

Technical report:

Setting up OracleRAC10gR2 over NFS on IBM System Storage N series

Best practices for using automatic storage management

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Abstract

Oracle10g RDBMS has a new facility called Automatic Storage Management (ASM) which provides integrated cluster file system and volume management features. ASM complements the Oracle10g RDBMS with both volume and disk management utilities, removing the need for thirdparty volume management tools while also reducing the complexity of the enterprise architecture. ASM provides simplicity of managing volumes that may be composed of blockbased devices (e.g., in a storage area network, or SAN) or file-based devices (e.g., in a network file system, or). These devices are the underlying storage for the Oracle RDBMS. Although ASM over SAN storage has been the more popular option, a customer has the choice of deploying ASM over NFS as well. IBM System Storage N series systems offer substantial advantages in an NFS environemtn. This paper facilitates a customer NFS on an IBM System Storage N series.

Introduction

This technical report covers the installation of Oracle Database 10g Release 2 with Real Application Clusters (OracleRAC10gR2) and Oracle Automatic Storage Management (ASM) with Oracle Clusterware over a network file system (NFS) on IBM® System StorageTM N series. This is now a certified configuration and therefore the components presented in this paper must be used in the same combination to gain support from all parties involved. The only exception is the application of certain patches as defined and required by all the vendors in this configuration. This report also covers the patches and recommendations for running OracleRAC10gR2 and ASM on N series Storage in an NFS environment.



Assumptions

We assume that readers are familiar with OracleRAC10*g*R2 and with the operation of IBM N series storage systems. We also assume that readers are familiar with the operation of the Enterprise Linux® operating-system environment and installation of Oracle Database 10*g* patches and any relevant Enterprise Linux Red Hat Package Managers (RPMs). It is also important to be familiar with all networking terminology and implementations.

System environment

The configuration presented in this document is based on the following OracleRAC10*g*R2 certification environment.



Figure 1) OracleRAC10gR2 on IBM xSeries (Intel x86) servers with IBM N series.

Figure 1 shows a typical configuration of OracleRAC10*g*R2 with N series storage and IBM xSeries® Intel® servers running the Oracle Enterprise Linux® (OEL4) operating system (OS). This configuration enables users to scale horizontally and internally in terms of processor, memory, and storage.

As shown in Figure 1, it is strongly recommended that you dedicate a private network connection between the OracleRAC10*g*R2 servers and the N series storage. This is accomplished by using a dedicated gigabit



network (with a gigabit switch) to the N series storage. A dedicated network connection is beneficial for the following reasons:

- In an OracleRAC10gR2 environment, it is important to eliminate contentions and latencies.
- Providing a separate network ensures security.

The cluster interconnect is an essential part of Oracle Database 10*g* clusters. Along with cache fusion, it is also used to monitor the heartbeat of the servers in the existing cluster group. This is a typical configuration that can be deployed in a customer's environment.

Requirements

Hardware

Cluster nodes:

- Two IBM xSeries 306 32-bit Intel® servers
- One 4-Port 10/100 Base-TX Ethernet PCI Adapter
- One 10/100/1000 Base-T Ethernet PCI Adapter (for private interconnect)
- One 10/100/1000 Base-T Ethernet PCI Adapter (connected to N series storage).

Storage Infrastructure:

- One IBM N series system with IBM System Storage N series with Data ONTAP® 7.2 or later
- One gigabit switch with at least four ports.
- One gigabit NIC in the system
- One or more disk shelves, based on the disk space requirements.

Software

For both nodes in the participating cluster unless specified otherwise:

- Oracle Enterprise Linux 4
- Oracle Database 10g Release 2 (10.2.0.1), with RAC license
- Oracle Database 10g Release 2 Patch 3.



Setup for IBM N series

- Configure an IBM N series system running Data ONTAP 7.2 or above and also with NFS and IBM System Storage N series with SnapRestore[®] license keys.
- 2. Create and export volumes for storing database files on the storage:

Create four volumes on the storage (Storage1) as listed below. orahome Shared Oracle and Cluster Registry Service (CRS) home (binaries) oradata Oracle data files and control files ora10g CRS files oralogs Database logs, a copy of control file and archive logs

To create volumes, use the following command at the N series storage console:

Storage1> vol create oradata 14

Note: Volume oradata was created with 14 disks and volumes oralogs and orahome with eight disks each. You can create your volumes based on your workload needs.

