
export ORACLE_SID=RAC1
ORAENV_ASK=NO
grep -q "^$ORACLE_SID" /etc/oratab && . oraenv
unset ORAENV_ASK
if [ $USER = "oracle" ]; then
  if [ $SHELL = "/bin/ksh" ]; then
    ulimit -p 16384
    ulimit -n 65536
  else
    ulimit -u 16384 -n 65536
  fi
fi
export PATH=$PATH:/usr/sbin
alias s=sqlplus
alias ss="sqlplus '/ as sysdba'"
alias cdoh="cd $ORACLE_HOME"
alias cda="cd $ADMIN_TOP; cd ./$ORACLE_SID 2>/dev/null||cd ./$ORACLE_SID/%?"
alias cdd="cd $ORACLE_BASE/diag"
alias oenv="echo "SIDs here are: $(egrep -v "(^#|^
$)" /etc/oratab|awk -F: '\|' '{printf$1 " "}\"')"; . oraenv"
    echo "Set environment by typing 'oenv' - default is instance $ORACLE_SID."
    PS1='\h:$PWD[$ORACLE_SID]\$ '"
```

15. **Close and re-open** your terminal sessions so that the new profiles take effect.
16. Install *fix_cssd* script.

*In VMware test environments you usually have a very small amount of memory. Oracle CSS processes can take up a “LOT” of the memory (over 50% in this lab) because it locks several hundred MB in physical memory. In VMware (for both ASM and RAC environments) this may be undesirable. This low-level hack will make the memory swappable at runtime.*

NEVER, EVER, EVER EVEN IN YOUR WILDEST DREAMS THINK ABOUT TRYING THIS ON ANYTHING CLOSE TO A PRODUCTION SYSTEM.

```
[oracle@collabn1 ~]$ su - root
[root@collabn1 ~]# cd /
[root@collabn1 ~]# tar xvf mnt/*/fix_cssd.tar
root/fix_cssd/fix_cssd.sh

[root@collabn1 ~]# gedit /etc/rc.d/rc.local
cd /root/fix_cssd
nohup ./fix_cssd.sh 2>&1 &

[root@collabn1 ~]# /etc/rc.d/rc.local
nohup: appending output to `nohup.out'
```

```
#!/bin/bash
while true
do
  for CHECK in [o]cssd [c]ssdmonitor [c]ssdagent; do
    PROC=$(ps ax|grep "$CHECK")
    if [[ -n "$PROC" ]]
      then
        if [[ -n "$(echo $PROC|awk '{print$3}'|grep L)" ]]
          then
            OPID=$(echo $PROC|awk '{print$1}')
            gdb -p $OPID <<'EOF'
            call munlockall()
            quit
            EOF
            fi
        fi
    done
  done
sleep 60
done
```

Lab 3: Create Cluster
### Lab 3.A: Create Interconnect

1. If the machine is running then **logout and shutdown**. The machine needs to be powered off.

2. In the **Inventory** tab at the left, select **collabn1** (the virtual machine we just created).

3. Scroll down to the **Hardware box** and **CONFIRM** that there is one Network Adapter of type **NAT**.

![Screenshot of VMware Infrastructure Web Access](image-url)
4. From the **Commands** box, click **Add Hardware**. In the window that appears, click **Network Adapter**.

5. Choose to create a **HostOnly** network connection. This will be used for the interconnect. Then click **Next**.
6. Click **FINISH** to create the network adapter.
Lab 3.B: Create Shared Disks

REPEAT STEPS 1-6 FOR ALL FOUR OF THESE DEVICES:

<table>
<thead>
<tr>
<th>Device</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCSI 1:0</td>
<td>3.25 GB</td>
<td>[RAC11g-shared] data.vmdk</td>
</tr>
<tr>
<td>SCSI 1:1</td>
<td>3.25 GB</td>
<td>[RAC11g-shared] backup.vmdk</td>
</tr>
</tbody>
</table>

1. In the **Inventory** tab at the left, select **collabn1**.

2. From the **Commands** box, click **Add Hardware**. In the window that appears, click **Hard Disk**.
3. Choose to Create a New Virtual Disk and click Next.

4. Enter a capacity of 3.25 GB and type the name “[RAC11g-shared] data.vmdk”.
   Choose File Options → Allocate all disk space now.
   Choose Disk Mode → Independent and Persistent.
   Choose Virtual Device Node → SCSI 1:0. Click Next to continue.
5. Click **Finish** to create the disk.

It may take a moment for the disk to appear to the VMware console. Wait until the new disk appears before you continue with the lab.

6. Repeat steps 1-5 for both of these devices

<table>
<thead>
<tr>
<th>Device</th>
<th>Size</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCSI 1:0</td>
<td>3.25 GB</td>
<td>[RAC11g-shared] vote.vmdk</td>
</tr>
<tr>
<td>SCSI 1:1</td>
<td>3.25 GB</td>
<td>[RAC11g-shared] backup.vmdk</td>
</tr>
</tbody>
</table>
7. **CONFIRM** that your list of Hard Disk and network devices matches this screenshot.

8. From the **Commands** box, click **Configure VM**.
9. Click the **Advanced** tab and scroll down to the **Configuration Parameters**. Use the **Add New Entry** button to add the entries listed here. Click **OK** to save the configuration changes.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk.locking</td>
<td>false</td>
</tr>
<tr>
<td>diskLib.dataCacheMaxSize</td>
<td>0</td>
</tr>
<tr>
<td>diskLib.maxUnsyncedWrites</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note:** I have found the following three websites among the most useful while creating custom VMware configurations. They show how powerful and versatile VMware is – even the free VMware Server product.

http://sanbarrow.com/vmx/vmx-advanced.html
http://sanbarrow.com/vmx/vmx-config.ini.html
http://vmfaq.com/?View=entry&EntryID=25
Lab 3.C: Copy VM

1. In Windows Explorer, browse to the folder \[RAC11g]\collabn1. The instructor will give you the location of the \[RAC11g]\ folder. Copy all of the files to the folder \[RAC11g]\collabn2.

Make sure that you copy - not move - the files. Hold down CTRL to copy with drag-and-drop in windows.
2. Browse to [RAC11g]\collabn2. Edit the file collabn1.vmx (the VMware Configuration File). You can use notepad or wordpad to edit the file.
3. Find the line `displayName` and change it to `collabn2` (the new node name), then save and close the file.

```plaintext
displayName = "collabn2"
```
**Lab 3.D: Configure Disks**

1. In the **Inventory** tab at the left, select **collabn1**.

2. Choose the **Console** tab. Click on the play button to start the VM.
3. Login as the `oracle` user with the password `racattack`.

4. Open a terminal window.
5. Switch to the root user with the "su -" command. (The password is racattack.) CONFIRM that two new disks exist and that they have the appropriate sizes. These two lines should exactly match!!

```
[root@collabn1 ~]# cat /proc/partitions
major minor #blocks name
... 
  8   16   5242880  sdb
  8   32   5242880  sdc
```

6. Create partitions on all of the newly created disks with fdisk.

a) run `fdisk /dev/sdb` You should see the message "Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel"
b) type "n" to create a new partition.
c) type "p" for a primary partition.
d) type partition number 1.
e) press enter twice to accept the default first/last cylinders.
f) type "t" to set the partition type.
g) enter partition type da (Non-FS data).
h) type "w" to write the partition table to disk.

Repeat these steps for sdc

```
[root@collabn1 ~]# fdisk /dev/sdb
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF disklabel
Building a new DOS disklabel. Changes will remain in memory only, until you decide to write them. After that, of course, the previous content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

Command (m for help): n
Command action
 e extended
 p primary partition (1-4)
 p
Partition number (1-4): 1
First cylinder (1-652, default 1): ^M [default]
Using default value 1
Last cylinder or +size or +sizeM or +sizeK (1-652, default 652):
Using default value 652

Command (m for help): t
Selected partition 1
Hex code (type L to list codes): da
Changed system type of partition 1 to da (Non-FS data)

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

WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table.
Syncing disks.
Lab 3.E: Configure Node 1

You should already be logged in as the oracle user on collabn1. You should already have a terminal open, logged in as root.

1. As the root user, CONFIRM that the IP address of eth0 starts with 192.168.78 and that the IP address of eth1 starts with 172.16.100.

   [root@collabn1 ~]# ifconfig|grep net
   eth0 Link encap:Ethernet  HWaddr 00:0C:29:07:F5:C0
   inet addr:192.168.78.128  Bcast:192.168.78.255  Mask:255.255.255.0
   inet6 addr: fe80::20c:29ff:fe07:f5c0/64 Scope:Link
   eth1 Link encap:Ethernet  HWaddr 00:0C:29:07:F5:CA
   inet addr:172.16.100.128  Bcast:172.16.100.255  Mask:255.255.255.0
   inet6 addr: fe80::20c:29ff:fe07:f5ca/64 Scope:Link
   inet addr:127.0.0.1  Mask:255.0.0.0
   inet6 addr: ::1/128 Scope:Host

2. Update the IP addresses by directly editing the linux network configuration files. Update the BOOTPROTO line and add the remaining lines.

   [root@collabn1 ~]# cd /etc/sysconfig/network-scripts
   [root@collabn1 network-scripts]# gedit ifcfg-eth0
   BOOTPROTO=none
   IPADDR=192.168.78.51
   NETMASK=255.255.255.0
   GATEWAY=192.168.78.2
   [root@collabn1 network-scripts]# gedit ifcfg-eth1
   BOOTPROTO=none
   IPADDR=172.16.100.51
   NETMASK=255.255.255.0

3. Update the DNS search domain

   [root@collabn1 network-scripts]# gedit /etc/resolv.conf
   search vm.ardentperf.com
   nameserver 192.168.78.2
4. As root, restart the network services by typing `service network restart`. Then confirm the new IP addresses with `ifconfig`. Also confirm the search domain by inspecting `/etc/resolv.conf` – if the file has reverted then edit it again. *(When I wrote this lab, the change stuck after the second time I edited the file.)* Note: you must perform this step in VMware; do not use PuTTY.

![Image of command output](image)

5. Edit `/etc/hosts`. EDIT the line with `127.0.0.1` and then ADD all of the other lines below:

```
[root@collabn1 etc]# vi /etc/hosts
192.168.78.51   collabn1 collabn1.vm.ardentperf.com
192.168.78.61   collabn1-vip collabn1-vip.vm.ardentperf.com
172.16.100.51   collabn1-priv collabn1-priv.vm.ardentperf.com
192.168.78.52   collabn2 collabn2.vm.ardentperf.com
192.168.78.62   collabn2-vip collabn2-vip.vm.ardentperf.com
172.16.100.52   collabn2-priv collabn2-priv.vm.ardentperf.com
192.168.78.250  collab-scan collab-scan.vm.ardentperf.com
192.168.78.251  collab-gns collab-gns.vm.ardentperf.com
::1             localhost6.localdomain6 localhost6
127.0.0.1       localhost.localdomain localhost ARDENTPERF.COM
```

![Image of command output](image)
**Lab 3.F: Configure Node 2**

1. In the VMware console, go to the Virtual Machine menu and choose Add Virtual Machine to Inventory.

2. Browse to RAC11g/collabn2 and open collabn1.vmx. Make sure you browse to the right folder!
3. In the **Inventory** tab at the left, select the new VM – **collabn2**. Choose the **Console** tab and click the play button to start the VM.

4. The VMware console should ask you whether you copied or moved the VM. Answer that you **copied** the files and click **OK**.
5. When you see the square boxes, click anywhere to open a console window.

6. Login as the **oracle** user with the password **racattack**.
7. Open a terminal (Applications >> Accessories >> Terminal) and switch to the root user.

8. **CONFIRM** that the IP address of eth1 starts with 172.16.100.

   ```bash
   [root@collabn1 ~]# ifconfig|grep net
   eth1   Link encap:Ethernet  HWaddr 00:0C:29:C9:3E:C8
          inet addr:172.16.100.129  Bcast:172.16.100.255  Mask:255.255.255.0
          inet addr:127.0.0.1  Mask:255.0.0.0
   
   9. Update the IP addresses by directly editing the linux network configuration files. Update the BOOTPROTO line and add the remaining lines.

      **COMMENT or DELETE** the line which begins with HWADDR.

   ```bash
   [root@collabn1 ~]# cd /etc/sysconfig/network-scripts
   [root@collabn1 network-scripts]# gedit ifcfg-eth0
   BOOTPROTO=none
   #HWADDR=...
   IPADDR=192.168.78.52
   NETMASK=255.255.255.0
   GATEWAY=192.168.78.2

   [root@collabn1 network-scripts]# gedit ifcfg-eth1
   BOOTPROTO=none
   #HWADDR=...
   IPADDR=172.16.100.52
   NETMASK=255.255.255.0
   ```
10. Update the DNS search domain

[root@collabn1 network-scripts]# gedit /etc/resolv.conf
search vm.ardentperf.com
nameserver 192.168.78.2

11. Update the HOSTNAME by editing the linux system configuration files. Set it to collabn2.vm.ardentperf.com. Then change the active system hostname with the hostname command.

[root@collabn1 network-scripts]# gedit /etc/sysconfig/network
HOSTNAME=collabn2.vm.ardentperf.com
[root@collabn1 network-scripts]# hostname collabn2.vm.ardentperf.com

12. As root, restart the network services by typing service network restart. Then confirm the new ip addresses with ifconfig. Confirm that search domain by inspecting /etc/resolv.conf – if the file has reverted then edit it again. (The change stuck after the second time I edited the file while walking through this lab.) Also confirm the new hostname with hostname. Note: you must perform this step in VMware; do not use PuTTY.

Exit your terminal session and start a new one so that you can see the updated hostname in the prompt.
13. Edit `/etc/hosts`. **EDIT** the line with `127.0.0.1` and then **ADD** all of the other lines below:

```
[root@collabn2 etc]# vi /etc/hosts
192.168.78.51  collabn1  collabn1.vm.ardentperf.com
192.168.78.61  collabn1-vip  collabn1-vip.vm.ardentperf.com
172.16.100.51  collabn1-priv  collabn1-priv.vm.ardentperf.com
192.168.78.52  collabn2  collabn2.vm.ardentperf.com
192.168.78.62  collabn2-vip  collabn2-vip.vm.ardentperf.com
172.16.100.52  collabn2-priv  collabn2-priv.vm.ardentperf.com
192.168.78.250  collab-scan  collab-scan.vm.ardentperf.com
192.168.78.251  collab-gns  collab-gns.vm.ardentperf.com
127.0.0.1       localhost.localdomain  localhost
::1             localhost6.localdomain6  localhost6
```
Lab 3.G: SSH and CVU

1. Login to node **collabn2**. As the **oracle** user, make sure that you can ping both nodes on the interconnect and public network.

   ```
   [oracle@collabn2 ~]$ ping -c 1 collabn1
   PING collabn1 (192.168.78.51) 56(84) bytes of data.
   64 bytes from collabn1 (192.168.78.51): icmp_seq=1 ttl=64 time=0.793 ms
   
   [oracle@collabn2 ~]$ ping -c 1 collabn2
   PING collabn2 (192.168.78.52) 56(84) bytes of data.
   64 bytes from collabn2 (192.168.78.52): icmp_seq=1 ttl=64 time=0.024 ms
   
   [oracle@collabn2 ~]$ ping -c 1 collabn1-priv
   PING collabn1-priv (172.16.100.51) 56(84) bytes of data.
   64 bytes from collabn1-priv (172.16.100.51): icmp_seq=1 ttl=128 time=0.901 ms
   
   [oracle@collabn2 ~]$ ping -c 1 collabn2-priv
   PING collabn2-priv (172.16.100.52) 56(84) bytes of data.
   64 bytes from collabn2-priv (172.16.100.52): icmp_seq=1 ttl=64 time=0.058 ms
   ```

2. Store the public keys for the hosts. You can do this with a tool called **ssh-keyscan**.

   ```
   [oracle@collabn2 .ssh]$ ssh-keyscan -t rsa collabn1 collabn1-priv collabn2 collabn2-priv >> ~/.ssh/known_hosts
   # collabn1 SSH-2.0-OpenSSH_4.3
   # collabn1-priv SSH-2.0-OpenSSH_4.3
   # collabn2 SSH-2.0-OpenSSH_4.3
   # collabn2-priv SSH-2.0-OpenSSH_4.3
   ```

3. Test ssh equivalence. It is important that there is no prompt and you are automatically logged in.

   ```
   [oracle@collabn2 .ssh]$ ssh collabn1
   Warning: Permanently added the RSA host key for IP address '192.168.78.51' to the list of known hosts.
   Last login: Tue Apr 15 16:59:36 2008 from collabn2
   [oracle@collabn1 ~]$ exit
   logout
   Connection to collabn1 closed.
   ```
4. Switch to node `collabn1`. As the oracle user, confirm that you can ping both servers. Then copy the `known_hosts` file from `collabn2`.

```
[oracle@collabn1 ~]$ ping -c 1 collabn1
PING collabn1 (192.168.78.51) 56(84) bytes of data.
64 bytes from collabn1 (192.168.78.51): icmp_seq=1 ttl=64 time=0.793 ms

[oracle@collabn1 ~]$ ping -c 1 collabn2
PING collabn2 (192.168.78.52) 56(84) bytes of data.
64 bytes from collabn2 (192.168.78.52): icmp_seq=1 ttl=64 time=0.024 ms

[oracle@collabn1 ~]$ ping -c 1 collabn1-priv
PING collabn1-priv (172.16.100.51) 56(84) bytes of data.
64 bytes from collabn1-priv (172.16.100.51): icmp_seq=1 ttl=128 time=0.901 ms

[oracle@collabn1 ~]$ ping -c 1 collabn2-priv
PING collabn2-priv (172.16.100.52) 56(84) bytes of data.
64 bytes from collabn2-priv (172.16.100.52): icmp_seq=1 ttl=64 time=0.058 ms
```

```
[oracle@collabn1 ~]$ scp collabn2:.ssh/known_hosts ~/.ssh/known_hosts
The authenticity of host 'collabn2 (192.168.78.52)' can't be established.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'collabn2,192.168.78.52' (RSA) to the list of known hosts.
known_hosts                                   100% 3146     3.1KB/s   00:00
```

5. Test ssh equivalence.

```
[oracle@collabn1 ~]$ ssh collabn2
Last login: Tue Apr 15 17:02:29 2008 from collabn2
[oracle@collabn2 ~]$ exit
logout
Connection to collabn2 closed.
```

6. You need to be able to login to yourself too; test this.

