Virtualize Microsoft SQL 2008 using VMware vSphere 5 on Hitachi Compute Rack 220 and Hitachi Unified Storage 150

Implementation Guide

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# Table of Contents

**Solution Components** ........................................................................................................ 2
  Hardware Components ........................................................................................................... 4
  Software Components .......................................................................................................... 4

**Solution Implementation** ..................................................................................................... 5
  Configure Hitachi Unified Storage 150 ................................................................. 5
  Configure Hitachi Compute Rack 220 ................................................................. 11
  Configure the Storage Area Network ................................................................. 15
  Configure vSphere Environment ........................................................................... 16
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Implementation Guide

This implementation guide focuses on deploying Microsoft SQL Server 2008 R2 using VMware vSphere 5 servers on Hitachi Compute Rack 220 and Hitachi Unified Storage 150 for an OLTP solution. It is based on the reference architecture described in Virtualizing Microsoft SQL Server 2008 R2 Using VMware vSphere 5 on Hitachi Compute Rack 220 and Hitachi Unified Storage 150 Reference Architecture Guide.

Microsoft SQL Server 2008 R2 is a comprehensive database server and information platform to help organizations derive the most value from their valuable business data. The effort to design and deploy a SQL Server OLTP solution using VMware virtualizing technology can be a difficult task. This solution reduces the complexity to implement a SQL Server solution using servers and storage from Hitachi that work together seamlessly while providing a high level of redundancy.

This implementation guide is intended for you if you are an administrator deploying Microsoft SQL Server 2008 R2 for your organization on Hitachi Compute Rack 220 and Hitachi Unified Storage 150. Familiarity with the following is necessary to benefit from this implementation guide.

- Hitachi Unified Storage 100 family
- Hitachi Storage Navigator Modular 2
- Microsoft Windows Server 2008 R2
- Microsoft SQL Server 2008 R2
- VMware vSphere 5

**Note**—These procedures were developed in a lab environment. Many things affect production environments beyond prediction or duplication in a lab environment. Follow recommended practice by conducting proof-of-concept testing for acceptable results before implementing this solution in your production environment. Test the implementation in a non-production, isolated test environment that otherwise matches your production environment.
Solution Components

The following are the components used in this solution:

- **Hitachi Compute Rack 220**—2U rack mountable server
- **Hitachi Unified Storage 150**—High performance and scalable storage system
- **Emulex LightPulse 8 Gb/sec Dual Port Fibre Channel HBA**—High performance connectivity to the storage network
- **Microsoft Windows Server 2008 R2**—Multi-purpose server software designed to increase the reliability and flexibility of your infrastructure
- **Microsoft SQL Server 2008 R2**—Enterprise-ready database technologies and tools to help you derive the most value from information at a high levels of performance, scalability, and availability
- **VMware vSphere 5**—Enterprise virtualization solution to create a dynamic and flexible data center with integrated management and reporting capability for a high level of server and service uptime
Figure 1 illustrates a VMware vSphere 5 cluster to deploy a Microsoft SQL Server 2008 R2 environment using Hitachi Compute Rack 220 and Hitachi Unified Storage 150.
Hardware Components

Table 1 lists the hardware used for this solution.

Table 1. Hardware Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Version</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server</td>
<td>Hitachi Compute Rack 220</td>
<td>7TTSHE-F9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>▪ Form Factor 2U (rack mountable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 2 Quad-Core Intel® Xeon® 2.4 GHz, E5620 processor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 96 GB RAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 12 × 8 GB DDR3 RDIMM</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 2 × 1000BASE-T/100BASE-TX/10BASE-T ports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage system</td>
<td>Hitachi Unified Storage 150</td>
<td>0915/B-H</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>▪ 17 × 600 GB 10k RPM SAS drives (2 disks configured as hot spares)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 1 × DBS disk box</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ 2 × controllers with 16 GB cache each</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Host bus adapter</td>
<td>Emulex LightPulse</td>
<td>LPe12002-M8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>▪ 8 Gb/sec dual port</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ PCI Express 2.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Software Components

Table 2 lists the software components used for this solution.