Add the following entries to the /etc/exports file on N series storage (Storage1):

```
/vol/orahome -anon=0
/vol/oradata -anon=0
/vol/oralogs -anon=0
/vol/oralog -anon=0
```

Execute the following command at the storage system console:

Storagel> exportfs -a

Note: It is recommended that you use flexible volumes in your database environment. IBM System Storage N series with FlexVol[™] technology pools storage resources automatically and enables you to create multiple flexible volumes on a large pool of disks. This flexibility means that you can simplify operations, gain maximum spindle utilization and efficiency, and make changes quickly and seamlessly.

The database volume layout discussed in this document was defined for certification purposes, and your setup may vary depending upon requirements.



Operating-system configuration

Patches

Before your OracleRAC10*g*R2 installation, the following RPMs need to be applied on IBM servers. Some of these RPMs may already be applied to your system. Be sure to verify whether they already exist before applying them.

To determine whether the required RPMs are already installed and committed, enter a command similar to the following:

rpm -qa | grep compat

If a patch is not installed and committed, then install it. Here is a list of required patches.

binutils-2.15.92.0.2-21 compat-libstdc++-296-2.96-132.7.2 compat-db-4.1.25-9 compat-libstdc++-33-3.2.3-47.3 make-3.80-6.EL4 glibc-common-2.3.4-2.25 glibc-2.3.4-2.25 glibc-devel-2.3.4-2.25 openmotif-2.2.3-10.RHEL4.5 setarch-1.6-1 control-center-2.8.0-12.rhel4.5 gcc-3.4.6-3.1 gcc-c++-3.4.6-3.1 gnome-libs-1.4.1.2.90-44.2 libstdc++-3.4.6-3.1 libstdc++-devel-3.4.6-3.1 libaio-0.3.105-2 pdksh-5.2.14-30.3 Note: Java 1.4.2 32-bit is installed with Oracle.

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Operating-system settings

On Enterprise Linux systems, the default ulimits for individual users are set in

/etc/security/limits.conf. As a root user, add the following entries using root users:

Oracle specific settings oracle soft nofile 4096 oracle hard nofile 65536 oracle soft nproc 2047 oracle hard nproc 16384 oracle soft memlock 3145728 oracle hard memlock 3145728

This needs to be done on all nodes of the cluster. It may be necessary to reboot the server to activate updated limits. After you modify the settings, the ulimit -a command should display the following:

```
# ulimit -a
```

```
core file size(blocks, -c) 0data seg size(kbytes, -d) unlimitedfile size(blocks, -f) unlimitedmax locked memory(kbytes, -l) unlimitedmax memory size(kbytes, -m) unlimitedopen files(-n) 4096pipe size(512 bytes, -p) 8stack size(kbytes, -s) unlimitedcpu time(seconds, -t) unlimitedmax user processes(-u) 15168virtual memory(kbytes, -v) unlimited
```

Verify the above setting for the oracle user.

Kernel settings

Add the following parameters for the shared memory and semaphores to the /etc/sysctl.conf file using root user.

```
kernel.shmall = 2097152
kernel.shmmax = 2147483648
kernel.shmmni = 4096
kernel.sem = 250 32000 100 128
fs.file-max = 65536
net.ipv4.ip_local_port_range = 1024 65000
net.core.rmem_default = 1048576
net.core.rmem_max = 1048576
net.core.wmem_default = 262144
net.core.wmem_max = 262144
```

Note: Set the parameter with the specified value in the /etc/sysctl.conf file:

```
vm.lower_zone_protection (= 100)
```

This parameter is to increases the default page threshold from 16 MB to 100 MB to ensure that kernel is available with sufficient memory during heavy online transaction processing (OLTP) operations on the system.



Preinstallation setup tasks (cluster nodes)

This information is intended for both nodes in the participating cluster unless specified otherwise.

- Have two IBM xSeries Intel servers ready with the latest recommended patches and operatingsystem settings as described in another section of this report.
- 2. Install and configure NICs in the cluster nodes (three per node).
 - a. Public IP: As indicated by name.
 - Private interconnects: Connect one gigabit NIC to the gigabit switch of all the nodes for cluster interconnects.
 - c. Server connection to N series storage: Connect one gigabit NIC to the gigabit switch, which will connect to the gigabit NIC on the N series storage.
- 3. Configure the network interfaces on each node.
 - a. Configure the three network interfaces:

```
# btc-ppe-wkst1 (Host 1)
en0 - ip: 10.73.68.155, netmask 255.255.254.0
en6 - ip: 10.73.69.155, netmask: 255.255.255.0
en4 - ip: 192.168.73.1, netmask: 255.255.255.0
# btc-ppe-wkst6 (Host 2)
en0 - ip: 10.73.68.156, netmask: 255.255.254.0
en6 - ip: 10.73.69.156, netmask: 255.255.255.0
en4 - ip: 192.168.73.2, netmask: 255.255.255.0
```

Where:

Interface en0 is the public IP for each node.