```
[oracle@collabn1 ~]$ ssh collabn1
Last login: Tue Apr 15 17:03:39 2008 from collabn2
[oracle@collabn1 ~]$ exit
logout
Connection to collabn1 closed.
```
7. Run `CLUVFY` to validate your hardware and OS installation! The shared disk test will fail; this is OK. Ignore that error.

collabn1:/home/oracle[RAC1]$ /mnt/cdrom*/grid/runcluvfy.sh stage -post hwos -n collabn1,collabn2

Performing post-checks for hardware and operating system setup

Checking node reachability...
Node reachability check passed from node "collabn1"

Checking user equivalence...
User equivalence check passed for user "oracle"

Checking node connectivity...
Checking hosts config file...

Verification of the hosts config file successful

Node connectivity passed for subnet "192.168.78.0" with node(s) collabn2,collabn1
TCP connectivity check passed for subnet "192.168.78.0"

Node connectivity passed for subnet "172.16.100.0" with node(s) collabn2,collabn1
TCP connectivity check passed for subnet "172.16.100.0"

Interfaces found on subnet "192.168.78.0" that are likely candidates for VIP are:
collabn2 eth0:192.168.78.52
collabn1 eth0:192.168.78.51

Interfaces found on subnet "172.16.100.0" that are likely candidates for a private interconnect are:
collabn2 eth1:172.16.100.52
collabn1 eth1:172.16.100.51

Node connectivity check passed

Check for multiple users with UID value 0 passed

Post-check for hardware and operating system setup was successful.
Lab 4: Grid Install (ASM)
Lab 4.A: Setup ASMLib

1. Login to collabn1 as oracle and open a terminal. Switch to the root user.

   [root@collabn1 ~]# su -
   Password:
   [root@collabn1 ~]# 

   [root@collabn1 ~]# cd /mnt

   # OracleASM
   rpm -Uvh */*/oracleasm-support*
   rpm -Uvh */*/oracleasm*el5-2* (Note - that's lowercase EL5-2.)
   # Missing from the install media; copied to RAC Attack DVD.
   rpm -Uvh */oracleasmlib*

   [root@collabn1 mnt]# /etc/init.d/oracleasm configure
   Configuring the Oracle ASM library driver.

   This will configure the on-boot properties of the Oracle ASM library
   driver. The following questions will determine whether the driver is
   loaded on boot and what permissions it will have. The current values
   will be shown in brackets ('[]'). Hitting <ENTER> without typing an
   answer will keep that current value. Ctrl-C will abort.
Default user to own the driver interface []: oracle
Default group to own the driver interface []: dba
Start Oracle ASM library driver on boot (y/n) [n]: y
Fix permissions of Oracle ASM disks on boot (y/n) [y]: y
Writing Oracle ASM library driver configuration: done
Initializing the Oracle ASMLib driver: [ OK ]
Scanning the system for Oracle ASMLib disks: [ OK ]

(Note: the disks are shared so you only need to initialize them once.)

[root@collabn1 ~]# /etc/init.d/oracleasm createdisk data /dev/sdb1
Marking disk "data" as an ASM disk: [ OK ]
[root@collabn1 ~]# /etc/init.d/oracleasm createdisk backup /dev/sdc1
Marking disk "backup" as an ASM disk: [ OK ]
[root@collabn1 ~]# /etc/init.d/oracleasm listdisks
BACKUP  DATA

(Now back to the steps that need to run on both servers!)

[root@collabn1 ~]# ssh collabn2
[root@collabn2 ~]# cd /mnt
# OracleASM
rpm -Uvh */*/oracleasm-support*
rpm -Uvh */*/oracleasm*el5-2*
# Missing from the install media; copied to RAC Attack DVD.
rpm -Uvh */oracleasmlib*
[root@collabn2 ~]# /etc/init.d/oracleasm configure
Configuring the Oracle ASM library driver.
This will configure the on-boot properties of the Oracle ASM library
driver. The following questions will determine whether the driver is
loaded on boot and what permissions it will have. The current values
will be shown in brackets ('[]'). Hitting <ENTER> without typing an
answer will keep that current value. Ctrl-C will abort.

Default user to own the driver interface []: oracle
Default group to own the driver interface []: dba
Start Oracle ASM library driver on boot (y/n) [n]: y
Fix permissions of Oracle ASM disks on boot (y/n) [y]: y
Writing Oracle ASM library driver configuration: done
Initializing the Oracle ASMLib driver: [ OK ]
Scanning the system for Oracle ASMLib disks: [ OK ]
[root@collabn2 ~]# /etc/init.d/oracleasm listdisks
BACKUP  DATA
1. Login to **collabn1** as the **oracle** user and open a terminal.

2. Run **CVU** to validate that you're ready to install CRS. Use the new “fixup” feature of 11gR2 CVU to create a script that can fix missing parameters.

   ```
   [oracle@collabn1 ~]$ /mnt/cdrom*/grid/runcluvfy.sh stage -pre crsinst -n collabn1,collabn2 -fixup -r 11gR2
   ```

   Performing pre-checks for cluster services setup

   Checking node reachability...
   Node reachability check passed from node "collabn1"

   Checking user equivalence...
   User equivalence check passed for user "oracle"
Checking node connectivity...
Checking hosts config file...

Verification of the hosts config file successful

Node connectivity passed for subnet "192.168.78.0" with node(s)
collabn2,collabn1
TCP connectivity check passed for subnet "192.168.78.0"

Node connectivity passed for subnet "172.16.100.0" with node(s)
collabn2,collabn1
TCP connectivity check passed for subnet "172.16.100.0"

Interfaces found on subnet "192.168.78.0" that are likely candidates for VIP are:
collabn2 eth0:192.168.78.52
collabn1 eth0:192.168.78.51

Interfaces found on subnet "172.16.100.0" that are likely candidates for a private interconnect are:
collabn2 eth1:172.16.100.52
collabn1 eth1:172.16.100.51

Node connectivity check passed

**Total memory check failed**
Check failed on nodes:
collabn2,collabn1
Available memory check passed

**Swap space check failed**
Free disk space check passed for "collabn2:/tmp"
Free disk space check passed for "collabn1:/tmp"
User existence check passed for "oracle"
Group existence check passed for "oinstall"
Group existence check passed for "dba"
Membership check for user "oracle" in group "oinstall" [as Primary] passed
Membership check for user "oracle" in group "dba" passed
Run level check passed
Hard limits check passed for "maximum open file descriptors"
Soft limits check passed for "maximum open file descriptors"
Hard limits check passed for "maximum user processes"
Soft limits check passed for "maximum user processes"
System architecture check passed
Kernel version check passed
Kernel parameter check passed for "semmsl"
Kernel parameter check passed for "semmns"
Kernel parameter check passed for "semopm"
Kernel parameter check passed for "semwni"
Kernel parameter check passed for "shmmx"
Kernel parameter check passed for "shmmni"
Kernel parameter check passed for "shmall"

**Kernel parameter check failed for "file-max"**
Check failed on nodes:
collabn2,collabn1
Kernel parameter check passed for "ip_local_port_range"
Kernel parameter check passed for "rmem_default"
Kernel parameter check passed for "rmem_max"
Kernel parameter check passed for "wmem_default"
**Kernel parameter check failed for "wmem_max"**
Check failed on nodes:
  collabn2,collabn1
**Kernel parameter check failed for "aio-max-nr"**
Check failed on nodes:
  collabn2,collabn1
Package existence check passed for "make-3.81"
Package existence check passed for "binutils-2.17.50.0.6"
Package existence check passed for "gcc-4.1.2"
Package existence check passed for "gcc-c++-4.1.2"
Package existence check passed for "libgomp-4.1.2"
Package existence check passed for "libaio-0.3.106"
Package existence check passed for "glibc-2.5-24"
Package existence check passed for "compat-libstdc++-33-3.2.3"
Package existence check passed for "elfutils-libelf-0.125"
Package existence check passed for "elfutils-libelf-devel-0.125"
Package existence check passed for "glibc-common-2.5"
Package existence check passed for "glibc-devel-2.5"
Package existence check passed for "glibc-headers-2.5"
Package existence check passed for "libaio-devel-0.3.106"
Package existence check passed for "libgcc-4.1.2"
Package existence check passed for "libstdc++-4.1.2"
Package existence check passed for "libstdc++-devel-4.1.2"
Package existence check passed for "libstdc++-devel-4.1.2"
Package existence check passed for "sysstat-7.0.2"
Package existence check passed for "unixODBC-2.2.11"
Package existence check passed for "unixODBC-devel-2.2.11"
Package existence check passed for "ksh-20060214"
Check for multiple users with UID value 0 passed
Current group ID check passed
Core file name pattern consistency check passed.
User "oracle" is not part of "root" group. Check passed
Default user file creation mask check passed
Starting Clock synchronization checks using Network Time Protocol (NTP)...
NTP Configuration file check started...
NTP Configuration file check passed
Checking daemon liveness...
**Liveness check failed for "ntpd"**
Check failed on nodes:
  collabn2,collabn1
PRVF-5415 : Check to see if NTP daemon is running failed
Clock synchronization check using Network Time Protocol (NTP) failed
Fixup information has been generated for following node(s):
  collabn2,collabn1
Please run the following script on each node as "root" user to execute the fixups:
'/tmp/CVU_11.2.0.1.0_oracle/runfixup.sh'
Pre-check for cluster services setup was unsuccessful on all the nodes.
3. Switch to the root user and run the fixup script on both nodes.

    collabn1:/home/oracle[RAC1]$ su -
    Password:
    -bash: oraenv: No such file or directory

    [root@collabn1 ~]# /tmp/CVU_11.2.0.1.0_oracle/runfixup.sh
    Response file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.response
    Enable file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.enable
    Log file location: /tmp/CVU_11.2.0.1.0_oracle/orarun.log
    Setting Kernel Parameters...
    fs.file-max = 6815744
    net.ipv4.ip_local_port_range = 9000 65500
    net.core.wmem_max=262144
    net.core.wmem_max = 1048576
    fs.aio-max-nr = 1048576

    [root@collabn1 ~]# ssh collabn2 /tmp/CVU_11.2.0.1.0_oracle/runfixup.sh
    root@collabn2's password:
    /root/.bashrc: line 16: oraenv: No such file or directory
    Response file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.response
    Enable file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.enable
    Log file location: /tmp/CVU_11.2.0.1.0_oracle/orarun.log
    Setting Kernel Parameters...
    fs.file-max = 6815744
    net.ipv4.ip_local_port_range = 9000 65500
    net.core.wmem_max=262144
    net.core.wmem_max = 1048576
    fs.aio-max-nr = 1048576

4. As the oracle user, run CVU again to make sure the fixit script worked. The NTP, memory and swap checks might fail – but this is acceptable for our VMware test cluster.

    [root@collabn1 ~]# exit
    logout
collabn1:/home/oracle[RAC1]$ /mnt/cdrom*/grid/runcluvfy.sh stage -pre crsinst
    -n collabn1,collabn2 -r 11gR2
    ...
    Total memory check failed
    ...
    Swap space check failed
    ...
    Kernel parameter check passed for "file-max"
    ...
    Kernel parameter check passed for "wmem_max"
    Kernel parameter check passed for "aio-max-nr"
    ...
    Liveness check passed for "ntpd"
    ...
Lab 4.C: Install Grid Infrastructure

1. As the oracle user, launch the grid installer. At the first screen, choose Install and Configure Grid Infrastructure for a Cluster and click NEXT.

[oracle@collabn1 ~]$ /mnt/cdrom*/grid/runInstaller
2. Choose **Advanced Installation** and click **NEXT**.

3. Accept the default language (English) and choose **NEXT**.
4. Name the cluster **collab** and make sure that the SCAN name is **collab-scan** with port **1521**, then click **NEXT**.

5. Add node **collabn2** with VIP **collabn2-vip** and choose **NEXT** to validate the cluster configuration.
6. Verify that eth0 on subnet 192.168.78.0 is PUBLIC and that eth1 on subnet 172.16.100.0 is PRIVATE, then click NEXT.

7. Choose to store the Clusterware Files in ASM and choose NEXT.
8. Create a diskgroup called DATA with External Redundancy using only the disk ORCL:DATA and click NEXT.

9. Choose to use the same passwords for all accounts and enter the password racattack, then click NEXT. (Ignore the message that Oracle doesn’t like this password.)
10. Do not use IMPI. Click NEXT.

11. Set the OSDBA group to asmdba, the OSOPER group to asmoper and the OSASM group to asmadmin. Then click NEXT.
12. Accept the **ORACLE_BASE** location of `/u01/app/oracle` and use the **ORACLE_HOME** location of `/u01/grid/oracle/product/11.2.0/grid_1`. Then click **NEXT**.

13. Accept the default inventory location and choose **NEXT**.
14. The prerequisite checks will execute. A warning will be issued saying that three checks failed: physical memory, swap size and network time protocol. Click the CHECK BOX to Ignore All, then click NEXT.

15. SAVE a response file called grid.rsp in the oracle user home directory. Then click FINISH to install grid infrastructure.
16. When prompted, open a terminal as the root user and run the two root.sh scripts. Make sure to run BOTH SCRIPTS on BOTH NODES!
[oracle@collabn1 ~]$ su -
Password: racattack

[root@collabn1 ~]# /u01/app/oraInventory/orainstRoot.sh
Changing permissions of /u01/app/oraInventory.
Adding read,write permissions for group.
Removing read,write,execute permissions for world.

Changing groupname of /u01/app/oraInventory to oinstall.
The execution of the script is complete.

[root@collabn1 ~]# /u01/grid/oracle/product/11.2.0/grid_1/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
ORACLE_OWNER= oracle
ORACLE_HOME= /u01/grid/oracle/product/11.2.0/grid_1

Enter the full pathname of the local bin directory: [/usr/local/bin]: /usr/bin
  Copying dbhome to /usr/bin ...
  Copying oraenv to /usr/bin ...
  Copying coraenv to /usr/bin ...

Entries will be added to the /etc/oratab file as needed by
Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
2011-03-30 16:49:13: Parsing the host name
2011-03-30 16:49:13: Checking for super user privileges
2011-03-30 16:49:13: User has super user privileges
Using configuration parameter file:
/u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
Creating trace directory
LOCAL ADD MODE
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
  root wallet
  root wallet cert
  root cert export
  peer wallet
  profile reader wallet
  pa wallet
  peer wallet keys
  pa wallet keys
  peer cert request
  pa cert request
  peer cert
  pa cert
  peer root cert TP
  profile reader root cert TP
  pa root cert TP
  peer pa cert TP
  pa peer cert TP
  profile reader pa cert TP
  profile reader peer cert TP
  peer user cert
  pa user cert
Adding daemon to initab
CRS-4123: Oracle High Availability Services has been started.
ohasd is starting
CRS-2672: Attempting to start 'ora.gipcd' on 'collabn1'
CRS-2672: Attempting to start 'ora.mdnsd' on 'collabn1'
CRS-2676: Start of 'ora.mdnsd' on 'collabn1' succeeded
CRS-2676: Start of 'ora.gipcd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.gpnpd' on 'collabn1'
CRS-2676: Start of 'ora.gpnpd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.cssdmonitor' on 'collabn1'
CRS-2676: Start of 'ora.cssdmonitor' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.cssd' on 'collabn1'
CRS-2676: Start of 'ora.gipcd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.diskmon' on 'collabn1'
CRS-2676: Start of 'ora.diskmon' on 'collabn1' succeeded
CRS-2676: Start of 'ora.cssd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.ctssd' on 'collabn1'
CRS-2676: Start of 'ora.ctssd' on 'collabn1' succeeded
ASM created and started successfully.

DiskGroup DATA created successfully.

c1scfg: -install mode specified
Successfully accumulated necessary OCR keys.
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
CRS-2672: Attempting to start 'ora.crsd' on 'collabn1'
CRS-2676: Start of 'ora.crsd' on 'collabn1' succeeded
CRS-4256: Updating the profile
Successful addition of voting disk 6b7c5142d3214fe9bf4d4273f0ff11fd.
Successfully replaced voting disk group with +DATA.
CRS-4256: Updating the profile
CRS-4266: Voting file(s) successfully replaced

<table>
<thead>
<tr>
<th>STATE</th>
<th>File Universal Id</th>
<th>File Name Disk group</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONLINE</td>
<td>6b7c5142d3214fe9bf4d4273f0ff11fd (ORCL:DATA)</td>
<td>[DATA]</td>
</tr>
</tbody>
</table>

Located 1 voting disk(s).
CRS-2673: Attempting to stop 'ora.crsd' on 'collabn1'
CRS-2677: Stop of 'ora.crsd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.asm' on 'collabn1'
CRS-2677: Stop of 'ora.asm' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.ctssd' on 'collabn1'
CRS-2677: Stop of 'ora.ctssd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.cssdmonitor' on 'collabn1'
CRS-2677: Stop of 'ora.cssdmonitor' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.cssd' on 'collabn1'
CRS-2677: Stop of 'ora.cssd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd' on 'collabn1'
CRS-2677: Stop of 'ora.gpnpd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.gipcd' on 'collabn1'
CRS-2677: Stop of 'ora.gipcd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.mdnsd' on 'collabn1'
CRS-2677: Stop of 'ora.mdnsd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.mdnsd' on 'collabn1'
CRS-2676: Start of 'ora.mdnsd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.gipcd' on 'collabn1'
CRS-2676: Start of 'ora.gipcd' on 'collabn1' succeeded

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CRS-2672: Attempting to start 'ora.gpnpd' on 'collabn1'
CRS-2676: Start of 'ora.gpnpd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.cssdmonitor' on 'collabn1'
CRS-2676: Start of 'ora.cssdmonitor' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.crsd' on 'collabn1'
CRS-2676: Start of 'ora.crsd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.diskmon' on 'collabn1'
CRS-2676: Start of 'ora.diskmon' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'collabn1'
CRS-2676: Start of 'ora.asm' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.cssd' on 'collabn1'
CRS-2676: Start of 'ora.cssd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.diskmon' on 'collabn1'
CRS-2676: Start of 'ora.diskmon' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'collabn1'
CRS-2676: Start of 'ora.asm' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.crtssd' on 'collabn1'
CRS-2676: Start of 'ora.crtssd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'collabn1'
CRS-2676: Start of 'ora.asm' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.DATA.dg' on 'collabn1'
CRS-2676: Start of 'ora.DATA.dg' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.registry.acfs' on 'collabn1'
CRS-2676: Start of 'ora.registry.acfs' on 'collabn1' succeeded

Preparing packages for installation...
cvuqdisk-1.0.7-1
Configure Oracle Grid Infrastructure for a Cluster... succeeded
Updating inventory properties for clusterware
Starting Oracle Universal Installer...

Checking swap space: must be greater than 500 MB. Actual 968 MB Passed
The inventory pointer is located at /etc/ora-inst.loc
The inventory is located at /u01/app/oraInventory
'UpdateNodeList' was successful.

[root@collabn1 ~]# ssh collabn2
root@collabn2's password: racattack
-bash: oraenv: No such file or directory
[root@collabn2 ~]# /u01/app/oraInventory/orainstRoot.sh
Changing permissions of /u01/app/oraInventory.
Adding read,write permissions for group.
Removing read,write,execute permissions for world.

Changing groupname of /u01/app/oraInventory to oinstall.
The execution of the script is complete.

[root@collabn2 ~]# /u01/grid/oracle/product/11.2.0/grid_1/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
  ORACLE_OWNER= oracle
  ORACLE_HOME= /u01/grid/oracle/product/11.2.0/grid_1

Enter the full pathname of the local bin directory: [/usr/local/bin]: /usr/bin
  Copying dbhome to /usr/bin ...
  Copying oraenv to /usr/bin ...
  Copying coraenv to /usr/bin ...

Entries will be added to the /etc/oratab file as needed by
Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
2011-03-30 17:04:26: Parsing the host name
2011-03-30 17:04:26: Checking for super user privileges
2011-03-30 17:04:26: User has super user privileges
Using configuration parameter file:
  /u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
Creating trace directory
LOCAL ADD MODE
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
Adding daemon to inittab
CRS-4123: Oracle High Availability Services has been started.
ohasd is starting
CRS-4402: The CSS daemon was started in exclusive mode but found an active
CSS daemon on node collabn1, number 1, and is terminating
An active cluster was found during exclusive startup, restarting to join the
cluster
CRS-2672: Attempting to start 'ora.mdnsd' on 'collabn2'
CRS-2672: Attempting to start 'ora.gipcd' on 'collabn2'
CRS-2672: Attempting to start 'ora.gnipd' on 'collabn2'
CRS-2672: Attempting to start 'ora.cssdmonitor' on 'collabn2'
CRS-2672: Attempting to start 'ora.asm' on 'collabn2'
CRS-2676: Start of 'ora.asm' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.crsd' on 'collabn2'
CRS-2676: Start of 'ora.crsd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.evmd' on 'collabn2'
CRS-2676: Start of 'ora.evmd' on 'collabn2' succeeded

collabn2 2011/03/30 17:12:32
/u01/grid/oracle/product/11.2.0/grid_1/cdata/collabn2/backup_20110330_171232.olr
Preparing packages for installation...
cvuqdisk-1.0.7-1
Configure Oracle Grid Infrastructure for a Cluster ... succeeded
Updating inventory properties for clusterware
Starting Oracle Universal Installer...

Checking swap space: must be greater than 500 MB. Actual 1205 MB Passed
The inventory pointer is located at /etc/oraInst.loc
The inventory is located at /u01/app/oraInventory
'UpdateNodeList' was successful.

17. After running both scripts, return to the installer window and click OK to continue running configuration assistants.
18. The Cluster Verification Utility will fail because NTP is not running. If you want to, check the error message at the very end of the logfile. Then click OK to close the messagebox and click NEXT to continue.

19. You should now see the final screen! Click CLOSE to exit the installer.
Lab 4.D: Increase CRS Fencing Timeouts

These steps are not necessary for a test or production environment, but they can help our VMware test cluster to be a bit more stable and provide a good learning opportunity about Grid Infrastructure.

1. Grid Infrastructure must be running on only one node to change these settings. Shutdown the clusterware on collabn2 as user root.

   [oracle@collabn1 ~]$ ssh collabn2
   Last login: Wed Mar 30 14:50:49 2011
   Set environment by typing 'oenv' - default is instance RAC1.

   collabn2:/home/oracle[RAC1]$ su -
   Password: racattack

   [root@collabn2 bin]# crsctl stop crs
   CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources on 'collabn2'
   CRS-2673: Attempting to stop 'ora.crsd' on 'collabn2'
   CRS-2790: Starting shutdown of Cluster Ready Services-managed resources on 'collabn2'
   ...
   ...
   CRS-2793: Shutdown of Oracle High Availability Services-managed resources on 'collabn2' has completed
   CRS-4133: Oracle High Availability Services has been stopped.

2. Return to node collabn1. As the root user, increase the misscount so that CRS waits 1.5 minutes before it reboots. (VMware can drag a little on some laptops!)

   [root@collabn1 ~]$ crsctl get css misscount
   30
   [root@collabn1 ~]$ crsctl set css misscount 90
   Configuration parameter misscount is now set to 90.

3. Increase the disktimeout so that CRS waits 10 minutes for I/O to complete before rebooting.

   [root@collabn1 ~]$ crsctl get css disktimeout
   200
   [root@collabn1 ~]$ crsctl set css disktimeout 600
   Configuration parameter disktimeout is now set to 600.

4. Restart CRS on the other node.

   [root@collabn1 bin]$ ssh collabn2
   [root@collabn2 bin]$ crsctl start crs
**Lab 4.E: Setup ASM**

1. As the oracle user, use the `oenv` macro (from Ardent Performance Computing) to set your environment for the SID `+ASM1`. Then, type `asmca` to launch ASMCA.

