

# HP Integrity servers running Oracle Real Application Clusters on Windows Server 2003 (64-bit)



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## Overview

This document describes the HP-recommended configuration and installation details for Oracle® Real Application Clusters (RAC) to leverage 64-bit HP Integrity servers with Intel® Itanium®2 processors in a 64-bit Windows® Server 2003 environment. This document has two objectives: 1) define a set of HP recommended architectures for use in deploying Oracle RAC that balances the high availability and scalability characteristics of Oracle RAC with an HP platform of compatible and complementary characteristics, and 2) provide details on an example 9i RAC installation process that highlights the configuration requirements and options specific to the Windows Server 2003 64-bit Itanium environment which are also applicable to Oracle 10g RAC.

## Assumptions

It is assumed that the reader is familiar with configuring computer networks and installing software in a Microsoft Windows Server 2003 environment and that the Hewlett Packard (HP) and Oracle documentation for Oracle 9i Release 2 Database and Real Application Clusters (RAC) for 64-bit Windows are available as references. Also, it is assumed that the hardware configuration has been completed and the necessary software is available.

## References

The following documents were used during the development of this installation guide, with many of the procedural steps derived from them. A shortcut name for each document is indicated, which is used in the procedures as a reference.

1. *Configuring Microsoft Windows Server 2003 Enterprise Edition (64-bit) on the HP Integrity Server*, referred to as "HP Config" (available with server from HP and also available from HP website).
2. *Oracle 9i Database and Client Release Notes for Release 2 (9.2.0.2.1) for 64-Bit Windows*, referred to as "DB Notes"
3. *Oracle 9i Database Installation Guide for Release 2 (9.2.0.2.1) for 64-Bit Windows*, referred to as "DB Install"
4. *Oracle Step-By-Step Installation of RAC with OCFS on Windows 2000* (document ID 178882.1), referred to as "Ora Steps"
5. *Oracle Readme for Oracle 9i SRVM, OSD, and OCFS Bundled Patch Set Notes Version 9.2.0.4.1 for 64-Bit Windows* (Patchset 3151740), referred to as "OSD Patch"
6. *Oracle Note 232239.1 DBCA Tips and Pitfalls in a Windows RAC Environment*, referred to as "DBCA Tips"

## HP-recommended architectures for Oracle RAC on Windows Itanium

Oracle Real Application Clusters (RAC) is a shared-everything architecture in which all nodes in the cluster have access to the data on shared disk. Data does not need to be partitioned among the nodes and all data synchronization and cache coherency are controlled by the Oracle software. This model enables seamless migration of any Oracle database into a RAC environment. Once enabled, the new RAC system immediately

provides significant high availability capabilities – such as clients being buffered from any server or instance level failure. From this point, many additional Oracle and third-party tools that provide performance and scalability can now be applied. Since there are now multiple nodes capable of processing any database function, opportunities are opened to prioritize access by process, user, data element, etc. or to expand processing capacity at will by adding new nodes, which again, increases availability. To fully leverage this architecture, a storage environment that is equally flexible and scalable is a must. Traditional SCSI environments are limited to two-node access and are catered to smaller environments that are not expected to expand or are used strictly as application development platforms. NAS and iSCSI are unproven options that currently bring more challenges than value. HP is working to evolve these options for future use with Oracle RAC. For these reasons, HP recommends that current deployment of RAC for production purposes be on Fibre Channel SANs.

From a server perspective, RAC offers an option to the traditional SMP scale-up model because all nodes in the cluster have concurrent access to a common database. Therefore, expanding processing capacity is accomplished by adding more processors and memory to the existing cluster nodes or by adding additional nodes. A well designed client interface to the RAC cluster that leverages Oracle and third-party technologies will seamlessly integrate additional nodes, rebalancing workload dynamically or statically for short term needs. This model offers significant total-cost-of-ownership advantages including much lower initial costs, closer alignment of capacity needs and costs, and the investment protection from ‘fork-lift’ upgrades. For these reasons, two- and four-processor server models are the focus of HP engineering work around RAC. HP entry-level Integrity Servers are the recommended platform for customers looking to leverage 64-bit Oracle, and often, database designs benefit from large memory capacity.