Interface en6 on both cluster nodes is connected to the gigabit switch for storage I/O. Interface en4 on both cluster nodes is connected to the gigabit switch for cluster private interconnects.

b. Update the /etc/hosts file on the cluster nodes and add entries for public, private, and virtual IP (VIP) addresses.

Note: In addition to the preconfigured public and private network, Oracle Database 10*g* requires additional IP addresses that will be mapped to the public address as VIPs. If a node fails when an application or user makes a connection using a VIP, the Oracle Clusterware will transfers the VIP address to another surviving instance. You should add the VIP to the /etc/hosts file on all nodes in the cluster as well as all nodes that access the database. VIP must have the same subnet as the public IP address of the database host.

An example of /etc/hosts entries:

```
# Internet Address Hostname # Comments
10.73.68.155
                  btc-ppe-wkst1
                                     btc-ppe-wkst1.btcppe.ibmn.com
10.73.69.155
                  btc-ppe-wkst1-en6
192.168.73.1
                  btc-ppe-wkstl-i
                                     btc-ppe-wkst1-i.btcppe.ibmn.com
                  btc-ppe-wkstl-v
10.73.68.195
                                     btc-ppe-wkstl-v.btcppe.ibmn.com
10.73.68.156
                  btc-ppe-wkst6
                                     btc-ppe-wkst6.btcppe.ibmn.com
10.73.69.156
                  btc-ppe-wkst6-en6
192.168.73.2
                  btc-ppe-wkst6-I
                                      btc-ppe-wkst6-i.btcppe.ibmn.com
10.73.68.196
                  btc-ppe-wkst6-v
                                      btc-ppe-wkst6-v.btcppe.ibmn.com
10.73.69.105
                  Storage1
```

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- 4. Use the ping command to ensure the connectivity of each interface (interconnects, public IPs, and storage).
- 5. Create NFS mount points and mount the volumes with the following mount options on all the cluster nodes. As a root user, update the /etc/fstab file on all server nodes and add the following entries:

```
Storage1:/vol/oradata /oradata
                                      nfs
hard, nointr, proto=tcp, suid, vers=3, rw, bg, rsize=32768, wsize=32768, actimeo=0, ti
meo=600
Storage1:/vol/orahome /orahome
                                      nfs
hard, nointr, proto=tcp, suid, vers=3, rw, bg, rsize=32768, wsize=32768, actimeo=0, ti
meo=600
Storage1:/vol/oralogs
                             /oralogs
                                              nfs
hard,nointr,proto=tcp,suid,vers=3,rw,bg,rsize=32768,wsize=32768,actimeo=0,ti
meo=600
Storage1:/vol/ora10g
                             /ora10g
                                              nfs
hard,proto=tcp,suid,vers=3,nointr,rw,bg,rsize=32768,wsize=32768,noac,timeo=6
```

Where:

00

Storage1 is the name of the N series storage system.

oradata, oralogs, orahome, and ora10g are the mount points on the cluster nodes.

ora10g is just a separate mount point for CRS files. CRS and cluster synchronization services (CSS) files (cluster registry file and voting disk file) can reside in the same /ora10g volume but they must be mounted with the noac mount option.

During the Oracle CRS installation, be sure to indicate a path starting with the /oral0g directory when prompted for the OCR and voting disk file location.

6. **Note:** If you dynamically mount the NFS volumes without adding entries in the /etc/fstab file, the Oracle installation will fail. Create the following mount points on all cluster nodes:

```
#mkdir /oradata
#mkdir /oralogs
#mkdir /orahome
#mkdir /oral0g
```

Mount exported volumes on the mount points created above on all the cluster nodes. It is always a good idea to verify mount options by using the mount command on each node. After the NFS volumes are mounted, change the ownership of these mounted volumes to oracle user and dba group.



Installation procedure

The following sections explain the steps to install OracleRAC10gR2 on Enterprise Linux.