```
collabn1:/home/oracle[RAC1]$ oenv
SIDs here are: grid +ASM1
ORACLE_SID = [RAC1] ? +ASM1
The Oracle base for ORACLE_HOME=/u01/grid/oracle/product/11.2.0/grid_1 is 
/u01/app/oracle

collabn1:/home/oracle[+ASM1]$ asmca
```

2. Make sure you’re on the **Disk Groups** tab and then right-click on the **DATA** diskgroup and choose **Edit Attributes**.

![ASM Configuration Assistant](image-url)
3. Set the Database Compatibility and the ADVM Compatibility both to 11.2.0.0.0 then click OK. Choose YES when prompted about advancing database compatibility.

4. Click the Create button to add a new diskgroup.
5. Name the new diskgroup **BACKUP**. Choose **External** redundancy and select the disk **ORCL:BACKUP**. Then, click the **Show Advanced Options** button.

6. Leave the Allocation Unit at **1MB** and set all compatibility parameters to **11.2.0.0.0**, then click **OK**.
7. Click **EXIT** to close the ASM Configuration Assistant.
Lab 5: Grid Install (CFS/NFS)
Lab 5.A: Setup OCFS2

1. Open a terminal as the root user on collabn1.

2. Create mountpoints on both nodes for two OCFS volumes: /u51 and /u52.

   [root@collabn1 ~]# mkdir /u51
   [root@collabn1 ~]# mkdir /u52

   [root@collabn1 ~]# ssh collabn2
   root@collabn2's password: racattack
   [root@collabn2 ~]# mkdir /u51
   [root@collabn2 ~]# mkdir /u52

3. Install and load the OCFS2 packages from the OEL (Oracle Enterprise Linux) installation media and then load the module. Install and load OCFS2 on collabn2 as well.

   [root@collabn1 ~]# cd /mnt

   # From Enterprise Linux 5 Disk 3
   rpm -Uvh */*/ocfs2-tools-1.*
   rpm -Uvh */*/ocfs2-*el5-*
   rpm -Uvh */*/ocfs2console-*
[root@collabn1 mnt]# /etc/init.d/o2cb load
Loading module "configfs": OK
Mounting configfs filesystem at /sys/kernel/config: OK
Loading module "ocfs2_nodemanager": OK
Loading module "ocfs2_dlm": OK
Loading module "ocfs2_dlmfs": OK
Creating directory '/dlm': OK
Mounting ocfs2_dlmfs filesystem at /dlm: OK

[root@collabn1 ~]# ssh collabn2
root@collabn2's password: racattack
[root@collabn2 ~]# cd /mnt

# From Enterprise Linux 5 Disk 3
rpm -Uvh */*/ocfs2-tools-1.*
rpm -Uvh */*/ocfs2-*el5-*
rpm -Uvh */*/ocfs2console-*

[root@collabn2 mnt]# /etc/init.d/o2cb load
Loading module "configfs": OK
Mounting configfs filesystem at /sys/kernel/config: OK
Loading module "ocfs2_nodemanager": OK
Loading module "ocfs2_dlm": OK
Loading module "ocfs2_dlmfs": OK
Creating directory '/dlm': OK
Mounting ocfs2_dlmfs filesystem at /dlm: OK

4. From the terminal window, as root, launch ocfs2console
5. Choose **CONFIGURE NODES...** from the **CLUSTER** menu. If you see a notification that the cluster has been started, then acknowledge it by clicking the **Close** button.
6. Click **ADD** and enter the **collabn1** and the private IP **172.16.100.51**. Accept the default port. Click **OK** to save.

7. Click **ADD** a second time and enter **collabn2** and **172.16.100.52**. Then choose to **APPLY** then click **CLOSE** to close the window.
8. Choose **PROPOGATE CONFIGURATION**... from the **CLUSTER** menu. If you are prompted to accept host keys then type **YES**. Type the root password **racattack** at the both prompts. When you see the message “Finished!” then press **<ALT-C>** to close the window.

9. From the **TASKS** menu, choose **FORMAT** to create the OCFS filesystem. Select */dev/sdb1* and type the volume label **u51-data**. Leave the rest of the options at their defaults and click **OK** to format the volume. Confirm by clicking **YES**.
10. Repeat step 9 for volume /dev/sdc1 and name it u52-backup.
11. Exit the OCFS2 console by selecting **QUIT** from the **FILE** menu.

12. Configure OCFS2 on both nodes. We will use a conservative disk heartbeat timeout (300 seconds) because VMware is slow on some laptops.

```
[root@collabn1 mnt]# /etc/init.d/o2cb configure
Configuring the O2CB driver.

This will configure the on-boot properties of the O2CB driver. The following questions will determine whether the driver is loaded on boot. The current values will be shown in brackets (\[['\]]). Hitting <ENTER> without typing an answer will keep that current value. Ctrl-C will abort.

Load O2CB driver on boot (y/n) [n]: y
Cluster stack backing O2CB [o2cb]:
Cluster to start on boot (Enter "none" to clear) [ocfs2]:
Specify heartbeat dead threshold (>=7) [31]: 300
Specify network idle timeout in ms (>=5000) [30000]:
Specify network keepalive delay in ms (>=1000) [2000]:
Specify network reconnect delay in ms (>=2000) [2000]:
Writing O2CB configuration: OK
Cluster ocfs2 already online
```
[root@collabn1 ~]# ssh collabn2
root@collabn2's password: racattack

[root@collabn2 mnt]# /etc/init.d/o2cb configure
figuring the O2CB driver.

This will configure the on-boot properties of the O2CB driver. The following questions will determine whether the driver is loaded on boot. The current values will be shown in brackets ('[]'). Hitting <ENTER> without typing an answer will keep that current value. Ctrl-C will abort.

Load O2CB driver on boot (y/n) [n]: y
Cluster stack backing O2CB [o2cb]:
Cluster to start on boot (Enter "none" to clear) [ocfs2]:
Specify heartbeat dead threshold (>=7) [31]: 300
Specify network idle timeout in ms (>=5000) [30000]:
Specify network keepalive delay in ms (>=1000) [2000]:
Specify network reconnect delay in ms (>=2000) [2000]:
Writing O2CB configuration: OK
Starting O2CB cluster ocfs2: OK

13. Reload the O2CB driver on the node where you ran ocfs2console.

[root@collabn1 mnt]# /etc/init.d/o2cb force-reload
Stopping O2CB cluster ocfs2: OK
Unmounting ocfs2_dlmfs filesystem: OK
Unloading module "ocfs2_dlmfs": OK
Unmounting configfs filesystem: OK
Unloading module "configfs": OK
Loading filesystem "configfs": OK
Mounting configfs filesystem at /sys/kernel/config: OK
Loading filesystem "ocfs2_dlmfs": OK
Mounting ocfs2_dlmfs filesystem at /dlm: OK
Starting O2CB cluster ocfs2: OK

14. Edit /etc/fstab to add entries for the new file systems.

[root@collabn1 ~]# vi /etc/fstab
LABEL=u51-data /u51 ocfs2 _netdev,datavolume,nointr 0 0
LABEL=u52-backup /u52 ocfs2 _netdev,datavolume,nointr 0 0

15. Mount the volumes and create directories for the oracle database files.

[root@collabn1 ~]# mount /u51
[root@collabn1 ~]# mount /u52
[root@collabn1 ~]# mkdir /u51/oradata
[root@collabn1 ~]# mkdir /u52/oradata
[root@collabn1 ~]# mkdir /u51/cluster
[root@collabn1 ~]# chown oracle:dba /u51/oradata /u52/oradata /u51/cluster
16. Login to the second node `collabn2` as `root` and repeat these steps there.

```
[root@collabn1 ~]# ssh collabn2
root@collabn2's password: racattack

[root@collabn2 ~]# vi /etc/fstab
LABEL=u51-data /u51 ocfs2 _netdev,datavolume,nointr 0 0
LABEL=u52-data /u52 ocfs2 _netdev,datavolume,nointr 0 0

[root@collabn2 ~]# mount /u51
[root@collabn2 ~]# mount /u52
```

```
[root@collabn2 ~]# df -k
Filesystem   1K-blocks   Used   Available Use% Mounted on
/dev/sdb1    4.0G       262M   3.8G    7%   /u51
/dev/sdc1    4.0G       262M   3.8G    7%   /u52
```

```
[root@collabn2 ~]# ls -l /u5*
/u51:
total 8
drwxr-xr-x 2 oracle dba  4096 Jul 31 22:22 cluster
drwxr-xr-x 2 root   root 4096 Jul 31 17:20 lost+found
drwxr-xr-x 2 oracle dba  4096 Jul 31 22:21 oradata

/u52:
total 8
drwxr-xr-x 2 root   root 4096 Jul 31 17:14 lost+found
drwxr-xr-x 2 oracle dba  4096 Jul 31 22:23 oradata
```

17. Optionally, examine `/var/log/messages` and `dmesg` output for status messages related to OCFS2.
**Lab 5.B: Cluster Verification Utility**

1. Login to `collabn1` as the `oracle` user and open a terminal.

2. Run CVU to validate that you're ready to install CRS. Use the new “fixup” feature of 11gR2 CVU to create a script that can fix missing parameters.

   ```
   [oracle@collabn1 ~]$ /mnt/cdrom*/grid/runcluvfy.sh stage -pre crsinst -n collabn1,collabn2 -fixup -r 11gR2
   Performing pre-checks for cluster services setup
   Checking node reachability...
   Node reachability check passed from node "collabn1"
   Checking user equivalence...
   User equivalence check passed for user "oracle"
   ```
Checking node connectivity...
Checking hosts config file...

Verification of the hosts config file successful

Node connectivity passed for subnet "192.168.78.0" with node(s)
collabn2,collabn1
TCP connectivity check passed for subnet "192.168.78.0"

Node connectivity passed for subnet "172.16.100.0" with node(s)
collabn2,collabn1
TCP connectivity check passed for subnet "172.16.100.0"

Interfaces found on subnet "192.168.78.0" that are likely candidates for VIP are:
collabn2 eth0:192.168.78.52
collabn1 eth0:192.168.78.51

Interfaces found on subnet "172.16.100.0" that are likely candidates for a private interconnect are:
collabn2 eth1:172.16.100.52
collabn1 eth1:172.16.100.51

Node connectivity check passed

Total memory check failed
Check failed on nodes:
collabn2,collabn1
Available memory check passed
Swap space check failed
Free disk space check passed for "collabn2:/tmp"
Free disk space check passed for "collabn1:/tmp"
User existence check passed for "oracle"
Group existence check passed for "oinstall"
Group existence check passed for "dba"
Membership check for user "oracle" in group "oinstall" [as Primary] passed
Membership check for user "oracle" in group "dba" passed
Run level check passed
Hard limits check passed for "maximum open file descriptors"
Soft limits check passed for "maximum open file descriptors"
Hard limits check passed for "maximum user processes"
Soft limits check passed for "maximum user processes"
System architecture check passed
Kernel version check passed
Kernel parameter check passed for "semmsl"
Kernel parameter check passed for "semmsns"
Kernel parameter check passed for "sempopm"
Kernel parameter check passed for "semjni"
Kernel parameter check passed for "shmmmax"
Kernel parameter check passed for "shmmjni"
Kernel parameter check passed for "shmall"

Kernel parameter check failed for "file-max"
Check failed on nodes:
collabn2,collabn1
 Kernel parameter check passed for "ip_local_port_range"
Kernel parameter check passed for "rmem_default"
Kernel parameter check passed for "rmem_max"
Kernel parameter check passed for "wmem_default"
**Kernel parameter check failed for "wmem_max"**
Check failed on nodes:
collabn2, collabn1

**Kernel parameter check failed for "aio-max-nr"**
Check failed on nodes:
collabn2, collabn1

Package existence check passed for "make-3.81"
Package existence check passed for "binutils-2.17.50.0.6"
Package existence check passed for "gcc-4.1.2"
Package existence check passed for "gcc-c++-4.1.2"
Package existence check passed for "libgomp-4.1.2"
Package existence check passed for "libaio-0.3.106"
Package existence check passed for "glibc-2.5-24"
Package existence check passed for "compat-libstdc++-33-3.2.3"
Package existence check passed for "elfutils-libelf-0.125"
Package existence check passed for "elfutils-libelf-devel-0.125"
Package existence check passed for "glibc-common-2.5"
Package existence check passed for "glibc-devel-2.5"
Package existence check passed for "glibc-headers-2.5"
Package existence check passed for "libaio-devel-0.3.106"
Package existence check passed for "libglibc-4.1.2"
Package existence check passed for "libstdc++-4.1.2"
Package existence check passed for "libstdc+++devel-4.1.2"
Package existence check passed for "sysstat-7.0.2"
Package existence check passed for "unixODBC-2.2.11"
Package existence check passed for "unixODBC-devel-2.2.11"
Package existence check passed for "ksh-20060214"
Check for multiple users with UID value 0 passed
Current group ID check passed
Core file name pattern consistency check passed.

User "oracle" is not part of "root" group. Check passed
Default user file creation mask check passed

Starting Clock synchronization checks using Network Time Protocol (NTP)...
NTP Configuration file check started...
NTP Configuration file check passed

Checking daemon liveness...
**Liveness check failed for "ntpd"**
Check failed on nodes:
collabn2, collabn1
PRVF-5415 : Check to see if NTP daemon is running failed
Clock synchronization check using Network Time Protocol (NTP) failed

Fixup information has been generated for following node(s):
collabn2, collabn1
Please run the following script on each node as "root" user to execute the fixups:
'/tmp/CVU_11.2.0.1.0_oracle/runfixup.sh'

Pre-check for cluster services setup was unsuccessful on all the nodes.
Lab 5.B: Cluster Verification Utility

3. Switch to the root user and run the fixup script on both nodes.

```
collabn1:/home/oracle[RAC1] $ su -
Password:
-bash: oraenv: No such file or directory

[root@collabn1 ~]# /tmp/CVU_11.2.0.1.0_oracle/runfixup.sh
```

Response file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.response
Enable file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.enable
Log file location: /tmp/CVU_11.2.0.1.0_oracle/orarun.log
Setting Kernel Parameters...
fs.file-max = 6815744
net.ipv4.ip_local_port_range = 9000 65500
net.core.wmem_max=262144
net.core.wmem_max = 1048576
fs.aio-max-nr = 1048576

```
[root@collabn1 ~]# ssh collabn2 /tmp/CVU_11.2.0.1.0_oracle/runfixup.sh
```

root@collabn2's password:
/root/.bashrc: line 16: oraenv: No such file or directory

Response file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.response
Enable file being used is :/tmp/CVU_11.2.0.1.0_oracle/fixup.enable
Log file location: /tmp/CVU_11.2.0.1.0_oracle/orarun.log
Setting Kernel Parameters...
fs.file-max = 6815744
net.ipv4.ip_local_port_range = 9000 65500
net.core.wmem_max=262144
net.core.wmem_max = 1048576
fs.aio-max-nr = 1048576

4. As the oracle user, run CVU again to make sure the fixit script worked. The NTP, memory and swap checks might fail – but this is acceptable for our VMware test cluster.

