

Oracle Database Best Practice with NeoSapphire Series



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1. Overview

Oracle Database is widely used for online transaction (OLTP) and real-time analytics applications. For these types of applications, I/O response time is most critical, as it impacts the overall productivity of an enterprise.

This document provides information on the reference architecture, implementation, and recommendations for deployment of Oracle Database with the AccelStor NeoSapphire all-flash array, using the NeoSapphire 3605 as an example. Employing the HammerDB benchmark tool, the TPM capability of the NeoSapphire all-flash array as compared with other existing storage arrays is clearly illustrated.

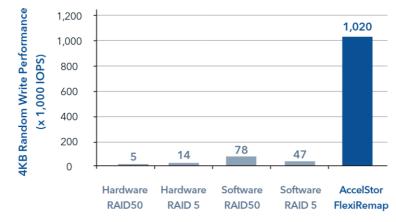
2. Goal

To provide an industry-standard benchmark for Oracle Database as greatly improved when used with the NeoSapphire all-flash array series.

3. Introduction: FlexiRemap Technology

FlexiRemap technology is flash-oriented software developed by AccelStor. This software features an architectural re-design tailored for the fundamentals and internal workings of flash memory. Unlike RAID algorithms, FlexiRemap remaps the data whenever beneficial before passing it to the underlying flash memory, avoiding unnecessary overhead and extending the lifespan of SSDs. Such remapping is especially crucial for random-write access patterns, which comprise most enterprise-data traffic and are a major cause of storage-access performance bottlenecks.

FlexiRemap features an exclusive data remapping algorithm based on the physical nature of NAND flash memory. Instead of writing the new data to the original location, FlexiRemap organizes the inbound writes to sequential logical addresses. 4KB random write performance is significantly improved, and total performance is dramatically enhanced for 1,020K IOPS as compared with RAID algorithm, which only generates around 5K IOPS to 78K IOPS (Figure 1).







4. Reference Architecture

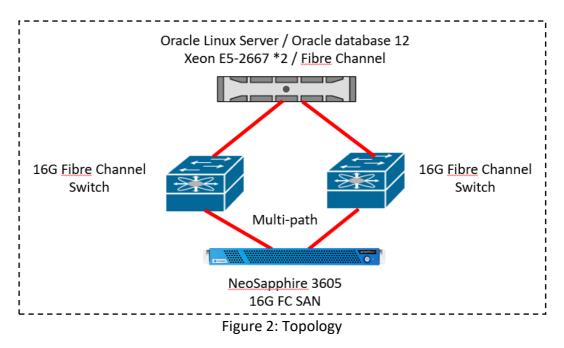
The test environment is listed below:

Server

- 2* Intel CPU E5-2670 v2 (25M Cache, 3.30 GHz, 8 cores, 16 Threads) http://ark.intel.com/products/75273/Intel-Xeon-Processor-E5-2667v2-25M-Cache-3_30-GHz
- 128GB RAM
- □ Emulex Fibre Channel HBA (16G port x 2)
- Oracle Linux Server release 7.2 http://www.oracle.com/technetwork/serverstorage/linux/downloads
- □ Oracle Database 12.1.0.2 64 bits
- □ HammerDB Release 2.20 for Linux 64 bit <u>http://www.hammerdb.com/</u>

NeoSapphire all-flash array 3605

- □ 1U rackmount design with 10 hot-swappable SSD
- □ 360K sustained IOPS for 4KB random write
- □ 5TB usable capacity
- □ 2 x 16G Fibre Channel LC SFP+
- □ System image version: 1.1.1(Build 3532)





5. LUN Configuration

Please note that LUN size in a disk group should be the same.

| Disk group name | Number of LUNs | Size | content |
|-----------------|----------------|-------|------------------------|
| u01 | 1 | 50GB | Oracle software |
| DATA | 2 | 500GB | Table data and indexes |
| REDO | 1 | 200GB | Online Redo log |
| TEMP | 1 | 100GB | Temporary Tablespace |
| FRA | 2 | 500GB | Flash Recovery Area |

6. Multipath Configuration

In SAN storage for Oracle Database, it is recommended that a multipath design be implemented to ensure fault tolerance and performance enhancement. In addition to better performance, the multipath connection also avoids a single point of failure. If one path is lost, the remaining paths still support I/O operation without interruption. Specify the LUN wwid in the file multipath.conf and assign an alias name for easy manageability. An example of the content of a multipath configuration is indicated below. Follow the above format and add all LUNs to the file multipath.conf.