RAC customers are almost always interested in the high availability features, as well as the potential for scale-out growth. For this reason, HP recommends redundancy and recovery options for storage and the RAC cluster interconnect to mitigate these components as potential points of system failure. It is important to note that a potential alternative to redundancy at this level is a larger node count, which effectively provides more paths to storage and cluster nodes without the added complexity of additional software.

In summary, HP recommends the following high level architectural approaches to RAC on 64-bit Windows-based Itanium platforms:

### Server recommendations:

- HP Integrity rx2600 server with 1 to 2 Intel Itanium2 processors (any speed)
- HP Integrity rx4640-8 server with 1 to 4 Intel Itanium2 processors (any speed)

### Storage recommendations:

- HP StorageWorks MSA1000 Fibre Channel SAN with 2GB switch
- HP StorageWorks EVA3000 / 5000 Fibre Channel SAN with 2GB switch
- HP Fibre Channel HBA AB232A

## Redundancy options:

- HP Secure Path for Windows - IO multi-path management software
- Microsoft MPIO multi-path environment (currently for EVA only)
- NIC Teaming drivers from HP

Oracle Real Application Clusters one-time initial deployment can be complex and time consuming but educational. HP recognizes the trade off between hands-on experience and break-through success in deciding how to approach initial installation of a RAC cluster. The HP Start-up service for Oracle RAC is a fixed-price, fixed-scope rapid deployment service designed to make the most efficient use of limited customer resources augmented by very precise support from HP. A small team of HP RAC experts maintain a knowledge base of the most current RAC installation details. The team shares this knowledge on-demand with HP field services personnel who, in turn, deliver that knowledge to our customers interactively on-site. By focusing the service deliverable on the one-time start-up complexities, customer resources are spared the hunt-and-peck and trouble shooting phase of start up. They experience rapid successful implementation without delays and confusion and have a firm foundation for moving forward. The scope of the service is very precise to ensure fastest time to acceptance.

## Installation example:

A “step-by-step” procedure is described below for installing a 2-node Oracle 9i Real Application Cluster (RAC) using OCFS for Database files on HP Integrity servers running Windows Server 2003 Enterprise Edition (64-Bit). Note that the sample database is created for testing and verification of the system. The procedure is organized into the following four sections:

- Pre-requisites for Installation of Oracle software
- Oracle 9i Database Enterprise Edition software Installation
- Post-installation Configuration
- Creation of Sample Oracle 9i Database.

## Pre-requisites for installation of Oracle software

### Windows Server 2003 Enterprise Edition 64-bit installation

1. Install the HP Integrity server nodes, network connections, and shared storage EVA 3000/5000 or MSA1000 array hardware, following the procedure for hardware installation in HP Config.
2. If the HP Integrity servers were ordered with Windows Server 2003 Enterprise Edition (64-bit), then they will already have the operating system pre-installed. If not, use HP’s SmartSetup CD and the Windows Server 2003 O.S. CD to install Windows Server 2003, following the instructions in HP Config. You may also use the HP Reinstall DVD to restore the factory configuration including Windows Server 2003. As indicated in the HP Config document, when installing it is very important that only the one disk drive on which the OS is to be installed is available—be certain that other local drives are not plugged in and that the shared storage (EVA 3000/5000 or MSA1000) is not

accessible. After the OS has been installed, then other local drives can be installed and the shared storage reconnected.

3. Oracle requires that the Windows automount feature is enabled on all server nodes before installing Real Application Clusters. To check the current setting, open a command window and from the prompt, execute the following commands:

```
C:\> diskpart
```

```
DISKPART > automount
```

If the message displayed indicates that automatic mounting of new volumes is disabled, then execute the following command:

```
DISKPART > automount enable
```

and the message should indicate that automount is enabled. Type exit to quit. This must be done on each of the nodes in the cluster before installing Oracle.

