Deploying Oracle 11gR2 Enterprise Edition on Hitachi Converged Platform for Oracle® Database

Implementation Guide

By Kishore Daggubati

June 1, 2012
Feedback

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Deploying Oracle 11gR2 Enterprise Edition on Hitachi Converged Platform for Oracle® Database

Implementation Guide

This implementation guide gives you instruction on how to deploy Hitachi Converged Platform for Oracle® Database. You have the option of whether to use PCI flash acceleration in your deployment. Using servers and storage from Hitachi, this seamless solution is for Oracle Database 11g Release 2.

A description of the architecture in this paper is in Deploying Oracle Database 11g R2 Enterprise Edition on Hitachi Converged Platform for Oracle® Database Reference Architecture Guide.

To benefit from this implementation guide, you need to be a database administrator, storage administrator, or have the responsibility to plan and deploy an Oracle Database 11g Release 2 solution. You need familiarity with the following:

- Hitachi Unified Storage
- Hitachi Compute Blade 2000
- Storage area networks
- Oracle Database 11g Release 2
- Oracle Automatic Storage Management
- Fusion-io ioDrive flash storage cards
Tested Solution Components

Figure 1 shows the infrastructure without PCIe flash acceleration.

Figure 1
Figure 2 shows the infrastructure using PCIe flash acceleration.
Table 1 lists the hardware components used in this implementation guide.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Version</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Chassis</td>
<td>Hitachi Compute Blade 2000</td>
<td>Firmware Version A0195-C-6443</td>
<td>1</td>
</tr>
<tr>
<td>Server Blades</td>
<td>Model GVAX57A1 (X57-A1), each configured as follows:</td>
<td>EFI BIOS Version 4.6.3.7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>- Intel Xeon X7560 at 2.26 GHz, two 8-core physical processors</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 96 GB RAM using 4 GB DIMMs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- One dual port Fibre Channel card (Mezzanine Slot 0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Two 1 Gb/sec Ethernet NICs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- (Used only with architecture using PCIe flash card) Two Fusion-io ioDrive 320 GB MLC, version 5.0.7, Revision 101971, in PCIe expansion Slot 0 and PCIe expansion Slot 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>See note at bottom of table.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage System</td>
<td>Hitachi Unified Storage 150, configured as follows:</td>
<td>0910TB5H</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>- 96 × 600 GB SAS 10k RPM drives in 4 trays, each tray with 24 disks, for about 56 TB raw capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 2 × 8 host port Fibre Channel controllers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 32 GB cache (16 GB per controller)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Two front-end ports on each controller connect to the Hitachi Compute Blade 2000.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAN Connectivity</td>
<td>6 port, 8 Gb/sec Fibre Channel switch modules</td>
<td>V 642b</td>
<td>2</td>
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</table>
This implementation guide uses X57-A1 (GVAX57A1) server blades with 4 GB DIMMs. You may upgrade to X57-A2 server blades using Intel Xeon Processor E7-8870. In addition, you may upgrade the 4 GB DIMMs to 8 GB DIMMs.

Table 2 lists the software components used in this implementation guide.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Version</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating System</td>
<td>Oracle Enterprise Linux</td>
<td>5 Update 5</td>
<td></td>
</tr>
<tr>
<td>TELNET Client</td>
<td>PuTTY</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Database Software</td>
<td>Oracle</td>
<td>11g R2, 11.2.0.1.0</td>
<td></td>
</tr>
<tr>
<td>Storage Management Software</td>
<td>Hitachi Command Suite</td>
<td>7.1.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hitachi Storage Navigator Modular 2</td>
<td>21.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hitachi Dynamic Link Manager</td>
<td>6.6.2-01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hitachi Dynamic Provisioning</td>
<td>Microcode dependent</td>
<td></td>
</tr>
</tbody>
</table>

This implementation guide uses Oracle Linux version 5, Update 5, and Oracle Database 11g R2. Instead of using Oracle Linux version 5, Update 5, you can use Red Hat Linux Version 5 or later. If you are using PCI flash acceleration, you must use Oracle Database 11g or later. If you are not using PCI flash acceleration, you can use Oracle Database 9i or later.
Hitachi Unified Storage 150

Hitachi Unified Storage is a midrange storage platform for all data. It helps businesses meet their service level agreements for availability, performance, and data protection.

The performance provided by Hitachi Unified Storage is reliable, scalable, and available for block and file data. Unified Storage is simple to manage, optimized for critical business applications, and efficient.

Using Unified Storage requires a smaller capital investment. Deploy this storage, which grows to meet expanding requirements and service level agreements, for critical business applications. Simplify your operations with integrated set-up and management for a quicker time to value.

Unified Storage enables extensive cost savings through file and block consolidation. Build a cloud infrastructure at your own pace to deliver your services.

Hitachi Unified Storage 150 provides a reliable, flexible, scalable, and cost-effective modular storage. Its symmetric active-active controllers provide input-output load balancing that is integrated, automated, and hardware-based.

Both controllers in Unified Storage 150 dynamically and automatically assign the access paths from the controller to a logical unit (LU). All LUs are accessible, regardless of the physical port or the server that requests access.

Hitachi Compute Blade 2000

Hitachi Compute Blade 2000 is an enterprise-class blade server platform. It features the following:

- Balanced system architecture that eliminates bottlenecks in performance and throughput
- Configuration flexibility
- Eco-friendly power-saving capabilities
- Fast server failure recovery using a N+1 cold standby design that allows replacing failed servers within minutes

Virtualization on Hitachi Compute Blade 2000 consolidates application and database servers for backbone systems. Removing performance and I/O bottlenecks opens opportunities for increasing efficiency and utilization rates. In addition, it reduces the administrative burden in your data center.
Hitachi Command Suite

Hitachi Command Suite manages virtualized storage and server infrastructures. With new levels of usability, workflow, performance, scalability, and private cloud enablement, Hitachi Command Suite lets you build sustainable infrastructures with leading storage technologies. It helps you flexibly align with changing business requirements and maximize return on IT investments.

In this solution, Hitachi Command Suite creates LDEVs and dynamic provisioning pools. It assigns the newly created LDEVs to host groups.

Hitachi Storage Navigator Modular 2

Hitachi Storage Navigator Modular 2 provides essential management and optimization of storage system functions. Using Java agents, Storage Navigator Modular 2 runs on most browsers. A command line interface is available.