Before setting up the DM-Multipath on your system, make sure the device-mappermultipath package has been installed.

```
defaults {
 user_friendly_names yes
 find multipaths yes
}
multipaths{
 multipath{
       wwid
                                   234074f14773b8cec #device id
       alias
                                   u01
       path_grouping_policy
                                   multibus
       path_selector
                                   "round-robin 0"
       failback
                                   immediates
       rr weight
                                   priorities
       no_path_retry
                                   5
     }
}
```



| Parameters | Explanation |
|----------------------|--|
| wwid | World Wide Identifier (WWID) is used to guarantee every device ID is unique. |
| alias | User-friendly name. |
| path_grouping_policy | Specifies the default path group policy. multibus = all valid paths in 1 priority group. |
| path_selector | Specifies the default algorithm to determine what path to use for the next I/O operation. |
| failback | Manages path group failback. |
| rr_weight | If set to priorities, the system will determine path weight by "path prio* rr_minio". |
| no_path_retry | Specifies the number of times the system should try to use a failure path before disabling it. |

Once the multipath configuration is complete, restart the multipath service to sync the new change and make it effective.

#service multipathd restart

You can check the following commands for the new LUN names.

```
#multipath -II | grep AS
temp (234074f147f99c9a4) dm-6 AStor ,NeoSapphire 3600
u01 (234074f14773b8cec) dm-4 AStor ,NeoSapphire 3600
redo (234074f14e6df8463) dm-3 AStor ,NeoSapphire 3600
fra2 (234074f1442853c96) dm-10 AStor ,NeoSapphire 3600
dra1 (234074f142e45943b) dm-8 AStor ,NeoSapphire 3600
data2 (234074f14f2f55b1) dm-7 AStor ,NeoSapphire 3600
data1 (234074f14a5ecda3c) dm-5 AStor ,NeoSapphire 3600
```



7. Create ASM Disk Group

For Oracle ASM using disks, the disks need to be identified with the correct ownership and permissions. ASMLib is used to manage these tasks.

In Linux, device manager "udev" is often used to perform such tasks.

In the file <u>/dev/udev/rules.d/12-dm-permissions.rules</u>, add the new disks into this file and change their owner and group to "grid, asmadmin" as in the example below.

| • • • | fryan — root@astor:/etc/udev/rules.d — ssh root@10.144.1.171 — 121×28 |
|-------------------------------------|---|
| [root@astor rules.d]# cat 12-dm-per | rmissions.rules |
| ENV{DM_NAME}=="u01", OWNER:="grid", | <pre>, GROUP:="asmadmin", MODE:="660", SYMLINK+="iscsi/oraasm-\$env{DM_NAME}"</pre> |
| ENV{DM_NAME}=="temp", OWNER:="grid" | ", GROUP:="asmadmin", MODE:="660", SYMLINK+="iscsi/oraasm-\$env{DM_NAME}" |
| ENV{DM_NAME}=="redo", OWNER:="grid" | ", GROUP:="asmadmin", MODE:="660", SYMLINK+="iscsi/oraasm-\$env{DM_NAME}" |
| ENV{DM_NAME}=="data1", OWNER:="grid | d", GROUP:="asmadmin", MODE:="660", SYMLINK+="iscsi/oraasm-\$env{DM_NAME}" |
| ENV{DM_NAME}=="data2", OWNER:="grid | d", GROUP:="asmadmin", MODE:="660", SYMLINK+="iscsi/oraasm-\$env{DM_NAME}" |
| ENV{DM_NAME}=="fra1", OWNER:="grid" | |
| ENV{DM_NAME}=="fra2", OWNER:="grid" | ", GROUP:="asmadmin", MODE:="660", SYMLINK+="iscsi/oraasm-\$env{DM_NAME}" |

For more detailed information about configuring users, groups, and environments, please refer to the <u>Oracle Database Installation Guide</u>.

Reboot to make the change effective. Run the command below to check.

[root@astor ~]# II /dev | grep grid

```
brw-rw----.1 grid asmadmin 252,10 Oct 21 13:20 dm-10brw-rw----.1 grid asmadmin 252,3 Oct 21 13:30 dm-3brw-rw----.1 grid asmadmin 252,4 Oct 21 13:21 dm-4brw-rw----.1 grid asmadmin 252,5 Oct 21 13:30 dm-5brw-rw----.1 grid asmadmin 252,6 Oct 21 13:30 dm-6brw-rw----.1 grid asmadmin 252,7 Oct 21 13:20 dm-7brw-rw---.1 grid asmadmin 252,8 Oct 21 13:30 dm-8
```

4KB alignment

On the host side, a non-aligned partition can have a major impact on performance. This can be caused by a partition tool that creates a disk partition not aligned with storage block size. Before creating Oracle ASM disks, all of the new disks need to be partitioned and checked for alignment.

