Microsoft® Hyper-V™ Server 2008 for Dell™ PowerEdge™ Systems

Networking Solutions Guide

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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Contents

1

Overview

The introduction of Microsoft® Hyper-V® Server 2008 has changed the way a virtual machine (VM) interacts with the host operating system and network resources. Unlike other Microsoft virtualization software like Virtual Server and Virtual PC, the virtualization technology of Hyper-V is integrated into the Microsoft Windows Server® 2008 x64 operating system. This facilitates better performance and increases integration of the virtualization layer (hypervisor) with other Microsoft Windows® components.

This document details the four available networking configurations for running Hyper-V on Dell™ PowerEdge™ systems. It also discusses the advantages and disadvantages of each networking configuration with an emphasis on typical Dell system configurations.

This document assumes that you have a basic understanding of Hyper-V.

Additional Documentation

The documents listed below are available from the Dell Support website at **support.dell.com**.

NOTE: To gain a preliminary understanding of Hyper-V solutions on Dell hardware, it is recommended that you read the *Dell Solutions Overview Guide for Microsoft Hyper-V* available, from the Dell Support website at **support.dell.com**, prior to reading this document.

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

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The Virtual Network Architecture for Hyper-V Server 2008

In Microsoft® Hyper-V® Server 2008, the *parent partition* manages the I/O devices instead of the hypervisor.

To provide virtual machines (VMs) with access to the I/O devices, Hyper-V supports a high-speed interconnect called the *VMBus*. Virtual devices for each VM, such as network and storage adapters, communicate with the parent partition through the VMBus.

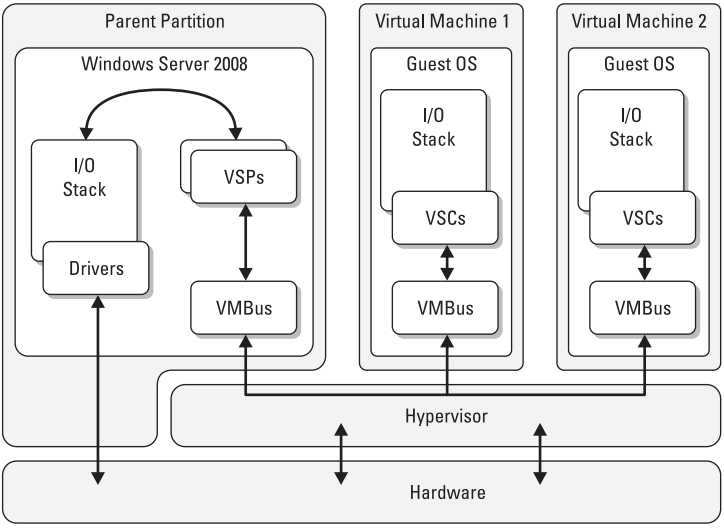
The parent partition receives requests through the virtual service providers (VSPs) and directs them to the underlying physical devices through its I/O stack. This model requires device drivers for the physical devices to be installed in the parent partition.

NOTE: Device-specific drivers and utilities created for Microsoft Windows Server® 2008 x64 operating system do not require any change 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 the VMs are able to utilize the underlying physical devices. Download the latest device drivers from the Dell Support website at **support.dell.com**.

Figure 2-1 illustrates the Hyper-V architecture.

Figure 2-1. Hyper-V Architecture



Guest operating systems require specialized drivers (VSCs) provided by Microsoft 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. They are installed as a part of the Integration Services available for the Hyper-V supported guest operating systems.

NOTE: All architecture-related information provided in this document assumes that the guest operating system has Integration Services installed.

Virtual Network Adapters

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

- **Legacy devices** emulate a physical network adapter in software. Although this process provides networking services to a VM, it requires additional host processing resources.
- **Synthetic devices** are comparable to proxy devices that present themselves as network devices, but only 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 VMs. It also lowers host system overhead.

Virtual Switches

A *virtual switch* forms the heart of connectivity in a Hyper-V virtual network. The virtual switch functions like a physical network switch by connecting physical and virtual network adapters. 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.

The following sections introduce virtual network types, discuss how they differ, and provide best practices for implementing each switch.

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Supported Hardware and Software Settings for the Network Adapter

NOTE: It is recommended to use the latest network adapter drivers for your Dell™ PowerEdge™ system running Microsoft® Hyper-V® Server 2008 downloaded from the Dell Support website at **support.dell.com**.

NOTE: Dell does not support drivers obtained from third-party vendors. These applications can be used to configure physical network adapters that are not connected to the virtual networks.

Hyper-V supports all network adapters recommended for Dell systems running the Microsoft® Windows Server® 2008 x64 operating system.