Table 2. Software Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Product</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypervisor</td>
<td>VMware ESXi Server</td>
<td>5.0</td>
</tr>
<tr>
<td>Virtual infrastructure Software</td>
<td>VMware vCenter</td>
<td>5.0</td>
</tr>
<tr>
<td>Virtual machine guest</td>
<td>Microsoft Windows Server 2008 R2 Enterprise</td>
<td></td>
</tr>
<tr>
<td>operating system</td>
<td>Edition, 64-bit with SP2</td>
<td></td>
</tr>
<tr>
<td>Database software</td>
<td>Microsoft SQL Server 2008 R2</td>
<td>Enterprise Edition, 64-bit with SP1</td>
</tr>
<tr>
<td>Storage management</td>
<td>Hitachi Storage Navigator Module 2</td>
<td>11.5</td>
</tr>
</tbody>
</table>
                      software         |                                              |                                              |
Solution Implementation

Deploying this solution requires the following steps.

1. “Configure Hitachi Unified Storage 150” on page 5
2. “Configure Hitachi Compute Rack 220” on page 11
3. “Configure the Storage Area Network” on page 15
4. “Configure vSphere Environment” on page 16

Configure Hitachi Unified Storage 150

Use the following instructions to configure Hitachi Unified Storage 150 for this solution.

To configure the storage, verify that the cabling for the solution is connected as shown in Table 3. Perform these configuration steps using a direct connection from a management PC or using a network hub that is connected to the management port of Hitachi Unified Storage 150. A designated management machine that hosts Hitachi Storage Navigator Modular 2 is required.

Recommended practice is to connect a port from each HBA directly to a different controller on Hitachi Unified Storage 150 for data redundancy. This solution does not require the use of Fibre Channel switches. However, you can use a pair of Fibre Channel switches for this solution, depending on your business requirements.

Table 3 shows the Fibre Channel connections required for this solution.

<table>
<thead>
<tr>
<th>ESX Server</th>
<th>HBA Adapter</th>
<th>Port</th>
<th>PCIe Slot</th>
<th>Storage Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server 1</td>
<td>HBA 1</td>
<td>0</td>
<td>S1</td>
<td>0A</td>
</tr>
<tr>
<td></td>
<td>HBA 1</td>
<td>1</td>
<td></td>
<td>1A</td>
</tr>
<tr>
<td>Server 2</td>
<td>HBA 1</td>
<td>0</td>
<td>S1</td>
<td>0B</td>
</tr>
<tr>
<td></td>
<td>HBA 1</td>
<td>1</td>
<td></td>
<td>1B</td>
</tr>
</tbody>
</table>

Use Hitachi Storage Navigator Modular 2 on the management machine to complete these configuration steps.

This guide assumes the successful registration of Hitachi Unified Storage 150 in Hitachi Storage Navigator Modular 2. Find additional instructions in the documentation on the CD that ships with the product.
Open Hitachi Storage Navigator Modular 2
Follow these steps to establish connection to Hitachi Storage Navigator Modular 2 to configure Hitachi Unified Storage 150 whenever required by this implementation guide.

To open Hitachi Storage Navigator Modular 2, do the following.
1. Open a web browser and type the following in the address bar:
   http://127.0.0.1:23015/StorageNavigatorModular/Login
2. Log on using these credentials.
   User ID: system
   Password: manager

Configure Fibre Channel Port Settings
To configure the Fibre Channel settings for Port OA, Port 1A, Port OB and Port 1B, do the following.
1. Open Hitachi Storage Navigator Modular 2.
2. Open the Fibre Channel port settings.
   (1) Click the **Array Name** link to open the storage system.
   (2) Expand the **Settings** heading and click the **FC Settings** link.
   (3) Click **FC Port <port name>**.
       The Fibre Channel port properties display with an option to edit the Fibre Channel port.
3. Edit the Fibre Channel port settings.
   (1) Click **Edit FC Port**.
   (2) Click **8Gbps** from the **Transfer Rate** menu.
   (3) Click **Loop** from the **Topology** menu.
   (4) Click **OK**.
       A message displays indicating that the change interrupts I/O between any hosts connected to the port at this time.
   (5) 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 configured ports with the status **LinkUp(Private Loop)**.
Create Dynamic Provisioning Pools