## Network configuration

1. Each node in the cluster must have at least two network interfaces, one for the public network and one for the private cluster interconnect. These need to be on separate networks. After editing the hosts file on each server node with the proper IP addresses and node name (<node name> for public address; <node name>.san for private address), verify that each node can be pinged from either the public or private node names.  
Note: The hosts file is located in the <Windows home directory>\system32\drivers\etc folder.
2. Remember to check the Advanced tab in Network and Dial-up Connections and make sure the Public LAN connection is listed first, followed by the private cluster interconnect (as described in Ora Steps).
3. Oracle recommends that the environmental variables for TEMP and TMP be reset to C:\TEMP and C:\TEMP on each node. Edit this information by right-clicking **My Computer**, select **Properties**, select **Advanced** tab, and click the **Environment Variables** button. In the User variables section, edit the two entries for TEMP and TMP, as noted above.
4. If NIC teaming is desired for the private cluster interconnect or both the private and the public network ports, you must use the HP utility to do this. The utility can be installed from the HP Smart Setup CD (located in the contents\utilities\nic\teaming folder) if it has not already been installed from the Reinstall DVD. Once installed, you may access the utility from the icon in the lower right corner of the desktop, near the time display. Select the pair of NICs to be teamed and choose **Fault Tolerant** and **Fail on Fault**. Assign an IP address to the team, using the Windows Network utility and update the hosts file with the new team IP address.

## HP software installation

1. Install other HP software, such as the external shared storage firmware, HBA drivers, and files for Secure Path or Windows MPIO redundant storage solutions. The software utility and instructions for flashing the MSA1000 firmware (version must be 4.24 or later) or the EVA3000/5000 firmware (version must be 3.010 or later) can be obtained from the HP

website. Updating firmware is done from one node in the cluster to the storage controllers.

2. There are two redundant storage solutions available for the Integrity servers: HP Secure Path's multipath solution and Windows MPIO solution. At this time, both are supported for the EVA 3000/5000 storage, but only Secure Path is supported for the MSA1000. Only one of these solutions may be installed on the servers—do not install both. The installation of the HBA driver and either Secure Path or MPIO files from HP need to be done on each server node in the cluster. The HBA driver should already be installed during the HP Smart Setup or HP Reinstall process. If Secure Path or MPIO are required, either multi-path software must be installed now. Obtain either the HP Secure Path software or the Microsoft MPIO software from the HP website, choosing the version that is appropriate for Windows Server 2003 64-bit.
3. After installation of Secure Path or MPIO, you may connect the second storage path (controller, cable, HBA port, and switch) to the MSA1000 or EVA 3000/5000.

## External shared storage configuration

### Configuration of HP StorageWorks MSA1000 storage

1. Confirm that the shared storage (MSA1000) is powered up. Use HP's ACU-XE utility for 64-bit Windows on Node 1 to configure the MSA1000 storage to have one logical drive of at least 2.1GB. Access the ACU-XE tool from **Start->Programs->HP System Tools->HP Array Configuration Utility->HP Array Configuration Utility**. Select the MSA1000 controller in the Configuration view.
2. If there is a pre-existing array configuration displayed, clear the configuration by performing the following:
  - Click **Clear Configuration** under the Configuration View. A confirmation window is displayed.
  - Click **OK** in the confirmation window.
  - Click **Save**. A confirmation window is displayed.
  - Click **OK** in the confirmation window.
3. Click **Create Array** under the Select a task for heading and a list of all drives available is displayed. Configure the storage array by performing the following:
  - Select all the disks and click **OK**. Select the newly created Array and select **Create Logical Drive**.
  - Select **RAID Level 1+0** and enter a size of **21000 MB** (2.1GB) and take the defaults for other fields.
  - Click **Save**. A confirmation window displays. Click **OK** to save the configuration.
4. Click **Selective Storage Presentation** (SSP) from the right windowpane. Configure SSP by performing the following:
  - Select **Enable** and **OK**.
  - Select **Windows** from the Host Mode drop box. (Scroll right to see these options)
  - Select all the logical drives for each adapter ID that need access to this server. (For this installation process select all of them).
  - Click **OK**. A warning window is displayed. Select **OK** in this warning window.

5. Click **Save**. A confirmation window is displayed. Select **OK** to save the configuration.
6. Click **Exit ACU**. The ACU-XE utility closes.
7. Repeat steps 4 through 6 on each of the other nodes in the cluster, to confirm that the shared storage is visible and that SSP is configured.