#parted /dev/mapper/data1 mklabel gpt mkpart primary 2048s 100% align-check optimal 1
#parted /dev/mapper/data2 mklabel gpt mkpart primary 2048s 100% align-check optimal 1
#parted /dev/mapper/fra1 mklabel gpt mkpart primary 2048s 100% align-check optimal 1
#parted /dev/mapper/fra2 mklabel gpt mkpart primary 2048s 100% align-check optimal 1
#parted /dev/mapper/redo mklabel gpt mkpart primary 2048s 100% align-check optimal 1
#parted /dev/mapper/redo mklabel gpt mkpart primary 2048s 100% align-check optimal 1

• Create Oracle ASM disks

Follow the steps below to create all new disks.

#oracleasm createdisk data1 /dev/mapper/data1 Writing disk header: done Instantiating disk : done



– 🗆 🗙

8. Oracle software Installation Location

Before installing the Oracle software, you must format the LUN for a file system. XFS is recommended with parameters as in the example below:

| • • • | 🏠 bryar | n — root@as | tor:~ — ssh root@10 |).144.1.171 - | — 121×26 | | |
|--|--------------------------------|-------------|---------------------|---------------|---------------|-----|--|
| [root@astor ~]# cat /etc/ | fstab | | | | | | |
| # | | | | | | | |
| # /etc/fstab | | | | | | | |
| # Created by anaconda on | Thu Oct 6 01:41:02 20 | 16 | | | | | |
| # | | | | | | | |
| # Accessible filesystems, | by reference, are mai | ntained | under '/dev | /disk' | | | |
| <pre># See man pages fstab(5),</pre> | findfs(8), mount(8) a | nd/or b | lkid(8) for i | more in | fo | | |
| # | | | | | | | |
| /dev/mapper/ol-root / | | xfs | defaults | 0 | 0 | | |
| /uev/mapper/ot-root / | | | | | | | |
| UUID=9e288dfb-8682-4855-a | 03b-8ea3ab208d61 /boot | | | xfs | defaults | 0 0 | |
| UUID=9e288dfb-8682-4855-a | 03b-8ea3ab208d61 /boot home | xfs | defaults | | defaults 0 | 0 0 | |
| UUID=9e288dfb-8682-4855-a /dev/mapper/ol-home / | | | | 0 | | 0 0 | |

9. Oracle Grid Infrastructure Installation

Switch to user "grid" and execute "runInstaller" to start installation of Grid Infrastructure.

🔮 Oracle Grid Infrastructure 12c Release 1 Installer - Step 1 of 16

| Select Installation Option | |
|---|--|
| 🙊 Installation Option | O Install and Configure Oracle Grid Infrastructure for a <u>C</u> luster |
| Cluster Type Installation Type Cluster Configuration Network Interface Usage Storage Option OCR Storage Voting Disk Storage Management Options Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product Finish | Install and Configure Oracle Grid Infrastructure for a <u>S</u>tandalone Server <u>Upgrade Oracle Grid Infrastructure or Oracle Automatic Storage Management</u> Install Oracle <u>G</u>rid Infrastructure Software Only |
| Help | <back next=""> Install Cancel</back> |



The first grid infrastructure will create an ASM disk group. The rest of the disk groups can be created with the command "asmca".

Click "Change Discovery Path" and change the path to "/dev/mapper".