Table 4 shows the dynamic provisioning pools used for this solution. This solution uses pools created with Hitachi Dynamic Provisioning to enable the ability to scale up the disk that is used for SQL server.

The dynamic provisioning pools used in this solution are part of a building block design created with a minimal building block configuration. Later, you can scale up the configuration once the solution exceeds the capacity or performance of the pools.

For more information on the building block design, see Virtualizing Microsoft SQL Server 2008 R2 Using VMware vSphere 5 on Hitachi Compute Rack 220 and Hitachi Unified Storage 150 Reference Architecture Guide.

Table 4. Dynamic Provisioning Pools

<table>
<thead>
<tr>
<th>DP Pool</th>
<th>RAID Type</th>
<th>Number of Drives</th>
<th>Usable Pool Capacity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP-00</td>
<td>RAID-5 (4D+1P)</td>
<td>5</td>
<td>2.2 TB</td>
<td>ESX SAN OS Boot, Virtual Machine OS</td>
</tr>
<tr>
<td>DP-01</td>
<td>RAID-10 (3D+3D)</td>
<td>6</td>
<td>1.6 TB</td>
<td>Database, tempdb</td>
</tr>
<tr>
<td>DP-02</td>
<td>RAID-10 (2D+2D)</td>
<td>4</td>
<td>1.1 TB</td>
<td>Transaction Log</td>
</tr>
</tbody>
</table>

To create each dynamic provisioning pool, do the following.

1. Open Hitachi Storage Navigator Modular 2.
2. Open the volumes settings.
   (1) Click the Array Name link to open the storage system.
   (2) Expand the Groups heading and click the Volumes link.

   The right area has three tabs: Volumes, RAID Groups, and DP Pools.
3. Create a dynamic provisioning pool.

   (1) Click the **DP Pools** tab and then click **Create Pool**.

       The **DP Pool Property** window opens.

   (2) Set values for **RAID Level** and **Combination**, as shown in Figure 2.

       Use settings from Table 3 on page 5.

       Create the pools in this order: DP-00, DP-01, DP-02.

![DP Pool Property](image)

**Figure 2**

The **Number of drives** changes automatically, based on the RAID level and combination you select.
(3) Click an option for **Drives**.

- **Automatic Selection**—Click this option to have Hitachi Storage Navigator Modular 2 select the next available drives shown in **Assignable Drives** table. Use the **Drive Type** and **Drive Capacity** lists to define the type of drive used for auto selection.

- **Manual Selection**—Click this option if you have different types of drives installed in the storage system so you can manually select each drive for the RAID group.

Hitachi Data Systems recommends clicking **Automatic Selection** when all your drives are the same type.

(4) Click the **Advanced** tab to modify any of the settings based on your environment requirements, and then click **OK**.

A message displays indicating successful creation of the RAID group.

Repeat this step to create each dynamic provisioning pool in Table 3 on page 5.

4. **Click Close**.

The DP pool immediately starts the formatting process in the background.

**Create Volumes**

Create the following volumes from the dynamic provisioning pools.

Table 5 has the volume configuration for this solution.

<table>
<thead>
<tr>
<th><strong>Table 5. Volume Configuration</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DP Pool</strong></td>
</tr>
<tr>
<td>DP-00</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>DP-01</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>DP-02</td>
</tr>
</tbody>
</table>

To create each volume in Table 5, do the following steps, starting with Volume 00:

1. Open Hitachi Storage Navigator Modular 2.

2. Open the volumes settings.

   (1) **Click the Array Name** link to open the storage system.