Supported Physical Network Adapter Settings

Guest operating systems are able to utilize physical devices present in a system, including some of the advanced features of these devices.

NOTE: When you configure physical network adapters for virtual networking in the Hyper-V environment, some functionality of the physical network adapters may not be accessible to the virtual networks.

Generally, physical network adapter features can be grouped into two categories: *stateless* and *stateful*.

- Stateless — Only stateless features may be leveraged for virtual networks. These features include Large Send Offload (LSO), Checksum Offload (CSO), and VLAN tagging (IEEE 802.1Q).

  NOTE: Hyper-V does not support LSO and CSO in an IPv6 network.

- Stateful — Stateful off-load features such as Broadcom® TCP offload engine (TOE) and Intel® I/O Acceleration Technology (I/OAT) are not leveraged by the Hyper-V virtual network. These features are not 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 I/OAT, as supported by the system and network adapters.

Stateless Offload (LSO and CSO)

The adapters provide the LSO and CSO capabilities if both the network adapters and drivers support them. If the network adapters or the drivers do not support these features, then these capabilities are still available, but performed by the operating system. It is recommended to use adapters with LSO and CSO capabilities as some overhead is incurred when the operating system provides these capabilities.

NOTE: The latest Dell-supported network adapters offer LSO and CSO hardware offload support. Hyper-V does not support CSO and LSO in an IPv6 network. In an IPv6 network, a team that supports CSO and/or LSO, and is bound to a Hyper-V virtual network, reports CSO and LSO as an offload capability in Broadcom Advanced Control Suite (BACS), even when CSO and LSO do not work. This is a limitation of Hyper-V.

VLAN Tagging

VLAN tagging (IEEE 802.1Q) of Hyper-V is supported. It allows both parent partition and VMs to logically separate their network connections. VMs may have more than one virtual adapter, and each virtual adapter may belong to any VLAN.

Supported Physical Network Adapter Settings

Table 3-1 summarizes the physical network adapter features 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 third-party software from Intel and Broadcom. However, you must not use this software to manage or configure physical network adapters connected to virtual networks.

Table 3-1. Physical NIC Support Features 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
Teaming with one primary and one standby adapter	Jumbo Frames
	Wake-On-LAN
	TOE
	VLAN Tagging (within third-party software)
	Network MAC Address

NOTE: For configuring NIC team and VLAN, the minimum supported driver version for the Broadcom NIC is 12.6 and for Intel NIC is 11.0. It is recommended that you download the latest drivers from the Dell Support website at **support.dell.com**.

NOTE: Hyper-V cannot manage tagging when using a teaming software. Instead, the teaming software can be used for VLAN tagging.

4

Determining a Virtual Network Implementation

As mentioned in earlier sections, the virtual switch, or vSwitch, forms the core of all the Microsoft® Hyper-V® Server 2008 virtual networks.

NOTE: The virtual switch never appears as an entity or icon in the Microsoft® Windows Server® 2008 parent partitions, including the **Network Connection** window. It is a logical representation.

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

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

NOTE: The dedicated virtual network implementation allows virtual machine (VM) traffic to be dedicated to a specific physical network port instead of being shared between VMs and the parent partition. The dedicated virtual network is the preferred implementation for most deployments of Hyper-V.

Private Virtual Network

In Hyper-V, you can use the private virtual network to allow network communications between VMs on a host. Private virtual network is the first of the three virtual switch configuration modes that you can configure from the Hyper-V GUI.

When you select and configure the private virtual network:

- A virtual switch is created and made available for VMs. See the **vSwitch #1** in Figure 4-1.

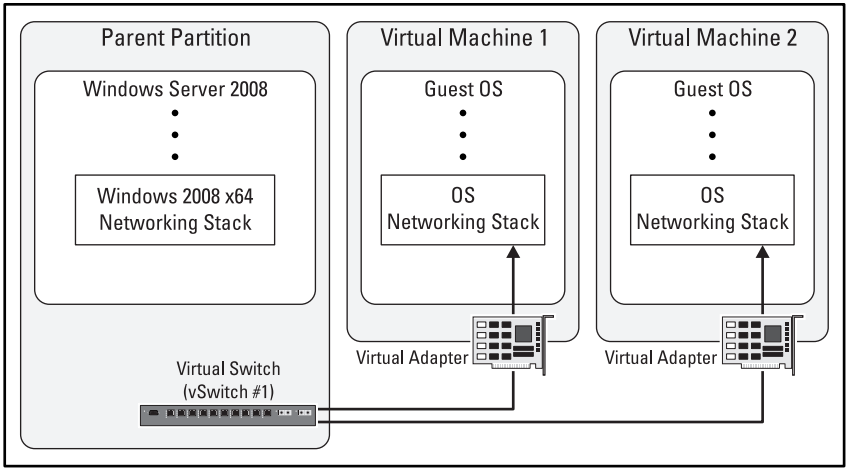
Advantages

- The private virtual network offers complete isolation from the parent partition and the external network.

