

Dell™ Networking Solutions Guide for Microsoft® Hyper-V™

Notes and Cautions



NOTE: A NOTE indicates important information that helps you make better use of your computer.



CAUTION: A CAUTION indicates potential damage to hardware or loss of data if instructions are not followed.

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Getting Started

With the introduction of Hyper-V™ in Windows® 2008, Microsoft® has changed the way virtual machines interact with the host operating system and other network resources. Unlike the Microsoft virtualization capabilities offered by Virtual Server and Virtual PC, Hyper-V's virtualization technology is integrated into the Windows Server 2008 x64 operating system. This change greatly improves performance and increases integration of the virtualization layer (hypervisor) with other Windows components.

This solutions guide details the four available networking configurations, and the advantages and disadvantages of each with an emphasis on typical Dell system configuration and the hardware offerings.

This solutions guide assumes that you have a basic understanding of Hyper-V. Dell strongly recommends that you review the *Dell Solutions Overview Guide for Microsoft Hyper-V* prior to reading this solutions guide to gain a preliminary understanding of Hyper-V solutions on Dell hardware.

Dell recommends reviewing these additional guides:

- *Dell Storage Solutions Guide for Microsoft Hyper-V*
- *Dell High Availability Solutions Guide for Microsoft Hyper-V*

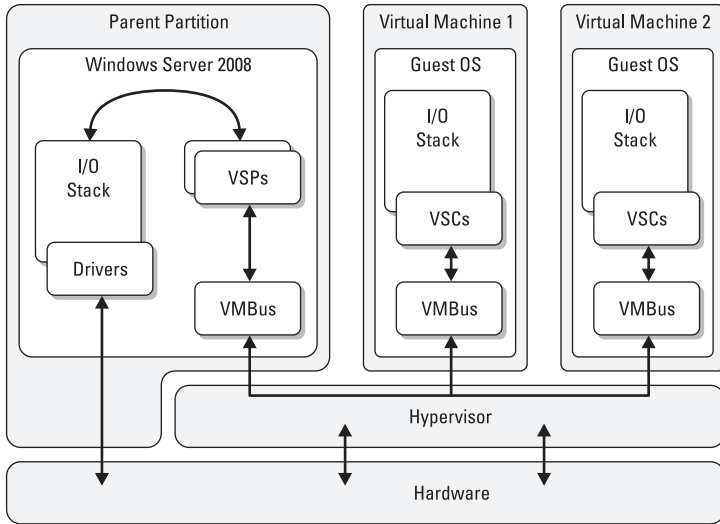
Understanding Hyper-V Virtual Network Architecture

As described in the *Dell Solutions Overview Guide for Microsoft Hyper-V*, the parent partition (not the hypervisor) manages the I/O devices. To provide virtual machines with access to those devices, Hyper-V supports a high-speed interconnect referred to as the VMBus. Virtual devices for each VM, such as network and storage adapters, communicate with the parent partition through the VMBus. The parent partition receives those requests through the VSPs and directs them to the underlying physical devices via the I/O stack of the parent partition (refer to Figure 2-1). This model requires device drivers for the physical devices to be installed in the parent partition. However, device specific drivers and utilities created for Windows Server 2008 x64 work as-is and do not require any changes when Hyper-V is enabled.




NOTE: It is recommended that you download the latest Dell certified drivers available for your system and install them in the parent partition. Using the latest drivers ensures that both the parent partition and VMs are able to fully utilize the underlying physical devices. Download the latest device drivers at support.dell.com.

Figure 2-1. Hyper-V Architecture



Guest operating systems require specialized drivers (VSCs) provided by Microsoft in order to access the VMBus. The drivers are specific to the type of device that is presented to the guest operating system through the VM configuration, and are installed as a part of the Integration Services that are available for Hyper-V supported guest operating systems.

 **NOTE:** All architecture related information provided in this guide assumes that the guest OS has Integration Services installed.

Virtual Network Adapters

Virtual machines can be presented with two types of virtual network adapters: Synthetic and Legacy (or emulated).

- **Legacy devices** emulate a physical network adapter in software. Although this process provides networking services to a virtual machine, it requires additional host processing resources.

- **Synthetic devices** can be thought of as proxy devices that present themselves as network devices, but only serve to pass bundles of data along the VMbus to other networking resources. This process does not require software emulation, and therefore offers higher networking performance for virtual machines and lower host system overhead.

Virtual Switches

A "virtual switch" forms the heart of connectivity in a Hyper-V virtual network. This virtual switch functions much like a physical network switch by connecting physical and virtual network adapters. Much like a physical network switch, a virtual switch has internal and external switch ports (network ports). The configuration of these ports is based on the type of virtual network created.

This document will introduce different virtual network types, discuss how they differ, and provide Dell best practices for implementing each.

Selecting Supported Hardware and Software Settings

Because Hyper-V is a Windows 2008 role, Hyper-V users are able to take full advantage of all networking adapters supported by Dell for Windows 2008 x64. Be sure to use certified Dell network adapters and install the latest drivers for the adapter available from support.dell.com.



NOTE: Dell does not support drivers obtained from 3rd party vendors. Additionally, Dell does not support the use of Broadcom[®] BACS or Intel[®] ProSET for configuration of physical network adapters connected to virtual networks at this time. These applications can be used to configure physical network adapters that are not connected to virtual networks. The process for connecting physical adapters to virtual networks will be described below.


Supported Physical Network Adapter Settings

As mentioned above, guest operating systems are able to utilize physical devices present in a system including some of the advanced features of these devices. However, care should be taken when configuring physical network adapters for Hyper-V virtual networking. Due to the special role of physical network adapters in virtual networking environments, some functionality may not be offered by the physical network adapters or not accessible to virtual networks.

Generally, physical network adapter features can be grouped into two categories: stateless and stateful. Only stateless features may be leveraged for virtual network. These features include Large Send Offload, Checksum Offload, and VLAN tagging (IEEE 802.1Q). Stateful off-load features such as TOE from Broadcom and IOAT from Intel are not leveraged by Hyper-V virtual networks. These features will not be leveraged even if they are enabled on the physical adapter that is connected to the virtual network. However, network adapters connected exclusively to the parent partition network adapter may still access all physical network adapter features including TOE and IOAT as supported by the system and network adapters.