Use Storage Navigator Modular 2 for the following:

- RAID-level configurations
- LUN creation and expansion
- Online microcode updates and other system maintenance functions
- Performance metrics

Hitachi Dynamic Link Manager Advanced

Hitachi Dynamic Link Manager Advanced combines all the capabilities of Hitachi Dynamic Link Manager and Hitachi Global Link Manager into a comprehensive multipathing solution. It includes capabilities such as the following:

- Path failover and failback
- Automatic load balancing to provide higher data availability and accessibility

Hitachi Dynamic Provisioning

On Hitachi storage systems, Hitachi Dynamic Provisioning provides wide striping and thin provisioning functionalities.

Using Hitachi Dynamic Provisioning is like using a host-based logical volume manager (LVM), but without incurring host processing overhead. It provides one or more wide-stripping pools across many RAID groups. Each pool has one or more dynamic provisioning virtual volumes (DP-VOLs) of a logical size you specify of up to 60 TB created against it without allocating any physical space initially.
Deploying Hitachi Dynamic Provisioning avoids the routine issue of hot spots that occur on logical devices (LDEVs). These occur within individual RAID groups when the host workload exceeds the IOPS or throughput capacity of that RAID group. Dynamic provisioning distributes the host workload across many RAID groups, which provides a smoothing effect that dramatically reduces hot spots.

When used with Hitachi Unified Storage, Hitachi Dynamic Provisioning has the benefit of thin provisioning. Physical space assignment from the pool to the dynamic provisioning volume happens as needed using 1 GB chunks, up to the logical size specified for each dynamic provisioning volume. There can be a dynamic expansion or reduction of pool capacity without disruption or downtime. You can rebalance an expanded pool across the current and newly added RAID groups for an even striping of the data and the workload.

PuTTY

Use PuTTY for the TELNET protocol when performing configuration tasks in this implementation guide. It is a free implementation of TELNET and Secure Shell (SSH) for Windows and UNIX platforms.

Oracle Database 11g Release 2

Oracle Database 11g Release 2 has Oracle Database Automatic Storage Management (ASM). It combines the features of a volume manager and an application-optimized general-purpose file system. It is optimized for use with Oracle products. ASM is part of the grid infrastructure component in Oracle Database 11gR2.

Oracle Linux 5 Operating System

Oracle Linux 5 is an enterprise-class operating system. It is fully compatible with the Red Hat Enterprise Linux kernel. Oracle Linux was built and tested to run Oracle hardware, databases, and middleware.

Fusion-io ioDrive PCIe Flash Card

When using PCIe flash acceleration, Hitachi Converged Platform for Oracle® Database uses the Fusion-io ioDrive PCIe flash storage card. This solution uses four 320 GB Fusion-io PCI Express PCIe flash cards. These high-performance block devices accelerate Oracle database input and output performance. The PCIe flash card has very low access latency with very high IOPS.
Solution Implementation

The following are the processes used to deploy the Hitachi Converged Platform for Oracle Database® for Oracle Database 11g Release 2 on Hitachi Unified Storage 150 and Hitachi Compute Blade 2000.

- Preparation
- Configure Hitachi Compute Blade 2000
- Configure SMP connection
- Configure LAN switch modules
- Configure the Storage array
- Configure the SAN
- Configure storage for Oracle database server
- Set up SAN OS boot.
- Install Oracle Enterprise Linux 5U5 on Oracle database server
- Install and Configure Hitachi Dynamic Link Manager Advanced
- Install and Configure Fusion-io ioDrive PCIe flash card (only when using PCIe flash acceleration)
- Install Oracle Database 11g Release 2 Automatic Storage Management
- Configure Oracle Database 11g Release 2 Automatic Storage Management
- Install Oracle Database 11g Release 2 Software
- Create Oracle Database

Some of these processes require that you use the following Hitachi Compute Blade 2000 interfaces:

- **Management module web GUI**—Manages the entire chassis using a web-based GUI. Open a web browser and enter the IP address of the management module.
- **Blade server web GUI**—Manages a server blade using a web-based GUI. Open a web browser and enter the IP address of a server blade.
- **Blade server command-line interface**—Configure SMP using a command-line interface. Use PuTTY to open a TELNET session to the IP address of a server blade.
- **Oracle ILOM Remote Console**—Remote kernel-based virtual machine for a server blade. Open a blade server web GUI and, when the logon window displays, click Launch Remote Console.
For more information, see the following documentation:

- Hitachi Storage Navigator Modular 2 online help
- Hitachi Dynamic Provisioning user guide
- Hitachi Dynamic Link Manager user guide
- Hitachi Compute Blade 2000 user guide
- Oracle 11g Release 2 database installation guide
- Fusio-io ioDrive knowledge base

Preparation

Prepare the following before implementing this solution:

- Verify that you have the following items:
  - USB DVD drive (comes with Hitachi Compute Blade 2000)
  - Microsoft Windows 2008 installation DVD or ISO image
  - Driver kit version 12-01 CD or ISO image (includes driver for mezzanine Emulex HBA)
  - Seven IP addresses:
    - Management module—2
    - Server blades—2
    - Blade management console (BMC)—2
    - Operating system—1
  - Four IP addresses in environments where these items are not already in place and connected:
    - Two for the storage systems
    - Two for the Fibre Channel switches
- Make the following LAN connections:
  - Connect one network cable from each network switch module to your corporate LAN. Do not use the first network switch module port because it is reserved for system settings.
  - Connect one cable from each management module to your corporate management LAN.
Configure Hitachi Compute Blade 2000

These procedures to configure Hitachi Compute Blade 2000 assume that the following has happened:

- Racking of the blade chassis
- Installation of the server blades into the chassis
- Completion of all cabling (LAN and SAN)

Configure Required Management IP Addresses

To configure the IP addresses for the management module and the server blades using the management module web GUI, do the following.

1. Connect a system console (laptop or PC) to the MGMT0 port of the management module with an Ethernet cable.

   If you have two management modules installed, connect to the management module with the solid green MSR LED lamp, as shown in Figure 3.

   ![Figure 3](image)

2. Open a browser and type `http://192.168.0.1/` in the address bar.

   A logon screen displays.