NOTE: The private virtual network is not recommended for environments utilizing Failover Clustering because the private network is localized to each host.

Figure 4-1 shows the logical representation of the private network configuration. It additionally shows VMs connected to the virtual switch.

Figure 4-1. Private Virtual Network Diagram



Internal Virtual Network

In Hyper-V, you can use the internal virtual network to allow network communication between VMs on a host, and also between VMs and the parent partition.

When you select and configure the internal virtual network:

1. A virtual switch is created and made available for the VMs. See the **vSwitch #1** in Figure 4-2.
2. A new virtual network adapter is created and connected to the parent partition.

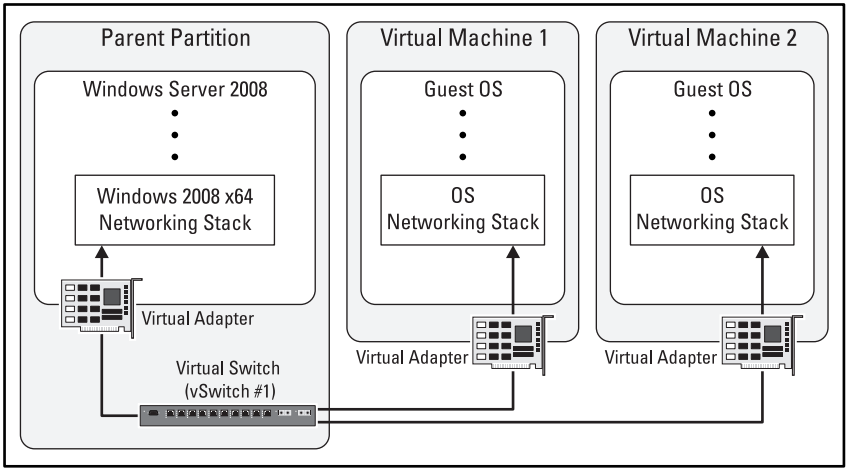
Advantages

- The internal virtual network enables isolation of VMs from the external network.

NOTE: The internal virtual network is not recommended for environments utilizing failover clustering because the internal network is localized to each host.

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

Figure 4-2. Internal Virtual Network Diagram



External Virtual Network

In Hyper-V, you can use the external virtual network to allow network communication between VMs, the parent partition, and the external network.

When you select and configure the external virtual network:

1. A virtual switch is created and connected to the VMs. See the **vSwitch #1** in Figure 4-3.
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.

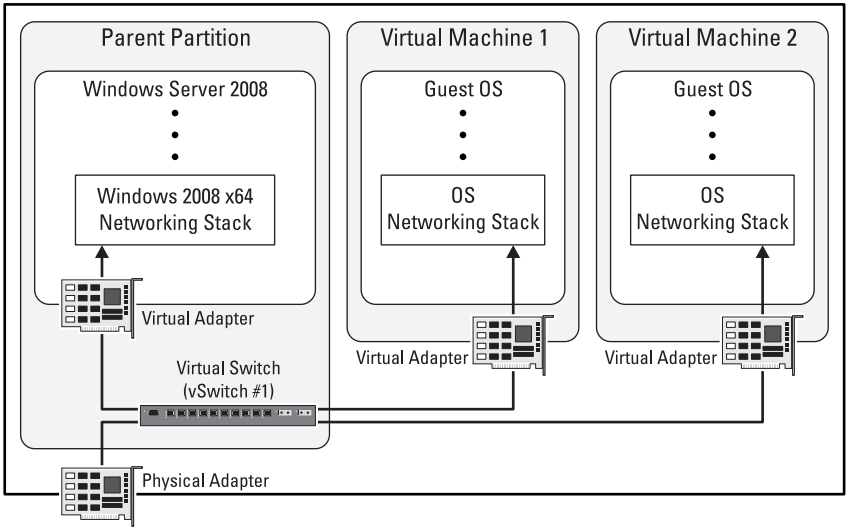
4 The virtual switch is connected to the physical network adapter that you enabled for external network access.

Disadvantages

- The second adapter in the parent partition can cause host connectivity issues. These issues include multiple DNS entries, delayed or incomplete NetBIOS resolution, and routing confusion.
- The multiple parent partition network adapter causes delayed NetBIOS resolution or incomplete network browsing. Multiple browsing lists are associated with each network adapter.