Preparing to install the Oracle RAC on clusters nodes

- This document assumes the oracle user account and the group to be oracle and dba, respectively, on both cluster nodes. The user ID and group name for the oracle account should be the same on both cluster nodes. A sample oracle user .bash_profile file is provided in the Appendix. Make sure that the user profile file exports at least the ORACLE_BASE, ORACLE_PRODUCT, ORACLE_HOME, ORACLE_SID, ORA_CRS_HOME, and PATH entries.
- 2. Grant appropriate permissions to the oracle user on all shared mounted volumes, /oradata, /orahome, and /oralogs:

```
#chown -R oracle:dba /oradata
#chmod -R 755 /oradata
Repeat this step for the orahome and oralogs volumes.
```

3. Set up account equivalence between the cluster nodes for the oracle user account. Add the following entries to the /etc/hosts.equiv file on all cluster nodes:

```
btc-ppe-wkst1 oracle
btc-ppe-wkst6 oracle
btc-ppe-wkst1-i oracle
btc-ppe-wkst6-i oracle
```

4. Log in as oracle user from both cluster nodes and then test the oracle user account equivalence by using a remote shell utility such as rsh:

```
btc-ppe-wkst1:
#su - oracle
$rsh btc-ppe-wkst1 pwd
$rsh btc-ppe-wkst6 pwd
$rsh btc-ppe-wkst1-i pwd
$rsh btc-ppe-wkst6-i pwd
btc-ppe-wkst6:
#su - oracle
```

\$rsh btc-ppe-wkst1 pwd \$rsh btc-ppe-wkst6 pwd \$rsh btc-ppe-wkst1-i pwd \$rsh btc-ppe-wkst6-i pwd



Installing OracleRAC10gR2 CRS

For detailed information on installing Oracle CRS on Linux, refer to the appropriate Oracle RAC installation and configuration guide (located, at the time of this report writing, at http://otn.oracle.com/docs/content.html). This section briefly describes the procedures for using Oracle Universal Installer (OUI) to install CRS.

Note: The CRS home that you identify in this phase of the installation is only for CRS software; this home cannot be the same home as the OracleRAC10*g* home. That is, ORACLE_HOME and CRS HOME must be different locations.

- Run the runInstaller command from the /crs subdirectory on the Oracle CRS R2 (10.2.0.1) CD-ROM or from the staging area where Oracle CRS software has been dumped. This is a separate CD that contains the CRS software. This document assumes that OUI is started from node 1 (btc-ppe-wkst1). When OUI displays the Welcome page, click Next.
- 2. On the Specify Inventory page, enter a nonshared location for Oracle Inventory. This is the only part of Oracle Database 10g that should not be shared. For this test, we used /home/oracle/oraInventory for the Oracle Inventory information. Click Next.
- 3. The Specify File Locations page contains predetermined information for the source of the installation files and the target destination information. Specify the destination path for the shared CRS home. The path should be on a shared file system and different from \$ORACLE_HOME. In this exercise, the shared CRS home was /orahome/ora10g/product/10.2.0/crs_1
- 4. On the next screen, specify the cluster name, public interface names (hostnames), private interface names and virtual interface hostnames to be used for the cluster interconnect. In our case, the public names are btc-ppe-wkst1 and btc-ppe-wkst6, the private names are btc-ppe-wkst1-i and btc-ppe-wkst6-i, and the virtual hostnames are btc-ppe-wkst1-v and btc-ppe-wkst6-v. Click next to continue.
- 5. On the Network Interface Usage page, specify the private network to be used for the cluster interconnect. This is an important step. Do not leave it set to the default, which is Do Not Use. In our case, eth1 (btc-ppe-wkstl-i) was used as the private interconnect; eth0 (btc-ppe-wkstl) was used as the public interface. Select the interface and click the Edit button to modify it. Click Next.
- 6. On the Oracle Cluster Registry page, specify the OCR file. Be sure to specify the full path to a shared location along with the name of the file. Do the same for a mirror file if you want normal redundancy. In our case, we used /oral0g/ocrfile and /oral0g/ocrfile_mirror. Click Next.
- 7. On the Voting Disk page, specify the CSS voting disk file location. We used /oral0g/cssfile for CSS services. In case of normal redundancy, specify the path along with name. Click Next to install the CRS.
- 8. When prompted, run the following script as root user starting from primary node:

```
/orahome/oral0g/orainventory/orainstRoot.sh
/oarhome/oral0g/product/10.2.0/crs_1/root.sh
```

