Overview

The Hyper-V role enables you to create a virtualized server computing environment using Hypervisor technology that is part of the Windows Server® 2008 R2 operating system. This solution is provided through Hyper-V. You can use a virtualized computing environment to improve the efficiency of your computing resources and improve server availability without using as many physical computers as you would need in a failover configuration that uses only physical computers.

The Failover Clustering feature enables you to create and manage failover clusters. A failover cluster is a group of independent computers that work together to increase the availability of applications and services. The clustered servers (called nodes) are connected by physical cables and by software. If one of the cluster nodes fails, another node takes over to provide service (a process known as failover). Users experience a minimum of disruptions in service.

This step-by-step guide shows you how to use these two technologies together to make a virtual machine highly available. We illustrate this process by creating a simple two-node cluster and a virtual machine, and then verifying the set-up by failing over the virtual machine from one node to the other.

This paper provides two main sections:

- Requirements for Using Hyper-V and Failover Clustering (page 3).
  Describes the basic hardware, software, and network infrastructure requirements.

- Configuring Hyper-V with Failover Clusters (page 7).
Requirements for Using Hyper-V and Failover Clustering

This section describes the hardware, software, accounts, and network infrastructure needed to use the Hyper-V role on a failover cluster with two nodes.

Windows Server 2008 R2 introduced a new failover clustering feature called **Cluster Shared Volumes** (CSV). With CSV, the configuration of clustered virtual machines is much simpler than before. For information about requirements for using Hyper-V with Cluster Shared Volumes, see [Hyper-V: Using Live Migration with Cluster Shared Volumes in Windows Server 2008 R2](http://go.microsoft.com/fwlink/?LinkId=164729).

### Hardware Requirements for Hyper-V

Hyper-V requires an x64-based processor, hardware-assisted virtualization, and hardware-enforced Data Execution Prevention (DEP). Specifically, you must enable the Intel XD bit (execute disable bit).

**Hardware Requirements for a Two-Node Failover Cluster**

See Appendix A (page 35) for a diagram of basic cluster network and fiber channel cabling.

You will need the following hardware for a two-node failover cluster:

- **Servers**: We recommend a set of matching computers that contains either the same or similar features.

- **Network adapters and network communication cable**: Like other features in the failover cluster solution, the network hardware must have the following certification marked: “Certified for Windows Server 2008 R2”.

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**Note**

If you plan to use HP ProLiant Network Teaming Software (NCS) to create teaming in Hyper-V environment, follow the steps described in the document below:


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Avoid having single points of failure in the network infrastructure that connects your cluster nodes. There are multiple ways of accomplishing this. You can connect your cluster nodes by multiple, distinct networks. Alternatively, you can connect your cluster nodes with one network that is constructed with teamed network adapters, redundant switches, redundant routers, or similar hardware that removes single points of failure.

**Note**

If you connect cluster nodes with a single network, the network will still pass the redundancy requirement in the **Validate a Configuration Wizard**. However, the report from the wizard will include a warning that the network should not have single points of failure.

- **Device controllers or appropriate adapters for the storage**: All storage host bus adapters (FC or SAS) that are dedicated to the cluster storage should be identical and use the same firmware version.

Note that the cluster configuration covered in this guide uses FC San shared storage only.
• **Storage:** You must use shared storage that is compatible with Windows Server 2008 R2.

A feature of failover clusters called Cluster Shared Volumes is specifically designed to enhance the availability and manageability of virtual machines. Cluster Shared Volumes are volumes in a failover cluster that multiple nodes can read from and write to at the same time. This feature enables multiple nodes to concurrently access a single shared volume. The Cluster Shared Volumes feature is only supported for use with Hyper-V and other technologies specified by Microsoft.

On a failover cluster that uses Cluster Shared Volumes, multiple clustered virtual machines that are distributed across multiple cluster nodes can all access their **Virtual Hard Disk** (VHD) files at the same time, even if the VHD files are on a single disk (LUN) in the storage. This means that the clustered virtual machines can fail over independently of one another, even if they use only a single LUN. When Cluster Shared Volumes is not enabled, a single disk (LUN) can only be accessed by a single node at a time. This means that clustered virtual machines can only fail over independently if each virtual machine has its own LUN, which makes the management of LUNs and clustered virtual machines more difficult.

For a two-node failover cluster, the storage should contain at least two separate volumes (LUNs), configured at the hardware level. Do not expose the clustered volumes to servers that are not in the cluster. One volume will function as the **witness disk** (described below). One volume will contain the files that are being shared between the cluster nodes. This volume serves as the shared storage on which you will create the virtual machine and the virtual hard disk. To complete the steps as described in this document, you only need to expose one volume.