Stateless Offload (LSO and CSO)

Large Send Offload (LSO) and Checksum Offload (CSO) are supported by virtual networks and offloaded to physical network adapters if supported by the network adapter and drivers. If these offloading features are not supported by the physical network adapter, the Hyper-V networking services will still perform these operations.

 **NOTE:** The latest network adapters from Dell offer LSO and CSO hardware offload support.

VLAN Tagging

VLAN tagging (IEEE 802.1Q) from within Hyper-V is also supported, allowing both parent partition and virtual machines to logically separate their network connections. Virtual machines may have more than one virtual adapter, and each virtual adapter may belong to any VLAN.

Supported Physical Network Adapter Features

Table 3-1 below summarizes which physical network adapter features are supported by Hyper-V when connected to a virtual network.


 **NOTE:** Network adapters not connected to virtual networks may be used for advanced features offered by 3rd party software from Intel and Broadcom. However, this software should not be used to manage or configure physical network adapters connected to virtual networks.

Table 3-1. Physical NIC Feature Support Matrix for Hyper-V Virtual Networks

Stateless Features (Supported)	Stateful Features (Not Supported)
LSO	802.1p (QoS)
CSO	Receive-Side Scaling (RSS)
VLAN Tagging (within Hyper-V)	Flow Control
	Jumbo Frames
	Wake-On-LAN
	TOE

Table 3-1. Physical NIC Feature Support Matrix for Hyper-V Virtual Networks (continued)

Stateless Features (Supported)	Stateful Features (Not Supported)
	VLAN Tagging (within 3rd party software) Network MAC Address

Determining a Virtual Network Implementation

Four virtual network options are available in Hyper-V. Each of these options offers different advantages and disadvantages, and some are only appropriate for special cases.

As mentioned earlier, the virtual switch, or "vSwitch", forms the center of all Hyper-V virtual networks. The virtual switch never appears as an entity or icon in Windows 2008 parent partitions including the **Network Connection** window: it is a logical representation that will be referred to by text references.

The virtual network options are:

- Private virtual network
- Internal virtual network
- External virtual network

In addition to these three, the fourth implementation allows virtual machine traffic to be dedicated to a specific physical network port instead of shared between virtual machines and the parent partition. This is the preferred implementation for most deployments.

- Dedicated virtual network

Private Virtual Network

In Hyper-V, the **private virtual network** type can be used to allow network communications between VMs on a host. Private virtual networks are the first of the three virtual switch configuration modes that can be configured by the Hyper-V GUI. When selected and configured, the following action is performed:

- A virtual switch is created (vSwitch #1 in Figure 4-1) and made available for virtual machines.

Advantages

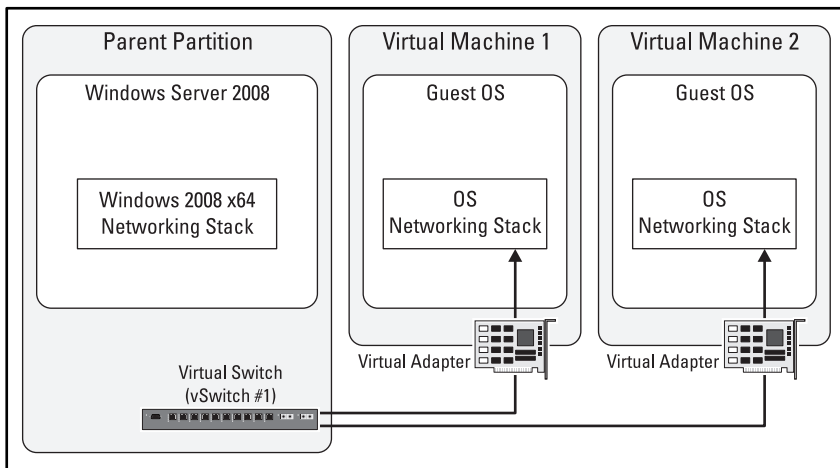
- Complete isolation from parent partition and external network



NOTE: Although possible, private virtual networks are not recommended for environments utilizing Failover Clustering because private networks are localized to each host.

Figure 4-1 shows the logical representation of private network configuration. This diagram additionally shows virtual machines connected to the virtual switch.

Figure 4-1. Private Virtual Network Diagram



Internal Virtual Network

In Hyper-V, the **internal virtual network** type can be used to allow network communication between virtual machines on a host, and between virtual machines and the parent partition. When internal virtual network is selected and configured in the Hyper-V GUI, the following actions are taken:

- 1 A virtual switch is created (vSwitch #1 in Figure 4-2) and made available for virtual machines.
- 2 A new virtual network adapter is created and connected to the parent partition (PP).

Advantages

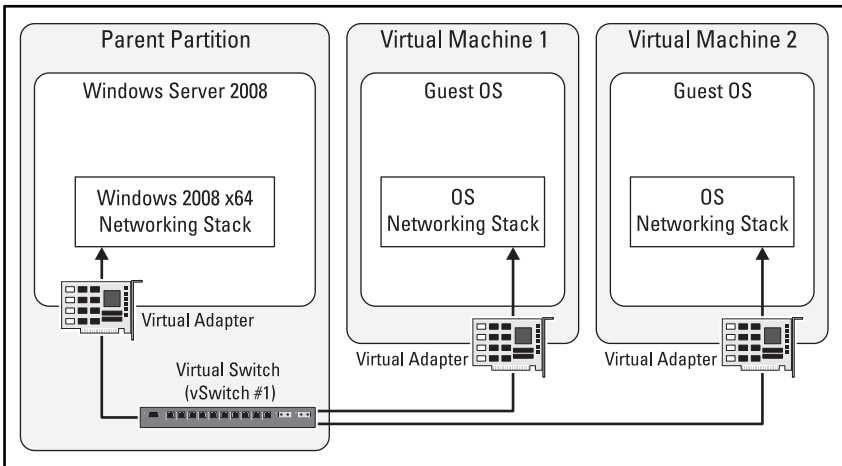
- Enables isolation of VMs from external network



NOTE: Although possible, internal virtual networks are not recommended for environments utilizing Failover Clustering because internal networks are localized to each host.

Figure 4-2 shows the logical representation of internal virtual network configuration. This additionally shows two virtual machines and the parent partition connected to the virtual switch.