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- 9. In the Configuration Assistant window, you may see some warnings. Click OK to continue.
- 10. Run the vipca utility from the \$ORA_CRS_HOME/bin directory as root user on the master Node (btc-ppe-wkst1). Click Next.
- 11. Select the Public Interface. Click Next.
- 12. Specify the VIP address and Subnet Mask of each node. Click Next.
- 13. Click Finish to continue VIPCA.
- 14. Click OK and then exit to finish VIPCA.
- 15. To verify your CRS installation by execute the olsnodes command from the \$CRS_HOME/bin directory. The olsnodes command syntax is:

```
olsnodes [-n] [-l] [-v] [-g]
```

Where:

```
-n displays the member number with the member name
-l displays the local node name
-v activates verbose mode
-g activates logging
```

The output from this command should be a list of the nodes on which CRS was installed.

Installing Oracle10gR2 software

- 1. After making sure that Oracle CRS have started on the cluster nodes, start runInstaller from Disk1 of the Oracle10gR2 CDs or from the staging area where you have kept the Oracle Database 10g downloads.
- 2. On the Specify File Locations screen, enter the destination path for the shared ORACLE_HOME. This should be a different location than the shared CRS Home. For this exercise, the shared ORACLE_HOME was /orahome/ora10g/product/10.2.0/db_1.
- 3. On the next screen, select Cluster Installation and then select all the nodes in the cluster. For our exercise, the two cluster nodes were btc-ppe-wkst1 and btc-ppe-wkst6. Click Next.

Note: If the nodes are not displayed in the cluster node selection, then Oracle CRS is not configured or started on those cluster nodes.

- 4. For installation type, select Enterprise Edition and click Next.
- 5. On the Select Database Configuration screen, select Do not create a starter database. We used dbca to create a database later. Click Next.
- 6. Run the following scripts as root user starting from master node when prompted.

./\$ORACLE_HOME/root.sh

7. Click exit to finish the database installation.

Note: Install Oracle10*g*R2 Patch 3 on both CRS_HOME and ORACLE_HOME using OUI . For more details about the patch installation, refer to the appropriate Oracle patch installation guide.



Configuring a listener for an ASM instance

- 1. Run netca (Oracle Net Configuration Assistant) as oracle user to create a listener.
- 2. Select Cluster Configuration and click Next to select all the nodes displayed to create the listener.
- 3. Select the default listener name that is displayed.

Creating an ASM instance

Note: The ASM instance created manages the Oracle data on the NFS file system instead of on raw devices. Therefore, the use of ASMLib is not required.

To create the ASM instance, you will need device file or block partitions that Oracle will use to disk groups. Before creating an ASM instance, create device files to act as ASM disks, using the following commands as oracle user:

```
dd if=/dev/zero of=/oradata/_file_disk1 bs=1M count=30720
dd if=/dev/zero of=/oradata/_file_disk2 bs=1M count=30720
```

Note: You can create multiple volumes in N series storage for the database, according to your business requirements.

Follow these steps to create an ASM instance:

- 1. Start Database Configuration Assistant (DBCA) as oracle user and select Oracle Real Application Clusters Instance.
- 2. In the Operations screen, select Configure Automatic Storage Management and click Next.

Database Configuration Ass	istant, Step 1 of 4 : Operations
	Select the operation that you want to perform:
	C Create a Database
	C Configure Database Options
	O Delete a Database
	C Manage Templates
	O Instance Management
	O Services Management
	Configure Automatic Storage Management
Cancel Help	Seck Next S



3. In the Node Selection screen, select all the nodes and click Next.

Database Configuration As	sistant, Step 2 of 4 : Node Selection	
Database Configuration As	sistant, Step 2 of 4 : Node Selection Select the nodes for which you want to manage ASM diskgroups. The local n wkst1" will always be used, whether or not it is selected. btc-ppe-wkst1 btc-ppe-wkst1 btc-ppe-wkst1	ode "btc-ppe-
Cancel Help	Sack Next ≫	Deselect All

4. In the Create ASM Instance screen, enter the password for the SYS user and click Next.

Database Configuration /	In order to use Automatic S In order to use Automatic S running on your machine. T page to specify parameters Next.	ASM Instance orage Management(ASM), you need to have an ASM i here are no ASM instances running on this machine. I for a new ASM instance which will be created when y	nstance Jse this you click
	The default settings for creative to the like to make changes to the	ating an ASM instance work for most installations. If y defaults, use the ASM Parameters button.	ou would
	ASM Parameters		
1 Magnetigikakan kan Visan tigikakan kan Visan tigikakan kan	The new ASM instance has i for that user.	ts own SYS user for remote management. Specify the	password
Nacional Administration	SYS password:	*****	
Magazzakierien Magazzakierien Ausza	Confirm SYS password:	****	
West Statements Market Statements Market Statements Market Statements Market Statements Market Statements			
Cancel Help)		