A **witness disk** is a disk in the cluster storage that is designated to hold a copy of the cluster configuration database. A failover cluster has a disk witness only if this is specified as part of the quorum configuration. For this two-node cluster, the quorum configuration will be **Node and Disk Majority**, the default for a cluster with an even number of nodes. **Node and Disk Majority** means that the nodes and the witness disk each contains copies of the cluster configuration, and the cluster has quorum as long as a majority (two out of three) of these copies are available.

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**Note**

For more details on understanding quorum in a failover cluster, see:


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Storage requirements include the following:

- For the partition style of the disk, you can use either master boot record (MBR) or GUID partition table (GPT).
- To use the native disk support included in failover clustering, use basic disks, not dynamic disks.
- We recommend that you format the partitions with NTFS (for the witness disk, the partition must be NTFS). If you have a disk witness or use Cluster Shared Volumes, the partition for each of those must be NTFS.

For Cluster Shared Volumes, there are no special requirements other than the requirement for NTFS.

**Deploying Storage Area Networks with Failover Clusters**

When deploying a storage area network (SAN) with a Failover cluster, follow the guidelines below.

- **Confirm compatibility of the storage:** Open **Failover Cluster Manager** and run **Cluster Validation Wizard**.
- **Isolate storage devices, one cluster per device:** Servers from different clusters must not be able to access the same storage device. In most cases, a LUN that is used for one set of cluster servers should be isolated from all other servers through LUN masking or zoning.
• **Consider using multipath I/O software:** In a highly available storage fabric, you can deploy failover clusters with multiple host bus adapters by using multipath I/O software. This provides the highest level of redundancy and availability. For Windows Server 2008 R2, the multipath solution must be based on Microsoft Multipath I/O (MPIO). HP usually supplies an MPIO device-specific module (DSM) for the storage, although Windows Server 2008 R2 includes one or more DSMs as part of the operating system.

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**Important**
This Host bus adapters and multipath I/O software can be very version sensitive. If you are implementing a multipath solution for your cluster, choose the correct adapters, firmware, and software for Windows Server 2008 R2.

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**Software Requirements for Using Hyper-V and Failover Clustering**

Software requirements for using Hyper-V and the Failover Cluster feature are described below.

- All the servers in a failover cluster must run the x64-based version of Windows Server 2008 R2. (Nodes within a single failover cluster cannot run different versions.)
- All the servers should have the same software updates (patches) and service packs.
- Windows Server 2008 R2 Enterprise or Windows Server 2008 R2 Datacenter must be used for the physical computers. These servers must run the same version of Windows Server 2008 R2, including the same type of installation. That is, both servers must be either a full installation or a Server Core installation.
- If you do not want to install Windows Server 2008 R2 Enterprise or Windows Server 2008 R2 Datacenter on the test virtual machine, you will need the installation media for the operating system. The instructions in this guide assume that you will install Windows Server 2008 R2 on the virtual machine.

**Network Infrastructure and Domain Account Requirements**

You will need the following network infrastructure for a two-node failover cluster and an administrative account with domain permissions, described below.

- **Network settings and IP addresses:** When you use identical network adapters for a network, also use identical communication settings on these adapters (such as speed, duplex mode, flow control, and Media Type). Also, compare the settings between the network adapter and the switch it connects to and make sure that no settings are in conflict.
- **DNS:** The servers in the cluster must be using Domain Name System (DNS) for name resolution. The DNS dynamic update protocol can be used.
- **Domain role:** All servers in the cluster must be in the same Active Directory domain.
- **Domain controller:** We recommend that your clustered servers be member servers. If they are, you need an additional server that acts as the domain controller in the domain that contains your failover cluster.
- **Clients:** As needed, you can connect one or more networked clients to the failover cluster that you create, and observe the effect on a client when you move or fail over the highly available virtual machine from one cluster node to the other.
- **Account for administering the cluster:** When you first create a cluster or add servers to it, you must be logged on to the domain with an account that has administrator rights and permissions on all servers in that cluster. The account does not need to be a Domain Admins account, but can be a
Domain Users account that is in the Administrators group on each clustered server. In addition, if the account is not a Domain Admins account, the account (or the group of which the account is a member) must be given the Create Computer Objects and Read All Properties permissions in the domain.

Limitations for Using Hyper-V and Failover Clustering

Specific limitations for using Hyper-V and the Failover Clustering feature are outlined below.

- A maximum number of 16 nodes in the failover cluster are allowed.
- You can have a maximum number of 1000 virtual machines per cluster for server computer virtualization, with a maximum of 384 on any one node. When Hyper-V is used in conjunction with Virtual Desktop Infrastructure (VDI) for client computer virtualization, you can have a maximum of 1000 VDI (Windows XP/Windows Vista®/Windows® 7) virtual machines per cluster, with a maximum of 384 on any one node.
- The number of virtual machines allowed for each node does not change regardless of the size of the cluster.
Configuring Hyper-V with Failover Clusters

This section provides step-by-step information for configuring Hyper-V with Failover Clusters.