   (2) Expand the **Groups** heading and click the **Volumes** link.
3. Create a volume.

   (1) Click **Create Vol**.

   The **Create Volume** window displays.

   (2) For **Type**, click the **DP Pool** option.

   (3) From the **RAID Group/DP Pool Number** list, click the DP pool number from Table 5.

      - For example, for Volume 00, click **000**.

   (4) In **Vol**, type the volume number from Table 5.

      - For example, for Volume 1, type **1**.

   (5) For **Capacity**, type the size in the box and click the unit from the list.

      - For example, for Volume 00, type **300** in the box and then click **GB** from the menu.

   (6) Leave the **Accelerate Wide Striping Mode** check box clear (unchecked).

   (7) Click **OK**.

   Repeat this step to create each volume in Table 5.

   The **Create Volume** area refreshes and populates with the new **Volume** information.

### Create Host Groups

This procedure creates the host group mappings to the World Wide Names (WWN) Of the ESXi host HBA. Map volumes to host groups isolate access to specific hosts.

To create host groups, do the following:

1. Open Hitachi Storage Navigator Modular 2.

2. From the **Actions** menu, point to **Ports/Host Groups** and then click **Create Host Groups**.

   The **Create Host Groups** window opens.

3. Type a name in the **Host Group Name** box.

4. From the **Host Mode** list, click **21[VMware Extension]**.

5. In the **Available Hosts** area, select one or more hosts.

6. In the **Available Ports** area, select one or more ports.
7. In the **Host Mode Options** area, select the following **Mode No.** and then click **Enable**.

   - 54—Support Option for the EXTENDED COPY command
   - 63—Support option for vStorage APIs based on T10 standards

   Following recommended practice, select these **Host Mode Options** to enable the LDEV to take advantage of features in **VMware VAAI**.

8. Click **Add**.

   The **Selected Host Groups** area is populated.

9. Click **Finish**.

   The **Create Host Groups** window opens.

10. Click **Apply**.

**Configure Hitachi Compute Rack 220**

Use the following instructions to configure Hitachi Compute Rack 220 for this solution.

**Configure Remote Management**

Hitachi Compute Rack 220 is equipped with a baseboard management controller (BMC) mounted on the motherboard. Use this controller to access devices remotely, such as the keyboard, mouse, virtual floppy disk, and virtual CD/DVD. This remote device function allows the following:

   - Operation of the system BIOS and Windows operating system
   - Installation of utilities from the virtual CD/DVD

Use these steps to connect and configure the remote management for the Hitachi Compute Rack 220 server. Figure 3 on page 12 shows the location of the management port used to configure the remote management. Make the connection by using one of the following:

   - A standard Ethernet cable and a switching hub
   - A direct connection to the management port with an Ethernet crossover cable
To configure the Hitachi Compute Rack 220 server, do the following:

1. Physically connect to the same switch hub.

   (1) From the management port on Hitachi Compute Rack, connect a network cable to a switch hub.

   (2) From a laptop computer, connect a network cable to the switch hub.

2. On the laptop, configure a static IP of 192.168.100.101.

---

Table 6. Hitachi Compute Blade 220 Default Factory Settings

<table>
<thead>
<tr>
<th>Item</th>
<th>Factory Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP address</td>
<td>192.168.100.100</td>
</tr>
<tr>
<td>Subnet mask</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>Default gateway</td>
<td>Not set</td>
</tr>
<tr>
<td>HTTP</td>
<td>Enabled</td>
</tr>
<tr>
<td>User Name</td>
<td>user01</td>
</tr>
<tr>
<td>Password</td>
<td>pass01</td>
</tr>
</tbody>
</table>

Figure 3

Table 6 has the factory default settings for Hitachi Compute Rack 220.
3. Verify connectivity.
   - Ping the management port **192.168.100.100**.
     - If there is no reply, check your connections to the switch hub.

4. On the laptop, install the **remote console software**.
   - The software ships with the hardware. In addition, you can download it from the Hitachi Data Systems website.
   - This software remotely manages Hitachi Compute Rack 220 and virtual devices.