	In order to use Automatic Storage Manager running on your machine. There are no ASI page to specify parameters for a new ASM Next.	ment(ASM), you need to have an A M instances running on this machi instance which will be created wh	SM instance ne. Use this nen you click
Human Andrew Human	DBCA will now create and start DBCA will now create and start After the ASM instance is starte groups to be used as storage f	the ASM instance. ad, you can create disk for your database.	. If you would / the password
Cancel Help		G Back Next ≫	

5. DBCA prompts you to start the creation of ASM instance. Click OK to continue.

 After the instance is created, DBCA prompts you to create a disk group. Click Create New to create a disk group. Click Change Disk Discovery Path to change the disk device location. Provide the following disk string path:

/oradata/*

Note: If you have multiple volumes on N series storage that you have mounted on the servers to store the database, you can specify those mounted directories in the disk string path putting a "-,-" as separator.

Example: /oradata1/*, /oradata2/*, /oradata3/*, and so on.

All the disks become visible.



Database Cor	nfiguration Assistant, St	ep 3 of 3 : ASM	Disk Groups				
	Using the choose to Create Disk Group	: ASM Disk Group Create a new di	os page you can isk group or add	view and mana Hidisks to an ev	age existing disk visting disk grou	(groups. Yr n All opers (ou can ations will
	Disk Group Name: Redundancy C High	@ N	ormal		O External		
Napritten Naprit	- Select Member Disks Show Candidates	Show All	lised a Game		Failure Cusure	Ci (11D)	
Antiba Antiba Antiba Antiba Antiba Antiba Antiba	Disk Path /oradata /_file /oradata /_file	e_disk1 e_disk2	CANDIDATE	ASM Name	Fallure Group	30720 30720	_
Nume					1	+	
Cancel	Note: If you don't see discovery path.	disks which you	believe should l	be available, yo	u may need to o	change the o sk Discovery	disk / Path)
				el Help)			

7. Enter a disk group name and select a redundancy option.

Select the disks to include in the disk group and click OK. DBCA creates the disk group and mounts it on the node from where DBCA is running. Then it mounts the disk group on other nodes of the cluster.

Note: If the ASM instance is not registered with the listener then DBCA returns a listener connectivity error when trying to mount the disk group on the other node. In that case, you can login in to the respective ASM instance and manually mount the disk group from the SQLPlus prompt using the "alter diskgroup dsgrp1 mount"; command.



	Using the	e ASM Disk Groups p a croate a now dick	bage you can	view and man	age existing dis	k groups. You can
and the second	be perfo	irmed on the set of r	nodes selecte	d in the previo)us page.	up. An operations v
	- Avail:	able Disk Groups —				
	Select	Disk Group Name	Size (MB)	Free (MB)	Redundancy	State
	0	DSGRP1	30720	30627	EXTERN	MOUNTED (2/2)
	0	DSGRP2	30720	30627	EXTERN	MOUNTED (2/2)
Antigation in Management						
Annan Version Market Ma						
Andrew An	Note: F	ree (MB) reflects the	e free space a	avaiable by tak	ing mirroring in	to account.

8. Repeat step 7 to create the required disk groups.

9. When all disk groups have been created, click Finish to exit DBCA.

Note: If DBCA does not mount the disk group on the other ASM instance, logon to the ASM instance as user SYS on the other node and check the status of the disk groups:

Select name, state from v\$asm_diskgroup;

The output of this command will shows the status (mounted or unmounted) of the disk groups. If the status of the disk groups is unmounted, then execute the following command to mount the disk groups:

Alter disk group <diskgroup_name> mount;



Creating a database using ASM disk groups

ASM disk groups can be used to store all types of database files, including binary and test files. We chose ASM disk group to store data files, control files, online redo logs, flash recovery area, and parameter files. We kept archive log and trace file destinations on file system.