Environment Setup

**Step 1: Connect Physical Computers to the Network and Storage**
Use the following instructions to connect both cluster servers to networks and storage.

**Step 1A: To connect to the cluster network, follow these steps:**
1. Connect and configure the networks that the servers in the cluster will use.
2. For Failover Clusters using Hyper-V, configure the following networks:
   - Virtual machine access
   - Management for cluster network
   - Live Migration
   - Cluster and Cluster Shared Volumes (CSV)
   - Private Cluster heartbeat

As a good practice, network for Live Migration and CSV should be on separate subnets, as shown in the example below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>70.0.0.1 Client 1Gb Virtual</td>
<td>Ring70.com</td>
</tr>
<tr>
<td>70.0.0.1 Client 1Gb Team</td>
<td>Ring70.com</td>
</tr>
<tr>
<td>70.0.1 LM 10Gb A</td>
<td>Unidentified network</td>
</tr>
<tr>
<td>70.0.2 CSV</td>
<td>Unidentified network</td>
</tr>
<tr>
<td>Private</td>
<td>Unidentified network</td>
</tr>
</tbody>
</table>

**Note**
The names of the network connections must be the same on all notes.

3. Configure static IP addresses for each network. Verify communication with PDC and join the domain.

**Step 1B: To connect to the cluster storage, following these steps:**
1. Follow the manufacturer’s instructions for physically connecting the servers to the storage.
2. Ensure that the disks (LUNs) that you want to use in the cluster are presented to the servers that you will cluster (and only those servers).
3. On one of the servers that you want to cluster, click **Start**, click **Administrative Tools**, click **Computer Management**, and then click **Disk Management**. (If the User Account Control dialog box appears, confirm that the action it displays is what you want, and then click **Continue.**) In **Disk Management**, confirm that the cluster disks are visible.
4. If you want to have a storage volume larger than 2 terabytes and you are using the Windows interface to control the format of the disk, convert that disk to the partition style called GUID partition table (GPT). To do this, back up any data on the disk, then, in **Disk Management**, right-click the disk (not a partition) and click **Convert to GPT Disk**. For volumes smaller than 2 terabytes, instead of using GPT, you can use the partition style called master boot record (MBR).

---

**Important**

You can use either the MBR or the GPT partition style for a disk that is used by a failover cluster, but you cannot use a disk that you have converted to dynamic by using **Disk Management**.

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5. Check the format of any exposed volume or LUN. We recommend NTFS for the format. (For the witness disk, you must use NTFS.)

**Step 2: Install Hyper-V and Failover Clustering on Both Physical Computers**

In this step, you install the Hyper-V role and the Failover Clustering feature.

---

**Important**

Before enabling Hyper-V role, you must uninstall HP Network Configuration Utility (NCU) if it is installed onto the system already. Enable Hyper-V, then reinstall NCU afterwards. For more information, see: [http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01663264/c01663264.pdf](http://h20000.www2.hp.com/bc/docs/support/SupportManual/c01663264/c01663264.pdf)

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**Step 2A: To install the Hyper-V Role:**

You must install the Hyper-V role on both servers. You can use **Server Manager** to install Hyper-V on a full installation, as described here.

1. Click **Start**, and then click **Server Manager**.
2. In the **Roles Summary** area of the Server Manager main window, click **Add Roles**.
3. On the Select Server Roles page, click Hyper-V.

4. On the Create Virtual Networks page, if the network adapters’ names are identical on both physical computers, select a physical adapter to create a virtual network that provides access to the physical network.

Note
If the network adapters are not identical, do not create a virtual network at this time. You can create the virtual network later by following the instructions in “Step 3: Create a Virtual Network.” (on page 11).
5. On the **Confirm Installation Selections** page, click **Install**.
6. The computer must be restarted to complete the installation. Click **Close** to finish the wizard, and then click **Yes** to restart the computer.
7. After you restart the computer, log on with the same account you used to install the role. After the **Resume Configuration Wizard** completes the installation, click **Close** to finish the wizard.

**Step 2B: To install the failover cluster feature:**

In this step, you install the failover cluster feature on both servers. The servers must be running Windows Server 2008 R2. Use the procedure below to install the failover cluster feature on a full installation of Windows Server 2008 R2:

1. In **Server Manager**, under **Features Summary**, click **Add Features**.
2. In the **Add Features Wizard**, click **Failover Clustering**, and then click **Install**.
3. Follow the instructions in the wizard to complete the installation of the feature. When the wizard finishes, close it.
4. Repeat the process for each server that you want to include in the cluster.
Step 3: Create a Virtual Network

Important
You will need to perform this step on both physical computers if you did not create the virtual network when you installed the Hyper-V role; see “Step 2: Install Hyper-V and Failover Clustering on Both Physical Computers” (on page 8).