### Configuration of StorageWorks EVA 3000/5000 storage

1. Obtain hostname, IP address, and HBA WorldWide ID (WWID) for each server in the cluster. To find the HBA WWID, you must use either the Emulex lputilnt utility or the HBAnyware utility that are both available on the HP Smart Setup CD. If they are not already installed, you can install them from the CD (located in contents\utilities\fc\_hba\ab232a). Once installed, you can start either by choosing **Start->Programs->Emulex**. For example, start the lputilnt utility and click the HBA listed in the left pane of the window that is displayed. Choose **Configuration Data** as the category and scroll down to **16-World Wide Name** in Region to see the WWID for that HBA. If you have two HBA ports, there will be two HBA's listed in the left pane.
2. Using the HP SAN Appliance, open the Command EVA utility and configure the EVA host profiles for the server nodes in the cluster. You will need to Add each host, and enter the hostname, the IP address (if not using DHCP), and from the pull-down menu, select the WWID for the HBA in that server. Select **Windows** as the OS. If you have more than one HBA port per server, select **Add port** and select the additional WWID for that server's other HBA port. You should have a host profile for each of the server nodes in the cluster.
3. Also using the HP SAN Appliance and the Command EVA utility, configure a LUN for the Oracle database on OCFS and present it to the server nodes in the cluster. Start by creating a Vdisk—you can take the default Vdisk name and select the desired disk group from the Disk Group Name drop down list. Select the **Vraid1** option for redundancy and enter 3GB in the size text field.
4. Under the Vdisk created in the previous step, click the **Active** icon. Click the **Presentation** tab and then click **Present**. Select all of the server hosts for which profiles were created in step 2 above.
5. Reboot each of the server nodes in the cluster.

### Configure shared storage in Windows Server 2003

1. Open the Windows Server 2003 Computer Management utility and select **Disk Management** under Storage.
2. The Windows Server 2003 Initialize and Convert disk wizard is displayed to initialize the disk volume(s) and the option to convert from Basic disk to Dynamic disk is offered. Initialize the disk and select **Partition** style of Master Boot Record (MBR), as this is required for Oracle. Do not convert to Dynamic disk, as this is not supported for an Oracle database. If it is necessary to change a Dynamic disk back to a Basic disk, all the data on the disk will be lost. Confirm that the disk is Basic and MBR by right-clicking the disk and choosing **Properties**. Select the **Volumes** tab. If the properties are not correct, reconfigure the disk.
  - Use Windows Disk Management to configure the shared disk storage partitions. Right-click the new disk from step 2 and select **Properties**. Create one extended partition of maximum size.

- Right-click the partition and choose to Create Logical drive. Choose a minimum of 21GB for the partition; do not choose a driver letter and do not format the drive.
- On each of the other nodes, use Windows Disk Management to verify that the shared storage partition can be seen, as this is required before installing the Oracle OSD's.

## Oracle Operating System Dependent (OSD) Cluster software installation

1. Test the network communication between the nodes by using the ping utility for both the public and private names of the nodes (the names used in step B.1 above). Also verify administrative access to all nodes by executing the following commands from each node at a command prompt:

```
NET USE \\<host name>\c$
```

where <host name> is the public name of the other node. The command should complete successfully.

2. Create a local image of Oracle 9i Database software on Node 1 of the cluster, by using following steps:
  - Obtain the Oracle 9i (9.2.0.2) Database software from Oracle (2 CD images)
  - Unzip the CD images (#1 and #2) which create Disk1 and Disk2 folders
  - Copy the Disk1 and Disk2 contents to CD's or to a location on the local drive of Node 1 (e.g., c:\orinst)
  - If the Disk1 and Disk2 contents are on CDs, copy each of them to a new folder on Node 1's local drive (e.g., c:\orinst), by using the xcopy command at the command prompt:
3. Obtain Oracle's 9.2.0.4.1 patchset # 3151740 for SRVM, OSD and OCFS Bundled Patch Set for 64-bit Windows from Metalink. Run the 3151740.exe file, which will unzip the files to a location on Node 1's local drive (e.g. c:\racpatchset). From that folder, execute the program racinstall.bat to replace the files in the 9.2.0.2 Disk1 and Disk2 folders with the 9.2.0.4.1 versions of SRVM, OSD, and OCFS. For example, run the following at a command prompt on Node 1:

```
cd c:\racpatchset
racinstall.bat c:\orainst
```