Figure 4-2. Internal Virtual Network Diagram



External Virtual Network

In Hyper-V, the **external virtual network** type can be used to allow network communication between virtual machines, the parent partition, and the external network.

When selected and configured, the following actions are taken:

- 1 A virtual switch is created (vSwitch #1 in Figure 4-3) and connected to the virtual machines.
- 2 A new virtual network adapter is created and connected to the parent partition.

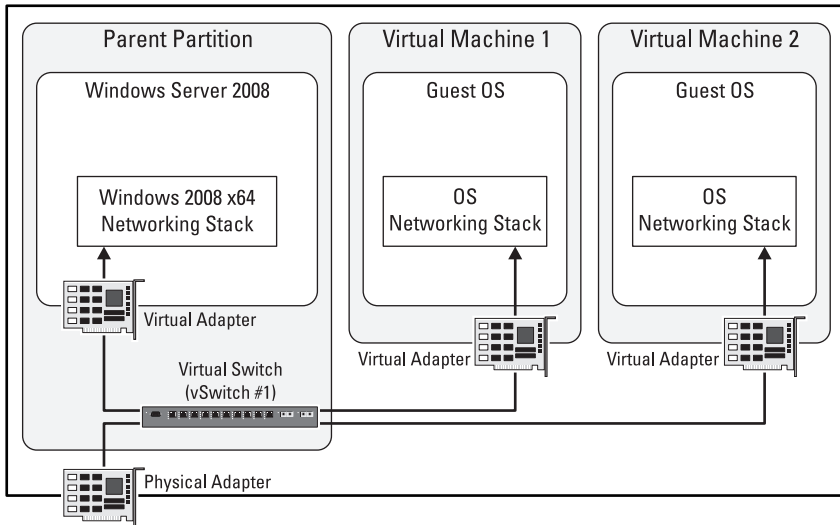
- 3 The parent partition virtual network adapter is connected to the virtual switch.
- 4 The virtual switch is connected to the physical network adapter specified by the user to enable external network access.

Disadvantages

- Second adapter in parent partition can cause host connectivity issues. These can include multiple DNS entries, delayed or incomplete NetBIOS resolution, and routing confusion.
- Delayed NetBIOS resolution or incomplete network browsing due to multiple parent partition network adapters (multiple browsing lists associated with each network adapter).

Figure 4-3 shows the logical representation of external virtual network configuration. This diagram shows two virtual machines (VMs), the parent partition, and one physical network adapter connected to the virtual switch.

Figure 4-3. External Virtual Network Diagram



Dedicated Virtual Network

The **dedicated virtual network** type is a modified form of the **external virtual network** type offered by Hyper-V. This virtual network type allows VMs to communicate with other VMs on the same machine as well as VMs on other systems. They are also able to access the external network, although these VMs do NOT have direct access to the parent partition as with the external virtual network configuration. Removing this direct path eliminates many of the drawbacks of the external virtual network type discussed above. The VMs still have access to the parent partition through the external network if the parent partition virtual network adapter is connected to the virtual switch.

Unlike the other three virtual network types discussed above, dedicated virtual networks are not directly configurable with Hyper-V Virtual Network Manager. The dedicated virtual network type discussed here will be created by first creating an external virtual network and then modifying the virtual network adapter added to the parent partition.

Advantages

- Dedicated physical network adapter for VM traffic, with no sharing with parent partition

Disadvantages

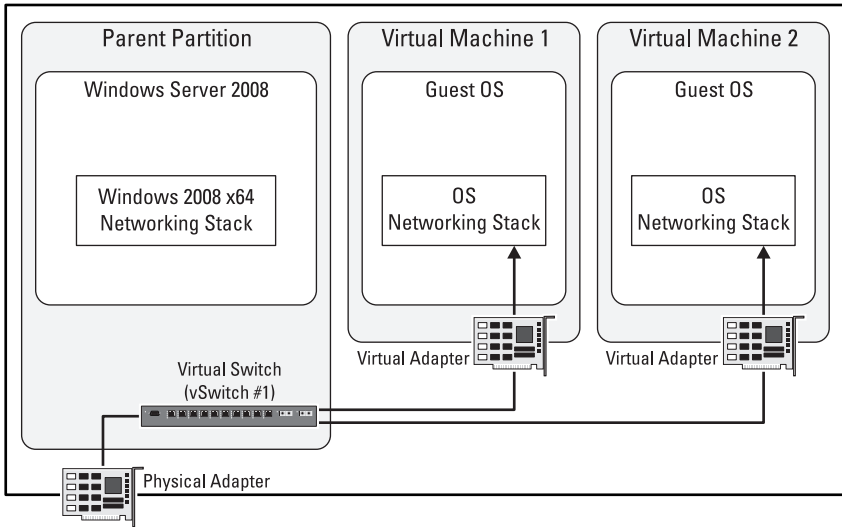
- Disabled network adapter appears in **Network Connections** window of the parent partition, network adapter settings must not be modified, and network adapter must not be enabled



NOTE: WMI can be used to implement a dedicated virtual network without causing an additional virtual network adapter to appear in the parent partition. Consult the Hyper-V WMI programming reference listed in "References" on page 41.

Figure 4-4 shows the logical representation of the dedicated virtual network configuration. This diagram shows two virtual machines, the parent partition, and one physical network adapter connected to the virtual switch.

Figure 4-4. Dedicated Virtual Network Diagram



Configuring the Virtual Network

This section offers guidance with hardware and software setup and provides Dell's best practice recommendations for configuring virtual machines. The information presented here will build on the virtual network types and usage models discussed in previous sections.

Hardware Setup

The following section will aid in determining how many network adapters are required to support various Hyper-V implementations. The tables are separated by two key Hyper-V implementation features: iSCSI support and Failover Clustering support. To use the tables, determine the combination of these features you need in your Hyper-V implementation. The assumptions used in these configurations are:

- The system has a minimum of two built-in network adapters (LOMs)
 - ✍ **NOTE:** Some systems have four built-in adapters.
- Servers are dedicated for hosting virtual machines (no other Windows 2008 roles are installed)

These recommendations are based on the following Dell best practices. Other combinations may be possible, but are not recommended:

- All iSCSI implementations use two connections to reduce single points of failure. Additionally, iSCSI connections do not share a physical network adapter with an adapter used for iSCSI connections.
- The parent partition does not share a physical network adapter with an adapter connected to a virtual switch if using an external virtual network
- One network adapter has been dedicated for parent partition management including remote desktop access and name resolution (DNS/NetBIOS), and this adapter is used for "public" network access in the Failover Clustering configuration

- Failover Cluster configurations use separate network adapters for cluster public and private traffic



NOTE: The cluster public adapter may be shared with the parent partition management network adapter.