This virtual network provides the highly available virtual machine with access to the physical network.

To create a virtual network, follow these steps:
1. Open Hyper-V Manager.
2. Select the server on the left pane.
3. From the Actions menu, click Virtual Network Manager.
4. Under Create virtual network, select External.
5. Click Add. The New Virtual Network page appears.
6. Type a name for the new virtual network switch.
7. Under Connection Type, click External and then select the physical network adapter.
8. Click **OK** to save the virtual network and close **Virtual Network Manager**.

**Step 4: Validate the Cluster Configuration**

Before you create the cluster, we strongly recommend that you run a full validation test of your configuration. Validation helps you confirm that the configuration of your servers, network, and storage meets a set of specific requirements for failover clusters. You can validate either an existing cluster or one or more servers that are not yet clustered.

To validate the failover cluster configuration, follow these steps:

1. To open the failover cluster snap-in, click **Start**, click **Administrative Tools**, and then click **Failover Cluster Management**. (If the User Account Control dialog box appears, confirm that the action it displays is what you want, and then click **Continue**.)
2. In the **Failover Cluster Manager** snap-in, confirm that **Failover Cluster Manager** is selected and then, in the center pane under **Management**, click **Validate a Configuration**.
3. Follow the instructions in the wizard to specify the servers. Run all tests to fully validate the cluster before creating a cluster.

The **Summary** page appears after the tests run.

4. While still on the **Summary** page, click **View Report** and read the test results. To view Help topics that will help you interpret the results, click **More about cluster validation tests**.
To view the results of the tests after you close the wizard, see `SystemRoot\Cluster\Reports\Validation Report` date and time.html where `SystemRoot` is the folder in which the operating system is installed (for example: `C:\Windows`).

5. As necessary, make changes to the configuration and rerun the tests.

Cluster and Virtual Machine Creation

Step 5: Create the Cluster

To create a cluster, you run the `Create Cluster` wizard, as follows:

1. To open the failover cluster snap-in, click **Start**, click **Administrative Tools**, and then click **Failover Cluster Management**. (If the User Account Control dialog box appears, confirm that the action it displays is what you want, and then click **Continue**.)

2. Confirm that **Failover Cluster Manager** is selected and then, in the center pane under **Management**, click **Create a cluster**.

Follow the instructions in the wizard to specify:
The servers to include in the cluster.

The name of the cluster.

Any IP address information that is not automatically supplied by your Dynamic Host Configuration Protocol (DHCP) setting.

3. After the wizard runs and the **Summary** page appears, to view a report of the tasks the wizard performed, click **View Report**.

   To view the report after you close the wizard, see `SystemRoot\Cluster\Reports\` where `SystemRoot` is the folder in which the operating system is installed (for example: `C:\Windows`).
Step 6: Configure Cluster Shared Volumes

Cluster Shared Volumes are volumes in a failover cluster that multiple nodes can read from and write to at the same time. The nodes coordinate the reading and writing activity so that the disk is not corrupted. In contrast, disks (LUNs) in cluster storage that are not Cluster Shared Volumes are always owned by a single node. Cluster Shared Volumes have the same requirements as non-Cluster Shared Volumes disk resources. The storage location in the Cluster Shared Volumes is under SystemDrive/ClusterStorage. When creating the virtual machine, we recommend that you use this storage location.

**Important**

For Hyper-V to function properly when used with Cluster Shared Volumes, the operating system (%SystemDrive%) of each server in your cluster must be set so that it boots from the same drive letter as all other servers in the cluster. In other words, if one server boots from drive letter C, all servers in the cluster should boot from drive letter C.

It is recommended that you first validate the cluster configuration before configuring Cluster Shared Volume. For more information about how to validate a cluster configuration, see the Failover Cluster Step-by-Step Guide: Validating Hardware for a Failover Cluster and The Microsoft Support Policy for Windows Server 2008 Failover Clusters.

**Note**

- The network connection that is used by Cluster Shared Volumes is fault tolerant; therefore, if the network that is used by Cluster Shared Volumes experiences a problem, network traffic will be moved to another network.
- Cluster Shared Volumes can only be enabled once per cluster.
- By enabling Cluster Shared Volumes for a failover cluster, all nodes in the cluster will be enabled to use shared volumes.