```
[root@collabn1 ~]# exit
logout

collabn1:/home/oracle[RAC1] $ /mnt/cdrom*/grid/runcluvfy.sh stage -pre crsinst -n collabn1,collabn2 -r 11gR2
```

... Total memory check failed
... Swap space check failed
... Kernel parameter check passed for "file-max"
... Kernel parameter check passed for "wmem_max"
... Kernel parameter check passed for "aio-max-nr"
... Liveness check failed for "ntpd"
...
Note: Oracle recommends not to store cluster files (OCR, Voting Disk) in OCFS2. However they offer robust support for certain NFS appliances and big-iron cluster filesystems. We will use OCFS2 here to practice 11gR2 with a filesystem.

11gR2 clusterware has a bug – and it doesn’t work with OCFS2 (though it is supposed to). To work around this bug, we will present the OCFS2 directory to clusterware with a local “loopback” NFS mount.

1. As the root user, Follow the steps below to setup the local NFS mount on node collabn1.

[root@collabn1 ~]# mkdir /u61
[root@collabn1 ~]# vi /etc/fstab
# create an NFS mount on u61 which points back to u51
localhost:/u51 /u61 nfs \
  rw,bg,hard,nointr,rsize=32768,wsize=32768,tcp,vers=3,timeo=600,noac

[root@collabn1 ~]# vi /etc/exports
/u51 *(rw,no_root_squash,sync)

[root@collabn1 ~]# chkconfig nfs on
[root@collabn1 ~]# service nfs start
[root@collabn1 ~]# mount /u61

2. Repeat all of these steps on node collabn2.

[root@collabn1 ~]# ssh collabn2

[root@collabn2 ~]# mkdir /u61
[root@collabn2 ~]# vi /etc/fstab
# create an NFS mount on u61 which points back to u51
localhost:/u51 /u61 nfs \
  rw,bg,hard,nointr,rsize=32768,wsize=32768,tcp,vers=3,timeo=600,noac

[root@collabn2 ~]# vi /etc/exports
/u51 *(rw,no_root_squash,sync)

[root@collabn2 ~]# chkconfig nfs on
[root@collabn2 ~]# service nfs start
[root@collabn2 ~]# mount /u61
Lab 5.D: Install Grid Infrastructure

Note: Oracle recommends not to store cluster files (OCR, Voting Disk) in OCFS2. However they offer robust support for certain NFS appliances and big-iron cluster filesystems. We will use OCFS2 here to practice 11gR2 with a filesystem.

1. As the oracle user, launch the grid installer. At the first screen, choose Install and Configure Grid Infrastructure for a Cluster and click NEXT.

[oracle@collabn1 ~]$ /mnt/cdrom/grid/runInstaller
2. Choose **Advanced Installation** and click **NEXT**.
3. Accept the default language (English) and choose **NEXT**.

4. Name the cluster **collab** and make sure that the SCAN name is **collab-scan** with port **1521**, then click **NEXT**.
5. Add node `collabn2` with VIP `collabn2-vip` and choose NEXT to validate the cluster configuration.

6. Verify that `eth0` on subnet 192.168.78.0 is PUBLIC and that `eth1` on subnet 172.16.100.0 is PRIVATE, then click NEXT.
7. Choose to store the Clusterware Files in the **Shared File System** and choose **NEXT**.

8. For the OCR, choose **External Redundancy** and type the path `/u61/cluster/ocr`. (This is the NFS location from the BUG WORKAROUND.) Click **NEXT** to continue.
9. For the Voting Disk, do the same – choose External Redundancy and type the path /u61/cluster/vdisk. (Again, this is the NFS location from the BUG WORKAROUND.) Click NEXT to continue.

10. Choose to use the same passwords for all accounts and enter the password racattack, then click NEXT. (Ignore the message that Oracle doesn't like this password.)
11. Do not use IMPI. Click NEXT.

12. Set the OSDBA group to asmdba, the OSOPER group to asmoper and the OSASM group to asmadmin. Then click NEXT.
13. Accept the `ORACLE_BASE` location of `/u01/app/oracle` and use the `ORACLE_HOME` location of `/u01/grid/oracle/product/11.2.0/grid_1`. Then click NEXT.

14. Accept the default inventory location and choose NEXT.
15. The prerequisite checks will execute. A warning will be issued saying that three checks failed: physical memory, swap size and network time protocol. Click the CHECK BOX to Ignore All, then click NEXT.

16. SAVE a response file called grid.rsp in the oracle user home directory. Then click FINISH to install grid infrastructure.
17. When prompted, open a terminal as the root user and run the two root.sh scripts. Make sure to run BOTH SCRIPTS on BOTH NODES!
[oracle@collabn1 ~]$ su -
Password: racattack

[root@collabn1 ~]# /u01/app/oraInventory/orainstRoot.sh
Changing permissions of /u01/app/oraInventory.
Adding read, write permissions for group.
Removing read, write, execute permissions for world.

Changing groupname of /u01/app/oraInventory to oinstall.
The execution of the script is complete.

[root@collabn1 ~]# /u01/grid/oracle/product/11.2.0/grid_1/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
  ORACLE_OWNER= oracle
  ORACLE_HOME= /u01/grid/oracle/product/11.2.0/grid_1

Enter the full pathname of the local bin directory: [/usr/local/bin]: /usr/bin
  Copying dbhome to /usr/bin ...
  Copying oraenv to /usr/bin ...
  Copying coraenv to /usr/bin ...

Entries will be added to the /etc/oratab file as needed by
Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
2011-03-30 16:49:13: Parsing the host name
2011-03-30 16:49:13: Checking for super user privileges
2011-03-30 16:49:13: User has super user privileges
Using configuration parameter file:
  /u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
Creating trace directory
LOCAL ADD MODE
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
  root wallet
  root wallet cert
  root cert export
  peer wallet
  profile reader wallet
  pa wallet
  peer wallet keys
  pa wallet keys
  peer cert request
  pa cert request
  peer cert
  pa cert
  peer root cert TP
  profile reader root cert TP
  pa root cert TP
  peer pa cert TP
  pa peer cert TP
  profile reader pa cert TP
  profile reader peer cert TP
  peer user cert
  pa user cert
Adding daemon to initab
CRS-4123: Oracle High Availability Services has been started.
chsd is starting
CRS-2672: Attempting to start 'ora.gipcd' on 'collabn1'
CRS-2672: Attempting to start 'ora.mdnsd' on 'collabn1'
CRS-2676: Start of 'ora.mdnsd' on 'collabn1' succeeded
CRS-2676: Start of 'ora.gipcd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.gpnpd' on 'collabn1'
CRS-2676: Start of 'ora.gpnpd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.crsdmonitor' on 'collabn1'
CRS-2676: Start of 'ora.crsdmonitor' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.cssd' on 'collabn1'
CRS-2672: Attempting to start 'ora.diskmon' on 'collabn1'
CRS-2676: Start of 'ora.diskmon' on 'collabn1' succeeded
CRS-2676: Start of 'ora.cssd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.ctssd' on 'collabn1'
CRS-2676: Start of 'ora.ctssd' on 'collabn1' succeeded
clscfg: -install mode specified
Successfully accumulated necessary OCR keys.
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.

CRS-2672: Attempting to start 'ora.crsd' on 'collabn1'
CRS-2676: Start of 'ora.crsd' on 'collabn1' succeeded
Now formatting voting disk: /u61/cluster/vdk.
CRS-4603: Successful addition of voting disk /u61/cluster/vdk.

<table>
<thead>
<tr>
<th>STATE</th>
<th>File Universal Id</th>
<th>File Name</th>
<th>Disk group</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONLINE</td>
<td>59f9f62cc0f4f4f35bff552ced06e35ee</td>
<td>(/u61/cluster/vdk)</td>
<td></td>
</tr>
</tbody>
</table>

Located 1 voting disk(s).

CRS-2673: Attempting to stop 'ora.crsd' on 'collabn1'
CRS-2677: Stop of 'ora.crsd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.asm' on 'collabn1'
CRS-2677: Stop of 'ora.asm' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.ctssd' on 'collabn1'
CRS-2677: Stop of 'ora.ctssd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.crsdmonitor' on 'collabn1'
CRS-2677: Stop of 'ora.crsdmonitor' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.cssd' on 'collabn1'
CRS-2677: Stop of 'ora.cssd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.cppd' on 'collabn1'
CRS-2677: Stop of 'ora.cppd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd' on 'collabn1'
CRS-2677: Stop of 'ora.gpnpd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.gipcd' on 'collabn1'
CRS-2677: Stop of 'ora.gipcd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.diskmon' on 'collabn1'
CRS-2677: Stop of 'ora.diskmon' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.cssdmonitor' on 'collabn1'
CRS-2677: Stop of 'ora.cssdmonitor' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.cssd' on 'collabn1'
CRS-2677: Stop of 'ora.cssd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.mdnsd' on 'collabn1'
CRS-2677: Stop of 'ora.mdnsd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.gpnpd' on 'collabn1'
CRS-2677: Stop of 'ora.gpnpd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.gipcd' on 'collabn1'
CRS-2677: Stop of 'ora.gipcd' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.diskmon' on 'collabn1'
CRS-2677: Stop of 'ora.diskmon' on 'collabn1' succeeded
CRS-2673: Attempting to stop 'ora.cssd' on 'collabn1'
CRS-2677: Stop of 'ora.cssd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.ctssd' on 'collabn1'
CRS-2676: Start of 'ora.ctssd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'collabn1'
CRS-2676: Start of 'ora.asm' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.crssd' on 'collabn1'
CRS-2676: Start of 'ora.crssd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.evmd' on 'collabn1'
CRS-2676: Start of 'ora.evmd' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'collabn1'
CRS-2676: Start of 'ora.asm' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.DATA.dg' on 'collabn1'
CRS-2676: Start of 'ora.DATA.dg' on 'collabn1' succeeded
CRS-2672: Attempting to start 'ora.registry.acfs' on 'collabn1'
CRS-2676: Start of 'ora.registry.acfs' on 'collabn1' succeeded

collabn1 2011/03/30 16:59:35
/u01/grid/oracle/product/11.2.0/grid_1/cdata/collabn1/backup_20110330_165935.rol
Preparing packages for installation...
cvuqdisk-1.0.7-1
Configure Oracle Grid Infrastructure for a Cluster ... succeeded
Updating inventory properties for clusterware
Starting Oracle Universal Installer...

Checking swap space: must be greater than 500 MB. Actual 968 MB Passed
The inventory pointer is located at /etc/oraInst.loc
The inventory is located at /u01/app/oraInventory
'UpdateNodeList' was successful.

[root@collabn1 ~]# ssh collabn2
root@collabn2's password: racattack
-bash: oraenv: No such file or directory
[root@collabn2 ~]# /u01/app/oraInventory/orainstRoot.sh
Changing permissions of /u01/app/oraInventory.
Adding read,write permissions for group.
Removing read,write,execute permissions for world.

Changing groupname of /u01/app/oraInventory to oinstall.
The execution of the script is complete.

[root@collabn2 ~]# /u01/grid/oracle/product/11.2.0/grid_1/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
ORACLE_OWNER= oracle
ORACLE_HOME= /u01/grid/oracle/product/11.2.0/grid_1

Enter the full pathname of the local bin directory: [/usr/local/bin]: /usr/bin
Copying dbhome to /usr/bin ...
Copying oraenv to /usr/bin ...
Copying coraenv to /usr/bin ...

Entries will be added to the /etc/oratab file as needed by Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
2011-03-30 17:04:26: Parsing the host name
2011-03-30 17:04:26: Checking for super user privileges
2011-03-30 17:04:26: User has super user privileges
Using configuration parameter file:
/u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
Creating trace directory
LOCAL ADD MODE
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
Adding daemon to inittab
CRS-4123: Oracle High Availability Services has been started.
chasd is starting
CRS-4402: The CSS daemon was started in exclusive mode but found an active CSS daemon on node collabn1, number 1, and is terminating
An active cluster was found during exclusive startup, restarting to join the cluster
CRS-2672: Attempting to start 'ora.mdnsd' on 'collabn2'
CRS-2676: Start of 'ora.mdnsd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.gipcd' on 'collabn2'
CRS-2676: Start of 'ora.gipcd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.gpnpd' on 'collabn2'
CRS-2676: Start of 'ora.gpnpd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.gpnpd' on 'collabn2'
CRS-2676: Start of 'ora.gpnpd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.cssdmonitor' on 'collabn2'
CRS-2676: Start of 'ora.cssdmonitor' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.cssd' on 'collabn2'
CRS-2676: Start of 'ora.cssd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.diskmon' on 'collabn2'
CRS-2676: Start of 'ora.diskmon' on 'collabn2' succeeded
CRS-2672: Start of 'ora.cssd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.ctssd' on 'collabn2'
CRS-2676: Start of 'ora.ctssd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.drivers.acfs' on 'collabn2'
CRS-2676: Start of 'ora.drivers.acfs' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.asm' on 'collabn2'
CRS-2676: Start of 'ora.asm' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.crsd' on 'collabn2'
CRS-2676: Start of 'ora.crsd' on 'collabn2' succeeded
CRS-2672: Attempting to start 'ora.evmd' on 'collabn2'
CRS-2676: Start of 'ora.evmd' on 'collabn2' succeeded

collabn2 2011/03/30 17:12:32
/u01/grid/oracle/product/11.2.0/grid_1/cdata/collabn2/backup_20110330_171232. olr
Preparing packages for installation...
cvugdisk-1.0.7-1
Configure Oracle Grid Infrastructure for a Cluster ... succeeded
Updating inventory properties for clusterware
Starting Oracle Universal Installer...

Checking swap space: must be greater than 500 MB. Actual 1205 MB Passed
The inventory pointer is located at /etc/oraInst.loc
The inventory is located at /u01/app/oraInventory
'UpdateNodeList' was successful.

18. After running both scripts, return to the installer window and click OK to continue running configuration assistants.
19. The Cluster Verification Utility will fail because NTP is not running. If you want to, check the error message at the very end of the logfile. Then click OK to close the messagebox and click NEXT to continue.

20. You should now see the final screen! Click CLOSE to exit the installer.
Lab 5.E: Increase CRS Fencing Timeouts

These steps are not necessary for a test or production environment, but they can help our VMware test cluster to be a bit more stable and provide a good learning opportunity about Grid Infrastructure.

1. Grid Infrastructure must be running on only one node to change these settings. Shutdown the clusterware on collabn2 as user root.

```
[oracle@collabn1 ~]$ ssh collabn2
Last login: Wed Mar 30 14:50:49 2011
Set environment by typing 'oenv' - default is instance RAC1.
collabn2:/home/oracle[RAC1]$ su -
Password: racattack
[root@collabn2 bin]# crsctl stop crs
CRS-2791: Starting shutdown of Oracle High Availability Services-managed resources on 'collabn2'
CRS-2673: Attempting to stop 'ora.crsd' on 'collabn2'
CRS-2790: Starting shutdown of Cluster Ready Services-managed resources on 'collabn2'
...
...
CRS-2793: Shutdown of Oracle High Availability Services-managed resources on 'collabn2' has completed
CRS-4133: Oracle High Availability Services has been stopped.
```

2. Return to node collabn1. As the root user, increase the misscount so that CRS waits 1.5 minutes before it reboots. (VMware can drag a little on some laptops!)

```
[root@collabn1 ~]# crsctl get css misscount
30
[root@collabn1 ~]# crsctl set css misscount 90
Configuration parameter misscount is now set to 90.
```

3. Increase the disktimeout so that CRS waits 10 minutes for I/O to complete before rebooting.

```
[root@collabn1 ~]# crsctl get css disktimeout
200
[root@collabn1 ~]# crsctl set css disktimeout 600
Configuration parameter disktimeout is now set to 600.
```

4. Restart CRS on the other node.

```
[root@collabn1 bin]# ssh collabn2
[root@collabn2 bin]# crsctl start crs
```
Lab 6: RAC Install
Lab 6.A: Install Database Software

1. Login to collabn1 as the oracle user and open a terminal. Run CLUVFY to check that you're ready to start the DB install. The memory, swap and NTP/time checks may fail but everything else should succeed.

[oracle@collabn1 ~]$ /mnt/cdrom*/grid/runcluvfy.sh stage -pre dbinst -n collabn1,collabn2 -r 11gR2
Performing pre-checks for database installation

Checking node reachability...
Node reachability check passed from node "collabn1"

Checking user equivalence...
User equivalence check passed for user "oracle"

Checking node connectivity...

Checking hosts config file...

Verification of the hosts config file successful

Node connectivity passed for subnet "192.168.78.0" with node(s)
collabn2,collabn1
TCP connectivity check passed for subnet "192.168.78.0"

Node connectivity passed for subnet "172.16.100.0" with node(s)
collabn2,collabn1
TCP connectivity check passed for subnet "172.16.100.0"

Interfaces found on subnet "192.168.78.0" that are likely candidates for VIP are:
collabn2 eth0:192.168.78.52 eth0:192.168.78.250 eth0:192.168.78.62
collabn1 eth0:192.168.78.51 eth0:192.168.78.61

Interfaces found on subnet "172.16.100.0" that are likely candidates for a private interconnect are:
collabn2 eth1:172.16.100.52
collabn1 eth1:172.16.100.51

Node connectivity check passed

Total memory check failed
Check failed on nodes:
collabn2,collabn1
Available memory check passed

Swap space check failed
Free disk space check passed for
"collabn2:/u01/grid/oracle/product/11.2.0/grid_1,collabn2:/tmp"
Free disk space check passed for
"collabn1:/u01/grid/oracle/product/11.2.0/grid_1,collabn1:/tmp"
User existence check passed for "oracle"
Group existence check passed for "oinstall"
Group existence check passed for "dba"
Membership check for user "oracle" in group "oinstall" [as Primary] passed
Membership check for user "oracle" in group "dba" passed
Run level check passed
Hard limits check passed for "maximum open file descriptors"
Soft limits check passed for "maximum open file descriptors"
Hard limits check passed for "maximum user processes"
Soft limits check passed for "maximum user processes"
System architecture check passed
Kernel version check passed
Kernel parameter check passed for "semmsl"
Kernel parameter check passed for "semmsns"
Kernel parameter check passed for "semopm"
Kernel parameter check passed for "semmni"
Kernel parameter check passed for "shmmmax"
Kernel parameter check passed for "shmmni"
Kernel parameter check passed for "shmall"
Kernel parameter check passed for "file-max"
Kernel parameter check passed for "ip_local_port_range"
Kernel parameter check passed for "rmem_default"
Kernel parameter check passed for "rmem_max"
Kernel parameter check passed for "wmem_default"
Kernel parameter check passed for "wmem_max"
Kernel parameter check passed for "aio-max-nr"
Package existence check passed for "make-3.81"
Package existence check passed for "binutils-2.17.50.0.6"
Package existence check passed for "gcc-4.1.2"
Package existence check passed for "libgomp-4.1.2"
Package existence check passed for "libaio-0.3.106"
Package existence check passed for "glibc-2.5-24"
Package existence check passed for "compat-libstdc++-33-3.2.3"
Package existence check passed for "elfutils-libelf-0.125"
Package existence check passed for "elfutils-libelf-devel-0.125"
Package existence check passed for "elfutils-libelf-devel-static-0.125"
Package existence check passed for "glibc-common-2.5"
Package existence check passed for "glibc-devel-2.5"
Package existence check passed for "glibc-headers-2.5"
Package existence check passed for "kernel-headers-2.6.18"
Package existence check passed for "gcc-c++-4.1.2"
Package existence check passed for "libaio-devel-0.3.106"
Package existence check passed for "libgcc-4.1.2"
Package existence check passed for "libstdc++-4.1.2"
Package existence check passed for "libstdc++-devel-4.1.2"
Package existence check passed for "sysstat-7.0.2"
Package existence check passed for "unixODBC-2.2.11"
Package existence check passed for "unixODBC-devel-2.2.11"
Package existence check passed for "ksh-20060214"
Check for multiple users with UID value 0 passed
Current group ID check passed
Default user file creation mask check passed

Checking CRS integrity...

CRS integrity check passed
Checking Cluster manager integrity...

Checking CSS daemon...
Oracle Cluster Synchronization Services appear to be online.

Cluster manager integrity check passed

Checking if Clusterware is installed on all nodes...
Check of Clusterware install passed

Checking if CTSS Resource is running on all nodes...
CTSS resource check passed

Querying CTSS for time offset on all nodes...
Query of CTSS for time offset passed

Check CTSS state started...
CTSS is in Observer state. Switching over to clock synchronization checks using NTP

Starting Clock synchronization checks using Network Time Protocol (NTP)...

NTP Configuration file check started...
NTP Configuration file check passed

Checking daemon liveness...

**Liveness check failed for "ntpd"**
Check failed on nodes:
collabn2, collabn1

PRVF-5415 : Check to see if NTP daemon is running failed
Clock synchronization check using Network Time Protocol (NTP) failed

PRVF-9652 : Cluster Time Synchronization Services check failed
Checking time zone consistency...
Time zone consistency check passed.

Pre-check for database installation was unsuccessful on all the nodes.
2. Launch the database installer with `/mnt/cdrom*/database/runInstaller`.

3. On the first screen, leave the email **blank** and uncheck the “security update” option. Click **NEXT** to continue. Choose **YES** to verify that you don't want to enter an email address.
4. Choose to Install Database Software Only and click NEXT.

5. Choose Real Application Clusters database installation and select all nodes. Click NEXT to continue.
6. Select the **English** language and click **NEXT**.

7. Choose **Enterprise Edition** install and click **NEXT**.
8. Confirm that the ORACLE_BASE is /u01/app/oracle and change the ORACLE_HOME to /u01/app/oracle/product/11.2.0/db_1. Click NEXT to continue.

9. Verify that the OSDBA group is dba and the OSOPER group is oper. Click NEXT to continue.
10. The prerequisite checks will execute. A warning will be issued saying that three checks failed: physical memory, swap size and network time protocol. Click the CHECK BOX to Ignore All, then click NEXT.

11. SAVE a response file called db.rsp in the oracle user home directory. Then click FINISH to install the oracle database software.
12. When prompted, open a terminal as the root user and run the root.sh script. Enter /usr/bin as the local bin directory and overwrite the files which were previously installed by grid infrastructure. Make sure to run it on BOTH NODES!
[oracle@collabn1 ~]$ su -
Password: racattack

[root@collabn1 ~]# /u01/app/oracle/product/11.2.0/db_1/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
  ORACLE_OWNER= oracle
  ORACLE_HOME= /u01/app/oracle/product/11.2.0/db_1

Enter the full pathname of the local bin directory: [/usr/local/bin]: /usr/bin

The file "dbhome" already exists in /usr/bin.  Overwrite it? (y/n) [n]: y
  Copying dbhome to /usr/bin ...

The file "oraenv" already exists in /usr/bin.  Overwrite it? (y/n) [n]: y
  Copying oraenv to /usr/bin ...

The file "coraenv" already exists in /usr/bin.  Overwrite it? (y/n) [n]: y
  Copying coraenv to /usr/bin ...

Entries will be added to the /etc/oratab file as needed by 
Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
Finished product-specific root actions.

[root@collabn1 ~]# ssh collabn2
root@collabn2's password: racattack
Last login: Tue Apr 15 19:34:33 2008 from 192.168.78.1

[root@collabn2 ~]# /u01/app/oracle/product/11.2.0/db_1/root.sh
Running Oracle 11g root.sh script...

The following environment variables are set as:
  ORACLE_OWNER= oracle
  ORACLE_HOME= /u01/app/oracle/product/11.2.0/db_1

Enter the full pathname of the local bin directory: [/usr/local/bin]: /usr/bin

The file "dbhome" already exists in /usr/bin.  Overwrite it? (y/n) [n]: y
  Copying dbhome to /usr/bin ...

The file "oraenv" already exists in /usr/bin.  Overwrite it? (y/n) [n]: y
  Copying oraenv to /usr/bin ...

The file "coraenv" already exists in /usr/bin.  Overwrite it? (y/n) [n]: y
  Copying coraenv to /usr/bin ...

Entries will be added to the /etc/oratab file as needed by 
Database Configuration Assistant when a database is created
Finished running generic part of root.sh script.
Now product-specific root actions will be performed.
Finished product-specific root actions.
13. After running both scripts, return to the installer window and click **OK** to finish the installation. You should now see the final screen! Click **CLOSE** to exit the installer.
Lab 7: Create Database
**Lab 7.A: Create DB**

1. Login to a terminal as the oracle user. Type `. oraenv` to setup the environment. Leave the default SID and enter `/u01/app/oracle/product/11.2.0/db_1` for the ORACLE_HOME. Then type `dbca` to launch the Database Configuration Assistant.

2. At the first prompt, choose Real Application Clusters Database and click NEXT.
3. Choose to **CREATE A DATABASE** then click **NEXT** to continue.

![Database Configuration Assistant](image1)

4. Select **GENERAL PURPOSE OR TRANSACTION PROCESSING** then click **NEXT** to continue.

![Database Templates](image2)
5. Choose Admin-Managed Database. Set the global database name to RAC.vm.ardentperf.com and select all cluster nodes. Then click NEXT to continue.

6. Do not configure Enterprise Manager (there's probably not enough memory here). Uncheck it and click the Automatic Maintenance Tasks tab.
7. Disable the automatic maintenance tasks (they can really tax the CPU on these vmware boxes...) After unchecking the box, click **NEXT** to continue.

8. Set all passwords to **racattack** and click **NEXT** to continue. Choose **YES** to continue even though Oracle doesn't like the password.
Lab 7.A: Create DB

### Oracle ASM

9. Choose a Storage Type of Automatic Storage Management (ASM).

| Type: Automatic Storage Management (ASM) |

| Use Oracle-Managed Files |
| Database Area: +DATA |

10. Choose ORACLE MANAGED FILES and type +DATA for the database area. Then click NEXT to continue.

| Use Oracle-Managed Files |
| Database Area: +DATA |

11. Choose to SPECIFY FLASH RECOVERY AREA and type +BACKUP as the destination. Increase the size to 3200MB. Do not enable archiving and choose NEXT to continue.

| Specify Flash Recovery Area |
| Flash Recovery Area: +BACKUP |
| Flash Recovery Area Size: 3200 |

Note: Oracle will automatically create a directory tree in the specified location and it will separate files by type and by database.

### CFS / NFS

Choose a Storage Type of Cluster File System.

| Type: Cluster File System |

| Use Oracle-Managed Files |
| Database Area: /u51/oradata |

Choose ORACLE MANAGED FILES and type /u51/oradata for the database area. Then click NEXT to continue.

Choose to SPECIFY FLASH RECOVERY AREA and type /u52/oradata as the destination. Increase the size to 3200MB. Do not enable archiving and choose NEXT to continue.

| Specify Flash Recovery Area |
| Flash Recovery Area: /u52/oradata |
| Flash Recovery Area Size: 3200 |

| Enable Archiving |
| Edit Archive Metadata |
12. Choose to install the sample schemas. After checking the box, click **NEXT** to continue.

13. Bump the memory target up to **400MB** and do not check Automatic Memory Management. Skip the other tabs and click **NEXT** to continue.
14. Accept the default storage settings and click **NEXT** to continue.

15. Go ahead and **generate scripts** (in the default location), but leave Create Database option checked. Click **FINISH** to begin database creation.
16. Review the summary, then click **OK** to continue.

17. DBCA will inform you after it generates the scripts. Click **OK** to continue with database creation.
18. When database creation is complete a summary window will appear. Click **EXIT** to close the installer.
19. One last thing: edit `/etc/oratab` on both nodes and replace the DB name with the Instance name. Also edit the `bash_profile` on node 2 and set the instance name to `RAC2`.