3. Log on using these defaults:

   **User name**: administrator
   **Password**: password

   The management module web GUI launches.
4. Open the **Management LAN network** window

   (1) Click the **Settings** tab.

   (2) In the navigation tree on the left, click **The configuration of network** link.

5. Configure the management LAN network.

   (1) Click **Edit**.

       The fields become editable.

   (2) Configure the management LAN network by typing the following for the
       management module and each partition:

       - IP address
       - Subnet mask
       - Default gateway

       You need a different IP address for the management module and each
       partition (server blade).

   (3) To save the settings, click **Confirm**, and then click **Apply** button.

6. Disconnect the Ethernet cable from the management module.

7. Connect an Ethernet cable from the management module to an external
   management LAN switch.

   - This allows you to perform management through any system console in
     the management LAN.

**Configure SMP connection**

Before configuring SMP between the two blades, make sure that the two blades
are connected using an SMP connector.

Complete the following procedures for configuring the SMP connection between
the two blades.

To configure SMP for the two blades, do the following:

1. Open a PuTTY session, using the following information.

   - **IP address**—192.168.0.1
   - **Connection type**—Telnet
   - **User name**—administrator
   - **Password**—password

2. To enter system command mode, type the following: $
3. To change the physical partition setting, type the following:
   (1) PR (physical partition setting)
   (2) C (edit partition configuration)
   (3) 0 (lowest number partition)
   (4) 2 (number of blades in the SMP configuration)
   (5) Y (confirm the deletion of Partition1)

4. To save the physical partition settings, type the following:
   (1) W (write configuration)
   (2) Y (confirm)

The configuration displays in the PuTTY session as in Figure 4.

![PuTTY Configuration Display](image)

Figure 4
Configure LAN Switch Modules

Table 3 has the default IP address for the switch modules.

<table>
<thead>
<tr>
<th>Item</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch module 0</td>
<td>192.168.0.28</td>
</tr>
<tr>
<td>Switch module 1</td>
<td>192.168.0.29</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>255.255.255.0</td>
</tr>
</tbody>
</table>

The command line interface for the system supports two command input modes:

- Operation command mode
- Configuration command mode

Configuration of the LAN switch modules requires the use of both command input modes. Table 4 describes features of command input modes and details on how to access and exit command input modes.

<table>
<thead>
<tr>
<th>Command Input Mode</th>
<th>User Level</th>
<th>Accessed by</th>
<th>Prompt</th>
<th>Exited by</th>
<th>Commands You Can Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation command</td>
<td>General user</td>
<td>Login: &lt;user-ID&gt;</td>
<td>&gt;</td>
<td>&gt;logout</td>
<td>Some operation commands</td>
</tr>
<tr>
<td>System administrator</td>
<td>&gt;enable</td>
<td>#</td>
<td># disable</td>
<td>All operation commands</td>
<td></td>
</tr>
<tr>
<td>Configuration command</td>
<td>System administrator</td>
<td># configure</td>
<td>(config)#</td>
<td>(config)# exit</td>
<td>All configuration commands</td>
</tr>
</tbody>
</table>

By default, the configuration of Switch 0 Port 1 is for dedicated VLAN management. It cannot communicate with a server blade and other external ports. If needed, reconfigure the other port to be Port 1.

Use a public network for the initial configuration.

To configure the LAN switch modules, do the following.

1. Connect the management PC to Switch 0 Port 1 with a LAN cable.
2. Connect to the default switch IP with TELNET, 192.168.0.28, using these defaults:
   
   **User name** — administrator
   
   **Password** — password

3. Enter configuration mode in the TELNET session.
(1) To enter the switch module, type the following: SW

(2) To Select the switch module, type the following to select Module 0: 0

(3) To confirm Module 0, type the following: Y

(4) To log on, type the following: operator
   A password is not required.

(5) To change to administrator mode, type the following: enable

(6) To display the current “running configuration” of the switch module, type the following: show run
   Every VLAN, switch port, and VLAN port displays.

(7) To enter configuration mode, type the following: config
   The cursor changes to this: (config) #

4. Create and name VLAN 100.
   (1) To create VLAN 100, type the following: vlan 100
   (2) To assign a name to VLAN 100, type the following: test vlan

5. Save the configuration changes.
   (1) To change back to config mode, type the following: exit
   (2) To write the changes to the configuration, type the following: save

Repeat this procedure to configure LAN Switch Module 1.

Configure the Storage Array
To install and configure Hitachi Storage Navigator Modular 2, do the following.

1. Connect the management PC to LAN Port 1 on the storage array with a LAN cable.

2. Use PuTTY to connect to a controller IP address.
   The default management IP address for each controller is the following:
   - Controller 0—172.17.46.142
   - Controller 1—172.17.46.143

3. Power the controller on.
   - Remove the front bezel panel to power the controller unit on.

4. Install Storage Navigator Modular 2.
   (1) On the management laptop, insert the CD with the software.
Follow the installation wizard to complete the install.

- Leave the default port as 23015

Click **Finish** to close the wizard.

Open a web browser and type the following in the address bar:

```
http://127.0.0.1:23015/StorageNavigatorModular/Login
```

Use the following default user credentials to log on to Storage Navigator Modular 2:

- **User ID**—system
- **Password**—manager

5. Add the storage system to Storage Navigator Modular 2.

   1. On the **SNM2 Explorer** pane, click **Add Array** to add new managed storage.
   2. Type the following IP addresses for the storage array IP addresses:
      - **Controller 0**—172.17.46.142
      - **Controller 1**—172.17.46.143
   3. Leave “Using Ports” as a non-secure port.
   4. Click **Next**.
   5. Click **Finish** to close the wizard.

6. Perform the storage system initial setup.

   1. On the **Common Array Tasks** screen, click **Initial Setup**.
   2. Click **Next**.
   3. Leave **E-mail Alert** clear (unselected) and then click **Next**.
   4. Make the IP address settings.
      i. Click the following for the **Protocol**: IPv4
      ii. Click the following for **Network Information**: Set Manually
      iii. Type the following for the controller **IP Address**: 172.17.46.142 (Controller 0) and 172.17.46.143 (Controller 1)
      iv. Type the following as the **Subnet** for both controllers: 255.255.255.0
      v. Type the following for the default **Gateway** for both controllers: 172.17.0.1
   5. On the **Set up Host Ports** page, only configure Fibre Channel Ports 0A, 1A, 0B, 1B.
Configure the Storage Area Network Port 0A, 1A, 0B, and 1B on Hitachi Unified Storage 150 are used for converged platform, with and without PCIe flash acceleration. Use Hitachi Dynamic Link Manager for multipathing with the extended least I/O load-balancing algorithm.