Refer to the following link for details on “Requirements for Using Cluster Shared Volumes in a Failover Cluster in Windows Server 2008 R2”:

Step 6A: To enable cluster shared volumes using failover cluster manager:

1. Open the failover cluster snap-in, if the cluster that you want to configure is not displayed, in the console tree, right-click Failover Cluster Manager, click Manage a Cluster, and then select or specify the cluster that you want.
2. Right-click the failover cluster, and then click Enable Cluster Shared Volumes. Or, under Configure (center pane), click Enable Cluster Shared Volumes. The Enable Cluster Shared Volumes dialog box opens. Read and accept the terms and restrictions, and click OK.
Step 6B: To add a disk to the cluster shared volume:

1. In the Failover Cluster Manager snap-in, if the cluster that you want to configure is not displayed, in the console tree, right-click Failover Cluster Manager, click Manage a Cluster, and then select or specify the cluster that you want.

2. If the console tree is collapsed, expand the tree under the cluster that you want to add a disk to the Cluster Shared Volumes.

3. Click Cluster Shared Volumes.

4. Under Actions (on the right), click Add storage.

5. In Add Storage, select from the list of available disks, and click OK. The disk or disks you selected appear in the Results pane for Cluster Shared Volumes.
The storage location appears as `SystemDrive\ClusterStorage` on all nodes of the failover cluster. Under `SystemDrive\ClusterStorage`, a specific folder appears for each volume on the disk (or disks) that was added to the Cluster Shared Volumes. You can view the list of volumes in **Failover Cluster Manager**.

**Step 6C**: To manage the network used for cluster shared volumes:

Failover clusters include a setting to prioritize the networks used for communication between the nodes in the cluster and for the network used for Cluster Shared Volume (CSV) traffic. You can identify the network used for CSV traffic and change the settings of the network using the Windows PowerShell cmdlet, `Get-ClusterNetwork`.

Each network in a cluster has two settings for network prioritization – **Metric** and **AutoMetric**. The Metric setting is used to determine the priority of the network (the network with the lowest value is the most preferred for CSV). The AutoMetric setting identifies whether the Metric setting was set manually or automatically by the failover cluster. For private networks, the Metric settings are between 1000 and 10,000, and for public networks, the Metric settings start at 10,000.

The following will describe how to properly configure the cluster networks so redirected I/O goes through a dedicated network for CSV traffic and not over a normal client access or the cluster heartbeat network.

1. Open PowerShell. Click **Start**, point to **All Programs**, locate **Windows Powershell 2.0**, and then click **Windows Powershell 2.0**.

   The Failover Clustering feature must be installed on the computer on which you are starting the PowerShell session. Or, you can use Remote Server Administration Tools for Windows® 7 to run the PowerShell session.

2. To install the Failover Cluster feature, type:
   ```
   Import-Module FailoverClusters
   ```

3. To identify the networks of a failover cluster and the properties of each network, type:
   ```
   Get-ClusterNetwork | FT Name, Metric, Role
   ```

   A list of cluster networks and their properties appears.
4. To change the metric setting to 800 for the network named **CSV Network 1**, type:

   ```
   Get-ClusterNetwork "CSV Network" | %{$_.Metric=800}
   ```

   Refer to [Configuring cluster networks for CSV redirected access](#) for more information. The AutoMetric setting changes from True to False after you manually change the Metric setting. This is to prevent the failover cluster from automatically assigning a Metric setting. If you want the cluster to start automatically assigning the Metric setting again, change the AutoMetric setting back to True.

**Step 7: Create a Virtual Machine and Reconfigure the Automatic Start Action**

In this step, you create a virtual machine and reconfigure the automatic action that controls the virtual machine’s behavior when the **Hyper-V Virtual Machine Management** service starts.

**Step 7A: To create a virtual machine:**

Use the **New Virtual Machine Wizard** to create a virtual machine.

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**Important**

If the virtual machine is to be saved on a Cluster Shared Volume, make sure this feature is enabled before proceeding.

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You must choose the shared storage as the location to store the virtual machine and the virtual hard disk. Otherwise, you will not be able to make the virtual machine highly available. To make the shared storage available to the virtual machine, you must create the virtual machine on the physical computer that is the node which owns the storage.

Use the following steps to create the virtual machine:

1. Open **Failover Cluster Manager** and connect to the cluster on which you want to create the virtual machine. Right-click **Service and applications** and select **Virtual Machines... > New Virtual Machine**. It does not matter which node you select for creating the virtual machine.

   ![Failover Cluster Manager](image)

   **Services and applications**

   - **Recent Cluster**
   - **Configure a Service or Application...**
   - **Virtual Machines...**
   - **New Virtual Machine...**
   - **New Hard Disk...**
   - **More Actions...**
   - **View**
   - **Refresh**
   - **Help**

   There are no services and applications in the cluster.

2. Verify that Cluster Share Volume is enabled properly by navigating to `C:\ClusterStorage`. Each LUN that you enabled has a Cluster Shared Volume shown as a folder. For example `C:\ClusterStorage/Volumen1`. 