The tables below offer minimum port allocations required for various iSCSI and Failover Clustering configurations as well as one configuration for implementing additional virtual machine networks. Additional virtual machine networks are recommended as the number of virtual machines increases.

Table 5-1. Port Layout without iSCSI or Failover Clustering

	Parent Partition/Cluster Public Network Adapter	Virtual Network Adapter
2 Ports (minimum)	Port 1	Port 2
3 Ports (as needed)	Port 1	Ports 2 & 3

Table 5-2. Port Layout without iSCSI and with Failover Clustering

	Parent Partition/Cluster Public Network Adapter	Virtual Network Adapter	Cluster Private Network Adapter
3 Ports (minimum)	Port 1	Port 2	Port 3
4 Ports (as needed)	Port 1	Ports 2 & 3	Port 4

Table 5-3. Port Layout with iSCSI and without Failover Clustering

	Parent Partition/Cluster Public Network Adapter	Virtual Network Adapter	iSCSI Network Adapter
4 Ports (minimum)	Port 1	Port 2	Ports 3 & 4
5 Ports (as needed)	Port 1	Ports 2 & 3	Ports 4 & 5

Table 5-4. Port Layout with iSCSI and Failover Clustering

	Parent Partition/ Cluster Public Network Adapter	Virtual Network Adapter	iSCSI Network Adapter	Cluster Private Network Adapter
5 Ports (minimum)	Port 1	Port 2	Ports 3 & 4	Port 5
6 Ports (as needed)	Port 1	Ports 2 & 3	Ports 4 & 5	Port 6

As a best practice, functional areas with more than one connection should be spread across adapters to help maintain redundant connectivity in the event of a device/port failure. For example, for iSCSI implementations as recommended above, dual paths to iSCSI targets allow for the loss of one network port or a whole adapter if the connections are spread across different adapters. This distributed iSCSI connection layout, when used in conjunction with proper iSCSI initiator and multi-path driver configuration, allows the parent partition and virtual machines to maintain access to storage resources in the event of a connectivity topology change.

Proper configuration is required to maintain connectivity in the event of a limited hardware failure. To insure proper iSCSI configuration, please consult the *Dell Storage Solutions for Hyper-V*. This includes proper installation of all storage-specific drivers (such as the multipath I/O driver) and support software. This document also contains information to insure proper external network switch configuration.

Proper planning is also required for the Failover Clustering environment. To ensure proper configuration and for more information on High Availability options available on Hyper-V, please consult the *Dell High Availability Solutions Guide for Microsoft Hyper-V*.

Software Setup

These configuration steps assume a fresh install of Windows 2008 x64 edition (with Hyper-V), and that the latest updates have been applied to the operating system including the Hyper-V RTM update (see "References" on page 41 for a link to the RTM Hyper-V update).

Due the number of network connections involved with Hyper-V deployments, clearly labeled network connections in Windows Server 2008 Network Connections manager are essential. It is often easier to label connections upfront rather than during a Hyper-V rollout.

Be sure you are running the latest Dell-qualified network drivers for your system and network hardware. These updates are available from support.dell.com and should be applied prior to enabling the Hyper-V role.

The internal and external virtual network configurations will place a virtual adapter in the parent partition. In these configurations, this virtual adapter will be a second network adapter for the parent partition. Presenting two networks to Windows Server 2008 can cause name resolution issues as well as slow or incomplete network browsing. The best practices presented in the "Internal Virtual Network" on page 26 and "External Virtual Network" on page 28 will mitigate these issues.

Initial Setup

- 1 In the **Network Connections** window of the Windows 2008 installation, label each LAN-on-motherboard (LOM) port for your system. Dell recommends LOM Port #*n* for these LOMs. Label the first LOM PPMgmt #1 for Parent Partition Management #1.



NOTE: The enumeration of these ports may NOT be correctly shown in the Windows 2008 **Network Connections** window. Please verify correct mappings between the LOM numbering displayed on the back of the system and the name assigned in Windows. This may require an active network cable be plugged into ports one at a time to map physical ports to Windows network adapters.

- 2 Label each port for each add-in network adapter in your system. Dell recommends a format similar to: "<Vendor>-<PCIe slot #>-<Port n>", for example **Broadcom-PCIe Slot 4-Port 2**. The slot numbers can be found on the back of the server.
- 3 Verify the system is using the latest qualified network adapter drivers as listed on support.dell.com. The drivers on dell.com have been fully testing and qualified by Dell.
- 4 Assign static IP addresses to each network adapter that will be used during configuration. Although it is possible to use Dynamic Host Configuration Protocol (DHCP) addressing, Dell recommends static addresses for all server connections.

Dell also recommends assigning static addresses from different subnets for all server connections by function. These include:

- Parent partition management including Failover Clustering public address
- Failover Clustering private address
- iSCSI connections (specific requirements may vary by storage solution, consult the *Dell Storage Solutions Guide for Microsoft Hyper-V*)
- Virtual machine networks (as needed)

Additionally, VLANs or separate network fabrics should be used to segregate network traffic.



NOTE: Unlike other Windows 2008 clustered applications, clustered virtual machines do not utilize the public IP address; instead, they maintain their own addresses for each virtual network adapter in each guest OS. The public address will only be used to manage the cluster.



NOTE: VLAN tagging is available on a per-VM connection basis (configured on each network adapter of each virtual machine) as well as for the parent partition (configured in the Virtual Network Manager for each virtual network). Third party software may be used to tag all other traffic presented exclusively to the parent partition. Also, switch-based tagging may be used to tag traffic from all physical network adapters.

Consult the *Dell Storage Solutions Guide for Microsoft Hyper-V* for special iSCSI network configuration best practices.

The next four sections will provide Dell specific configuration information for each of the four virtual network configurations.