The following sections describe how to configure the SAN for this solution.

Zone SAN Switches
The Oracle database server has four Fibre Channel ports, with two ports from the mezzanine card on each server blade. These mezzanine cards connect internally to the Fibre Channel switch modules located in the Hitachi Compute Blade 2000 chassis.

Connect two ports from each of the two internal Fibre Channel switch modules to the four ports on the Hitachi Unified Storage 150 storage system as shown in Figure 1 and Figure 2. This provides a four-path connection.

Configure each connection with zones on fabric switches to provide four zones for the Oracle database server.

In addition, follow these recommended practices:

- Use World Wide Port Name (WWPN) identification for all zoning configuration.
- Connect a minimum of two HBAs per server for multipath high availability.
- Disable all unused switch ports to increase security.
- Configure ports for point-to-point topology.
- Set ports to a specific speed. Do not use the auto negotiate setting.
- Use single initiator zoning.

To configure zoning for the SAN switches, do the following.
1. Create aliases for ports.
2. Create zones.
3. Add members (aliases) to the zones.
4. Save the zones.
5. Enable the zones.

Your organization’s guidelines for zoning might vary. Check with your IT department.

Table 5 has the zoning for this solution. Use the same zoning whether your implementation is with or without PCIe flash acceleration.

### Table 5. Zoning for Converged Platform

<table>
<thead>
<tr>
<th>Server</th>
<th>HBA Ports</th>
<th>Switch Zone</th>
<th>Storage Port</th>
<th>Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database server</td>
<td>B0-HBA1-1</td>
<td>BS2K_13_B0_HBA1_1_ASE46_142_0A</td>
<td>0A</td>
<td>5300-05</td>
</tr>
<tr>
<td></td>
<td>B0-HBA1-2</td>
<td>BS2K_13_B0_HBA1_2_ASE46_142_0B</td>
<td>0B</td>
<td>5300-06</td>
</tr>
<tr>
<td></td>
<td>B1-HBA1-1</td>
<td>BS2K_13_B1_HBA1_1_ASE46_142_1A</td>
<td>1A</td>
<td>5300-05</td>
</tr>
<tr>
<td></td>
<td>B1-HBA1-2</td>
<td>BS2K_13_B1_HBA1_2_ASE46_142_1B</td>
<td>1B</td>
<td>5300-06</td>
</tr>
</tbody>
</table>

Configure Storage for Oracle Database Server

These procedures to configure the storage assume you have installed all appropriate licenses on your storage system.

### Configure Fibre Channel Port Settings

To configure your storage Fibre Channel ports using Hitachi Storage Navigator Modular 2 software, do the following.

1. Log on to Storage Navigator Modular 2.
   - You must have **modify** privileges when using Storage Navigator Modular 2 software to complete this process.

2. Click the **Array Name** link to open the Oracle database server environment storage system.

3. Expand the **Settings** heading and click the **FC Settings** link.

4. Check the **Topology** column to find the ports that are zoned to connect to the Oracle database server on the SAN.

5. Click **Edit FC Port**.

6. Click **Point-to-Point** from the **Topology** list and then click **OK**.

   A message displays saying that the change will interrupt I/O to any currently-connected host to the port.
7. Click **Confirm** and wait a few seconds for the change to take place.

After establishing the connection between the storage system and the host, the **FC Settings** window shows all ports in a **LinkUp(F_Port Connected)** status.

**Create RAID Groups**

This solution uses four RAID groups for O/S Boot, Oracle Online redo logs, and archived redo logs for this solution. Table 6 has the RAID group configuration.

Table 6. RAID Groups Assignment

<table>
<thead>
<tr>
<th>RAID Group</th>
<th>Purpose</th>
<th>RAID Level</th>
<th>Drive Type</th>
<th>No of Drives</th>
<th>Capacity (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>O/S Boot</td>
<td>RAID- 1 (1D+1D)</td>
<td>600 GB 10k RPM SAS</td>
<td>2</td>
<td>535.7</td>
</tr>
<tr>
<td>002</td>
<td>Oracle Online Redo Logs</td>
<td>RAID-10 (2D+2D)</td>
<td>600 GB 10k RPM SAS</td>
<td>4</td>
<td>1000</td>
</tr>
<tr>
<td>003</td>
<td>Oracle Online Redo Logs</td>
<td>RAID-10 (2D+2D)</td>
<td></td>
<td>4</td>
<td>1000</td>
</tr>
<tr>
<td>004</td>
<td>Oracle Archived Redo Logs</td>
<td>RAID-10 (2D+2D)</td>
<td></td>
<td>4</td>
<td>1000</td>
</tr>
</tbody>
</table>

To create a RAID group using Hitachi Storage Navigator Modular 2 software, do the following.

1. Log on to Storage Navigator Modular 2.
   - You must have **modify** privileges when using Storage Navigator Modular 2 software to complete this process.

2. Click the **Array Name** link to open the storage system.

3. Expand the **Groups** heading in the storage system pane and then click the **Volumes** link.

   The right pane displays three tabs: **Volumes**, **RAID Groups**, and **DP Pools**.

4. Click the **RAID Groups** tab and then click **Create RG**.

   The **Create Raid Group** window opens.

5. Use Table 6 to configure the **RAID Level** and **Combination** for each RAID group in the **Create Raid Group** window.

   The **Number of Parity Groups** changes based on your RAID level and combination choices.

6. Click the **Automatic Selection** option.
   - If you have different types of drives installed in the storage system (either type or capacity), click the **Drive Type** value and **Drive Capacity** value from each list.
Using automatic selection is the recommended practice from Hitachi Data Systems.

Storage Navigator Modular 2 uses the next available drives of the type and capacity clicked.

7. **Click OK.**

A message says that there is the successful creation of the RAID group.

8. **Click Close.**

The formatting process to create the RAID group starts immediately in the background.

Use this process for all RAID groups in your solution.

**Create Dynamic Provisioning Pools**

This solution uses one dynamic provisioning pool. Table 7 has its details.