   ![Cluster Storage](image)
3. On the **Specify Name and Location** page, specify a name for the virtual machine, such as VM1. Click **Store the virtual machine in a different location**, and then type the full path or click **Browse** and navigate to the Cluster Shared Volume folder.

4. On the **Memory** page, specify the amount of memory required for the operating system that will run on this virtual machine. For example, specify 1024 MB to run Windows Server 2008 R2. The memory will be static by default when you create a new virtual machine. You may change this to dynamic afterwards.

5. On the **Networking** page, connect the network adapter to the virtual network that is associated with the physical network adapter.

6. On the **Connect Virtual Hard Disk** page, click **Create a virtual hard disk**. If you want to change the name, type a new name for the virtual hard disk. Click **Next**.
On the Installation Options page, click **Install an operating system later**.

**Important**

Do not start the virtual machine at this point. The virtual machine must be turned off so that you can make it highly available.
Step 7B: To configure automatic start action for the virtual machine:

Automatic actions let you automatically manage the state of the virtual machine when the **Hyper-V Virtual Machine Management** service starts or stops. However, when you make a virtual machine highly available, the management of virtual machine state should be controlled through the **Cluster** service. In this step, you reconfigure the automatic start action for the virtual machine.

**Important**
Do not intentionally shut down a node while a virtual machine is running on the node. If you need to shut down the node, take the virtual machine offline, and then shut down the node.

1. In Hyper-V Manager, under **Virtual Machines**, select **VM1**, the virtual machine that you created in Step 7 (page 19), and then in the **Action** pane, under the virtual machine name, click **Settings**.

2. In the left pane, click **Automatic Start Action**.

3. Under **What do you want this virtual machine to do when the physical computer starts?**, click **Nothing** and then click **Apply**.

---

**Step 8: Configure Virtual Machine**

In this step, you configure a virtual machine to use dynamic memory and add virtual processors to increase performance.
1. Open Hyper-V Manager. Click Start, point to Administrative Tools, and then click Hyper-V Manager.

2. **Right-click the virtual** machine and select **Settings**.

3. Select **Memory** from the virtual hardware list on the left.

4. In the settings panel, select **Dynamic** and specify the startup and maximum RAM for the virtual machine. (Note: Dynamic Memory support is only available in SP1 and forward.)

5. Select **Processor** from the virtual hardware list on the left.

6. In the settings panel, select the number of logical processors desired.
7. To add additional networks for the virtual machine, select **Add Hardware**.

8. An additional network adapter will appear in the hardware list on the left. If you are using the existing virtual network, check **Enable virtual LAN identification** if necessary. As an alternative, you may create a new virtual switch using **Hyper-V Virtual Network Manager** as shown in “Step 3: Creating a Virtual Network” (on page 11).

9. Click **OK** to apply settings.

**Step 9: Install the Guest Operating System on the Virtual Machine**

In this step, you install Windows Server 2008 or any other supported OS on the virtual machine that you created in Step 7 (on page 19). Then, you install the integration services, which improve performance and integration with the physical computer.
To install the guest operating system on the virtual machine, follow these steps:

1. Open Hyper-V Manager. Click **Start**, point to **Administrative Tools**, and then click **Hyper-V Manager**.

2. Right-click the virtual machine and select **Settings**.

3. Select **DVD Drive** and specify the image file location or physical CD/DVD drive where the operating system is located.

4. Connect to the virtual machine. From the **Virtual Machines** section of the results pane, using one of the following methods:
   - Right-click the name of the virtual machine, and then click **Connect**.
   - Select the name of the virtual machine. In the **Action** pane, click **Connect**.

---

**Note**

If you are installing a different operating system, integration services may not be available. For more information, see “About Virtual Machines and Guest Operating Systems” ([http://go.microsoft.com/fwlink/?LinkId=128037](http://go.microsoft.com/fwlink/?LinkId=128037)).
5. The **Virtual Machine Connection** tool opens.
6. From the **Action** menu in the **Virtual Machine Connection** window, Click **Start**.
7. The virtual machine starts, searches the startup devices, and loads the installation package.
8. Proceed through the installation.

**Note**
Depending on the operating system being installed, the mouse pointer may change to a small dot when you move the mouse cursor over the image of the setup window. If this occurs, click anywhere in the virtual machine window. This action "captures" the mouse so that keyboard and mouse input is sent to the virtual machine. To return the mouse input to the physical computer, press **Ctrl+Alt+Left arrow** and then move the mouse pointer outside of the virtual machine window.

9. Hyper-V includes a software package for supported guest operating systems that improves integration between the physical computer and the virtual machine. This package is referred to as **integration services**. Newer versions of supported Windows operating systems include the integration services and do not require installation after you install the guest operating system. For more information about which operating systems are supported and which of those require you to install integration services, see the deployment content for Hyper-V at the Windows Server 2008 Technical Library (http://go.microsoft.com/fwlink/?LinkID=128037).