| M Installation Option | Select Disk Group characteristics and select disks | |
|--|---|--|
| Product Languages | Disk group name DATA | |
| 🖕 Create ASM Disk Group | Redundancy 🔿 High 🔿 No <u>r</u> mal 💿 <u>E</u> xternal | |
| ASM Password | | |
| Management Options | Allocation Unit Size 1 	 MB | |
| Operating System Groups | 🛃 Change Disk Discovery Path 🛛 🗙 🚽 | |
| Installation Location | Changing the Disk Discovery Path will affect ALL Disk Groups | |
| Prerequisite Checks | Disk Discovery Path: //dev/mapper | |
| Summary | <u>OK</u> Cancel | Size (in MB) Sta 476840 Candio |
| Install Product | | 476840 Candi |
| O Finish | /dev/mapper/fra1 /dev/mapper/fra2 | 572208 Candi 572208 Candi |
| | /dev/mapper/onetb1 | 476840 Candi |
| | <pre>//dev/mapper/onetb2 //dev/mapper/redo</pre> | 476840 Candi 190736 Candi |
| | <pre>//dev/mapper/redolog1 //dev/mapper/redolog2</pre> | 47684 Candi 47684 Candi |
| | | |
| | | Change Discover |
| Eep sk group name: ancy: External ed unit size: 1MB | | Next > Install |
| sk group name: ancy: External d unit size: 1MB | DATA S c Release 1 Installer - Step 3 of 12 | Next> Install CRACLE SRID INFRASTRUCTURE |
| sk group name: ancy: External ed unit size: 1MB S Oracle Grid Infrastructure 120 | DATA S c Release 1 Installer - Step 3 of 12 | - I |
| sk group name: ancy: External ed unit size: 1MB oracle Grid Infrastructure 12e Create ASM Disk Group | DATA c Release 1 Installer - Step 3 of 12 | - I |
| sk group name: ancy: External ed unit size: 1MB oracle Grid Infrastructure 12e Create ASM Disk Group | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA | - I |
| sk group name: ancy: External ed unit size: 1MB oracle Grid Infrastructure 12e Create ASM Disk Group | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Nogmal External | - I |
| Sk group name: ancy: External d unit size: 1MB Tracle Grid Infrastructure 12c Create ASM Disk Group | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA | - I |
| sk group name: ancy: External d unit size: 1MB oracle Grid Infrastructure 12x Create ASM Disk Group | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Nogmal External | - I |
| sk group name: ancy: External d unit size: 1MB oracle Grid Infrastructure 12x Create ASM Disk Group Installation Option. Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Location | DATA c Release 1 Installer - Step 3 of 12 Select Disk Croup characteristics and select disks Disk group name DATA Redundancy High Normal O External Allocation Unit Size 1 MB Add Disks | - I |
| Sk group name: ancy: External d unit size: 1MB oracle Grid Infrastructure 124 Create ASM Disk Group Installation Option Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Location Root script execution | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size 1 MB | |
| sk group name: ancy: External ed unit size: 1MB oracle Grid Infrastructure 12e Create ASM Disk Group Installation Option Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Leastion Root script execution Prerequisite Checks | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size 1 MB Add Disks © Gandidate Disks All Disks Disk Path | SRID INFRASTRUCTURE |
| Sk group name: ancy: External d unit size: 1MB oracle Grid Infrastructure 12x Create ASM Disk Group Installation Option Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Location Root script execution Prerequisite Checks Summary | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size 1 MB Add Disks © Candidate Disks All Disks Disk Path V /dev/mapper/data1 | |
| k group name: incy: External d unit size: 1MB oracle Grid Infrastructure 124 reate ASM Disk Group installation Option Product Languages Greate ASM Disk Group ASM Password Management Options Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size 1 MB Add Disks © Candidate Disks All Disks Disk Path Ø /dev/mapper/data1 / dev/mapper/fra1 | Size (in MB) Stat 476840 Candic 572208 Candic |
| Sk group name: ancy: External d unit size: 1MB Oracle Grid Infrastructure 12x Create ASM Disk Group Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Location Root script execution Prerequisite Checks Summary | DATA c Release 1 Installer - Step 3 of 12 Select Disk Croup characteristics and select disks Disk group name DATA Redundancy High Normal © External Allocation Unit Size 1 	MB Add Disks © Candidate Disks All Disks Disk Path V /dev/mapper/data1 /dev/mapper/data2 | - [CRACLEC BRID INFRASTRUCTURE Size (in MB) Stat 476840 Candid 476840 Candid |
| sk group name: ancy: External ancy: External d unit size: 1MB oracle Grid Infrastructure 12x Create ASM Disk Group installation Option Product Languages Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size 1 MB Add Disks © Gandidate Disks All Disks Disk Path V /dev/mapper/fra1 /dev/mapper/fra1 /dev/mapper/fra2 /dev/mapper/fra2 /dev/mapper/fra2 | - [CRACLE SRID INFRASTRUCTURE SRID INFRASTRUCTURE 476840 Candic 572208 Candic 572208 Candic 572208 Candic 476840 Candic 476840 Candic |
| k group name: ancy: External d unit size: 1MB Oracle Grid Infrastructure 12x Create ASM Disk Group Installation Option Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product | DATA c Release 1 Installer - Step 3 of 12 Select Disk Croup characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size I M8 Add Disks Candidate Disks All Disks Disk Path V /dev/mapper/data1 /dev/mapper/data2 /dev/mapper/onetb1 /dev/mapper/onetb1 /dev/mapper/rea0 /dev/mapper/rea0 /dev/mapper/rea0 /dev/mapper/rea0 | - [CRACLEC SRID INFRASTRUCTURE SRID INFRASTRUCTURE 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic |
| Sk group name: ancy: External d unit size: 1MB oracle Grid Infrastructure 124 Create ASM Disk Group Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product | DATA c Release 1 Installer - Step 3 of 12 Select Disk Group characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size 1 MB Add Disks Candidate Disks All Disks Disk Path / dev/mapper/fra1 / dev/mapper/fra2 / dev/mapper/fra2 / dev/mapper/retb1 / dev/mapper/retb2 / dev/mapper/retb2 | |
| sk group name: ancy: External d unit size: 1MB oracle Grid Infrastructure 12x Create ASM Disk Group installation Option Product Languages Create ASM Disk Group ASM Password Management Options Operating System Groups Installation Location Root script execution Prerequisite Checks Summary Install Product | DATA c Release 1 Installer - Step 3 of 12 Select Disk Croup characteristics and select disks Disk group name DATA Redundancy High Normal External Allocation Unit Size I M8 Add Disks Candidate Disks All Disks Disk Path V /dev/mapper/data1 /dev/mapper/data2 /dev/mapper/onetb1 /dev/mapper/onetb1 /dev/mapper/rea0 /dev/mapper/rea0 /dev/mapper/rea0 /dev/mapper/rea0 | - [CRACLEC SRID INFRASTRUCTURE SRID INFRASTRUCTURE 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic 476840 Candic |