<table>
<thead>
<tr>
<th>Dynamic Provisioning Pool ID</th>
<th>DP RAID Group</th>
<th>RAID Level</th>
<th>Drive Type</th>
<th>No of Drives</th>
<th>Pool Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>005 - 014</td>
<td>RAID-10 (4D+4D)</td>
<td>600GB 10k RPM SAS</td>
<td>80</td>
<td>20.8 TB</td>
</tr>
</tbody>
</table>

This solution uses 80 drives. However, RAID-10 (4D+4P) only permits adding eight drives at a time to the dynamic provisioning pool. This requires that you do the following:

1. Create the dynamic provisioning pool initially with eight drives.
2. Add the remaining drives eight at a time until you have added all drives.

To create a dynamic provisioning pool using Hitachi Storage Navigator Modular 2 software, do the following.

1. **Log on to Storage Navigator Modular 2.**
   - You must have **modify** privileges when using Storage Navigator Modular 2 software to complete this process.
2. **Click the Array Name link** to open the storage system.
3. **Expand the Groups heading** in the storage system pane and then click the **Volumes** link.
   - The right pane displays three tabs: **Volumes, RAID Groups**, and **DP Pools**.
4. **Click the DP Pools tab** and then click **Create Pool.**
   - The **Create DP Pool** window opens.
5. Click RAID1+0 from the RAID Level list and 4D+4D from the Combination list.

The Number of drives automatically changes, based on your RAID level and combination choices.

When created, the dynamic provisioning pool consists of a single RAID group. After initially setting the RAID level and combination, all RAID groups added to the dynamic provisioning pool have the same settings.

6. Click the Automatic Selection option.

- If you have different types of drives installed in the storage system (either type or capacity), click the Drive Type value and Drive Capacity value from each list.

Using automatic selection is the recommended practice from Hitachi Data Systems.

Storage Navigator Modular 2 uses the next available drives of the type and capacity clicked.

7. Click the Advanced tab, change settings based on your requirements, and then click OK.

A message says that there is successful creation of the dynamic provisioning pool.

8. Click Close.

The pool immediately starts the formatting process in the background of the initial eight drives.

9. Add the remaining drives.

Repeat until you have added all 80 drives to the dynamic provisioning pool

(1) Click the DP Pools tab, select the check box for the pool, and then click the Add Pool Capacity button.

(2) Click the Automatic Selection option and then click OK.

Enabling automatic selection means that Storage Navigator Modular 2 selects the next available drives of the type shown in the box.
Create Volumes

This procedure creates the 25 storage volumes used for the operating system and Oracle database server. All the storage volumes are mapped to the storage ports 0A, 1A, 0B, and 1B. Table 8, Table 9, and Table 10 have the details of the LUs. Use Table 9 or Table 10, based on whether your implementation uses PCIe flash acceleration.

Table 8. Operating System and Oracle Database Server Volume Information

<table>
<thead>
<tr>
<th>RAID Group</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>0001</td>
<td>150</td>
<td>O/S Boot</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td>001</td>
<td>0002</td>
<td>250</td>
<td>Oracle software</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td>002</td>
<td>0003</td>
<td>50</td>
<td>Oracle online redo logs</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td>002</td>
<td>0004</td>
<td>50</td>
<td></td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td>002</td>
<td>0005</td>
<td>50</td>
<td></td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td>002</td>
<td>0006</td>
<td>50</td>
<td>Oracle control file</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td>RAID Group</td>
<td>LUNs</td>
<td>LUN Size (GB)</td>
<td>Purpose</td>
<td>Storage Port</td>
</tr>
<tr>
<td>------------</td>
<td>------</td>
<td>---------------</td>
<td>------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>003</td>
<td>0007</td>
<td>50</td>
<td>Oracle online redo logs</td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>003</td>
<td>0008</td>
<td>50</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>003</td>
<td>0009</td>
<td>50</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>003</td>
<td>0010</td>
<td>50</td>
<td>Oracle control file</td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>004</td>
<td>0011</td>
<td>300</td>
<td>Oracle archived redo logs</td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>004</td>
<td>0012</td>
<td>300</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>004</td>
<td>0013</td>
<td>300</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
</tbody>
</table>
To create volumes using Hitachi Storage Navigator Modular 2, follow these steps.

1. Log on to Storage Navigator Modular 2.
   - You must have modify privileges when using Storage Navigator Modular 2 software to complete this process.

2. Click the Array Name link to open the storage system.

3. Expand the Groups heading in the storage system pane and then click the Volumes link.

4. Click Create VOL.

The Create Volume window opens.

### Table 9. Dynamic Provisioning Pool Volume Information without PCIe Acceleration

<table>
<thead>
<tr>
<th>Dynamic Provisioning Pool ID</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>0014-0025</td>
<td>200</td>
<td>Oracle System, Sysaux, Undo, Temp, OLTP application tablespaces</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
</tbody>
</table>

### Table 10. Dynamic Provisioning Pool Volume Information with PCIe Acceleration

<table>
<thead>
<tr>
<th>Dynamic Provisioning Pool ID</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>0014-0020</td>
<td>200</td>
<td>Oracle ASM Preferred Mirror Read, 2nd Failure Group to host application tablespace</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td></td>
<td>0021-0025</td>
<td>200</td>
<td>Oracle System, Sysaux, Undo, Temp</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
</tbody>
</table>
5. Create the volume.

   (1) For Type, click either the RAID Group option or the DP Pool option.

   (2) From the RAID Group/DP Pool Number list, click 001.

   (3) In the VOL field, type the logical unit number from one of the tables.

   (4) Type the LUN size from one of the tables in Capacity, and then click GB from the list.

   (5) Do not select the Accelerate Wide Striping Mode check box.

   (6) Click OK.

   The Create Volume pane refreshes, populated with the new LUN information.

Repeat this process for every Oracle database server volume.

Set up SAN Operating System Boot

SAN boot is the capability to boot the operating system from a volume on Hitachi Unified Storage 150 without using the internal disks of the server. The following describes how to set up the SAN operating system boot.

Register Boot Device

To configure HBAs on the Oracle database server using Oracle Integrated Lights Out Manager Remote Console, do the following:

1. Open a browser and type the server blade IP address in the address bar.

   A logon screen opens.

2. Click Launch Remote Console and log on to Remote Console.

   ▪ The default User ID is user01 and the default password is pass01.