NOTE: These steps are not intended to be used serially, but rather they should be used as needed to implement each of the different virtual network types.

Private Virtual Network

Because private virtual networks are completely isolated from the parent partition and external network, no changes are made to either environment once the general installation and naming steps above are complete.

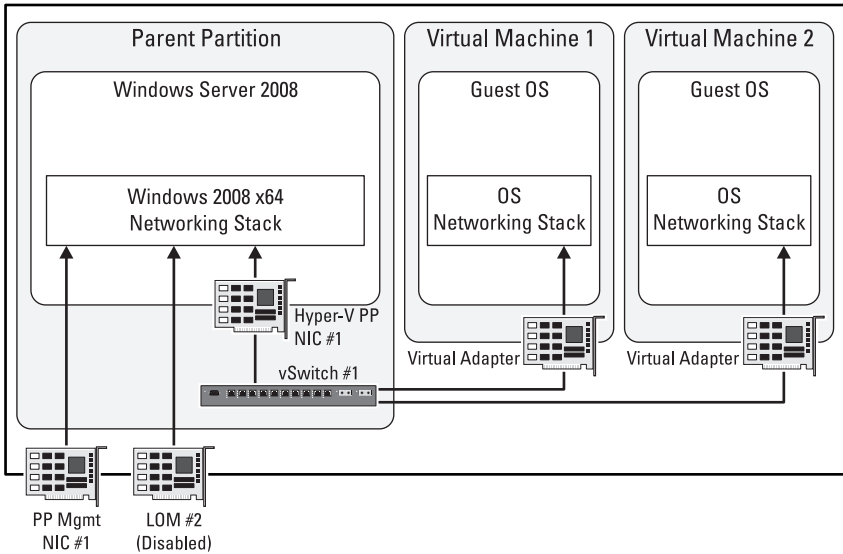
Internal Virtual Network

The following steps represent Dell's best practice recommendations for configuring internal virtual network configurations within Hyper-V. These steps assume you have already performed the general installation and naming steps mentioned above.

The following steps will modify the default configuration of the Windows 2008 parent partition network settings according to Dell best practices. These steps are needed due to the additional virtual network adapter added to the parent partition when the internal virtual network is implemented. These changes will include:

- Modifying the adapter binding order so that the dedicated parent partition physical network adapter is preferred
- Modifying the adapter metric values to ensure the dedicated physical network adapter is the preferred route
- Modifying DNS resolution and the NetBIOS setting to ensure proper name registration
- Disabling any unused network adapters

Figure 5-1. Implementation of Internal Network (Two Adapter System)



Virtual Network Configuration steps

- 1 Enable the Hyper-V role, but do not select any network adapters when prompted on the **Create Virtual Networks** screen. Continue with the install, rebooting as required. Multiple reboots will be required. Installation will continue upon login.
- 2 Launch the **Hyper-V Manager** (**Administrative Tools**→**Hyper-V Manager**), and select your server.
- 3 Under **Actions** on the right, select **Virtual Network Manager**. In the **Name** field, enter a name for the virtual switch, **vSwitch #1 (Internal)** for this example.
- 4 Make sure that **Internal** is selected, and click **Add**.
- 5 Click **OK** to finalize the virtual network configuration.
- 6 Close the **Hyper-V Manager** window. At this point a virtual switch named **vSwitch #1 (Internal)** has been created.

Network Configuration

1 Open Network Connections.



NOTE: The **Device Name** field now shows `vSwitch #1 (Internal)`, indicating that the new parent partition network adapter is now connected to a virtual switch. The status field may show `Unidentified network` to indicate a domain name was not located on this network. Once a domain controller is added to this virtual switch, this status field may change.

- 2 Rename the new parent partition virtual network adapter to `Hyper-V PP NIC #1`.
- 3 Modify the adapter binding order to ensure that `PP Mgmt NIC #1` is listed at the top in the **Connections** window. The network adapter labeled `Hyper-V PP NIC #1` should appear second. (**Network Connections**→**Advanced**→**Advanced Settings**).
- 4 Set the metric for `Hyper-V PP NIC #1` to 9999 (**Network Connection**→**Hyper-V PP NIC #1 properties**→**IP v4 properties**→**IP settings**→**Advanced**→**IP Settings**). This setting will ensure the parent partition traffic will not prefer the new Hyper-V virtual network adapter to the dedicated physical parent network adapter. A value of 9999 assigns the virtual network adapter the highest user-assignable link cost.
- 5 In the **Advanced TCP/IP** dialog box for the `Hyper-V PP NIC #1` network adapter, select the **DNS** tab. Unselect **Register this connection's addresses in DNS**. This will prevent the system from registering this connection in DNS. Only the `PP Mgmt NIC #1` NIC should be allowed to register in DNS to further prevent this network adapter from handling any traffic besides virtual machine traffic.
- 6 Click the **WINS** tab in the **Advanced TCP/IP Settings** window. Select **Disable NetBIOS over TCP/IP**, and unselect **Enable LMHOSTS lookup**.
- 7 Disable any unused network adapters.

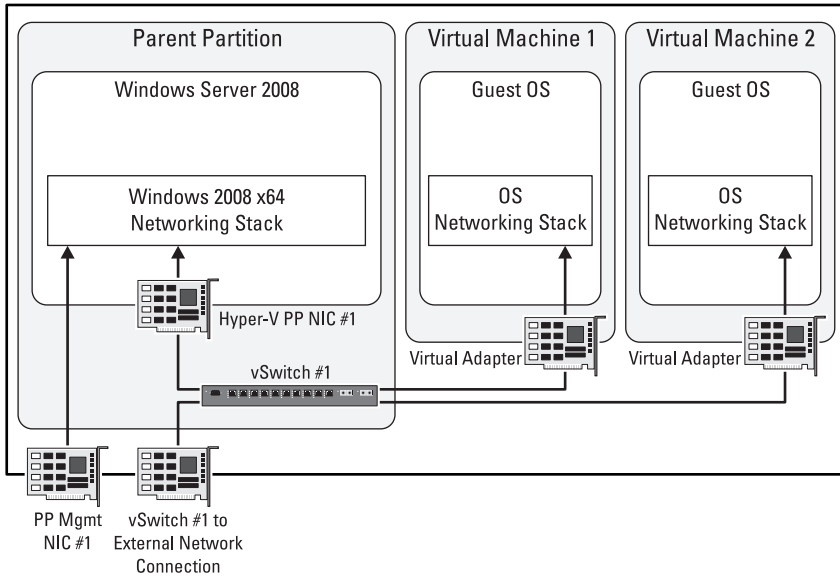
External Virtual Network

The following steps represent Dell's best practice recommendations for configuring external virtual network configurations within Hyper-V. These steps assume you have already performed the general installation and naming steps mentioned above.