**Step 10: Configure Cluster Networks for Live Migration**
Cluster networks are automatically configured for live migration. You can use Failover Cluster Manager to customize using the following procedure.

To configure a cluster network for live migration, follow these steps:

1. In the Failover Cluster Manager snap-in, if the cluster that you want to configure is not displayed, in the console tree, right-click **Failover Cluster Manager**, click **Manage a Cluster**, and then select or specify the cluster that you want.
2. Expand **Services and applications**.
3. In the console tree (on the left), select the clustered virtual machine for which you want to configure the network for live migration.
4. Right-click the virtual machine resource displayed in the center pane (not on the left), and then click **Properties**.
5. Click the **Network for live migration** tab, and select one or more cluster networks to use for live migration. Use the buttons on the right to move the cluster networks up or down to ensure that a private cluster network is the most preferred. The default preference order is as follows:

- Networks that have no default gateway should be located first;
- Networks that are used by cluster shared volumes and cluster traffic should be located last.

Live migration will be attempted in the order of the networks specified in the list of cluster networks. If the connection to the destination node using the first network is not successful, the next network in the list is used until the complete list is exhausted, or there is a successful connection to the destination node using one of the networks.
Virtual Machine and Cluster Management

Step 11: Test a Planned Failover

To test a planned failover, you use Failover Cluster Manager to move VM1, the virtual machine that you created in Step 7 (page 19), to another node.

To test a planned failover, follow these steps:

1. Open Failover Cluster Manager snap-in and click Manage a Cluster, and then select or specify the cluster that you want.
2. Expand Services and Applications, and then click the virtual machine that you created in Step 7 (on page 19).
3. Under Actions (on the right), click Live migrate virtual machine to another node, and click the name of the other node.

As the virtual machine is moved, the status is displayed in the results pane (center pane). Optionally, you can repeat this step to move the virtual machine to an additional node or back to the original node.
4. You can verify that the move succeeded by inspecting the details of each node.

**Step 12: Test an Unplanned Failover**

To test an unplanned failover, you stop the Cluster service, as follows.

1. Open Failover Cluster Manager snap-in and click Manage a Cluster, and then select or specify the cluster that you want.

2. To minimize disruption to clients, before stopping the Cluster service on a node, move the applications that are currently owned by that node to another node. To do this, expand the console tree under the cluster that you want to manage, and then expand Services and Applications. Click each service or application and (in the center pane) view the Current Owner. If the owner is the node on which you want to stop the Cluster service, right-click the service or application, click Live migrate virtual machine to another node, and then choose the node.

3. Expand the console tree under Nodes.

4. Right-click the node that runs the virtual machine, and then click More Actions.

5. Click Stop Cluster Service.

6. The virtual machine will be moved to the other node.

**Step 13: Modify the Settings of a Virtual Machine**

To change the configuration of a virtual machine, we recommend using the Failover Cluster Manager snap-in to access the virtual machine settings. When you do this, the cluster is updated automatically with the configuration changes. However, if you make changes to the virtual machine settings from the Hyper-V Manager snap-in, you must update the cluster manually after you make the changes. If the configuration is not refreshed after networking or storage changes are made, a subsequent failover may not succeed or may succeed but result in the virtual machine being configured incorrectly.

To modify the settings of a virtual machine, follow these steps:

1. Open Failover Cluster Manager snap-in and click Manage a Cluster, and then select or specify the cluster that you want.

2. Expand Services and Applications, and then click VM1, the virtual machine that you created in Step 7 (on page 19), to modify the settings for this virtual machine.

3. In the center pane, right-click the virtual machine resource, and then click Settings. (If you do not see Settings in the menu, collapse the virtual machine resource and then right-click it.) The Settings interface appears. This is the same interface that you see in Hyper-V Manager.

4. Configure the settings for the virtual machine.

**Note**

If you use Hyper-V Manager instead of Failover Cluster Manager to configure settings for a virtual machine, be sure to refresh the configuration of the virtual machine in Failover Cluster Manager. To do this, expand Services and Applications, and then click the virtual machine for which you want to refresh the configuration. In the Actions pane, scroll down, click More Actions, and then click Refresh virtual machine configuration.

**Step 14: Duplicate a Virtual Machine**

Sometimes you want to duplicate a virtual machine in a cluster to avoid having to reinstall guest OS.
Note
This procedure is a quick workaround to duplicate multiple virtual machines quickly. You will need to change static IP address and hostname for each guest that is duplicated. You can also do this using the Window PowerShell cmdlet.