   Remote Console launches.

3. Enter the system BIOS.

   (1) From the Keyboard menu, click Ctrl+Alt+Del to start the system.

   (2) When "Press <Alt+E> or <Ctrl+E> enter Emulex BIOS configuration Utility" displays during system startup, press Ctrl+E.
4. Change a BIOS setting.
   (1) Type the number shown on the LightPulse BIOS Utility screen for the BIOS to be changed.
   (2) Select **Configure Boot Devices**.
   (3) Type the boot entry number to register the boot device and then press Enter.
      A list of boot devices appears.
   (4) Type the 2-digit number of the boot device to register and then press Enter.
   (5) Type the 2-digit number (in hexadecimal) of the LUN of the boot device to register and then press Enter.
      The volumes display in the ascending order of LUNs, starting with volume of the boot device to register.
   (6) Type 01 and then press Enter.

5. Check the registration of the boot device.
   (1) Type 1 and then press Enter to boot the device.
      A screen with a list of saved boot devices displays.
   (2) Verify device registration in the boot entry.

6. Reboot so change takes effect.
   (1) To terminate the BIOS utility, type x.
   (2) To reboot, press Y.

Mount the Oracle Enterprise Linux 5U5 ISO Image from a Remote CD/DVD Image
To perform this procedure, you need the Remote Console session from “Register Boot Device.”

To mount the Oracle Enterprise Linux 5U5 ISO image from a Remote CD/DVD Image, do the following steps.

1. From the **Remote CD/DVD** menu, click **Redirect CD/DVD Image**.
2. From the **Keyboard** menu, click **Ctrl+Alt+Del** to start the system.
3. When "Press <DEL> or <F2> to enter setup" displays during system startup, press F2.
   The Extensible Firmware Interface (EFI) setup screen opens.
4. From the EFI menu, select **Boot**.

5. From the Boot Option Priorities area, select the boot device **HITACHI Remote CD/DVD** for **Boot Option #1**.

6. From the EFI menu, select **Save & Exit**, and then **Save Changes**.

Install Oracle Enterprise Linux 5U5 on Oracle Database Server

This procedure assumes that the configuration of the Oracle database server is to boot the operating system from an ISO image on a remote CD/DVD image. See "Mount the Oracle Enterprise Linux 5U5 ISO Image from a Remote CD/DVD Image."

The Oracle database server starts with a splash screen for Oracle Enterprise Linux. The bottom of the screen lists instructions, function keys, and the boot prompt.

To install Oracle Enterprise Linux 5U5 on Oracle database server, do the following.


2. Display the installation instructions.
   - On the Oracle Enterprise Linux splash screen, at the **boot** prompt, type the following:

     ```
     linux text
     ```

3. Follow the on-screen instructions to complete the installation.

4. Change to boot the Compute Blade 2000 server from the Hitachi Unified Storage 150 storage system.
   - Reboot the system.
   - When "Press <DEL> or <F2> to enter setup" displays during system startup, press F2.
   - From the Boot Option Priorities area, select Hitachi Unified Storage 150 for **Boot Option #1**.
   - From the EFI menu, select **Save & Exit**, and then **Save Changes**.
Install and Configure Hitachi Dynamic Link Manager Advanced

This solution uses the extended least I/O load-balancing algorithm. Your choice of load-balancing algorithm depends on the specific environment and access patterns of the application. In some environments, such as an environment shared with other applications, one of the other algorithms might give the best overall performance.

To install Hitachi Dynamic Link Manager Advanced on the Oracle database server, do the following:

1. Log on to the Oracle database server as the root user.
2. Prepare the license key. Use either of the following methods to store the license key file in the specified directories:
   - Store the license key file (*.plk) in the /var/tmp directory, under the name hdlm_license.
     
     /var/tmp/hdlm_license
   - Execute the following commands to create the license key file (dlm.lic_key) in the /etc/opt/DynamicLinkManager directory.
     
     # mkdir /etc/opt/DynamicLinkManager
     # echo "license-key" >/etc/opt/DynamicLinkManager/dlm.lic_key
3. Insert the installation media, such as a CD-ROM, for Hitachi Dynamic Link Manager Advanced into the I/O device.
4. Check the version of Dynamic Link Manager Advanced.
   - Execute installux.sh using the "v" switch.
     
     How to execute the command when the mount point for the DVD-ROM is /media/cdrom:
     
     #/media/cdrom/installux.sh -v
     
     Use this information to verify what version is being installed.
5. Install Dynamic Link Manager Advanced.
   - Execute installux.sh.
     
     How to execute the command when the mount point for the DVD-ROM is /media/cdrom:
     
     #/media/cdrom/installux.sh
     
     A message displays to confirm that you want to perform a new installation.
6. If the Dynamic Link Manager Advanced version is correct, type y.
7. Verify that installation of Dynamic Link Manager Advanced.
   - Execute the following command to display detailed information about the installed package.
     ```
     rpm -qi HDLM
     ```

8. Simplify the execution of Dynamic Link Manager Advance commands and utilities easier by adding `/opt/DynamicLinkManager/bin` to the environment variable `PATH` in the environment setup file of the root user.
   - When using the Bourne shell or Korn shell:
     ```
     PATH=$PATH:/opt/DynamicLinkManager/bin ; export PATH
     ```
   - When using the C shell:
     ```
     set path= ( $path /opt/DynamicLinkManager/bin )
     ```

9. Restart the Oracle database server.
   - Execute the following command to restart the host:
     ```
     # shutdown -r now
     ```

10. Check the settings, status, and path configuration of Dynamic Link Manager Advanced.
    (1) To check the settings and status, execute the following command:
        ```
        dlnkmgr view -sys
        ```
    (2) To check the path configuration, execute the following command:
        ```
        # /opt/DynamicLinkManager/bin/dlnkmgr view -path
        ```
        There should be four paths for each LUN.
Install and Configure Fusion-io ioDrive PCIe Flash Card Acceleration

**Note**—Using Fusion-io ioDrive PCIe flash card acceleration in your installation is optional.

When using flash acceleration, the Hitachi Converged Platform for Oracle® Database uses four 320 GB Fusion-io PCI Express PCIe flash cards.

### Install Fusion-io ioDrives

To Install Fusion-io ioDrives in the Oracle database server, do the following.