```bash
[oracle@collabn1 ~]$ vi /etc/oratab
RAC1:/u01/app/oracle/product/11.1.0/db_1:N
```

```bash
[oracle@collabn1 ~]$ ssh collabn2
[oracle@collabn2 ~]$ vi /etc/oratab
RAC2:/u01/app/oracle/product/11.1.0/db_1:N
```

```bash
[oracle@collabn2 ~]$ vi /home/oracle/.bash_profile
export ORACLE_SID=RAC2
```
Lab 8: Rolling Patches
**Lab 8.A: Patching Grid and Database Software**

<table>
<thead>
<tr>
<th>Patching Overview</th>
<th>Upgrade</th>
<th>Patch Set</th>
<th>PSU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.2</td>
<td>11.1.0.0</td>
<td>11.2.0.0</td>
</tr>
<tr>
<td></td>
<td>#</td>
<td>11.1.0.6.1</td>
<td>#</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.1.0.6.2</td>
<td>#</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.1.0.7.0</td>
<td>#</td>
</tr>
</tbody>
</table>

- **Upgrades** to the “base version” are very complicated and always use the full Oracle installer (`runInstaller`). Major new features are only introduced in new base versions.
- **Patch Sets** are also installed with the full Oracle installer. Historically, each patchset must be installed on top of the base version (top row in the illustration) by using `runInstaller`. Starting with 11.2.0.2 the patch sets can be installed as a new installation without the base version. Sometimes minor new features are included with Patch Sets (for example RAT data collection).
- **PSUs** are installed with `opatch`. They include security updates and important bug fixes. They are released quarterly and always include the latest CPU.
- **CPUs** are installed with `opatch`. CPUs include only security updates, and are also released quarterly. They cannot be applied after you have applied any PSU. (Until you upgrade to a new patch set or base version.)

**Support Status and Known Issues**

Before performing any installation or upgrade of Oracle, you should always check the Support Status and Known Issues for the release. Metalink note 161818.1 is always the starting point – open this note and review it. Next, follow the link for 11.2.0.X to metalink note 880782.1 and review that note. Finally, follow the link to note 880707.1 and review the known issues with Oracle 11.2.0.1 which is the version we will be using for this lab.

*These notes have been saved as PDF files on the the virtual DVD provided by the instructor. It is available in your Virtual RAC Nodes at /mnt/cdrom5.*

**Practice Rolling Application**

For this lab, the instructor has provided recent PSUs. PSUs and CPUs are collections of one-off patches. One-off patches can only be applied to an Oracle database in a rolling manner if they have been certified for rolling upgrades.

1. Review the installation instructions. We're going to install three patches and you can find the README files at these locations:
   - `/mnt/cdrom5/patch/psu4-db-10248516/10248516/README.html`
   - `/mnt/cdrom5/patch/psu2-gi-9655006/README.txt`
   - `/mnt/cdrom5/patch/opatch-6880880/README.txt`
Rolling Patches

Lab 8.A: Patching Grid and Database Software

2. First we need to update the OPatch utility. Find patch 6880880 on the instructor-provided CDROM and unzip it directly into both the grid home and the database home. Before unzipping the file, backup the existing OPatch programs.

```bash
$ oenv
SIDs here are: grid +ASM1 RAC1
ORACLE_SID = [RAC1] ? grid
$ cd $ORACLE_HOME
$ tar czvf ~/gi-opatch-backup_2011-04-01.tgz OPatch/
...
$ unzip -o /mnt/cdrom*/patch/opatch-6880880/p6880880_112000_LINUX.zip
...
$ OPatch/opatch version
Invoking OPatch 11.2.0.1.5
OPatch Version: 11.2.0.1.5
OPatch succeeded.

$ oenv
SIDs here are: grid +ASM1 RAC1
ORACLE_SID = [grid] ? RAC1
$ cd $ORACLE_HOME
$ mv OPatch OPatch.backup
$ unzip /mnt/cdrom*/patch/opatch-6880880/p6880880_112000_LINUX.zip
...
$ OPatch/opatch version
Invoking OPatch 11.2.0.1.5
OPatch Version: 11.2.0.1.5
OPatch succeeded.

3. Repeat step 2 on node collabn2.

```bash
$ ssh collabn2
... repeat step 2...
```

4. This new version of OPatch requires an “OCM response file” for certain operations. Use the OCM utility to generate this file. We don't want to configure OCM; leave your username blank and confirm that “YES” you don't want to enter any account information.

```bash
[grid]$ $ORACLE_HOME/OPatch/ocm/bin/emocmrsp -output /home/oracle/ocm.rsp
OCM Installation Response Generator 10.3.4.0.0 - Production
Copyright (c) 2005, 2010, Oracle and/or its affiliates. All rights reserved.

Provide your email address to be informed of security issues, install and initiate Oracle Configuration Manager. Easier for you if you use your My Oracle Support Email address/User Name.
Email address/User Name: <enter>

You have not provided an email address for notification of security issues. Do you wish to remain uninformed of security issues ([Y]es, [N]o) [N]: Y
The OCM configuration response file (/home/oracle/ocm.rsp) was successfully created.
```
5. Find the Grid Infrastructure and Database PSUs on the instructor-provided DVD.

```
$ cd /mnt/cdrom5/patch
$ ls
opatch-6880880  psu2-gi-9655006  psu4-db-10248516
```

6. We know that these PSUs can be applied in a rolling manner, but verify this.

```
$ for D in psu*/[0-9]*; do
  echo -n $D:
  cd $D
  $ORACLE_HOME/OPatch/opatch query -is_rolling_patch | grep rolling
  cd ../..
done

psu2-gi-9655006/9654983: Patch is a rolling patch: true
psu2-gi-9655006/9655006: Patch is a rolling patch: true
psu4-db-10248516/10248516: Patch is a rolling patch: true
```

7. We also know that there won't be any patch conflicts (since these are the first patches we're installing) – but verify this too.

```
$ oenv
ORACLE_SID = [RAC1] ? grid
[grid]$ cd psu2-gi-9655006
psu2-gi-9655006[grid]$ $ORACLE_HOME/OPatch/opatch prereq
CheckConflictAgainstOHWithDetail -phBaseDir ./9655006
...
Invoking prereq "checkconflictagainstohwithdetail"
Prereq "checkConflictAgainstOHWithDetail" passed.

[grid]$ oenv
ORACLE_SID = [RAC1] ? RAC1
[RAC1]$ cd ../psu4-db-10248516
psu4-db-10248516[RAC1]$ $ORACLE_HOME/OPatch/opatch prereq
CheckConflictAgainstOHWithDetail -phBaseDir ./10248516
...
Invoking prereq "checkconflictagainstohwithdetail"
Prereq "checkConflictAgainstOHWithDetail" passed.
```

8. The automated patch application process will automatically shutdown and restart all database processes on the node. However, we don't want the automatic restart – because we are applying two PSUs (one for grid and one for database). Disable the instance auto-start for node collabn1 and manually shutdown the instance for patch application.

- On a production system, all active connections would be migrated to the other instance first.

```
collabn1$ srvctl disable instance -d rac -i RAC1
collabn1$ srvctl stop instance -d rac -i RAC1
```
9. We will use automated patch application to apply the grid infrastructure PSU. First use `oenv` to enter the grid environment, then switch to the root user and run `opatch auto`.
   - Note: any database processes on this node will be automatically shutdown during patching.
   - When prompted for the OCM response file path, enter `/home/oracle/ocm.rsp` and press enter.
   - When prompted about the grid home being shared, type `yes` to continue.

Make sure to specify the grid home on the command line so that the patch doesn't find the database home and apply itself there in addition.

```
$ oenv
SIDs here are: grid +ASM1 RAC1
ORACLE_SID = [RAC1] ? grid
The Oracle base for ORACLE_HOME=/u01/grid/oracle/product/11.2.0/grid_1 is /u01/app/oracle

[grid]$ cd /mnt/cdrom5/patch/psu2-gi-9655006
psu2-gi-9655006[grid]$ su
Password: racattack

psu2-gi-9655006# $ORACLE_HOME/OPatch/opatch auto . -oh $ORACLE_HOME
Executing /usr/bin/perl /u01/grid/oracle/product/11.2.0/grid_1/OPatch/crs/patch112.pl -patchdir .
-patchn . -oh /u01/grid/oracle/product/11.2.0/grid_1 -paramfile /u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
opatch auto log file location is /u01/grid/oracle/product/11.2.0/grid_1/OPatch/crs/../../cfgtoollogs/opatchauto2011-04-01_22-44-08.log
Detected Oracle Clusterware install
Using configuration parameter file: /u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
OPatch is bundled with OCM, Enter the absolute OCM response file path: /home/oracle/ocm.rsp
Can't change permissions of ./: Read-only file system

Unable to determine if /u01/grid/oracle/product/11.2.0/grid_1 is shared oracle home
Enter 'yes' if this is not a shared home or if the prerequisite actions are performed to patch this shared home (yes/no): yes
Successfully unlock /u01/grid/oracle/product/11.2.0/grid_1
patch ././9655006 apply successful for home /u01/grid/oracle/product/11.2.0/grid_1
patch ././9654983 apply successful for home
ACFS-9300: ADVM/ACFS distribution files found.
ACFS-9312: Existing ADVM/ACFS installation detected.
ACFS-9314: Removing previous ADVM/ACFS installation.
ACFS-9315: Previous ADVM/ACFS components successfully removed.
ACFS-9307: Installing requested ADVM/ACFS software.
ACFS-9308: Loading installed ADVM/ACFS drivers.
ACFS-9321: Creating udev for ADVM/ACFS.
ACFS-9323: Creating module dependencies - this may take some time.
ACFS-9327: Verifying ADVM/ACFS devices.
ACFS-9309: ADVM/ACFS installation correctness verified.
CRS-4123: Oracle High Availability Services has been started.
```
10. Return to the oracle user and find the Database PSU on the instructor-provided DVD. Use `oenv` to enter the database environment, then run `opatch apply`.
   - Run OPatch in local mode so that it does not attempt an automatic rolling install across the entire cluster.
   - When prompted about OCM, leave your username blank and confirm that “YES” you don’t want to enter any account information.

```
# exit
$ cd ..../psu4-db-10248516

psu4-db-10248516$ oenv
SIDs here are: grid +ASM1 RAC1
ORACLE_SID = [grid] ? RAC1
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/db_1 is /u01/app/oracle

psu4-db-10248516[RAC1]$ cd 10248516

10248516[RAC1]$ $ORACLE_HOME/OPatch/opatch apply -local
Invoking OPatch 11.2.0.1.5
Oracle Interim Patch Installer version 11.2.0.1.5
Copyright (c) 2010, Oracle Corporation. All rights reserved.

Oracle Home : /u01/app/oracle/product/11.2.0/db_1
Central Inventory : /u01/app/oraInventory
   from : /etc/oraInst.loc
OPatch version : 11.2.0.1.5
OUI version : 11.2.0.1.0
OUI location : /u01/app/oracle/product/11.2.0/db_1/oui
Log file location :
   /u01/app/oracle/product/11.2.0/db_1/cfgtoollogs/opatch/opatch2011-04-02_16-10-50PM.log

Patch history file:
   /u01/app/oracle/product/11.2.0/db_1/cfgtoollogs/opatch/opatch_history.txt
ApplySession applying interim patch '10248516' to OH
   '/u01/app/oracle/product/11.2.0/db_1'

Running prerequisite checks...
Provide your email address to be informed of security issues, install and initiate Oracle Configuration Manager. Easier for you if you use your My Oracle Support Email address/User Name.
Email address/User Name: <enter>

You have not provided an email address for notification of security issues. Do you wish to remain uninformed of security issues ([Y]es, [N]o) [N]: Y

You selected -local option, hence OPatch will patch the local system only.
Please shutdown Oracle instances running out of this ORACLE_HOME on the local system.  
(Oracle Home = '/u01/app/oracle/product/11.2.0/db_1')

Is the local system ready for patching? [y|n]  
\[y\]  
User Responded with: Y  
Back up files and inventory (not for auto-rollback) for the Oracle Home  
Back up files affected by the patch '10248516' for restore. This might take a while...  
Back up files affected by the patch '10248516' for rollback. This might take a while...  
Execution of 'sh /mnt/cdrom6/patch/psu4-db-10248516/10248516/custom/scripts/pre -apply 10248516 ':  

Return Code = 0  
Patching component oracle.rdbms.rsf, 11.2.0.1.0...  
...  
...  
...  
Running make for target itnslsnr  
ApplySession adding interim patch '10248516' to inventory  

Verifying the update...  
Inventory check OK: Patch ID 10248516 is registered in Oracle Home inventory with proper meta-data.  
Files check OK: Files from Patch ID 10248516 are present in Oracle Home.  

The local system has been patched and can be restarted.  

OPatch succeeded.

11. Enable and start the Oracle database instance on node collabn1. After the instance is running, stop and disable the instance on node collabn2. There should be no point at which the database is not running.

\$ srvctl enable instance -d rac -i RAC1  
\$ srvctl start instance -d rac -i RAC1  

• On a production system, all active connections would be migrated to the other instance now.

\$ srvctl disable instance -d rac -i RAC2  
\$ srvctl stop instance -d rac -i RAC2
12. Use automated patch application to apply the grid infrastructure PSU to collabn2.
   - Note: any database processes on this node will be automatically shutdown during patching.
   - Copy the OCM response file (/home/oracle/ocm.rsp) to collabn2.
   - When prompted about the grid home being shared, type yes to continue.

Make sure to specify the grid home on the command line so that the patch doesn't find the database home and apply itself there in addition.

```bash
$ scp /home/oracle/ocm.rsp collabn2:/home/oracle/
$ ssh collabn2
$ oenv
SIDs here are: grid +ASM2 RAC2
ORACLE_SID = [RAC2] ? grid
The Oracle base for ORACLE_HOME=/u01/grid/oracle/product/11.2.0/grid_1 is /u01/app/oracle

[grid]$ cd /mnt/cdrom5/patch/psu2-gi-9655006
psu2-gi-9655006[grid]$ su
Password: racattack

psu2-gi-9655006# $ORACLE_HOME/OPatch/opatch auto . -oh $ORACLE_HOME
Executing /usr/bin/perl /u01/grid/oracle/product/11.2.0/grid_1/OPatch/crs/patch112.pl -patchdir . -patchn . -oh /u01/grid/oracle/product/11.2.0/grid_1 -paramfile /u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
opatch auto log file location is /u01/grid/oracle/product/11.2.0/grid_1/OPatch/crs/../../cfgtoollogs/opatchauto2011-04-02_16-42-52.log
Detected Oracle Clusterware install
Using configuration parameter file: /u01/grid/oracle/product/11.2.0/grid_1/crs/install/crsconfig_params
OPatch is bundled with OCM, Enter the absolute OCM response file path: /home/oracle/ocm.rsp
Can't change permissions of ./: Read-only file system

Unable to determine if /u01/grid/oracle/product/11.2.0/grid_1 is shared oracle home
Enter 'yes' if this is not a shared home or if the prerequisite actions are performed to patch this shared home (yes/no): yes
Successfully unlock /u01/grid/oracle/product/11.2.0/grid_1
patch ././9655006 apply successful for home /u01/grid/oracle/product/11.2.0/grid_1
patch ././9654983 apply successful for home /u01/grid/oracle/product/11.2.0/grid_1
ACFS-9300: ADVM/ACFS distribution files found.
ACFS-9312: Existing ADVM/ACFS installation detected.
ACFS-9314: Removing previous ADVM/ACFS installation.
ACFS-9315: Previous ADVM/ACFS components successfully removed.
ACFS-9307: Installing requested ADVM/ACFS software.
ACFS-9308: Loading installed ADVM/ACFS drivers.
ACFS-9321: Creating udev for ADVM/ACFS.
ACFS-9323: Creating module dependencies - this may take some time.
ACFS-9327: Verifying ADVM/ACFS devices.
ACFS-9309: ADVM/ACFS installation correctness verified.
CRS-4123: Oracle High Availability Services has been started.
13. Return to the oracle user and find the Database PSU on the instructor-provided DVD. Use `oenv` to enter the database environment, then run `opatch apply`.