1. Use the Failover Cluster Manager snap-in to take the virtual machine offline. Under Services and Applications, right-click the VM1 virtual machine and select Shut down virtual machines. Click Yes to confirm.

2. Open Windows Explorer and navigate to the Cluster Shared Storage Volume that the virtual machine is saved on.

3. Create folders for each additional virtual machine to be created.
4. Copy *VM1.vhd* and paste into each virtual machine folder. For example, if three virtual machines need to be created, *VM1.vhd* will need to be copied and pasted 3 times.

5. Rename the copied *VM1.vhd* to the new name of the cloned virtual machine.

6. Open Failover Cluster Manager. Right-click *Services and applications* and select *Virtual Machines… > New Virtual Machine…* and select any node.

7. The **New Virtual Machine Wizard** will now open. Enter a name for the duplicate virtual machine (it’s best to enter the same name that you renamed the *vhd* file in Step 5, on page 14). Select *Store the virtual machine in a different location* (you will only need to point to the volume where the virtual hard disk was copied earlier).

8. Enter memory and network configuration for the virtual machine. Static memory will be assigned by default but may be changed to dynamic memory after the virtual machine is created.
9. Do not create a new virtual hard disk. Select **Use an existing virtual hard disk** and browse to the vhd file that was copied.

10. Click **next** and confirm virtual machine settings. The wizard will take a moment to create your new virtual machine.

11. Failover Cluster Manager will now show your new virtual machine.

12. Right click **VM2** and select **Start virtual machines** and connect to the virtual machine.

13. The cloned virtual machine will have the same hostname (and IP if it is static) as the original virtual machine that was used to make duplicates. You will need to change the hostname of the copied virtual machines to avoid network conflicts.
Step 15: Remove a Virtual Machine from a Cluster

The procedure to remove a virtual machine from a cluster varies depending on whether you want to keep the virtual machine or not. Both scenarios are described here.

Step 15A: To remove a virtual machine from a cluster and retain the virtual machine

1. Open Failover Cluster Manager snap-in and select the virtual machine to be removed.
2. Under Services and Applications, right-click the virtual machine and select **Shut down virtual machines**.
3. This is an optional step to export the virtual machine. Exporting a virtual machine allows you to move the virtual machine to another server running Hyper-V, such as a non-clustered server. Switch to Hyper-V Manager and verify that the **VM1** virtual machine is selected. Under Actions, click **Export**. Type or browse to specify a location in which to export the virtual machine, and then click **Export**.
Important
If you plan to import the virtual machine to another cluster, use either Hyper-V Manager or Microsoft System Center Virtual Machine Manager (VMM).

4. In Hyper-V Manager, verify that the VM1 virtual machine is selected. Under Actions, click Delete.
5. Switch to the Failover Cluster Manager snap-in. Expand Services and Applications, and then select the VM1 virtual machine. Right-click VM1 and then click Delete. This action removes the virtual machine from the cluster.

Step 15B: To remove a virtual machine from a cluster and delete the virtual machine

Important
The following steps show you how to delete a virtual machine and its files. Perform these steps only if you do not want to keep the virtual machine.

1. Use the Failover Cluster Manager snap-in to take the virtual machine offline. Under Services and Applications, right-click the VM1 virtual machine and select Shut down virtual machines.
2. Switch to Hyper-V Manager and select the VM1 virtual machine. Under Actions, click Delete.
3. Switch to the Failover Cluster Manager snap-in. Expand Services and Applications, and then select the VM1 virtual machine. Right-click VM1 and then click Delete. This action removes the virtual machine from the cluster.
4. Manually delete the virtual machine, and virtual hard disk from the shared storage. Navigate to C:\ClusterStorage\Volume1 (or the appropriate volume number) and then delete the folder where the virtual machine is saved.
Appendix A

Cluster Network and Fiber Channel Cabling

The following diagram is an example of a cluster without Single Point of Failure (SPOF), including all essential hardware required and cabling scheme.

Note that this is not an actual configuration used in this guide, but just an illustration of minimum configuration.

Example cluster hardware cabling scheme (N-node cluster)
For More Information

For an overview of the HP ProLiant DL980 G7 server:
http://www.hp.com/servers/dl980

For more information about the HP DL980 G7 server with HP PREMA Architecture:

To download any recommended HP components described in this document, along with other drivers and software, visit the HP DL980 G7 Support web page:
http://www.hp.com/support/dl980g7

For a complete library of all documentation supporting the DL980 G7 server:
http://www.hp.com/go/proliant_servers-docs (click on the link, “HP ProLiant DL980 G7 Server series”)

For information about requirements for using Hyper-V with Cluster Shared Volumes, see Hyper-V: Using Live Migration with Cluster Shared Volumes in Windows Server 2008 R2 (http://go.microsoft.com/fwlink/?LinkId=164729)

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