The following steps will modify the default configuration of the Windows 2008 parent partition network settings according to Dell best practices. These steps are needed due to the additional virtual network adapter added to the parent partition when the external virtual network is implemented. These changes will include:

- Renaming a parent partition virtual network adapter
- Disabling network adapter power management
- Modifying the adapter binding order to that the dedicated parent partition physical network adapter is preferred
- Modifying the adapter metric values to ensure the dedicated physical network adapter is the preferred route
- Disabling auto-negotiate, and setting port duplex and speed
- Modifying DNS resolution and the NetBIOS setting to ensure proper name registration
- Creating a static DNS entry for secondary network adapter of parent partition (optional)
- Disabling any unused network adapters

Figure 5-2. Implementation of External Network (Two Adapter System)



Virtual Network Configuration steps

Any settings assigned to the physical network adapter prior to the virtual switch creation will be transferred to the new virtual network adapter. Additionally, the physically network adapter will be exclusively bound to the Microsoft Virtual Network Switch Protocol following virtual switch creation. All other bindings will be removed.

- 1 Enable the Hyper-V role, but do not select any network adapters when prompted on the **Create Virtual Networks** window. Continue with the install, rebooting as required. Multiple reboots will be required. Installation will continue upon login.
- 2 Launch the **Hyper-V Manager (Administrative Tools→Hyper-V Manager)**, and select your server.
- 3 Under **Actions** on the right, select **Virtual Network Manager**. In the **Name** field, enter a name for the virtual switch, **vSwitch #1 (External)** for this example.

- 4 Make sure **External** is selected, and click **Add**. Select the physical network adapter/LOM to be connected to the virtual switch. For this example, the second LOM will be selected, modified as needed based on the hardware available.



NOTE: While configuring the new virtual network, a parent partition VLAN may be configured. Setting this parameter only affects the parent partition connection. Virtual machines can be configured to other VLANs or no VLANs as needed without affecting parent partition traffic. Verify the network is configured to accept VLAN tagged traffic prior to setting a VLAN ID.

- 5 Click **OK** to finalize the virtual network configuration.
- 6 Close the **Hyper-V Manager** window. At this point a virtual switch named `vSwitch #1 External` has been created.

Network Configuration

- 1 Open **Network Connections**.



NOTE: The LOM selected in the **Virtual Network Manager** has changed to an **Enabled** status. This indicates the network adapter is now connected to a virtual switch, `vSwitch #1 (External)` as shown in the **Device Name** field. Also notice a new network adapter has been added to the parent partition to replace the network adapter now connected to the virtual switch.

- 2 Rename the new parent partition virtual network adapter to `Hyper-V PP NIC #1`.
- 3 Make the following changes for the physical network adapter providing external connectivity to the virtual switch, `LOM #2`:
 - Rename this network adapter to `vSwitch #1 to External Network Connection`.
 - Disable power management for this network adapter by unselecting **Allow the computer to turn off this device to save power** (**Network Adapter Properties**→**Configure**→**Power Management**).
 - Set the speed and duplex for this network adapter. Select the speed to match the speed of your network. If the network parameters for this connection are unknown, leave these set to **Auto**.



NOTE: Incorrectly setting the speed and duplex may cause your system and virtual machines to lose connectivity.

- 4 Modify the adapter binding order to ensure that PP Mgmt NIC #1 is listed at the top in the **Connections** window. The network adapter labeled Hyper-V PP NIC #1 should appear last in the list (**Network Connections**→**Advanced**→**Advanced Settings**).
- 5 Set the metric for Hyper-V PP NIC #1 to 9999 (**Network Connection**→**Hyper-V PP NIC #1 properties**→**IP v4 properties**→**IP settings**→**Advanced**→**IP Settings**). This setting will ensure the parent partition traffic will not prefer the new Hyper-V virtual network adapter to the dedicated physical parent network adapter. A value of 9999 assigns the virtual network adapter the highest user-assignable link cost.
- 6 In the **Advanced TCP/IP** window, click the **DNS** tab. Unselect **Register this connection's addresses in DNS**. This will prevent the system from registering this connection in DNS. Only the PP Mgmt NIC #1 network adapter should be allowed to register in DNS to further prevent this network adapter from handling any traffic besides virtual machine traffic.
- 7 Click the **WINS** tab of the **Advanced TCP/IP Settings** window. Select **Disable NetBIOS over TCP/IP**, and unselect **Enable LMHOSTS lookup**.
- 8 Disable any unused network adapters.
- 9 (Optional) Create a static DNS entry for the secondary parent partition (Hyper-V PP NIC #1). This will provide a secondary address for accessing the parent partition if the primary address (PP Mgmt NIC #1) is not available. The static DNS name should NOT be the same as the name of the server.

The **Network Connections** window should display the following settings:

Network Identifier (Domain Name) (2)

Hyper-V PP NIC #1vSwitch #1 (External)

PP Mgmt NIC #1Broadcom BCM5708C NetXtreme II GigE (NDIS VBD Client)

Enabled (1)

vSwitch #1 to External Network Connection Broadcom BCM5708C NetXtreme II GigE (NDIS VBD Client) #2