Follow these steps to create an Oracle Database using ASM disk groups:

1. Start DBCA and select Create a Database.

Database Configuration Ass	istant, Step 1 of 18 : Operations	
	Select the operation that you want to perform:	
	Create a Database	
	C Configure Database Options	
	C Delete a Database	
	O Manage Templates	
	O Instance Management	
	C Services Management	
	Configure Automatic Storage Management	
Cancel Help	S Back Next >	



2. In the Node Selection screen, select all the nodes and click Next.

Database Configuration A	ssistant , Step 2 of 18 : Node Selection
	Select the nodes for which you want to manage ASM diskgroups. The local node "btc-ppe-wkst1" will always be used, whether or not it is selected. btc-ppe-wkst1 btc-ppe-wkst6 Select All Deselect All
Cancel Help) 🕜 Back Next >>

- 3. In the Database Templates screen, select General Purpose and click Next.
- 4. In the Database Identification screen, enter a Global Database Name and SID prefix. Click Next.
- 5. In the Management options, select Configure the Database with Enterprise Manager to configure the DB console and its repository. Click Next.
- 6. In the Database Credentials screen, enter a password for SYS and SYSTEM and click Next.

Note: If you have already created a RAC listener, DBCA prompts you to register the database with the listener in the Network Configuration screen. If you want to create separate listener for database, then skip this option.



7. In the Network Configuration screen, select Register this database with all listeners and click Next.

Database Configuration Assi	stant, Step 7 of 17 : Network Configuration
Database Configuration Assi	Stant, Step 7 of 17 : Network Configuration Listeners Listeners There are multiple listeners in this Oracle Home. Select the listeners for which you want to register this database: Register this database with all the listeners Register this database with selected listeners only Available Listeners LISTENER_BTC-PPE-WKST6 LISTENER_BTC-PPE-WKST1 Selected Listeners Selected Listeners Selected Listeners
Cancel Help	G Back Next >>



8.	In the Storage Options screen,	select Automatic Storage	Management (ASM)	and click Next.
----	--------------------------------	--------------------------	------------------	-----------------

📑 Database Configuration Assis	stant, Step 8 of 16 : Storage Options 📃 🗖 🔀
	Select the storage mechanism you would like to use for the database. Cluster File System Use cluster file system for database storage. Automatic Storage Management (ASM) Automatic Storage Management simplifies database storage administration and optimizes database layout for I/O performance. To use this option you must either specify a set of disks to create an ASM disk group or specify an existing ASM disk group. Raw Devices Raw partitions or volumes can provide the required shared storage for Real Application Clusters (RAC) databases if you do not use Automatic Storage Management and a Cluster File System is not available. You need to have created one raw device for each datafile, control file, and log file you are planning to create in the database. Specify Raw Devices Mapping File Browse
Cancel Help	<u> </u>



9. In the ASM Disk Groups screen, select the disk groups where you want to create or store the database files. In this example, disk group DSGRP1 is selected to store system files, control files and online redo log files. Click Next.

Database Configuration Assist	stant, S	tep 9 of 16 : ASM Di	isk Groups				
	Select or create a	ne or more disk grou new disk group or a able Disk Groups —	ps to be used dd disks to ar	as storage fo n existing disk	r the database. . group.	. You can choose to	
	Select Disk Group Name Size (M			Free (MB) Redundanc		State	
		DSGRP1	30720	30627	EXTERN	MOUNTED (2/2)	
		DSGRP2	30720	30627	EXTERN	MOUNTED (2/2)	
Augustanting Au	Note: F	ree (MB) reflects the	free space av	raiable by taki	ng mirrorina in	to account.	
	Cre	ate New Add Disk	s Mount	Mount All			
Cancel Help				۷	Back Next		



 In the Database File Locations screen, select an option. In this test process, we selected Use Oracle-Managed files. Enter the disk group in which DBCA will create all the database files. Click Next.

🕼 Database Configuration Assistant , Step 10 of 16 : Database File Locations
Database Configuration Assistant, Step 10 of 16 : Database File Locations Specify locations for the Database files to be created: Specify locations for the Database files to be created: Use Database File Locations from Template Use Common Location for All Database Files Database Files Location: Browse Use Oracle-Managed Files Database Area: +DSGRP1 Multiplex Redo Logs and Control Files If you want to specify different locations for any database files, pick either of the above options and use the Storage page to specify each location.
Cancel Help <u>Seck</u>



11. In the Recovery Configuration screen, select Specify Flash Recovery Area. Enter disk group DSGRP2 as the flash recovery area destination and enter 2048 as the size. Click Next.