- Run OPatch in **local** mode so that it does not attempt an automatic rolling install across the entire cluster.
- When prompted about OCM, leave your username **blank** and confirm that “YES” you don’t want to enter any account information.

```
# exit

$ cd ../~psu4-db-10248516

psu4-db-10248516$ oenv
SIDs here are: grid +ASM2 RAC2
ORACLE_SID = [grid] ? RAC2
The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/db_1 is /u01/app/oracle

psu4-db-10248516[RAC2]$ cd 10248516

10248516[RAC2]$ $ORACLE_HOME/OPatch/opatch apply -local

Oracle Interim Patch Installer version 11.2.0.1.5
Copyright (c) 2010, Oracle Corporation. All rights reserved.

Oracle Home : /u01/app/oracle/product/11.2.0/db_1
Central Inventory : /u01/app/oraInventory
    from : /etc/oraInst.loc
OPatch version : 11.2.0.1.5
OUI version : 11.2.0.1.0
OUI location : /u01/app/oracle/product/11.2.0/db_1/oui
Log file location :
/u01/app/oracle/product/11.2.0/db_1/cfgtoollogs/opatch/opatch2011-04-02_17-11-00PM.log

Patch history file:
/u01/app/oracle/product/11.2.0/db_1/cfgtoollogs/opatch/opatch_history.txt

ApplySession applying interim patch '10248516' to OH '/u01/app/oracle/product/11.2.0/db_1'

Running prerequisite checks...
Provide your email address to be informed of security issues, install and initiate Oracle Configuration Manager. Easier for you if you use your My Oracle Support Email address/User Name.
Email address/User Name: <enter>

You have not provided an email address for notification of security issues. Do you wish to remain uninformed of security issues ([Y]es, [N]o) [N]: Y

You selected -local option, hence OPatch will patch the local system only.
Lab 8.A: Patching Grid and Database Software

Please shutdown Oracle instances running out of this ORACLE_HOME on the local system.
(Oracle Home = '/u01/app/oracle/product/11.2.0/db_1')

Is the local system ready for patching? [y|n]

User Responded with: Y

Backing up files and inventory (not for auto-rollback) for the Oracle Home
Back up files affected by the patch '10248516' for restore. This might take a while...
Back up files affected by the patch '10248516' for rollback. This might take a while...
Execution of 'sh /mnt/cdrom6/patch/psu4-db-10248516/10248516/custom/scripts/pre -apply 10248516 ':

Return Code = 0

Patching component oracle.rdbms.rsf, 11.2.0.1.0...
...
...
...
Running make for target itnslsnr
ApplySession adding interim patch '10248516' to inventory

Verifying the update...
Inventory check OK: Patch ID 10248516 is registered in Oracle Home inventory with proper meta-data.
Files check OK: Files from Patch ID 10248516 are present in Oracle Home.

The local system has been patched and can be restarted.

OPatch succeeded.

14. Enable and restart the Oracle database instance on node collabn2.

$ srvctl enable instance -d rac -i RAC2
$ srvctl start instance -d rac -i RAC2

$ srvctl status database -d rac
Instance RAC1 is running on node collabn1
Instance RAC2 is running on node collabn2

15. Run the catbundle.sql script.

$ ss
SQL> @/?rdbms/admin/catbundle.sql psu apply

$ less /u01/app/oracle/product/11.2.0/db_1/cfgtoollogs/catbundle/catbundle_PSU_RAC_APPLY_2011Apr02_17_28_19.log
16. Optional: if you want more practice working with patches, then try rolling back the database PSU and then try applying it in automated rolling mode (without local flag) or in the “minimum downtime” mode.
Lab 9: Clusterware Testing
Lab 9.A: Clusterware and Fencing

Contributed by Dan Norris

The goal of this lab is to demonstrate Oracle Clusterware’s fencing ability by forcing a configuration that will trigger Oracle Clusterware’s built-in fencing features. With Oracle Clusterware, fencing is handled at the node level by rebooting the non-responsive or failed node. This is similar to the as Shoot The Other Machine In The Head (STOMITH) algorithm, but it’s really a suicide instead of affecting the other machine. There are many good sources for more information online. For more information, I highly recommend reading this blog posting from Kevin Closson (now with Oracle):


1. Start with a normal, running cluster with the database instances up and running.

2. Monitor the logfiles for clusterware on each node. On each node, start a new window and run the following command:

   `[oracle@<node_name> ~] $ tail -f \\
   > /u01/grid/oracle/product/11.2.0/grid_1/log/`hostname -s`/crsd/crsd.log
   
   `[oracle@<node_name> ~] $ tail -f \\
   > /u01/grid/oracle/product/11.2.0/grid_1/log/`hostname -s`/cssd/ocssd.log

3. We will simulate “unplugging” the network interface by taking one of the private network interfaces down. On the collabn2 node, take the private network interface down by running the following command (as the root user):

   `[root@collabn2 ~]# ifconfig eth1 down`
Alternatively, you can also simulate this by physically taking the **HostOnly** network adapter offline in VMware.

4. Following this command, watch the logfiles you began monitoring in step 2 above. You should see errors in those logfiles and eventually (could take a minute or two, literally) you will observe one node reboot itself.

If you used `ifconfig` to trigger a failure, then the node will rejoin the cluster and the instance should start automatically.

If you used `VMware` to trigger a failure then the node will not rejoin the cluster.

- Which file has the error messages that indicate why the node is not rejoining the cluster?
- Is the node that reboots always the same as the node with the failure? Why or why not?
The goal of this lab is to demonstrate Oracle Fast Application Notification (FAN) Callouts. In versions prior to 11g, these were also known as Oracle Clusterware Callouts.

This feature is a relatively little-known capability for Oracle Clusterware to fire a script (or a whole directory full of them) to perform whatever tasks you may want performed when a cluster-wide event happens.

For more information, consult the documentation here:
http://download.oracle.com/docs/cd/B28359_01/rac.111/b28254/hafeats.htm#BABGCEBF

For this exercise, we’ll configure some FAN callout scripts on each node and then trigger various cluster events to see how each one triggers the callout script.

1. Start with a normal, running cluster with both nodes up and running.

2. From a shell prompt (logged in as oracle) on each server, navigate to
   /u01/grid/oracle/product/11.2.0/grid_1/racg/usrco. Create file there called
callout1.sh using vi (or your favorite editor). The contents of the file should be this:

```bash
#!/bin/ksh
umask 022
FAN_LOGFILE=/tmp/`hostname`_uptime.log
echo $* "reported="`date` >> $FAN_LOGFILE &
```

(Note the use of backticks around the hostname and date commands.)

3. Make sure that the permissions on the file are set to 755 using the following command:

   `[oracle@<node_name> ~]$ chmod 755 /
   > /u01/grid/oracle/product/11.2.0/grid_1/racg/usrcocallout1.sh`

4. Monitor the logfiles for clusterware on each node. On each node, start a new window and run the following command:

   `[oracle@<node_name> ~]$ tail -f /u01/grid/oracle/product/11.2.0/grid_1/log/`hostname`-s`/crsd/crsd.log`
5. Next, we need to trigger an event that will cause the callout to fire. One such event is node shutdown. Shutdown the clusterware on node `collabn2`.

```
[root@collabn2 ~]# crsctl stop crs
Stopping resources.
This could take several minutes.
Successfully stopped Oracle Clusterware resources
Stopping Cluster Synchronization Services.
Shutting down the Cluster Synchronization Services daemon.
Shutdown request successfully issued.
```

6. Following this command, watch the logfiles you began monitoring in step 2 above. Because we set long timeouts on our test cluster, you might have to wait for a few minutes before you see anything.

- You should eventually observe entries noting that the node has failed and shortly following that, you should observe an entry placed in the `/tmp/<hostname>_uptime.log` file indicating that the node is down.
- Note which members run the clusterware callout script. (A surviving member could run commands to notify clients and/or application servers that one of the cluster nodes has died.)

You should see these messages in the `/tmp/*_log` files:

```
NODE VERSION=1.0 host=collabn2 incarn=0 status=nodedown reason=public_nw_down
timestamp=30-Aug-2009 01:56:12 reported=Sun Aug 30 01:56:13 CDT 2009

NODE VERSION=1.0 host=collabn2 incarn=147028525 status=nodedown
reason=member_leave timestamp=30-Aug-2009 01:57:19 reported=Sun Aug 30
01:57:20 CDT 2009
```

7. Restart the clusterware. Is there a node up event?

```
[root@collabn2 bin]# crsctl start crs
```

8. Try powering off one of the virtual machines – is there an difference from the previous test? What if you disable a linux network interface or VMware network card?
9. You may conduct more testing, if you wish. Another interesting event is a database instance going down unexpectedly. Come back to this lab after installing a database to test that situation.

[oracle@collabn2 ~]$ sqlplus "/ as sysdba"

SQL*Plus: Release 11.1.0.6.0 - Production on Fri Aug 1 14:49:29 2008
Copyright (c) 1982, 2007, Oracle. All rights reserved.

Connected to:
Oracle Database 11g Enterprise Edition Release 11.1.0.6.0 - Production
With the Partitioning, Real Application Clusters, OLAP, Data Mining
and Real Application Testing options

SQL> shutdown abort;
ORACLE instance shut down.
SQL>

INSTANCE VERSION=1.0 service=RAC.vm.ardentperf.com database=RAC instance=RAC2
host=collabn2 status=down reason=user timestamp=01-Aug-2008 12:34:02
reported=Fri Aug 1 12:34:03 CDT 2008

One popular use for clusterware callouts is to notify administrators (possibly via email) that a cluster event has occurred. You may use the arguments to the script (you’ll see the arguments in the logfile we’ve created) to conditionally perform notification as well. For example, you may not want to notify anyone unless a node crashes unexpectedly. By testing some of these arguments, you may be able to send notifications only when desired.
Lab 10: Services and Failover
Lab 10.A: Install Instant Client

In order to test failover it would be best to connect from a client outside the cluster, so we’ll start by downloading and installing Oracle’s Basic Instant Client (English-only) and the Instant Client SQLPlus package.

1. Login to the node collabn1 as user oracle and open a connection to the database as SYSDBA and unlock the SH user account. Also grant DBA access.

   SQL> alter user sh identified by sh account unlock;
   User altered.

   SQL> grant dba to sh;
   Grant succeeded.

2. Download Oracle’s Basic (English-only) Instance Client and Oracle’s Instant Client SQLPlus package. The lab instructor may have made them available, or they can also be downloaded from Oracle’s website here:

   http://www.oracle.com/technetwork/topics/winsoft-085727.html

   The two files you need are:
   - instantclient-basiclite-*.zip
   - instantclient-sqlplus-*.zip

3. Each archive contains a folder named “instantclient_11_2”. Extract this folder (from both archives) into C:\. (In Explorer you can drag-and-drop or you can choose "Extract All" from the File menu.)
4. Edit `c:\windows\system32\drivers\etc\hosts` and add IP addresses for the RAC nodes. *(Your database connections won't work without this - you can't just create a tnsnames that uses IP addresses. Try it out by doing step 4 a few times in a row before this step. Does step 4 sometimes just hang? Do you know why? We'll explore it more later...*)

```
192.168.78.250   collab-scan.vm.ardentperf.com collab-scan
192.168.78.61    collabn1-vip.vm.ardentperf.com collabn1-vip
192.168.78.62    collabn2-vip.vm.ardentperf.com collabn2-vip
192.168.78.51    collabn1.vm.ardentperf.com collabn1
192.168.78.52    collabn2.vm.ardentperf.com collabn2
```

5. Test your Instant Client installation by connecting to the database.

```
C:\instantclient_11_2> sqlplus sh/sh@//collab-scan/RAC.vm.ardentperf.com
```

```
Connected to: Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production
With the Partitioning, Real Application Clusters, Automatic Storage Management,
OLAP, Data Mining and Real Application Testing options
SQL> select instance_name from v$instance;
INSTANCE_NAME
RAC1
```

---

**ARDENTPERF.COM**
6. Create a TNSNAMES file and copy the RAC, RAC1 and RAC2 entries from either cluster database node.

C:\instantclient_11_2> notepad C:\instantclient_11_2\tnsnames.ora

RAC =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = collab-scan)(PORT = 1521))
   (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = RAC.vm.ardentperf.com)
    )
  )

RAC2 =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = collabn-scan)(PORT = 1521))
   (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = RAC.vm.ardentperf.com)
    (INSTANCE_NAME = RAC2)
    )
  )

RAC1 =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = collabn-scan)(PORT = 1521))
   (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = RAC.vm.ardentperf.com)
    (INSTANCE_NAME = RAC1)
    )
  )
7. Test your TNSNAMES by setting the TNS_ADMIN environment variable and running SQLPLUS.

C:\instantclient_11_2> set TNS_ADMIN=c:\instantclient_11_2
C:\instantclient_11_2> sqlplus sh/sh@RAC

Connected to:
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - Production
With the Partitioning, Real Application Clusters, Automatic Storage Management,
OLAP, Data Mining and Real Application Testing options
SQL> select instance_name from v$instance;
INSTANCE_NAME
----------
RAC1
SQL> -
Lab 10.B: Service Failover

8. Login to collabn1 as the oracle user. Create a new service svctest with RAC1 as a preferred instance and RAC2 as an available instance. This means that it will normally run on the RAC1 instance but will failover to the RAC2 instance if RAC1 becomes unavailable.

```bash
    collabn1:/home/oracle[RAC1]$ srvctl add service -d RAC -s svctest -r RAC1 -a RAC2 -P BASIC
    collabn1:/home/oracle[RAC1]$ srvctl start service -d RAC -s svctest
```

9. Examine where the service is running by checking lsnrctl on both nodes and looking at the SERVICE_NAMES init parameter on both nodes. Note that you should never set the SERVICE_NAMES init parameter on a RAC database!! This parameter is maintained automatically by the clusterware.

```bash
    collabn1:/home/oracle[RAC1]$ srvctl status service -d RAC -s svctest
    Service svctest is running on instance(s) RAC1

    collabn1:/home/oracle[RAC1]$ lsnrctl services
    Service "svctest.vm.ardentperf.com" has 1 instance(s).
    Instance "RAC1", status READY, has 2 handler(s) for this service...
    Handler(s):
      "DEDICATED" established:0 refused:0 state:ready
      REMOTE SERVER
        (ADDRESS=(PROTOCOL=TCP)(HOST=collabn1.vm.ardentperf.com)(PORT=1521))
      "DEDICATED" established:0 refused:0 state:ready
      LOCAL SERVER

    collabn1:/home/oracle[RAC1]$ ssh collabn2
    Last login: Sun Aug  3 13:13:16 2008 from collabn1
    The Oracle base for ORACLE_HOME=/u01/app/oracle/product/11.2.0/db_1 is /u01/app/oracle
    Set environment by typing 'oenv' - default is instance RAC1.

    collabn2:/home/oracle[RAC2]$ lsnrctl services

    collabn2:/home/oracle[RAC2]$ lsnrctl services
    Service "svctest.vm.ardentperf.com" has 1 instance(s).
    Instance "RAC1", status READY, has 1 handler(s) for this service...
    Handler(s):
      "DEDICATED" established:0 refused:0 state:ready
      REMOTE SERVER
        (ADDRESS=(PROTOCOL=TCP)(HOST=collabn1.vm.ardentperf.com)(PORT=1521))

    SQL> col value format a60
    SQL> select inst_id, value from gv$parameter where NAME='service_names';

                     INST_ID VALUE
    ----------------- -----------------------------------
    1 svctest, RAC.vm.ardentperf.com
    2 RAC.vm.ardentperf.com
10. Use SHUTDOWN ABORT to kill the instance where service svctest is running.

```sql
SQL> show user
USER is "SYS"
SQL> select instance_name from v$instance;

INSTANCE_NAME
------------
RAC1

SQL> shutdown abort;
ORACLE instance shut down.
```

11. Wait a few moments and then repeat step 2. What has happened?

```
collabn1:/home/oracle[RAC1]$ srvctl status service -d RAC -s svctest
```

12. Restart the instance that you killed. (Side question... this does not initiate any instance recovery at all. Do you know why?)

```
collabn1:/home/oracle[RAC1]$ srvctl status database -d RAC
Instance RAC1 is not running on node collabn1
Instance RAC2 is running on node collabn2
```

```
collabn1:/home/oracle[RAC1]$ srvctl start instance -d RAC -i RAC1
```

```
collabn1:/home/oracle[RAC1]$ srvctl status database -d RAC
Instance RAC1 is running on node collabn1
Instance RAC2 is running on node collabn2
```

13. Repeat step 2. Where is the service running now?

```
collabn1:/home/oracle[RAC1]$ srvctl status service -d RAC -s svctest
```

14. Manually failover the service. Confirm where it is now running. Note that this does not disconnect any current sessions

```
collabn1:/home/oracle[RAC1]$ srvctl relocate service -d RAC -s svctest -i RAC2 -t RAC1
```

```
collabn1:/home/oracle[RAC1]$ srvctl status service -d RAC -s svctest
```
**Lab 10.C: Connection Failover**

**IMPORTANT NOTE:** This lab was written for Oracle 11gR1. It is included in this 11gR2 lab handbook to demonstrate how failover works and the importance of using proper addresses in TNSNAMES. However, starting with 11gR2 the node VIPs should never be used to connect to the database – the SCAN VIP should always be used instead. The 11gR2 client has this same failover functionality built-in for multiple SCAN VIPs returned on a single DNS entry.

15. On your local computer edit the TNSNAMES.ORA file used by the Instance Client. Add two entries called CFTEST and CFTEST-NOVIP which connect to the RAC service with no load balancing. Explicitly enable connection failover even though it is already enabled by default anyway. Don't use the VIP's for the second entry (this is wrong but we'll test it to see what happens).

```
C:\instantclient_11_2> notepad c:\instantclient_11_2\tnsnames.ora

CFTEST =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = collabn1-vip)(PORT = 1521))
    (ADDRESS = (PROTOCOL = TCP)(HOST = collabn2-vip)(PORT = 1521))
    (LOAD_BALANCE = no)
    (FAILOVER = yes)
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = RAC.vm.ardentperf.com)
    )
  )

CFTEST-NOVIP =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = collabn1)(PORT = 1521))
    (ADDRESS = (PROTOCOL = TCP)(HOST = collabn2)(PORT = 1521))
    (LOAD_BALANCE = no)
    (FAILOVER = yes)
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = RAC.vm.ardentperf.com)
    )
  )
```

16. On collabn1 check the number of established connections from the listener to the RAC service. Connect from Windows to CFTEST and CFTEST-NOVIP several times and then check the lsnrctl statistics again. All connections from the Windows machine are attaching to listener on collabn1 but this listener is spreading the connections between both instances.

```
First look at the number of established connections on node 1. It's ok if they're not all zero.

collabn1:/home/oracle[RAC1]$ lsnrctl services
Service "RAC.vm.ardentperf.com" has 2 instance(s).
  Instance "RAC1", status READY, has 2 handler(s) for this service...
    Handler(s):
      "DEDICATED" established:0 refused:0 state:ready
        LOCAL SERVER
      "DEDICATED" established:0 refused:0 state:ready
        REMOTE SERVER
```
Instance "RAC2", status READY, has 1 handler(s) for this service...
Handler(s):
  "DEDICATED" established:0 refused:0 state:ready

REMOTE SERVER
  (ADDRESS=(PROTOCOL=TCP)(HOST=collabn2.vm.ardentperf.com)(PORT=1521))

Second, connect to the database several times in a row and use both service names. You can exit each session after you check how long it takes to connect. All of the sessions should connect quickly. Count the number of times you connect.

C:\instantclient_11_2> sqlplus sh/sh@CFTEST
C:\instantclient_11_2> sqlplus sh/sh@CFTEST
C:\instantclient_11_2> sqlplus sh/sh@CFTEST-NOVIP
C:\instantclient_11_2> sqlplus sh/sh@CFTEST-NOVIP
C:\instantclient_11_2> sqlplus sh/sh@CFTEST
C:\instantclient_11_2> sqlplus sh/sh@CFTEST-NOVIP

Third, check the listener connections on node 1 again. Make sure that the total number of established connections shows an increase by at least the same number of sessions that you connected. (That is, confirm that all of your sessions connected to this node.) There might be more connections; that's ok.

Also, notice how the listener is distributing connections to both instances - even though our client is only connecting to the listener on one node. It doesn't matter how many connections go to each instance; it's ok if you don't see 3 and 3.

collabn1:/home/oracle[RAC1]$ lsnrctl services
Service "RAC.vm.ardentperf.com" has 2 instance(s).
Instance "RAC1", status READY, has 2 handler(s) for this service...
  Handler(s):
    "DEDICATED" established:3 refused:0 state:ready
    LOCAL SERVER
    "DEDICATED" established:0 refused:0 state:ready
    REMOTE SERVER
    (ADDRESS=(PROTOCOL=TCP)(HOST=collabn1.vm.ardentperf.com)(PORT=1521))
Instance "RAC2", status READY, has 1 handler(s) for this service...
  Handler(s):
    "DEDICATED" established:3 refused:0 state:ready
    REMOTE SERVER
    (ADDRESS=(PROTOCOL=TCP)(HOST=collabn2.vm.ardentperf.com)(PORT=1521))
17. In the VMware Console, make sure that you have opened the node **collabn1** which you are connecting to from Windows. Simulate a complete node failure by choosing **Power Off** from the **Virtual Machine** menu.

18. Wait about a minute (so that the cluster can detect the failed node). Then, from Windows, connect to the CFTEST and CFTEST-VIP services again. What happens when you use the NOVIP connection?

```
C:\instantclient_11_2> sqlplus sh/sh@CFTEST
C:\instantclient_11_2> sqlplus sh/sh@CFTEST
C:\instantclient_11_2> sqlplus sh/sh@CFTEST-NOVIP
C:\instantclient_11_2> sqlplus sh/sh@CFTEST-NOVIP
C:\instantclient_11_2> sqlplus sh/sh@CFTEST
C:\instantclient_11_2> sqlplus sh/sh@CFTEST-NOVIP
```

*The purpose of this lab is to demonstrate why you should always use VIP connections!*
Lab 10.D: Runtime Failover

1. Power on collabn1 from the VMware Console. After it has started, login as the oracle user and failback the svctest service which we created earlier in this lab.