1. Shut the Oracle database server down.
2. Log on to the server blade with Remote Console, using the IP address and default user credentials.
   - Click **Launch Remote Console**.
3. Power the server blades off.
   - From the **Power and Reset** menu, click **Forced Power Off**.
4. Install the Fusion-io ioDrive storage devices in the PCIe expansion Slot 0 and PCIe expansion Slot 1 for each server blade.
   - This solution uses two server blades and four Fusion-io ioDrives.
5. Power on the server blades.
   - From the **Power and Reset** menu, click **Power On**.

### Configure Fusion-io ioDrives

You need an account on the Fusion-io Dashboard to complete this process.

To configure Fusion-io ioDrive storage devices, do the following.

1. Download the driver for the Fusion-io ioDrive from the Fusion-io Dashboard.
2. Follow the instructions in the knowledge base on the Fusion-io Dashboard to configure the driver.
3. Check the status of the Fusion-io ioDrives by typing the following command:
   ```bash
   chkconfig --list iomemory-vsl
   fio-status -a
   ```
4. Check the path of the Fusion-io ioDrives by typing the following command:
   ```bash
   ls -l /dev/fct*
   ```
5. In case the Fusion-io ioDrives are not attached, including after the reboot of the Oracle database server, attach the drives by typing the following command:

   `fio-attach /dev/[drive number]`

   For example, for drive `/dev/fct0`, type the following:

   `fio-attach /dev/fct0`

   Repeat this command for each Fusion-io ioDrive:

   - `/dev/fct0`
   - `/dev/fct1`
   - `/dev/fct2`
   - `/dev/fct3`

   After configuration, an ioDrive re-labels as a block device (`/dev/fcta`, `/dev/fctb`, `/dev/fctc`, and `/dev/fctd`).

### Install Oracle Database 11g Release 2 Automatic Storage Management

Installing Oracle Grid Infrastructure successfully creates an instance of Oracle Database 11g Release 2 Automatic Storage Management (ASM). To install Oracle Grid Infrastructure Software, follow the steps in Oracle Database 11g Release 2 Installation Guide.
Configure Oracle Database 11g Release 2 Automatic Storage Management

Use "Without PCIe Flash Acceleration" or "Using PCIe Flash Acceleration," depending on your installation.

**Without PCIe Flash Acceleration**

Table 11 defines Oracle ASM disks and disk groups for online redo logs, control file, and archived redo logs when not using PCIe flash acceleration.

### Table 11. Oracle ASM Disks and Disk Groups for Online Redo Logs, Control File, and Archived Redo Logs without PCIe Flash Acceleration

<table>
<thead>
<tr>
<th>RAID Group</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Oracle ASM Disks</th>
<th>Oracle ASM Disk Group</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>0003</td>
<td>50</td>
<td>Oracle Online Redo logs</td>
<td>RGDISK01</td>
<td>REDODG01</td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1B</td>
</tr>
<tr>
<td>002</td>
<td>0004</td>
<td>50</td>
<td></td>
<td>RGDISK02</td>
<td></td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1B</td>
</tr>
<tr>
<td>002</td>
<td>0005</td>
<td>50</td>
<td></td>
<td>RGDISK03</td>
<td></td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1B</td>
</tr>
<tr>
<td>002</td>
<td>0006</td>
<td>50</td>
<td>Oracle Control File</td>
<td>CTDISK01</td>
<td></td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1B</td>
</tr>
</tbody>
</table>
Table 11. Oracle ASM Disks and Disk Groups for Online Redo Logs, Control File, and Archived Redo Logs without PCIe Flash Acceleration (Continued)

<table>
<thead>
<tr>
<th>RAID Group</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Oracle ASM Disks</th>
<th>Oracle ASM Disk Group</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>0007</td>
<td>50</td>
<td>Oracle Online Redo Logs</td>
<td>RGDISK11</td>
<td>REDODG11</td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1B</td>
</tr>
<tr>
<td>003</td>
<td>0008</td>
<td>50</td>
<td></td>
<td>RGDISK12</td>
<td></td>
<td>0A</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td></td>
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<td>0B</td>
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<td>003</td>
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<td>RGDISK13</td>
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<td>Oracle Control File</td>
<td>CTDISK11</td>
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<td>1B</td>
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<tr>
<td>004</td>
<td>0011</td>
<td>300</td>
<td>Oracle Archived Redo Logs</td>
<td>ARDISK01</td>
<td>ARCHDG</td>
<td>0A</td>
</tr>
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<tr>
<td>004</td>
<td>0012</td>
<td>300</td>
<td></td>
<td>ARDISK02</td>
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<td>ARDISK03</td>
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<td>1B</td>
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</tbody>
</table>
Table 12 defines Oracle ASM disks and disk groups for Oracle database application data when not using PCIe flash acceleration.

Table 12. Oracle ASM Disks and Disk Groups for Application Data without PCIe Flash Acceleration

<table>
<thead>
<tr>
<th>Dynamic Provisioning Pool ID</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Oracle ASM Disks</th>
<th>Oracle ASM Disk Group</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>0014-0025</td>
<td>200</td>
<td>Oracle System</td>
<td>DADISK01 - DADISK12</td>
<td>DATADG</td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sysaux</td>
<td></td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Undo</td>
<td></td>
<td></td>
<td>0B</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Temp</td>
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<td></td>
<td>1B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OLTP Application Tablespace</td>
<td></td>
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</tr>
</tbody>
</table>

To configure Automatic Storage Management when not using PCIe Flash Acceleration, do the following.

1. Create Automatic Storage Management disk groups.
   (1) Log on as a grid user from the bin directory located in Oracle Grid Infrastructure home.
      - Verify that you enable X Terminal. Follow the documentation on how to enable X Terminal for the X server software that you are using.
   (2) Configure the Oracle Grid Infrastructure home as the following:
      ```
      /u01/app/grid/product/11.2.0/grid
      
      $/u01/app/grid/product/11.2.0/grid/bin/asmca
      ```

2. Follow the on-screen instructions to create the ASM disk groups.
Using PCIe Flash Acceleration

Install and configure Fusion-io ioDrive PCIe flash acceleration before doing this process. See "Install and Configure Fusion-io ioDrive PCIe Flash Card Acceleration."