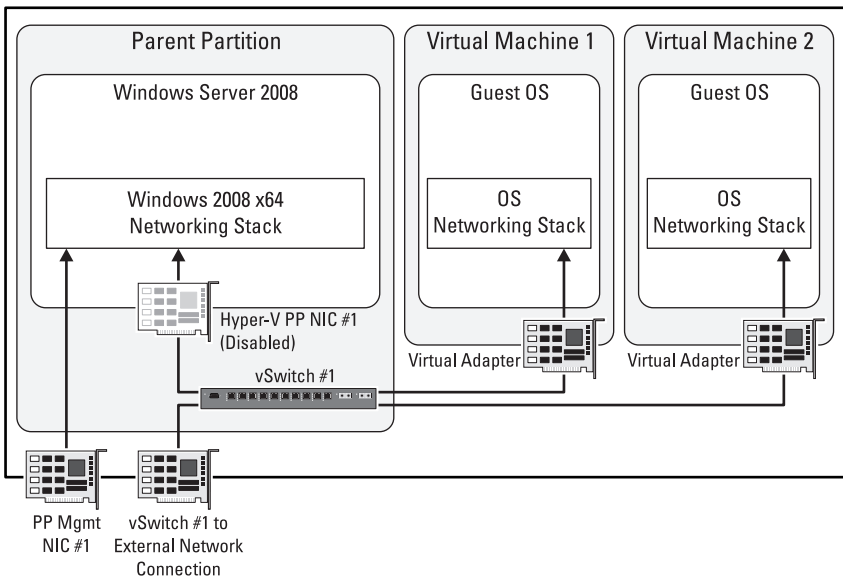
Dedicated Virtual Network

The following steps represent Dell's best practice recommendations for configuring a dedicated virtual network within Hyper-V. These steps assume you have already performed the general installation and naming steps mentioned above.

The following steps will modify the default configuration of the Windows 2008 parent partition network settings according to Dell best practices. These changes will include:


- Renaming a parent partition virtual network adapter.
- Disabling network adapter power management.
- Disabling auto-negotiate, and setting port duplex and speed.
- Disabling the new virtual network adapter in the parent partition. This disabled network adapter will be referred to as a "Stub" adapter because it is present, but disabled by design.
- Disabling any unused network adapters.

Figure 5-3. Implementation of Dedicated Network (Two Adapter System)





Virtual Network Configuration Steps

Any settings assigned to the physically network adapter prior to the virtual switch creation will be transferred to the new virtual network adapter. Additionally, the physically network adapter will be exclusively bound to the Microsoft Virtual Network Switch Protocol following virtual switch creation. All other bindings will be removed.


- 1 Enable the Hyper-V role, but do not select any network adapters when prompted on **Create Virtual Networks**. Continue with the install, rebooting as required. Multiple reboots will be required. Installation will continue upon login.
- 2 Launch the Hyper-V Manager (**Administrative Tools**→**Hyper-V Manager**), and select your server.
- 3 Under **Actions** on the right, select **Virtual Network Manager**. In the **Name** field, enter a name for the virtual switch, `vSwitch #1 (Dedicated)` for this example.
- 4 Make sure **External** is selected, and click **Add**. Select the physical network adapter/LOM to be connected to the virtual switch. For example, the second LOM will be selected, modified as needed based on the hardware available.
 **NOTE:** While configuring the new virtual network, a parent partition VLAN may be configured. It is important to note that setting this parameter only affects the parent partition connection. Virtual machines can be configured to other VLANs or no VLANs as needed without affecting parent partition traffic. Verify the network is configured to accept VLAN tagged traffic prior to setting a VLAN ID.
- 5 Select **OK** to finalize the virtual network configuration. You may lose connectivity during this process.

Network Configuration


- 1 Close the **Hyper-V Manager** window, and open **Network Connections**.
 **NOTE:** The LOM selected in the **Virtual Network Manager** has changed to an **Enabled** status. This indicates the network adapter is now connected to a virtual switch, `vSwitch #1 (Dedicated)` as shown in the **Device Name** field.

 **NOTE:** A new network adapter has been added. This is a new virtual network adapter that has been added to the parent partition to replace the LOM lost when connected to the virtual switch.

- 2 Rename the new parent partition virtual network adapter to `Stub Hyper-V PP NIC #1`.
- 3 Make the following changes for the physical network adapter providing external connectivity to the virtual switch, `LOM #2`:
 - Rename this network adapter to `vSwitch #1 to External Network Connection`.
 - Disable power management for this network adapter by unselecting **Allow the computer to turn off this device to save power** (**Network Adapter Properties**→**Configure**→**Power Management**).
 - Set the speed and duplex for this network adapter. Select the speed to match the speed of your network. If the network parameters for this connection are unknown, leave these set to **Auto**.

 **NOTE:** Incorrectly setting the speed and duplex may cause your system and virtual machines to lose connectivity.

- 4 Disable the `Stub Hyper-V PP NIC #1` network adapter. This will remove the network adapter from the parent partition, creating a dedicated path for VM traffic.

 **NOTE:** These steps assume this network adapter (`Stub Hyper-V PP NIC #1`) will never be turned on and become active in the parent partition. If this cannot be guaranteed, the external virtual network configuration steps should be performed and the network adapter disabled as a final step instead of the steps here.

Alternately, a second method to ensure the stub network adapter does not negatively interfere with the host would be to disable all of the network adapter bindings from the network adapter. If the network adapter is accidentally turned on, it will be essentially blind to the environment around it.

- 5 Disable any unused network adapters.

The **Network Connections** window should display the following settings:

```
PP Mgmt NIC #1Broadcom BCM5708C NetXtreme II GigE  
(NDIS VBD Client)
```

Disabled (1)

Stub Hyper-V PP NIC #lvSwitch #1 (Dedicated)

Enabled (1)

vSwitch #1 to External Network Connection Broadcom BCM5708C NetXtreme II GigE (NDIS VBD Client) #2

Virtual Machine Setup and Guest Configuration

The following represent Dell's best practices for setting up and configuring virtual machines in a Hyper-V environment while running on Dell systems.

The recommendations presented here assume the host Hyper-V environment has already been configured using the best practice recommendations mentioned earlier in this document. Also, these recommendations will assume the virtual machines have some connectivity to other VMs, the parent partition, and/or the external network environment. If no connectivity is required, these steps are not needed.

Virtual Machine Network Environment Setup

When a virtual machine is created, Hyper-V will, by default, present the virtual machine with a "synthetic" virtual network adapter. This adapter tightly integrates with the Hyper-V VMBus (as discussed in "Understanding Hyper-V Virtual Network Architecture" on page 7) to provide high performance while minimizing resource overhead. Due to its tight integration with the virtualization microkernel, a special driver must be utilized with this synthetic adapter. "Guest Operating System Network Driver Setup" on page 36 will discuss driver installation.