4. Verify that the Extended partition is visible from both nodes, using Windows Disk Management, and that there are no drive letters associated with any logical drives on the partition. If there are drive letters, they must be removed.
5. Install the OSD's by running the Oracle cluster setup wizard program, clustersetup.exe, located in the \preinstall\_rac\clustersetup directory in the installation directory for Disk1, created above (e.g., c:\orainst\Disk1). The Welcome page is displayed. Click **Next**. Select **Create a cluster** and click **Next**. Select to **Use Private Network** for interconnect and click **Next**. Enter a cluster name and the names of the nodes (you can enter the public name and tab to the private name field, which will be filled in by default with public name followed by .san). Click **Next**. It is assumed that the Oracle Home with binary files will be installed on each node, but that the datafiles will be placed on OCFS. Select Cluster File System for Oracle Datafiles. Select the partition created for the data and

choose a drive letter to be associated with it (e.g., O:). Click **Next**. Reply appropriately if VIA is used or not. Click **Next**. Take the default location. Click **Finish**. The progress page is displayed.

6. When the wizard finishes, it disappears from the screen. Confirm that the OracleCMService9i and the OracleObjectService services are running on each of the nodes in your RAC cluster. Also, check the cmsrvr.<node name>.log file on each node to verify that all of the nodes are active in the cluster. This log file is located at \<Windows home directory>\system32\osd9i, and the end of the file should contain one line for each node indicating that "Node (n) is active member of cluster" where n = 0,1 , which is the number of nodes less one (0 and 1 for a 2-node cluster). After that, a line in the log should indicate "Successful reconfiguration, <N> active node(s)..." where N is the number of nodes in the cluster. This confirms a working cluster.

## Oracle 9i Database Enterprise Edition software installation

1. Install the Oracle 9i Database software using the Oracle Universal Installer (OUI), by running the setup.exe program located in the Oracle installation folder in Disk1. The OUI Welcome screen is displayed. Click **Next**.
2. On the Cluster Node Selection screen, select both nodes in the cluster, using the shift key. Click **Next**. If both nodes are not listed, then there is a problem with the OSD installation that must be fixed before going on.
3. Confirm File Locations and click **Next**.
4. Select the **Oracle 9i Database 9.2.0.2.0** product, the **Enterprise Edition** type, and the **Software Only** database configuration (you will create the sample database later) on the next screens and click **Next**. Keep the default value on other screens and click **Next**.
5. Check the **Summary** screen for the Oracle9i Real Application Clusters entry (scroll down to see it). Click **Install**.
6. It will take about 15 minutes to complete this process, including installing the software on the second node. When finished, click **Exit** and confirm it with **Yes**.

## Post-installation configuration

### Update the GSD Services

1. Use the Windows Services control panel icon to display services. If the OracleGSDService exists and is running, stop it on each node.
2. Create an ORA\_DBA group on each node if it does not already exist. Use the Manage option of "My Computer" to access the Users and Groups function to do this. Add the Administrator user (or a different user with administrative privileges, if desired) to the ORA\_DBA group. This is the user that will administer the Oracle database.
3. If the OracleGSDService does not exist, create it by running the following from a command prompt on each node:

```
cd c:\oracle\ora92\bin  
  
gsdservice.exe -install
```
4. Right-click the **OracleGSDService** in the Windows Services window on each node and select **Properties**. Select the **Log On** tab and select "Log on as" > This Account. Enter the

- user name and password for the administrator user account added to the ORA\_DBA group in step 2 above. Click **OK** and then, in the message window, click **OK** again.
5. From the command prompt, issue the `gsdctl start` command on each node to start the OracleGSDService.

## Apply Patchsets 9.2.0.4.1 for 64-Bit Windows Server 2003

1. Obtain Oracle's 9.2.0.4.1 patchset # 3095277 for 64-bit Windows from MetaLink, unzip the file, and copy it to a folder (e.g. `c:\Disk1`) on the local drive on Node 1.
2. Stop all existing Oracle processes on each node, except the following:  
`OracleCMService9i, OracleClusterVolumeService, Oracle Object Service, OraFenceService, and OCFS` (some of these will not exist, if using Raw Partitions instead of OCFS).
3. Install the OUI 2.2.1.9.0 release and the Oracle 9.2.0.4.1 database patchset, by running the `setup.exe` program in the `Disk1` folder containing the patchset 3095277 files. The OUI Welcome screen is displayed. Click **Next**.
4. Select all nodes in the cluster using the shift key and click **Next**. Confirm the File Locations and click **Next**.
5. On the Available Products screen, select to install the OUI software first. Click **Next**.
6. On the Summary screen, click **Install**.
7. After the OUI installation completes, select the **Next Install** button.
8. Repeat step 4.
9. On the Available Products screen, select to install the Oracle 9i 9.2.0.4.1 patch set. Click **Next**.
10. On the Summary screen, click **Install**.
11. After the patch set installation completes, click **Exit** and confirm it.