For more detailed information about Oracle Grid Infrastructure installation, please refer to the <u>Oracle Database Installation Guide</u>.



After Grid Infrastructure installation is complete, execute the command "asmca" by "grid" to create the rest of the disk groups.

| Click "Create". | ASM: Disk Groups | | | | | | | × | |
|-----------------|---|--------------|-----------|-------------|------------|--------|---|------|--|
| | ASM Instance: +ASM | | | | | | | | |
| | Disk Groups Volumes ASM Cluster File Systems | | | | | | | | |
| | You can choose to create a new disk group or add disks to an existing disk group. To create dynamic volumes, you need disk groups with 11.2 ASM compatibility or higher. Tip: To perform operations on a disk group, right mouse click on the row. Disk Groups | | | | | | | | |
| | Disk Group Name | Size (GB) | Free (GB) | Usable (GB) | Redundancy | State | | | |
| | DATA | 931.33 | 931.25 | 931.25 | EXTERN | MOUNTE | D | _ | |
| | Create Mount All | Dismount All | | | | | | | |
| Help | | | | | | | | Exit | |

Input disk group name: FRA Redundancy: External Choose disk group member

🔮 Create Disk Group

| Eligible 🔘 Show All | | | | | |
|---------------------|--|--|---|--|--|
| | | | | | The second se |
| | re voting files in exter | nded clusters ar | nd do not con | tain any user da | ata. They require ASM compatib |
| | 1 | | | | |
| | | Disk Name | and the second se | Quorum | |
| | | | | | |
| lev/mapper/fra2 | FORMER | | 572208 | | |
| lev/mapper/onetb1 | FORMER | | 476840 | | |
| lev/mapper/onetb2 | FORMER | | 476840 | | |
| lev/mapper/redolog1 | CANDIDATE | (| 47684 | | |
| lev/mapper/redolog2 | FORMER | | 47684 | | |
| lev/mapper/redolog3 | FORMER | | 47684 | | |
| lev/mapper/redolog4 | FORMER | | 47684 | Γ | |
| lev/mapper/u01 | CANDIDATE | | 47684 | | |
| | failure groups are used to sto r higher. sk Path ev/mapper/fra1 ev/mapper/onetb1 ev/mapper/onetb2 ev/mapper/redolog1 ev/mapper/redolog2 ev/mapper/redolog3 ev/mapper/redolog4 | failure groups are used to store voting files in exter r higher. sk Path Header Status ev/mapper/fra1 FORMER ev/mapper/onetb1 FORMER ev/mapper/onetb2 FORMER ev/mapper/redolog1 CANDIDATE ev/mapper/redolog2 FORMER ev/mapper/redolog3 FORMER ev/mapper/redolog4 FORMER | failure groups are used to store voting files in extended clusters are rhigher. sk Path Header Status Disk Name ev/mapper/fra1 FORMER ev/mapper/fra2 FORMER ev/mapper/onetb1 FORMER ev/mapper/onetb2 FORMER ev/mapper/redolog1 CANDIDATE ev/mapper/redolog3 FORMER ev/mapper/redolog3 FORMER | failure groups are used to store voting files in extended clusters and do not con r higher. sk Path Header Status Disk Name Size (MB) ev/mapper/fra1 FORMER 572208 ev/mapper/fra2 FORMER 572208 ev/mapper/onetb1 FORMER 476840 ev/mapper/onetb2 FORMER 476840 ev/mapper/redolog1 CANDIDATE 47684 ev/mapper/redolog2 FORMER 47684 ev/mapper/redolog3 FORMER 47684 | failure groups are used to store voting files in extended clusters and do not contain any user driving files. sk Path Header Status Disk Name Size (MB) Quorum ev/mapper/fra1 FORMER 572208 Image: Comparison of the status Size (MB) Quorum ev/mapper/fra2 FORMER 572208 Image: Comparison of the status Size (MB) Quorum ev/mapper/redoing FORMER 476840 Image: Comparison of the status Image: Comparison of the status ev/mapper/redoing1 CANDIDATE 476840 Image: Comparison of the status Image: Comparison of the status ev/mapper/redoing2 FORMER 47684 Image: Comparison of the status Image: Comparison of the status ev/mapper/redoing3 FORMER 47684 Image: Comparison of the status |