In all except special situations (like PXE booting), the higher performing synthetic network adapter should be used instead of the legacy network adapter. When used in conjunction with the Integration Services discussed in the next section, the synthetic network adapter will offer the best performance.

Guest Operating System Network Driver Setup

As mentioned earlier, Hyper-V offers a "Legacy Network Adapter" and "Synthetic Network Adapter" for virtual machines. The legacy network adapter is an emulated Intel 21140-Based PCI Fast Ethernet Adapter device.

This legacy device has a device driver in most supported guest OSes. The synthetic network adapter does not have a native device driver in any current OSes. A device driver for this synthetic NIC is installed as part of the Integration Services installation. Drivers for this adapter are available for supported guest operating systems. For a list of supported guest operating systems, see "References" on page 41.

For more information on Integration Services installation, refer to the *Dell Solutions Overview Guide for Microsoft Hyper-V*.

Best Practices for Administering Network Adapter Drivers

Although Dell recommends using the latest network adapter drivers available from support.dell.com, special care should be taken when removing or upgrading network adapter drivers. The sections below will clarify the expected behavior in each of these scenarios. These behaviors are not specific to systems running Hyper-V, but can cause more of an issue in these environments due to the greater number of network adapters typically present in these systems. Parent partition iSCSI connections may also be affected.

Installing and Upgrading Drivers

Dell recommends using the latest drivers available from support.dell.com. Following a fresh user installation of Windows 2008 x64 using Dell media, the system will most likely have basic functionality for the onboard network adapters and possibility for additional add in network adapters. However, drivers for all network adapters present in the system should be downloaded from support.dell.com and installed.

Drivers may be upgraded at any time to ensure maximum network adapter feature support and to make sure the latest bug fixes are running on the system. Updated drivers may contain new features, functionality, and bug fixes that could improve your system performance.



NOTE: Dell recommends recording all network related settings such as IP addresses, subnet masks, and gateways as well as Hyper-V virtual networking settings/mappings prior to upgrading network adapter drivers and software.

The latest drivers are available from support.dell.com.

Uninstalling Broadcom or Intel drivers

If for any reason updated drivers need to be uninstalled from a system, be sure to thoroughly document any network adapter settings, naming, and virtual network connections prior to removing the driver. During the uninstall

process all network adapters will be reset to default settings and disassociated from any virtual switches. All settings and virtual switches will need to be reconfigured.

With Hyper-V, when drivers are uninstalled any virtual networks connected to physical network adapters will become Internal type and the external connection uninstalled. The virtual switch can be reconnected to the external network by selecting the virtual network in the **Virtual Network Manager**, changing the connection type to **External**, and selecting a valid physical network adapter (most likely the one that was previously connected).

References

- Dell Solutions for Windows Server 2008 Hyper-V at www.dell.com/hyper-v
 - *Dell Virtualization Solutions Advisor Tool*
 - *Dell Solutions Overview Guide for Microsoft Hyper-V*
 - *Dell Networking Solutions Guide for Microsoft Hyper-V*
 - *Dell Storage Solutions Guide for Microsoft Hyper-V*
 - *Dell Virtualization Reference Architecture for Hyper-V*
- *How to Install Windows Server 2008 Hyper-V* from <http://www.microsoft.com/windowsserver2008/en/us/hyperv-install.aspx>
- *Windows Server 2008 Hyper-V FAQ* from <http://www.microsoft.com/windowsserver2008/en/us/hyperv-faq.aspx>
- *Microsoft Virtualization and Consolidation with Hyper-V* from <http://www.microsoft.com/windowsserver2008/en/us/virtualization-consolidation.aspx>
- *Supported Guest OS in Windows Server 2008 Hyper-V* from <http://www.microsoft.com/windowsserver2008/en/us/hyperv-supported-guest-os.aspx>
- *Windows Server 2008 TechCenter* from <http://technet.microsoft.com/en-us/windowsserver/2008/default.aspx>
- *Upgrading Beta Hyper-V Code to Gold Code*: Install the update associated with Microsoft KB950050 to upgrade the beta Hyper-V code found on the Dell media to the final code (aka RTM code)
- *Hyper-V Functional Specification* from <http://www.microsoft.com/downloads/details.aspx?FamilyID=91e2e518-c62c-4ff2-8e50-3a37ea4100f5&displaylang=en>
- *WinHEC 2006 Presentation Slides* from <http://blogs.technet.com/virtualization/archive/2006/06/14/WinHEC-2006-Slides.aspx>

Glossary

CHILD PARTITION — Any partition (VM) that is created by the root partition.

DEVICE VIRTUALIZATION — A mechanism that lets a hardware resource be abstracted and shared among multiple consumers.

EMULATED DEVICE — A virtualized device that mimics an actual physical hardware device so that guests can use the typical drivers for that hardware device.

ENLIGHTENMENT — An optimization to a guest operating system to make it aware of VM environments and tune its behavior for VMs.

GUEST — Software that is running in a partition. It can be a full-featured operating system or a small, special-purpose kernel. The hypervisor is "guest-agnostic."

HYPERVISOR — A layer of software that sits just above the hardware and below one or more operating systems. Its primary job is to provide isolated execution environments called partitions. Each partition has its own set of hardware resources (CPU, memory, and devices). The hypervisor is responsible for controls and arbitrates access to the underlying hardware.

ROOT PARTITION — A partition that is created first and owns all the resources that the hypervisor does not own including most devices and system memory. It hosts the virtualization stack, and creates and manages the child partitions.

SYNTHETIC DEVICE — A virtualized device with no physical hardware analog so that guests might need a driver (virtualization service client) to that synthetic device. The driver can use VMBus to communicate with the virtualized device software in the root partition.

VIRTUAL MACHINE (VM) — A virtual computer that was created by software emulation and has the same characteristics as a physical computer.

VIRTUALIZATION STACK — A collection of software components in the root partition that work together to support VMs. The virtualization stack works with and sits above the hypervisor. It also provides management capabilities.

The terms and definitions listed here are from public Microsoft Hyper-V documentation. They are considered to be industry used terms for Hyper-V environments. A complete list can be found at http://www.microsoft.com/whdc/system/sysperf/Perf_tun_srv.msp