## Creation of Sample Oracle 9i Database using OCFS

1. On the OCFS drive (e.g., drive letter O:) that you created for Datafiles (in step E.4), create a directory named `oradata`, using the following command at a command prompt on Node1:  

```
cd O:
O:\> md oradata
```
2. Verify that this `oradata` directory is visible from the other node.
3. On each node, confirm that the OracleGSDService is not running. If it is, stop it using Windows Services control panel icon, or run `gsdctl stop` from the command line.
4. On each node, open a new command window and run the `gsd.bat` program, as follows:  

```
cd c:\oracle\ora92\bin
gsd.bat
```

Minimize the window, but leave this running while doing the next steps.
5. On Node 1, run Oracle's Net Configuration Assistant utility (found under Windows **Start Menu->Programs->Oracle OraHome 92->Configuration and Migration Tools->**)
6. Choose a **Cluster** configuration. Select all nodes and take default Listener name. Select Listener configuration, then **Add**, and then select **TCP Protocol**, and other defaults. When finished, click **Finish**.

7. Create a DBCA trace file for more complete logging, if the DBCA fails. Do this by editing the dbca.bat file, after making a copy of it first. For example, do the following commands:
 

```
cd c:\oracle\ora92\bin
copy dbca.bat dbcacopy.bat
Notepad dbca.bat
[Edit the lines with "\Program Files\Oracle\jre\<version
#>\BIN
          \JAVAW" to
add the following text
-DTRACING.ENABLED=true -DTRACING.LEVEL=2
before the text
-DORACLE_HOME="%OH%"... ]
```
8. On Node 1, open a new command window and run the following commands to start the dbca tool with tracing to the dbca\_trace.txt file:
 

```
cd c:\oracle\ora92\bin
dbca -datafileDestination O:\oradata > dbca_trace.txt
          [where O: is the OCFS drive letter]
```
9. The DBCA Welcome page is displayed. Select **Oracle Cluster Database** and click **Next**.
10. Choose to **Create a Database** and click **Next**.
11. Select all the nodes in the Cluster and click **Next**.
12. Select **New Database template** and click **Next**.
13. Enter the Global Database Name and SID Prefix (e.g., ORCL) and click **Next**.
14. Select any desired database options and click **Next**.
15. Select **Dedicated Server Mode** option and click **Next**.
16. Click **All Initialization Parameters** button and in the Initialization Parameters window, modify any desired settings. Under **File Locations** tab, confirm the location of the server parameter file (spfile) on OCFS drive O: and click **OK**.
17. In the Database Storage Window, confirm the file names for the default tablespaces and redo log files have the OCFS drive letter and oradata defined earlier. Click **Next**.
18. On the Creations Options window, click the **Create Database** box and click **Finish**.
19. A Common Options screen is displayed. Review the information and click **OK**. DBCA will start to create the database.
20. The creation process is slow and may appear to hang at times. There are some known bugs that cause errors to be displayed (e.g., ORA-29807 and ORA-01430); if these are displayed, select "Ignore" and continue. It may hit 100% completed and still be running. A password selection screen is displayed (after about 45 minutes) and you must change the passwords for SYS and SYSTEM users. Click the **Exit** button and exit DBCA.
21. If the creation process hangs (after an hour), go to step 22 to see if the database has been created successfully. If it shows that both threads are running and open, then the creation completed successfully and you can close the DBCA window.
22. After all instances have been created on the nodes, verify the database is running correctly in the cluster by using SQLPLUS at a command prompt with the following commands on each node:

```
Sqlplus /nolog
SQL> connect / as sysdba
SQL> select * from v$thread;
```

The output displayed in the command window should list all the nodes with a status of open, once they have all been started.

```
SQL> select * from v$active_instances;
```

The output should list a row for each node and give the names of all the nodes, after all the instances have been started.

This completes the installation of the Oracle 9i RAC database.

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