Table 13 lists Oracle ASM disks and disk groups for online redo logs, control file, and archived redo logs using PCIe flash acceleration.

Table 13. Oracle ASM Disks and Disk Groups for Online Redo Logs, Control File, and Archived Redo Logs using PCIe Flash Acceleration

<table>
<thead>
<tr>
<th>RAID Group</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Oracle ASM Disks</th>
<th>Oracle ASM Disk Group</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>002</td>
<td>0003</td>
<td>50</td>
<td>Oracle Online Redo logs</td>
<td>RGDISK01</td>
<td>REDODG01</td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>1A</td>
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<tr>
<td>002</td>
<td>0004</td>
<td>50</td>
<td></td>
<td>RGDISK02</td>
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<td>1B</td>
</tr>
<tr>
<td>002</td>
<td>0005</td>
<td>50</td>
<td></td>
<td>RGDISK03</td>
<td></td>
<td>0A</td>
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<tr>
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<td></td>
<td>1B</td>
</tr>
<tr>
<td>002</td>
<td>0006</td>
<td>50</td>
<td>Oracle Control File</td>
<td>CTDISK01</td>
<td></td>
<td>0A</td>
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<td>1B</td>
</tr>
</tbody>
</table>
Table 13. Oracle ASM Disks and Disk Groups for Online Redo Logs, Control File, and Archived Redo Logs using PCIe Flash Acceleration (Continued)

<table>
<thead>
<tr>
<th>RAID Group</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Oracle ASM Disks</th>
<th>Oracle ASM Disk Group</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>003</td>
<td>0007</td>
<td>50</td>
<td>❑ Oracle Online Redo Logs</td>
<td>RGDISK11</td>
<td>REDODG11</td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>003</td>
<td>0008</td>
<td>50</td>
<td></td>
<td>RGDISK12</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>003</td>
<td>0009</td>
<td>50</td>
<td>❑ Oracle Control File</td>
<td>RGDISK13</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>003</td>
<td>0010</td>
<td>50</td>
<td>❑ Oracle Archived Redo Logs</td>
<td>CTDISK11</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>004</td>
<td>0011</td>
<td>300</td>
<td>❑ Oracle Archived Redo Logs</td>
<td>ARDISK01</td>
<td>ARCHDG</td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>004</td>
<td>0012</td>
<td>300</td>
<td></td>
<td>ARDISK02</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
<tr>
<td>004</td>
<td>0013</td>
<td>300</td>
<td></td>
<td>ARDISK03</td>
<td></td>
<td>0A 1A 0B 1B</td>
</tr>
</tbody>
</table>
Table 14 defines Oracle ASM disks and disk groups using Fusion-io block devices for application data for Oracle database.

Table 14. Oracle ASM Disks and Disk Groups for Application Data using Fusion-io Block Devices

<table>
<thead>
<tr>
<th>Fusion-io block devices</th>
<th>Device Size (GB)</th>
<th>Purpose</th>
<th>Oracle ASM Disks</th>
<th>Oracle ASM Disk Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>fioa - fiod</td>
<td>320</td>
<td>1st Failure Group to host</td>
<td>ASMFIOA - ASMFIOD</td>
<td>PFMDG850:FIO GROUP1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>application tablespace</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 15 defines Oracle ASM disks and disk groups for application data for Oracle database using PCIe flash acceleration.

Table 15. Oracle ASM Disks and Disk Groups for Application Data using PCIe Flash Acceleration

<table>
<thead>
<tr>
<th>Dynamic Provisioning Pool ID</th>
<th>LUNs</th>
<th>LUN Size (GB)</th>
<th>Purpose</th>
<th>Oracle ASM Disks</th>
<th>Oracle ASM Disk Group</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>0014 - 0020</td>
<td>200</td>
<td>2nd Failure Group to host application tablespace</td>
<td>DADISK01 - DADISK07</td>
<td>PFMDG850:SAND ISKGROUP1</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
<tr>
<td>001</td>
<td>0021 - 0025</td>
<td>200</td>
<td>Oracle System, Sysaux, Undo, Temp</td>
<td>DADISK08 - DADISK12</td>
<td>DATADG</td>
<td>0A, 1A, 0B, 1B</td>
</tr>
</tbody>
</table>
To configure Automatic Storage Management when using PCIe Flash Acceleration, do the following.

1. Map the Fusion-io ioDrives to Oracle ASM.
   - Typing the following command:
     ```
     /usr/sbin/asmtool -C -l /dev/oracleasm -n ASMFIOA -s /dev/
     [drive name] -a force=yes
     ```
   
   For example, for drive /dev/fioa, type the following:
   ```
   /usr/sbin/asmtool -C -l /dev/oracleasm -n ASMFIOA -s /dev/
   fioa -a force=yes
   ```

   Repeat this command for each Fusion-io ioDrive:
   - /dev/fioa
   - /dev/fiob
   - /dev/fioc
   - /dev/fiod

2. To verify the labeling of the Fusion-io ioDrives as Oracle ASM disks, type the following command:
   ```
   oracleasm listdisks | grep -i fio
   ```

3. Follow the instructions to create disk groups as described in "Without PCIe Flash Acceleration."

4. Configure ASM_PREFERRED_READ_FAILURE_GROUPS initialization parameter in the Oracle ASM instance to specify a list of failure groups as preferred read disks by typing the following:
   ```
   ASM_PREFERRED_READ_FAILURE_GROUPS=PFMDG850.FIOGROUP1
   ```

### Install Oracle Database 11g Release 2

To install Oracle Database 11g Release 2, follow the instructions in Database Quick Installation Guide for Linux x86-64. This document (in HTML and PDF) is in Installing and Upgrading of the Oracle Database Documentation Library.

### Create Oracle Database

To create the Oracle database, you can use customized scripts or the dbca tool that is packaged in the Oracle software library. This solution uses the dbca tool.

Make sure you have enabled X Terminal. Follow the documentation on enabling X Terminal for the X server software that you are using.

To create the Oracle database, do the following:

1. Launch the dbca tool.
(1) Log on as Oracle User from the bin directory located in Oracle Software home.

(2) Type the following to configure the Oracle software home:

```
/u01/app/oracle/product/11.2.0/dbhome
$/u01/app/oracle/product/11.2.0/dbhome/bin/dbca
```

2. Follow the instructions in the wizard to create the Oracle database.
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