×



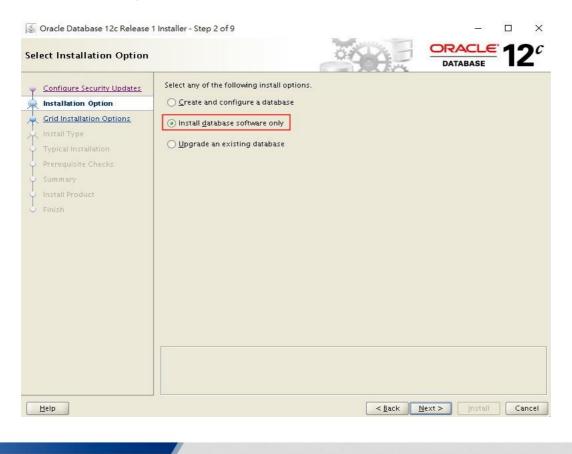
Follow the steps above to complete all disk groups.

| | ASM Instance: +ASM | | | | | |
|--|--|--------------------|--------------|-------------|----------------------|----------------------|
| | Disk Groups Volume | s ASM Cluster | File Systems | | | |
| | You can choose to create groups with 11.2 ASM co Tip: To perform operatio Disk Groups | mpatibility or hig | iher. | | oup. To create dynam | ic volumes, you need |
| | Disk Group Name | Size (GB) | Free (GB) | Usable (GB) | Redundancy | State |
| The second s | DATA | 931.33 | 931.25 | 931.25 | EXTERN | MOUNTED |
| | FRA | 1117.59 | 1117.52 | 1117.52 | EXTERN | MOUNTED |
| | REDO | 186.27 | 186.21 | 186.21 | EXTERN | MOUNTED |
| | TEMP | 93.13 | 93.08 | 93.08 | EXTERN | MOUNTED |
| | | | | | | |
| | | | | | | |

10. Oracle Database Software Installation

There are 2 steps to install Oracle Database. First, install Oracle software. Switch to user "oracle" and run the command below.

oracle@astor ~]\$ cd database oracle@astor ~]\$./runInstaller





×

Select the type of database installation, e.g., "Single instance database installation".

🛓 Oracle Database 12c Release 1 Installer - Step 3 of 9

| Gri | d Installation Options | |
|-------------------|---|---|
| ų | Configure Security Updates | Select the type of database installation you want to perform. |
| 人 | Installation Option | ⊙ Single instance database installation |
| Ŕ | Grid Installation Options | Oracle Real Application Clusters database installation |
| - (-) | Install Type Typical Installation Prerequisite Checks Summary Install Product Finish | Oracle RAC Ong Node database installation |
| | Help | < <u>Back</u> Next > Install Cancel |

For more detailed information about Oracle Database software installation, please refer to the <u>Oracle Database Installation Guide</u>.





11. Oracle Database Creation

After the Oracle Database software installation is complete, the second step is to create an Oracle database and assign the location of data files, redo log files, and a fast recovery area.

Switch to user "oracle" and run command "dbca".

oracle@astor ~]\$ dbca

| Database Configuration Ass | istant - Welcome - Step 1 of 6 | - 🗆 × |
|---|--|--------------------------|
| Database Operation | | |
| Database Operation Creation Mode Prerequisite Checks Summary Progress Page Finish | Select the operation that you want to perform. | |
| Help | < <u>8</u> | ack Next > Einish Cancel |



D X

Under Creation Mode, click "Advanced Mode".