[root@collabn1 ~]# srvctrl status database -d RAC
Instance RAC1 is running on node collabn1
Instance RAC2 is running on node collabn2

collabn1:/home/oracle[RAC1]$ srvctl status service -d RAC -s svctest
Service svctest is running on instance(s) RAC2

collabn1:/home/oracle[RAC1]$ srvctl relocate service -d RAC -s svctest -i RAC2 -t RAC1

collabn1:/home/oracle[RAC1]$ srvctl status service -d RAC -s svctest
Service svctest is running on instance(s) RAC1
2. On your local computer edit the `TNSNAMES.ORA` file used by the Instance Client. Add a new entry called `SVCTEST` which connects to the `svctest` service and make sure that the connection works. Also check your TAF settings after connecting. *(Side note: we did not configure this service with a domain name, but you can't connect to it unless you specify one in the TNSNAMES entry. Try it. Where did this domain name come from?)*

```
C:\instantclient_11_2> notepad c:\instantclient_11_2\tnsnames.ora
SVCTEST =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = collab-scan)(PORT = 1521))
    (LOAD_BALANCE = yes)
    (CONNECT_DATA =
       (SERVER = DEDICATED)
       (SERVICE_NAME = svctest.vm.ardentperf.com)
    )
  )
SVCTEST-NOVIP =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = collabn1)(PORT = 1521))
    (ADDRESS = (PROTOCOL = TCP)(HOST = collabn2)(PORT = 1521))
    (LOAD_BALANCE = yes)
    (CONNECT_DATA =
       (SERVER = DEDICATED)
       (SERVICE_NAME = svctest.vm.ardentperf.com)
    )
  )

C:\instantclient_11_2> sqlplus sh/sh@svctest
SQL> select instance_name from v$instance;

<table>
<thead>
<tr>
<th>INSTANCE_NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAC1</td>
</tr>
</tbody>
</table>

SQL> col service_name format a20
SQL> col username format a10
SQL> select username, service_name, failover_method, failover_type
    2 from v$instance where sid=(select max(sid) from v$mystat);

<table>
<thead>
<tr>
<th>USERNAME</th>
<th>SERVICE_NAME</th>
<th>FAILOVER_METHOD</th>
<th>FAILOVER_TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH</td>
<td>svctest</td>
<td>NONE</td>
<td>NONE</td>
</tr>
</tbody>
</table>
```
3. From your Windows SQLPlus session, update the server-side TAF (Transparent Application Failover) settings for the `svctest` service.

```sql
begin
    dbms_service.modify_service(
        service_name=>'svctest',
        failover_type=>dbms_service.failover_type_select,
        failover_method=>dbms_service.failover_method_basic,
        failover_delay=>5,
        failover_retries=>60
    );
end;
/
```

PL/SQL procedure successfully completed.

4. Reconnect and check your session's TAF settings again.

```
SQL> exit
Disconnected from Oracle Database 11g Enterprise Edition Release 11.1.0.6.0 - Production
With the Partitioning, Real Application Clusters, OLAP, Data Mining and Real Application Testing options
C:\instantclient_11_2> sqlplus sh/sh@svctest
SQL> select instance_name from v$instance;
INSTANCE_NAME
----------
RAC1
SQL> col service_name format a20
SQL> col username format a10
SQL> select username, service_name, failover_method, failover_type
    2 from v$session where sid=(select max(sid) from v$mystat);

USERNAME   SERVICE_NAME         FAILOVER_M FAILOVER_TYPE
---------- -------------------- ---------- -------------
SH         svctest              BASIC      SELECT
```
5. Simultaneously open a second sqlplus session connected to the NOVIP service.

C:\> cd \instantclient_11_2
C:\instantclient_11_2> set TNS_ADMIN=c:\instantclient_11_2
C:\instantclient_11_2> sqlplus sh/sh@svctest-novip

SQL> select instance_name from v$instance;

INSTANCE_NAME
----------------
RAC1

SQL> col service_name format a20
SQL> col username format a10
SQL> select username, service_name, failover_method, failover_type
2 from v$session where sid=(select max(sid) from v$mystat);

USERNAME SERVICE_NAME FAILOVER_M FAILOVER_TYPE
---------- -------------------- ---------- -------------
SH svctest BASIC SELECT

6. Start a long-running query in both queries. While the query is running, **Power Down** the node that they are connected to. What happens to each session?

```sql
select c.cust_last_name, p.prod_name, s.quantity_sold
from   products p, sales s, customers c
where  p.prod_id = s.prod_id and c.cust_id = s.cust_id;
```
Lab 11: Load Balancing
1. Power on both nodes from the VMware Console.

   ![VMware Console](image)

   [root@collabn1 ~]# srvctl status database -d RAC
   Instance RAC1 is running on node collabn1
   Instance RAC2 is running on node collabn2

2. Open a SQLPlus session on the database and confirm that there are no sessions for the SH user.

   SQL> select inst_id, count(*) from gv$session where username='SH' group by inst_id;
   no rows selected

3. Disable server-side load balancing on both instances by clearing the REMOTE_LISTENER init param and re-registering. Before registering with the listeners, restart them to reset the connection statistics.

   SQL> alter system set remote_listener='';
   System altered.

   collabn1:/home/oracle[RAC1]$ lsnrctl stop
   collabn1:/home/oracle[RAC1]$ lsnrctl start
SQL> -- instance RAC1
SQL> alter system register;

System altered.

collabn1:/home/oracle[RAC1]$ lsnrctl services
Service "RAC.vm.ardentperf.com" has 1 instance(s).
    Instance "RAC1", status READY, has 1 handler(s) for this service...
    Handler(s):
        "DEDICATED" established:0 refused:0 state:ready
        LOCAL SERVER

collabn2:/home/oracle[RAC2]$ lsnrctl stop
collabn2:/home/oracle[RAC2]$ lsnrctl start

SQL> -- instance RAC2
SQL> alter system register;

System altered.

collabn2:/home/oracle[RAC2]$ lsnrctl services
Service "RAC.vm.ardentperf.com" has 1 instance(s).
    Instance "RAC2", status READY, has 1 handler(s) for this service...
    Handler(s):
        "DEDICATED" established:0 refused:0 state:ready
        LOCAL SERVER

4. In your other connected SQLPlus session, keep an eye on the balance of connections. At the same
time, open a new shell session and run this script which will open 160 connections to the database.

```
a=160; while [ $a -gt 0 ]; do
    sqlplus sh/sh@RAC &
    a=$((a-1))
done
```

How were the connections distributed between the database instances during client-side load balancing?

5. Terminate all of the sqlplus sessions by running these two commands. After you run
the second command, press <Ctrl-C> after you start seeing the message "no more
job".

```
killall sqlplus
while true; do fg; done
<Ctrl-C>
```
**Lab 11.B: Server Load Balancing**

1. Open a SQLPlus session on the database and confirm that there are no sessions for the **SH** user.

   ```sql
   SQL> select inst_id, count(*) from gv$session where username='SH' group by inst_id;
   no rows selected
   
   If there are any sessions, you can kill them with the output of this SQL:
   
   ```sql
   select 'alter system disconnect session '''||sid||','||serial#||'' immediate;' from v$session where username='SH';
   ```

2. Re-enable server-side load balancing on **both instances** by setting the REMOTE_LISTENER init parameter back to its default (LISTENERS_RAC) and re-registering. Before registering with the listeners, restart them to reset the connection statistics.

   ```sql
   SQL> alter system set remote_listener='LISTENERS_RAC';
   System altered.
   
   collabn1:/home/oracle[RAC1]$ lsnrctl stop
   collabn1:/home/oracle[RAC1]$ lsnrctl start
   
   collabn2:/home/oracle[RAC2]$ lsnrctl stop
   collabn2:/home/oracle[RAC2]$ lsnrctl start
   
   (Side question: why is it true that you only need to run the “alter system” command once, but you need to run the lsnrctl command on both nodes?)
   ```

   ```sql
   SQL> -- instance RAC1
   SQL> alter system register;
   System altered.
   
   collabn1:/home/oracle[RAC1]$ lsnrctl services
   Service "RAC.vm.ardentperf.com" has 1 instance(s).
   Instance "RAC1", status READY, has 2 handler(s) for this service...
   Handler(s):
   "DEDICATED" established:0 refused:0 state:ready
   REMOTE SERVER
   (ADDRESS=(PROTOCOL=TCP)(HOST=collabn1.vm.ardentperf.com)(PORT=1521))
   "DEDICATED" established:0 refused:0 state:ready
   LOCAL SERVER
   Instance "RAC2", status READY, has 1 handler(s) for this service...
   Handler(s):
   "DEDICATED" established:0 refused:0 state:ready
   REMOTE SERVER
   (ADDRESS=(PROTOCOL=TCP)(HOST=collabn2.vm.ardentperf.com)(PORT=1521))
   ```
3. Edit the TNSNAMES.ORA file on the server you're connected to. Add an entry called LBTEST that connects to the RAC service - but only uses one listener.

```
[root@collabn1 ~]# vi $ORACLE_HOME/network/admin/tnsnames.ora
LBTEST =
    (DESCRIPTION =
        (ADDRESS = (PROTOCOL = TCP)(HOST = collabn1-vip)(PORT = 1521))
        (LOAD_BALANCE = no)
        (CONNECT_DATA =
            (SERVER = DEDICATED)
            (SERVICE_NAME = RAC.vm.ardentperf.com)
        )
    )
```

4. In your other connected SQLPlus session, keep an eye on the balance of connections. At the same time, open a new shell session and run this script which will open 160 connections to the database - but this time it will use the LBTEST connection.

```
a=160; while [ $a -gt 0 ]; do
    sqlplus sh/sh@LBTEST &
a=$((a-1))
done
```

How were the connections distributed between the database instances during server-side load balancing?

5. Terminate all of the sqlplus sessions by running these two commands. After you run the second command, press <Ctrl-C> after you start seeing the message "no more job".

```
killall sqlplus
while true; do fg; done
<Ctrl-C>
```
Lab 12: RAC SQL
Lab 12.A: Install Runstats

1. Connect to the database as SYSDBA.

2. First, install the DBMS_LOCK package by running `@/rdbms/admin/dbmslock.sql`

   SQL> @/rdbms/admin/dbmslock.sql

   Package created.
   Synonym created.
   Grant succeeded.

3. Tom Kyte’s runstats package is available from http://asktom.oracle.com/tkyte/runstats.html. First, create the run_stats global temporary table:

   ```
   create global temporary table run_stats
   ( runid varchar2(15),
     name varchar2(80),
     value int )
   on commit preserve rows;
   ```

4. Next, create the stats view.

   ```
   create or replace view stats
   as select 'STAT...' || a.name name, b.value
     from v$statname a, v$mystat b
     where a.statistic# = b.statistic#
   union all
   select 'LATCH.' || name, gets
     from v$latch
   union all
   select 'STAT...Elapsed Time', hsecs from v$timer;
   ```
5. Finally, create the runstats package itself:

```sql
create or replace package runstats_pkg
as
    procedure rs_start;
    procedure rs_middle;
    procedure rs_stop( p_difference_threshold in number default 0 );
end;
/

create or replace package body runstats_pkg
as

  g_start number;
  g_run1  number;
  g_run2  number;

  procedure rs_start
  is
    begin
      delete from run_stats;
      insert into run_stats
        select 'before', stats.* from stats;
      g_start := dbms_utility.get_time;
    end;

  procedure rs_middle
  is
    begin
      g_run1 := (dbms_utility.get_time-g_start);
      insert into run_stats
        select 'after 1', stats.* from stats;
      g_start := dbms_utility.get_time;
    end;

  procedure rs_stop(p_difference_threshold in number default 0)
  is
    begin
      g_run2 := (dbms_utility.get_time-g_start);
      dbms_output.put_line
        ( 'Run1 ran in ' || g_run1 || ' hsecs' );
      dbms_output.put_line
        ( 'Run2 ran in ' || g_run2 || ' hsecs' );
      dbms_output.put_line
        ( 'run 1 ran in ' || round(g_run1/g_run2*100,2) || '% of the time' );
      dbms_output.put_line( chr(9) );
      insert into run_stats
        select 'after 2', stats.* from stats;
      dbms_output.put_line
```
( rpad( 'Name', 30 ) || lpad( 'Run1', 12 ) ||
  lpad( 'Run2', 12 ) || lpad( 'Diff', 12 ) );

for x in
  ( select rpad( a.name, 30 ) ||
      to_char( b.value-a.value, '999,999,999' ) ||
      to_char( c.value-b.value, '999,999,999' ) ||
      to_char( ( (c.value-b.value)-(b.value-a.value)), '999,999,999' )
    from run_stats a, run_stats b, run_stats c
  where a.name = b.name
    and b.name = c.name
    and a.runid = 'before'
    and b.runid = 'after 1'
    and c.runid = 'after 2'
    -- and (c.value-a.value) > 0
    and abs( (c.value-b.value) - (b.value-a.value) )
      > p_difference_threshold
    order by abs( (c.value-b.value)-(b.value-a.value))
  ) loop
    dbms_output.put_line( x.data );
  end loop;

dbms_output.put_line( chr(9) );
dbms_output.put_line
  ( 'Run1 latches total versus runs -- difference and pct' );
dbms_output.put_line
  ( lpad( 'Run1', 12 ) || lpad( 'Run2', 12 ) ||
    lpad( 'Diff', 12 ) || lpad( 'Pct', 10 ) );

for x in
  ( select to_char( run1, '999,999,999' ) ||
    to_char( run2, '999,999,999' ) ||
    to_char( diff, '999,999,999' ) ||
    to_char( round( run1/run2*100,2 ), '99,999.99' ) || '%'
    from ( select sum(b.value-a.value) run1, sum(c.value-b.value) run2,
      sum( (c.value-b.value)-(b.value-a.value)) diff
      from run_stats a, run_stats b, run_stats c
      where a.name = b.name
        and b.name = c.name
        and a.runid = 'before'
        and b.runid = 'after 1'
        and c.runid = 'after 2'
        and a.name like 'LATCH%'
    )
  ) loop
    dbms_output.put_line( x.data );
  end loop;
end;
end;
/
Lab 12.B: Sequence Test

The first test we will perform is a sequence test. Sequential fields often become points of contention in cluster database systems.

1. First, open a connection to the database as SYSDBA on both nodes.

2. Setup a table and several sequence types for comparison. Also enable serveroutput.

```sql
create table SEQTEST (seqid varchar2(30), highval number);
insert into SEQTEST values ('MYTABLE', 1);
commit;

create sequence SEQTEST_O_NC ORDER NOCACHE;
create sequence SEQTEST_O_C ORDER CACHE 100;
create sequence SEQTEST_NO_NC NOORDER NOCACHE;
create sequence SEQTEST_NO_C NOORDER CACHE 100;

set serveroutput on;
```

3. On node collabn1 measure the differences between various methods. Run this two or three times to warm up the machines. (Note: subtract 500 from the runtimes reported (in hsecs) to account for time in DBMS_LOCK.SLEEP)

```sql
exec runstats_pkg.rs_start;
DECLARE
    myval number;
BEGIN
    FOR counter IN 1..10
    LOOP
        select highval into myval from SEQTEST where seqid='MYTABLE' for update;
        update SEQTEST set highval=highval+1 where seqid='MYTABLE';
        dbms_lock.sleep(0.5);
        commit;
    END LOOP;
END;
/
exec runstats_pkg.rs_middle;
DECLARE
    myval number;
BEGIN
    FOR counter IN 1..10
    LOOP
        myval := SEQTEST_O_C.NEXTVAL;
        dbms_lock.sleep(0.5);
        commit;
    END LOOP;
END;
/
exec runstats_pkg.rs_stop;
```
4. On the other node - **collabn2** - start an anonymous PL/SQL block that retrieves a value every half second.

```sql
DECLARE
  myval number;
BEGIN
  LOOP
    select highval into myval from SEQTEST where seqid='MYTABLE' for update;
    update SEQTEST set highval=highval+1 where seqid='MYTABLE';
    select SEQTEST_O_NC.NEXTVAL into myval from dual;
    select SEQTEST_O_C.NEXTVAL into myval from dual;
    select SEQTEST_NO_NC.NEXTVAL into myval from dual;
    select SEQTEST_NO_C.NEXTVAL into myval from dual;
    dbms_lock.sleep(0.5);
    commit;
  END LOOP;
END;
/  
```

5. Repeat step 3. on node **collabn1**. See how the results are different as soon as cluster contention is introduced.

6. Perform more tests, comparing different types of sequences. What conclusions can you draw about sequences? Does caching matter for ORDER sequences?

```sql
exec runstats_pkg.rs_start;
DECLARE
  myval number;
BEGIN
  FOR counter IN 1..10
    LOOP
      myval := SEQTEST_O_NC.NEXTVAL;
      dbms_lock.sleep(0.5);
      commit;
    END LOOP;
  END;
END;
/  
exec runstats_pkg.rs_middle;
DECLARE
  myval number;
BEGIN
  FOR counter IN 1..10
    LOOP
      myval := SEQTEST_O_C.NEXTVAL;
      dbms_lock.sleep(0.5);
      commit;
    END LOOP;
  END;
END;
/  
exec runstats_pkg.rs_stop;
```
Lab 12.C: Parallel Query Test

The second test we will perform is a parallel query test.

1. Login to the node collabn1 and open a connection to the database as SYSDBA and unlock the SH user account. Also grant it DBA access.

   SQL> alter user sh identified by sh account unlock;
   User altered.

   SQL> grant dba to sh;
   Grant succeeded.

2. Reconnect to the database as the sh user with the RAC1 service name. Check your SID and the service you're connected to.

   SQL> connect sh/sh@RAC1
   Connected.

   SQL> select sid from v$mystat where rownum=1;
   SID
   ------
   145

   SQL> col sid format 9999
   SQL> col username format a10
   SQL> col program format a40
   SQL> col service_name format a20
   SQL> set linesize 100
   SQL> select sid, username, program, service_name from v$session where username='SH';

   SID     USERNAME     PROGRAM                                                SERVICE_NAME
   -----    --------     -----------------------------------------------     -------------------------------
   145      SH         sqlplus@collabn1.vm.ardentperf.com (TNS RAC.vm.ardent
3. Enable tracing and run a parallel query on the SH schema. Look for the trace files to determine where the slaves ran. Which nodes to the slaves run on?

```sql
exec dbms_session.set_identifier('racpx01');
alter session set tracefile_identifier = 'racpx01';
exec dbms_monitor.client_id_trace_enable(client_id=>'racpx01');

select /*+parallel*/ p.prod_name, sum(s.amount_sold)
from products p, sales s
where p.prod_id = s.prod_id
group by p.prod_name;

exec dbms_monitor.client_id_trace_disable(client_id=>'racpx01');
```

```sql
SQL> col value format a60
SQL> select inst_id, value from gv$parameter where name='user_dump_dest';

           INST_ID VALUE
---------- ------------------------------------------------------------
          1 /u01/app/oracle/diag/rdbms/rac/RAC1/trace
          2 /u01/app/oracle/diag/rdbms/rac/RAC2/trace

SQL> host ssh collabn1 ls -sh
/u01/app/oracle/diag/rdbms/rac/RAC1/trace/*racpx01.trc

SQL> host ssh collabn2 ls -sh
/u01/app/oracle/diag/rdbms/rac/RAC2/trace/*racpx01.trc
```
4. Create a new service which only runs on node 2 and repeat the test (from collabn1). Which nodes to the slaves run on now? How is this different from Oracle 10g?

collabn1:/home/oracle[RAC1] $ srvctl add service -d RAC -s pxtest -r RAC2 -a RAC1

collabn1:/home/oracle[RAC1] $ srvctl start service -d RAC -s pxtest

collabn1:/home/oracle[RAC1] $ lsnrctl services

Service "pxtest.vm.ardentperf.com" has 1 instance(s).
Instance "RAC2", status READY, has 1 handler(s) for this service...
  Handler(s):
    "DEDICATED" established:0 refused:0 state:ready
  REMOTE SERVER
    (ADDRESS=(PROTOCOL=TCP)(HOST=collabn2.vm.ardentperf.com)(PORT=1521))

collabn1:/home/oracle[RAC1] $ vi $ORACLE_HOME/network/admin/tnsnames.ora

PXTEST =
(Description =
  (Address = (Protocol = TCP)(Host = collabn1-vip)(Port = 1521))
  (Address = (Protocol = TCP)(Host = collabn2-vip)(Port = 1521))
  (Load Balance = yes)
  (Connect Data =
    (Server = DEDICATED)
    (Service_Name = PXTEST.vm.ardentperf.com)
  )
)

collabn1:/home/oracle[RAC1] $ sqlplus sh/sh@pxtest

SQL> col sid format 9999
SQL> col username format a10
SQL> col program format a40
SQL> col service_name format a20
SQL> select sid, username, program, service_name from v$session where username='SH';

<table>
<thead>
<tr>
<th>SID</th>
<th>USERNAME</th>
<th>PROGRAM</th>
<th>SERVICE_NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>SH</td>
<td><a href="mailto:sqlplus@collabn1.vm.ardentperf.com">sqlplus@collabn1.vm.ardentperf.com</a> (TNS V1-V3)</td>
<td>pxtest</td>
</tr>
</tbody>
</table>

exec dbms_session.set_identifier('racpx05');
alter session set tracefile_identifier = 'racpx05';
exec dbms_monitor.client_id_trace_enable(client_id=>'racpx05');

select /*+parallel*/ p.prod_name, sum(s.amount_sold)
from   products p, sales s
where  p.prod_id = s.prod_id
group by p.prod_name;

exec dbms_monitor.client_id_trace_disable(client_id=>'racpx05');

host ssh collabn1 ls -sh
/u01/app/oracle/diag/rdbms/rac/RAC1/trace/*racpx05.trc
host ssh collabn2 ls -sh
/u01/app/oracle/diag/rdbms/rac/RAC2/trace/*racpx05.trc
Lab 13: RAC PL/SQL
**Lab 13.A: Scheduler Test**

In RAC, PL/SQL can execute on either node - and this must be taken into account when processes are architected. We will take a brief look at this property through two simple tests.

First we’ll have a look at the scheduler. Note that this lab relies on the PXTEST service created in lab #8.

1. Login to the node **collabn1** as oracle and confirm that the **pxtest** service is running on instance **RAC2**.

   ```
collabn1:/home/oracle[RAC1]$
   srvctl status service -d RAC -s pxtest
   Service pxtest is running on instance(s) RAC2
   collabn1:/home/oracle[RAC1]$
   ```

2. Shut down the service.

   ```
collabn1:/home/oracle[RAC1]$
   srvctl stop service -d RAC -s pxtest
   collabn1:/home/oracle[RAC1]$
   ```

3. Login to the **RAC1** service as **sh** and create a job class and a PL/SQL procedure that we can execute from the job. Note that the service name is case sensitive!

   ```
collabn1:/home/oracle[RAC1]$
   sqlplus sh/sh@RAC1
   exec dbms_scheduler.create_job_class('TESTOFF1',service=>'pxtest');
   ```

   ```
   create or replace procedure traceme(id varchar2) as
   x number;
   begin
   execute immediate 'alter session set tracefile_identifier="'||id||"";
   dbms_session.session_trace_enable(true,true);
   select count(*) into x from sh.customers;
   dbms_session.session_trace_disable();
   end;
   /
   ```

4. Schedule the job to run immediately with the job class that's tied to the PXTEST service. Check to see if it ran. Query the user_schedule_jobs table a few times in a row. Did anything happen?

   ```
   select job_name, schedule_type, job_class, enabled, auto_drop, state
   from user_scheduler_jobs;
   ```

   ```
   begin
   dbms_scheduler.create_job('TESTJOB1','PLSQL_BLOCK',
   job_action=>'traceme("scheduler01")',
   job_class=>'TESTOFF1',enabled=>true);
   end;
   /
   ```

   ```
   select job_name, schedule_type, job_class, enabled, auto_drop, state
   from user_scheduler_jobs;
   ```
5. Startup the PXTEST service and check the status of the job again. Make sure to query the user_schedule_jobs table a few times in a row. (Be patient for at least one minute.) Did the job execute? If so, then on which node?