Database Configuration As	sistant, Step 11 of 16 : Recovery	Configuration	
	Choose the recovery options for t ✓ Specify Flash Recovery Area This is used as the default for for automatic backup using Er files and recovery files be loc: performance. Flash Recovery Area:	the database: r all backup and recovery operations, and is also required nterprise Manager. Oracle recommends that the database ated on physically different disks for data protection and +DSGRP2 Browse	1
	Enable Archiving	Edit Archive Mode Parameters	
Cancel Help		G Back Next >>	



12. In the next screen, accept the default options. In the Creation Options screen, click Finish to start the database creation. After successful creation of the database, DBCA shows the completion message.

Copying database files Creating and starting Oracle instance Creating cluster database views Completing Database Creation Database Configuration Assistant Database creation complete. Check the logfiles at /orahome/ora10g/product/10 /db_1/cfgtoollogs/dbca/orcl for details. Database information: Global Database Name: orcl System Identifier(SID) Prefix: orcl Server Parameter Filename: +DSGRP1/orcl/spfileorcl.ora The Database Control URL is http://btc-ppe-wkst1:1158/em Note: All database accounts except SYS, SYSTEM, DBSNMP, and SYSMAN are lock Select the Password Management button to view a complete list of locked account manage the database accounts(except DBSNMP and SYSMAN). From the Passwore Management window, unlock only the accounts you will use. Oracle Corporation s recommends changing the default passwords immediately after unlocking the account	ed. ts or to d trongly count.

IBM

Database settings for I/O performance

Logon as oracle user, export the ORACLE_SID and connect to the database instance as the SYS user. Check the parameter settings in spfile as follows:

[root@btc-srv1 ~]# su - oracle [oracle@btc-srv1 ~]\$ export ORACLE_SID=orcl1 [oracle@btc-srv1 ~]\$ sqlplus "/ as sysdba"

Check for the disk_asynch_io and filesystemio_options parameter settings in spfile:

SQL > show parameter disk_asynch_io							
NAME	TYPE	VALUE					
disk_asynch_io	boolean	FALSE					

If disk_asynch_io is FALSE, change this parameter value to TRUE with the following command:

SQL > alter system set disk_asynch_io=TRUE scope=spfile;						
SQL > show parameter filesystemio_options						
NAME	TYPE	VALUE				
filesystemio_options	string	NONE				

If the filesystemio_options setting is NONE, change this parameter value to setall with the following command:

SQL > alter system set filesystemio_options = setall scope=spfile;

Bring down all the database instances and ASM instance on all the cluster nodes.

Relink the oracle binaries in all cluster nodes as follows:

```
[oracle@btc-srv1 ~]$ cd $ORACLE_HOME/rdbms/lib
```

[oracle@btc-srv1 ~]\$ make PL_ORALIBS=-laio -f ins_rdbms.mk async_on

Repeat this command in all cluster nodes. It should relink the Oracle binaries without any error.

Start up the ASM instance and database instance on all cluster nodes.

To confirm whether both direct I/O and asynch I/O are enabled, issue the following commands as oracle user:

[oracle@btc	-srv1	~]\$	cat	/pr	proc/slabinfo grep kio			
kioctx	53	75	256	15	5 1 : tunables 120 60 8 : slabdata	5	5	0
kiocb	47	64	128	31	1 : tunables 120 60 8 : slabdata	3	5	0

Non-zero values indicate that both direct I/O and asynch I/O are enabled.



Appendix: Sample .bash_Profile file for

the oracle user

```
export ORACLE_BASE=/orahome/oral0g;
export ORACLE_PRODUCT=$ORACLE_BASE/product;
export ORACLE_HOME=$ORACLE_PRODUCT/10.2.0/db_1;
export ORACLE_CRS=$ORACLE_PRODUCT/10.2.0/crs_1;
export ORACLE_SID=orcl;
export
LD_LIBRARY_PATH=$ORACLE_HOME/lib:$ORACLE_CRS/lib:$ORACLE_HOME/lib32:$LD_LIBRARY_PATH;
export LIBPATH=$ORACLE_HOME/lib:$ORACLE_CRS/lib:$ORACLE_HOME/lib32:$LD_LIBRARY_PATH;
export PATH=$PATH:$ORACLE_HOME/lib:$ORACLE_CRS/lib:$ORACLE_HOME/lib32:$LIBPATH
export PATH=$PATH:$ORACLE_HOME/lib:$ORACLE_HOME:$ORACLE_CRS/lib:$ORACLE_CRS/lib:$ORACLE_CRS/lib;
export PATH=$PATH:$ORACLE_HOME/lib;
```



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