🚡 Database Configuration Assistant - Create Database - Step 2 of 14

| atabase Operation | \bigcirc <u>C</u> reate a database with default co | onfiguration | |
|--|--|---|---------------|
| Creation Mode | <u>G</u> lobal Database Name: | orci | |
|)atabase Template | <u>S</u> torage Type: | Automatic Storage Management (ASM) | |
| atabase Identification | Database Files Location: | +DATA | Browse |
| fanagement Options Database Credentials | F <u>a</u> st Recovery Area: | +FRA | Browse |
| itorage Locations | Database Character Set: | WE8MSWIN1252 - MS Windows Code Page 125 | 2 8-bit Wes 👻 |
| atabase Options | Administrative Password : | | |
| nitialization Parameters | Confirm <u>Bassword</u> : | | |
| reation Options | Create As Container Datab | 1 | |
| rerequisite Checks | Pluggable Database Name: | | |
| ummary Yrogress Page | Advanced Mode | L | |
| inish | A Careca Hour | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Under Storage Locations, choose the settings below:

Database files Storage Type: Automatic Storage Management (ASM) Use Common Location for All Database Files; File Location: **+DATA**.

Recovery files Storage Type: Automatic Storage Management (ASM) Fast Recovery Area: **+FRA**.

| torage Locations | | |
|--|---|-------------------------|
| Database Operation Creation Mode Database Template Database Identification Management Options Database Credentials Network Configuration Storage Locations Database Options Initialization Parameters Creation Options Prerequisite Checks Summary Progress Page Emish | Database files Storage Type: Automatic Storage Management (AS Use Database File Locations from Template Use Common Location for All Database Files File Location: +DATA Use Oracle-Managed Files Multiplex Redo Logs and Choose the recovery options for the database. Regovery files Storage Type: Automatic Storage Management (A Sgecify Fast Recovery Area Fast Recovery Area: +FRA Fast Recovery Area Size: File Enable Archiving Egit Archive Mode Parameters | d Control Files |
| Help | < Back | File Location Variables |



Under Initialization Parameters, click "All Initialization Parameters".

| Database Operation | Memory Sizing Character | Sets Connectio | on Mode | |
|---------------------------|-----------------------------------|----------------|-------------------------|-------------|
| Creation Mode | Typical Settings | | | |
| Database Template | Memory Size (SGA and PGA): | 51440 MB | | |
| Database Identification | Percentage: 40 | | 250 MB | 128628 M |
| Management Options | ✓ Use Automatic Memory Management | | Show Memory D | istribution |
| Database Credentials | | - | | |
| Network Configuration | Custom Settings | | | |
| Storage Locations | Memory Management | Automatic SI | hared Memory Management | ~ |
| Database Options | SGA Size: | | 38,580 👘 M Bytes 🛩 | |
| Initialization Parameters | PGA Size: | | 12,860 🖨 [M Bytes 👻 | |
| Creation Options | | | 12,000 + [(0) DY(62 + | |
| Prerequisite Checks | Total Memory for Oracle: | 51440 MB | | |
| Summary | | | | |
| Progress Page | | | | |
| Finish | | | | |
| Finish | | | | |
| | | | | |
| | | | | |

For the destination of db_create_online_log_dest_1, specify +REDO. For the destination of db recovery file dest, specify +FRA.

| Name 🔺 | Value | Override Default | Category | |
|-----------------------------|---------------------------------|---------------------|-------------------------|--|
| cluster_database | FALSE | | Cluster Database | |
| compatible | 12.1.0.2.0 | V | Miscellaneous | |
| control_files | ("{ORACLE_BASE}/oradata/{DB_UNI | | File Configuration | |
| db_block_size | 8 | × | Cache and I/O | |
| db_create_file_dest | +DATA | × | File Configuration | |
| db_create_online_log_dest_1 | +REDO | | File Configuration | |
| db_create_online_log_dest_2 | | | File Configuration | |
| db_domain | | × | Database Identification | |
| db_name | orcl | × | Database Identification | |
| db_recovery_file_dest | +FRA | × | File Configuration | |
| db_recovery_file_dest_size | 4560 | V | File Configuration | |
| db_unique_name | | | Miscellaneous | |
| instance_number | 0 | 12 | Cluster Database | |
| log_archive_dest_1 | | | Archive | |
| log_archive_dest_2 | | 12 | Archive | |
| log_archive_dest_state_1 | enable | 22 | Archive | |
| log_archive_dest_state_2 | enable | 22 | Archive | |
| nls_language | AMERICAN | 2 | NLS | |
| nls_territory | AMERICA | 12 | NLS | |
| open_cursors | 300 | Cursors and Libra | | |
| pga_aggregate_target | 12860 | Sort, Hash Joins, I | | |
| processes | 300 | Processes and Se | | |
| remote_listener | | | Network Registration | |
| remote_login_passwordfile | EXCLUSIVE | Security and Audit | | |
| sessions | 172 | | Processes and Sessions | |
| sga_target | 38580 | V | SGA Memory | |
| shared_servers | 0 | | Shared Server | |
| ctar transformation anabled | FAISE | | Ontimizor | |