5. Launch the **remote console software**.
   - (1) On the desktop of the laptop, click **Remote Console**.
   - (2) In **IP address**, type 192.168.100.100.

6. Log on using the default user name and password in Table 6.
   - After a successful connection, the console displays (Figure 4).
     - If not, press Alt+G to display the console.

   **Figure 4**

   **Access Web Console**
   Use the web console to do the following:
   - View server and log information
   - Configure networking settings
   - Update BMC firmware

   To use the web console, do the following:
   1. Open a web browser and type the following into the address bar:
      ```
      http://192.168.100.100/cgi-bin/login.cgi
      ```
   2. Log on using the default user name and password (Table 6 on page 12).
Figure 5 shows the detailed information after a successful log on.

Figure 5

Configure the HBA and Server BIOS

Use this process to configure the HBA BIOS and system BIOS on Hitachi Compute Rack 220. This process is required for the SAN OS boot process to work successfully.

Do this process after racking of the server and completing all cabling, as shown on Table 3 on page 5. Use the remote management console to configure the HBA and server BIOS.

To configure the HBA and server BIOS on Hitachi Compute Rack 220, do the following:

1. Flash the HBAs firmware.

   Flashing the HBA firmware with the x86 BootBIOS boot code is required for use on the Hitachi Compute Rack 220
   - Use the x86 BootBIOS boot code. Get this firmware code from the Support section of the Emulex website.
   - For instruction on how to flash the firmware, see the boot code user manual from http://www.emulex.com/downloads.

2. Configure the HBA BIOS.

   (1) Start the HBA BIOS configuration.
   - Reset or reboot the server.
   - During boot up, press Ctrl+E to configure the HBA BIOS.
   - On the main menu, choose Enable Boot from SAN.
   - Press Esc to return to the main menu.
(2) Choose the topology.
   i. On the main menu, choose **Topology** and then choose **Auto Topology: Loop First**.
   ii. Press Esc to return to the main menu.

(3) Choose the link speed.
   i. On the main menu, choose **Link Speed** and then choose **8 Gigaband [sic]**.
   ii. Press Esc to return to the main menu.

(4) Choose **Save** to exit the HBA BIOS screen.

3. Configure the Server BIOS.
   (1) During boot up, press F2 to configure the server BIOS.
   (2) On the **boot** tab, verify that the **DVD-ROM** is set to be the first device for boot priority.
   (3) Press **F10** to save and to exit.

4. Configure HBA 1 and Port 0 as the primary boot device.
   (1) On the main menu, choose **Boot Device**.
   (2) From the list of saved boot devices, choose **1. Unused**.
   (3) Choose a boot volume and set the boot LUN to **00** for primary boot.
   (4) Press Esc to return to the main screen.
   (5) Choose **Save** to exit.

**Configure the Storage Area Network**

This solution does not require the use of Fibre Channel switches. All HBA ports from the ESX servers are connected directly to the storage ports as shown on Table 3 on page 5.
Configure vSphere Environment

This solution uses two ESXi hosts placed in a VMware High Availability cluster. This adds an additional layer of protection and redundancy for disaster recovery situations. The VMware cluster hosts the following virtual machine guests:

- **VMware vCenter**—Microsoft Windows 2008 R2 virtual machine running VMware vCenter Server 5.0 for complete management of the virtualized infrastructure

- **Microsoft SQL Server**—Microsoft Windows 2008 R2 virtual machine running Microsoft SQL Server 2008 R2

- **Active Directory Server**—Microsoft Windows 2008 R2 virtual machine running Active Directory and DNS service to support the virtual environment.

For more information on VMware deployment best practices, consult the [vSphere High Availability Deployment Best Practices](#).

Find additional VMware performance tuning consideration for your Microsoft SQL Server deployment in [Best Practices for Performance Tuning of Latency-Sensitive Workloads in vSphere VMs](#).
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