```
host srvctl start service -d RAC -s pxtest

select job_name, schedule_type, job_class, enabled, auto_drop, state
from user_scheduler_jobs;

host ssh collabn2 ls -sh /u01/app/oracle/diag/rdbms/rac/RAC2/trace/*scheduler01.trc
host ssh collabn1 ls -sh /u01/app/oracle/diag/rdbms/rac/RAC1/trace/*scheduler01.trc
```

6. Modify the PXTEST service to run on both nodes and stop it.

```
SQL> host srvctl modify service -d RAC -s pxtest -n -i RAC1,RAC2

SQL> host srvctl stop service -d RAC -s pxtest
```

7. Submit 20 jobs to run the program and then enable the service. (This way all of the jobs should get scheduled nearly concurrently.) On which node(s) did they execute?

```
begin
  FOR i IN 10..29
  LOOP
    dbms_scheduler.create_job('TESTJOB'||i,'PLSQL_BLOCK',
      job_action=>'traceme(''Scheduler'||i||''');',
      job_class=>'TESTOFF1',enabled=>true);
  END LOOP;
end;
/

select job_name, schedule_type, job_class, enabled, auto_drop, state
from user_scheduler_jobs;

SQL> host srvctl start service -d RAC -s pxtest

select job_name, schedule_type, job_class, enabled, auto_drop, state
from user_scheduler_jobs;

host ssh collabn2 ls -sh /u01/app/oracle/diag/rdbms/rac/RAC2/trace/*scheduler*.trc
host ssh collabn1 ls -sh /u01/app/oracle/diag/rdbms/rac/RAC1/trace/*scheduler*.trc
```
Lab 13.B: File Test

Our second PL/SQL test will look at the UTL_FILE package. With any PL/SQL operations on RAC you must be aware that the code could execute on any node where its service lives. This could also impact packages like DBMS_PIPE, UTL_MAIL, UTL_HTTP (proxy server source IP rules for example), or even DBMS_RLS (refreshing policies).

1. Login to RAC1 as sh and create a file that we can try reading later.

collabn1:/home/oracle[RAC1]$ sqlplus sh/sh@RAC1

create directory orahome as '/home/oracle';

declare
    fl utl_file.file_type;
begin
    fl := utl_file.fopen('ORAHOME','data.txt','w');
    utl_file.put_line(fl, 'Some sample data for an oracle test.', TRUE);
    utl_file.fclose(fl);
end;
/

2. Exit SQLPLUS. At the prompt, copy this command to connect to the RAC service as sh again and attempt to read the file you just wrote. Run this command 10-20 times in a row. (Cut-and-paste is recommended.) What happens? Why?

sqlplus -S sh/sh@RAC <<EOF
declare
    fl utl_file.file_type;
    data varchar2(1024);
begin
    fl := utl_file.fopen('ORAHOME','data.txt','r');
    utl_file.get_line(fl, data);
    utl_file.fclose(fl);
end;
/
exit;
EOF
Lab 14: RAC Backups
Lab 14.A: Setup

Includes contributions by Parto Jalili

During this lab we will intentionally misconfigure the cluster database backups and make some common mistakes with local, non-shared storage.

1. Login to a terminal on collabn1 as the user oracle.

2. On collabn1 create a directory /u01/app/oradata and try to configure it as the Flash Recovery Area (FRA) through the init param db_recovery_file_dest. The operation will fail.

```sql
collabn1:/home/oracle[RAC1]$ mkdir /u01/app/oradata
collabn1:/home/oracle[RAC1]$ ss
SQL*Plus: Release 11.1.0.6.0 - Production on Mon May 4 07:39:57 2009
SQL> show parameter recovery_file
```

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>db_recovery_file_dest</td>
<td>string</td>
<td>+FRA</td>
</tr>
<tr>
<td>db_recovery_file_dest_size</td>
<td>big integer</td>
<td>4000M</td>
</tr>
</tbody>
</table>

```sql
SQL> alter system set db_recovery_file_dest='/u01/app/oradata';
alter system set db_recovery_file_dest='/u01/app/oradata'
* ERROR at line 1:
ORA-32008: error while processing parameter update at instance RAC2
ORA-02097: parameter cannot be modified because specified value is invalid
ORA-01261: Parameter db_recovery_file_dest destination string cannot be translated
ORA-01262: Stat failed on a file destination directory
Linux Error: 2: No such file or directory
```

Note: the error occurred on the remote node, but was reported here. It was also recorded on the remote node – do you know where it is recorded? What kind of monitoring would need to be in place to be proactively alerted by messages like this?

3. Now create the directory on the remote node and re-run the operation. This should succeed but it is still a poor configuration; we will investigate the reasons later in this lab.

```sql
SQL> host ssh collabn2 mkdir /u01/app/oradata
SQL> alter system set db_recovery_file_dest='/u01/app/oradata';
System altered.
```
4. Shutdown the database across the cluster. Then mount it on **collabn1** and put the database into archivelog mode. No archivelog destination is assigned – where will the archivelogs go and why?

*(Note: you do not need to disable the cluster_database init param for this.)*

collabn1:/home/oracle[RAC1]$ srvctl stop database -d RAC

collabn1:/home/oracle[RAC1]$ srvctl status database -d RAC

Instance RAC1 is not running on node collabn1
Instance RAC2 is not running on node collabn2

collabn1:/home/oracle[RAC1]$ ss

SQL*Plus: Release 11.1.0.6.0 - Production on Mon May 4 09:08:01 2009

    SQL> startup mount

    SQL> alter database archivelog;
        Database altered.

    SQL> alter database open;

    collabn1:/home/oracle[RAC1]$ srvctl start database -d RAC
Lab 14.B: Flashback Database

Includes contributions by Parto Jalili

1. Before opening the database, enable flashback database.

SQL> alter database flashback on;
Database altered.

SQL> alter database open;
Database altered.

SQL> select flashback_on from v$database;
FLASHBACK_ON
--------------
YES

SQL> select oldest_flashback_scn,flashback_size from v$flashback_database_log;
OLDEST_FLASHBACK_SCN  FLASHBACK_SIZE
----------------------  --------------
610425                 8192000

2. Now, login to collabn2 and startup the database from sqlplus. You will get an error message.

collabn2:/home/oracle[RAC2]$ ss

SQL> startup
ORACLE instance started.
Total System Global Area  318054400 bytes
Fixed Size                  1299624 bytes
Variable Size             142609240 bytes
Database Buffers          167772160 bytes
Redo Buffers                6373376 bytes
Database mounted.
ORA-38760: This database instance failed to turn on flashback database

SQL> select flashback_on from v$database;
FLASHBACK_ON
--------------
YES

SQL> select oldest_flashback_scn,flashback_size from v$flashback_database_log;
OLDEST_FLASHBACK_SCN  FLASHBACK_SIZE
----------------------  --------------
0                    16384000
3. Interestingly, the database seems to be running alright. Investigate the alert log for error messages.

collabn2:/home/oracle[RAC2]$ cdd
collabn2:/u01/app/oracle.diag[RAC2]$ cd rdbms/rac/RAC2/trace/
collabn2:/u01/app/oracle.diag/rdbms/rac/RAC2/trace[RAC2]$ less alert_RAC2.log

Mon May 04 09:22:07 2009
Errors in file /u01/app/oracle.diag/rdbms/rac/RAC2/trace/RAC2_ora_22856.trc:
ORA-38701: Flashback database log 1 seq 1 thread 1:
"/u01/app/oradata/RAC/flashback/ack/o1_mf_4zzxs99n_.flb"
ORA-27037: unable to obtain file status
Linux Error: 2: No such file or directory
Additional information: 3

4. Investigate the alert log on collabn1 – do any error messages appear here? Do any other problems occur?

(Hints: you might have to wait for a few minutes. Check the output of “srvctl status database -d RAC” too.)

5. Disable flashback database. You do not need to shutdown for the disable operation.

SQL> alter database flashback off;
Database altered.
Lab 14.C: Block Change Tracking

1. Enable block change tracking on the database and explicitly choose the local FRA destination. (Typically the block change tracking file is created in the OMF DB destination rather than the FRA.)

   SQL> alter database enable block change tracking using file '/u01/app/oradata/changetracking.ctf';

   What happens? Make sure to check the alert logs. Try it with only one instance open, and then open the other instance to see what happens.

2. Disable block change tracking.

   SQL> alter database disable block change tracking;

   SQL> col filename format a40
   SQL> select * from v$block_change_tracking;

   STATUS      FILENAME                                             BYTES
     --------    ----------------------------------------------    ---------
       DISABLED  --------------------------------------------------    --------
Lab 14.D: Archived Logs

Includes contributions by Parto Jalili

1. Look at the sequence number of the two current logs.

   SQL> select thread#, sequence# from v$log where status='CURRENT';
   
   THREAD#  SEQUENCE#
   ---------- ----------
   1          6
   2          3

2. Execute "alter system switch logfile" and check the result. What happened?

   SQL> alter system switch logfile;
   System altered.

   SQL> select thread#, sequence# from v$log where status='CURRENT';
   
   THREAD#  SEQUENCE#
   ---------- ----------
   1          6
   2          4

3. Execute "alter system archive log current" and check the result. What happened now?

   SQL> alter system archive log current;
   System altered.

   SQL> select thread#, sequence# from v$log where status='CURRENT';
   
   THREAD#  SEQUENCE#
   ---------- ----------
   1          7
   2          5

4. Check where the archived logs are being stored by default. (Was this what you expected?) Explicitly assign them to the FRA and test to see if your changes took effect.

   SQL> col t format a5
   SQL> col name format a70
   SQL> select thread# || '.' || sequence# t, name from v$archived_log;
   T       NAME
   ----- -----------------------------------
   1.6  /u01/app/oracle/product/11.1.0/db_1/dbs/arch1_6_685220246.dbf
   1.6  /u01/app/oradata/RAC/archivelog/2009_05_04/ol_mf_1_6_4zy1wofw_.arc
   2.4  /u01/app/oracle/product/11.1.0/db_1/dbs/arch2_4_685220246.dbf
   2.4  /u01/app/oradata/RAC/archivelog/2009_05_04/ol_mf_2_4_4zy1wpn9_.arc
SQL> alter system set log_archive_dest_1='LOCATION=USE_DB_RECOVERY_FILE_DEST';
System altered.

SQL> alter system archive log current;
System altered.

SQL> select thread#||'.'||sequence# t, name from v$archived_log;
T     NAME
----- ----------------------------------------------------------------------
2.5   /u01/app/oradata/RAC/archivelog/2009_05_04/o1_mf_2_5_4zy2xzv3_.arc
1.7   /u01/app/oradata/RAC/archivelog/2009_05_04/o1_mf_1_7_4zy2y1q6_.arc

5. **Take a backup of all the current archivelogs, using the default RMAN configuration. Why does it fail?**

collabn1:/home/oracle[RAC1]$ rman target /
Recovery Manager: Release 11.1.0.6.0 - Production on Mon May 4 10:43:45 2009
connected to target database: RAC (DBID=2273202257)

RMAN> backup archivelog all;
Starting backup at 04-MAY-09
current log archived
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=113 instance=RAC1 device type=DISK
archived log
/u01/app/oradata/RAC/archivelog/2009_05_04/o1_mf_1_4_4zy03zdh_.arc not found
or out of sync with catalog
trying alternate file for archived log of thread 1 with sequence 4
RMAN-00571: ===========================================================
RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS ===============
RMAN-00571: ==============================================================
RMAN-03002: failure of backup command at 05/04/2009 10:47:56
RMAN-06059: expected archived log not found, lost of archived log compromises recoverability
ORA-19625: error identifying file
/u01/app/oracle/product/11.1.0/db_1/dbs/arch1_4_685220246.dbf
ORA-27037: unable to obtain file status
Linux Error: 2: No such file or directory
Additional information: 3

6. **Crosscheck the archived logs; most will fail. Then copy the files from the local FRA on collabn2 and crosscheck them again.**

RMAN> crosscheck archivelog all;
RMAN> list archivelog all;

List of Archived Log Copies for database with db_unique_name RAC
=====================================================================
Key     Thrd Seq     S Low Time
-------- ----- -------- ---------
6        1           4       X 26-APR-09
 Name: /u01/app/oradata/RAC/archivelog/2009_05_04/o1_mf_1_4_4zy03zdh_.arc
RMAN> host 'scp -r collabn2:/u01/app/oradata/RAC/archivelog/*
/u01/app/oradata/RAC/archivelog/';

ol_mf_1_5_4zy044n1_.arc 100% 1024 1.0KB/s 00:00
ol_mf_2_6_4zy3k2s0_.arc 100% 12KB 11.5KB/s 00:00
ol_mf_2_3_4zy1txkr_.arc 100% 13KB 12.5KB/s 00:01
ol_mf_1_4_4zy03zd4_.arc 100% 29MB 4.9MB/s 00:06
ol_mf_2_2_4zy1dksv_.arc 100% 1209KB 1.2MB/s 00:01
ol_mf_2_4_4zy1wpn9_.arc 100% 233KB 233.0KB/s 00:00
ol_mf_2_5_4zy2xzwv3_.arc 100% 19KB 19.0KB/s 00:00

RMAN> crosscheck archivelog all;
RMAN> list archivelog all;

List of Archived Log Copies for database with db_unique_name RAC
=====================================================================}
<table>
<thead>
<tr>
<th>Key</th>
<th>Thrd</th>
<th>Seq</th>
<th>S Low Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>1</td>
<td>4</td>
<td>A 26-APR-09</td>
</tr>
</tbody>
</table>

Name: /u01/app/oradata/RAC/archivelog/2009_05_04/ol_mf_1_4_4zy03zd4_.arc

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Lab 14.E: Database Backups

Note: We will configure backups to take full advantage of the cluster by running in parallel.

1. Configure the RMAN default channels and parallelism.

RMAN> configure device type disk parallelism 2 backup type to compressed backupset;
RMAN> configure channel 1 device type disk connect 'sys/racattack@rac1';
RMAN> configure channel 2 device type disk connect 'sys/racattack@rac2';
RMAN> show all;

2. Take a complete hot backup of the entire database.

RMAN> backup database plus archivelog;

Starting backup at 04-MAY-09
current log archived
channel ORA_DISK_1: starting compressed archived log backup set
channel ORA_DISK_2: starting compressed archived log backup set
...
Finished backup at 04-MAY-09

Starting backup at 04-MAY-09
channel ORA_DISK_1: starting compressed full datafile backup set
channel ORA_DISK_2: starting compressed full datafile backup set
...
Finished backup at 04-MAY-09

Starting backup at 04-MAY-09
current log archived
channel ORA_DISK_1: starting compressed archived log backup set
channel ORA_DISK_2: starting compressed archived log backup set
...
Finished backup at 04-MAY-09

3. Crosscheck the backup. What happens and why?

RMAN> list backupset summary;

<table>
<thead>
<tr>
<th>Key</th>
<th>TY</th>
<th>LV</th>
<th>S</th>
<th>Device Type</th>
<th>Completion Time</th>
<th>#Pieces</th>
<th>#Copies</th>
<th>Compressed</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>B</td>
<td>A</td>
<td>A</td>
<td>DISK</td>
<td>04-MAY-09</td>
<td>1</td>
<td>1</td>
<td>YES</td>
</tr>
<tr>
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<td>A</td>
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<td>YES</td>
</tr>
<tr>
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<td>A</td>
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<td>04-MAY-09</td>
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<td>1</td>
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</tr>
<tr>
<td>4</td>
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<td>A</td>
<td>A</td>
<td>DISK</td>
<td>04-MAY-09</td>
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<td>1</td>
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</tr>
<tr>
<td>5</td>
<td>B</td>
<td>F</td>
<td>A</td>
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<td>04-MAY-09</td>
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<td>1</td>
<td>YES</td>
</tr>
<tr>
<td>6</td>
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<td>F</td>
<td>A</td>
<td>DISK</td>
<td>04-MAY-09</td>
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<td>1</td>
<td>YES</td>
</tr>
<tr>
<td>7</td>
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<td>F</td>
<td>A</td>
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<td>04-MAY-09</td>
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<td>F</td>
<td>A</td>
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<td>A</td>
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<td>1</td>
<td>YES</td>
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<td>A</td>
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<td>04-MAY-09</td>
<td>1</td>
<td>1</td>
<td>YES</td>
</tr>
</tbody>
</table>
RMAN> allocate channel for maintenance device type disk;

released channel: ORA_DISK_1
released channel: ORA_DISK_2
allocated channel: ORA_MAINT_DISK_1
channel ORA_MAINT_DISK_1: SID=111 instance=RAC1 device type=DISK

RMAN> crosscheck backup;
RMAN> list backupset summary;

Try this again, without allocating the maintenance channel. What happens and why?
Lab 15: RAC Recovery
Lab 15.A: Database Recovery

Includes contributions by Parto Jalili

Note: This lab depends on the completion of the Lab 6 exercises.

1. Clear the RMAN channels and parallelism configuration.

   RMAN> configure channel 1 device type disk clear;
   RMAN> configure channel 2 device type disk clear;
   RMAN> configure device type disk parallelism 1;
   RMAN> show all;

2. Preview a restore of the entire database. Why does it fail? How can you remediate this?

   RMAN> restore database preview;

   Starting restore at 04-MAY-09
   allocated channel: ORA_DISK_1
   channel ORA_DISK_1: SID=114 instance=RAC1 device type=DISK

   RMAN-00571: ---------------------------------------------------------------
   RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS ===============
   RMAN-00571: ---------------------------------------------------------------
   RMAN-03002: failure of restore command at 05/04/2009 11:44:53
   RMAN-06026: some targets not found - aborting restore
   RMAN-06023: no backup or copy of datafile 5 found to restore
   RMAN-06023: no backup or copy of datafile 3 found to restore
   RMAN-06023: no backup or copy of datafile 2 found to restore

3. Revert the FRA to the correct shared location, assigned during DB creation before lab 6.

   SQL> alter system set db_recovery_file_dest='+FRA';
   System altered.

4. Repeat the exercises in lab 6 with shared storage.