For more detailed information about creating a database, please refer to the Oracle Database Installation Guide.



12. Relocate TEMP Tablespace

Relocate TEMP tablespace to +temp. You will need to restart the database after the steps below are completed.

SQL> create temporary tablespace temp123 tempfile '+temp' 2 size 20M autoextend on next 640k maxsize unlimited; Tablespace created.

SQL> alter database default temporary tablespace temp123; Database altered.

SQL> alter tablespace temp tempfile offline; Tablespace altered.

SQL> drop tablespace temp including contents and datafiles; Tablespace dropped.

SQL> alter tablespace temp123 rename to temp; Tablespace altered.

13. 4KB Redo Log Files

The online redo log files are crucial for the database to perform transactions reliably. All changed transaction records must be written to redo log files.

Traditionally, the default block size of redo log files is equal to the physical block size of storage. Typically, it is 512 bytes. With the proprietary algorithm of FlexiRemap, the block size is increased to 4KB. The larger block size allows for higher capacity storage as well as improved performance.

It is strongly recommended to set the block size to 4096 bytes when creating redo log files. Note the example below:

SQL> alter database add logfile group 2 (
2 '+REDO/ORCL/ONLINELOG/group21',
3 '+REDO/ORCL/ONLINELOG/group22') size 15G blocksize 4096 reuse;



14. HammerDB Configuration

Remember to create the user TPC-C with dba privileges in the database. Here it is only necessary to adjust the number of Warehouse and Virtual Users to build Schema. The other settings remain as default.

| X Oracle TPC-C Build Options | – 🗆 X |
|---------------------------------|---------------|
| 3 | Build Options |
| Oracle Service Name : | oracle |
| System User : | system |
| System User Password : | manager |
| TPC-C User : | tpcc |
| TPC-C User Password : | tpcc |
| TPC-C Default Tablespace : | tpeetab |
| Order Line Tablespace : | tpectab |
| TPC-C Temporary Tablespace : | temp |
| TimesTen Database Compatible : | |
| Partition Order Line Table : | |
| Number of Warehouses : | 10 |
| Virtual Users to Build Schema : | 10 |
| Use PL/SQL Server Side Load : | |
| Server Side Log Directory : | /tmp |
| | OK Cancel |

This value may exceed default maximum processes of the database. If HammerDB reports a warning, it is necessary to increase the number of maximum processes. Virtual Users: 256.

| 🗙 Virtual User Opt | tions | 3 <u>000</u> | | \times | |
|--------------------|---------------|--------------|------|----------|--|
| Sec. 19 | Virtual Us | ser Opti | .ons | | |
| Virtual Users : | 256 | | | | |
| User Delay(ms) : | 500 | | | | |
| Repeat Delay(ms) : | 500 | | | | |
| Iterations : | 1 | | | | |
| | 🛪 Show Output | | | | |
| | 🗌 Log Out | put to | Temp | | |
| | 🗌 Use Uni | que Log | Name | | |
| | 🖂 No Log | Buffer | | | |
| | 0 | к | Cano | el: | |

For more detailed information, please download <u>HammerDB Oracle OLTP Load</u> <u>Testing.</u>



tpm

15. Performance

The NeoSapphire 3605 offers 5TB usable capacity, while the NeoSapphire 3611 provides 11TB in a very compact 1U rack-mount form factor. The low latency and high reliability of Fibre Channel makes these new arrays ideal for demanding, timecritical applications including banking, finance, and media production. Reliability is further enhanced by hot-swappable drives and redundant power supplies. NeoSapphire series are equipped with AccelStor's exclusive FlexiRemap softwaredefined flash technology. Designed for sustained performance and reliability even in the random-access scenarios typical of enterprise storage needs, FlexiRemap software technology remaps random data writes as sequential whenever beneficial, before passing them to the underlying SSDs. The high performance of 1.2M TPM from the HammerDB benchmark and NeoSapphire's powerful features will boost IT staff productivity and make deployment easier.