Figure 4-3 shows the logical representation of the external virtual network configuration. This diagram shows two 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* is a modified form of the external virtual network offered by Hyper-V. This virtual network allows VMs to communicate with other VMs on the same system and to VMs on other systems. The VMs can also access the external network.The VMs have access to the parent partition through the external network if the parent partition virtual network adapter is connected to the virtual switch.

NOTE: The VMs on a dedicated virtual network 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.

Unlike the other three virtual network types, you cannot directly configure the dedicated virtual networks with the Hyper-V **Virtual Network Manager**. You can create the dedicated virtual network by first creating an external virtual network and then modifying the virtual network adapter that you added to the parent partition.

Advantages

- The physical network adapter is dedicated for VM traffic, so there is no sharing with the parent partition

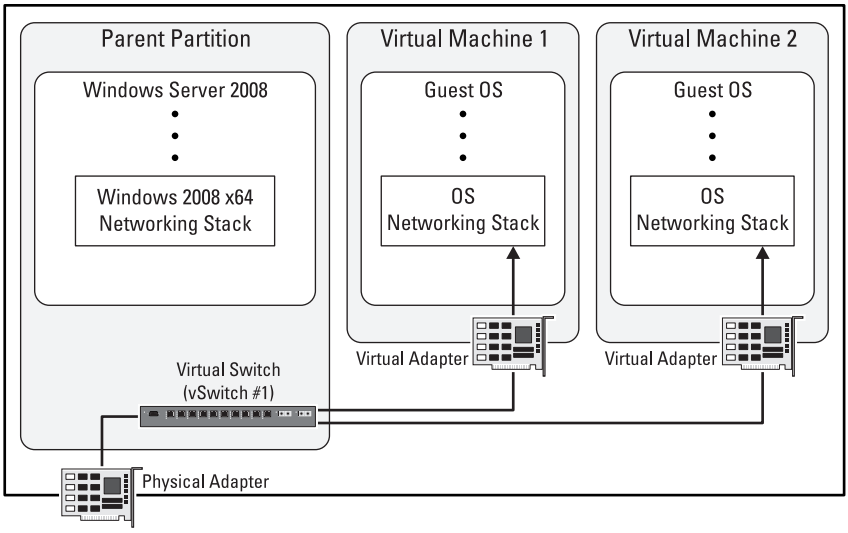
Disadvantages

- The disabled network adapter appears in the **Network Connections** window of the parent partition. You must not modify the network adapter settings or enable the network adapter.

NOTE: The Microsoft® Windows Management Instrumentation (WMI) can be used to implement a dedicated virtual network without causing an additional virtual network adapter to appear in the parent partition. For more information, see the Hyper-V WMI programming reference listed in "Appendix B" on page 43.

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

Figure 4-4. Dedicated Virtual Network Diagram



5

Configuring the Virtual Network

This section offers guidance with the hardware and software setup, and best practice recommendations for configuring virtual machines (VMs). The information presented here builds on the virtual network types and usage models discussed in previous sections.

Hardware Setup

This section helps in determining how many network adapters are required to support various implementations of the Microsoft® Hyper-V® Server 2008 operating system. Table 5-1 to Table 5-4 discuss 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 the Hyper V configurations are:

- The system has a minimum of two built-in network adapters (LOMs).

  NOTE: Some systems have four built-in adapters.

- Systems are dedicated to hosting VMs. These systems have no other Microsoft® Windows Server® 2008 roles installed.

These recommendations are based on the following 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 physical network adapters with adapters used for other types of connections like parent partition network, VM network(s), etc.
- If you use an external virtual network, the parent partition does not share a physical network adapter with an adapter connected to a virtual switch.

- One network adapter is dedicated for parent partition management including remote desktop access and name resolution (DNS/NetBIOS). 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.

Table 5-1 to Table 5-4 offer minimum port allocations required for various iSCSI and failover clustering configurations, and one configuration for implementing additional VM networks. It is recommended to use additional VM networks when the number of VMs increase.

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 and 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 and 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

Recommendations

- Functional areas with more than one connection must be spread across adapters to help maintain redundant connectivity in the event of a device or port failure.
  For example, for iSCSI implementations, dual paths to iSCSI targets allow for the loss of one network port or an adapter if the connections are spread across different adapters. This distributed iSCSI connection layout, when used in conjunction with a proper iSCSI initiator and a multi-path driver configuration, allows the parent partition and VMs 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 ensure proper iSCSI configuration, see the *Dell Storage Solutions for Hyper*-V guide available from the Dell Support website at **support.dell.com**. The document discusses the proper installation of all storage-specific drivers (such as the multipath I/O drivers) and support software. This document also contains information to ensure the correct external network switch configuration.
- Proper planning is required for the failover clustering environment.
  To ensure proper configuration, and for more information on high availability options available on Hyper-V, see the *Dell High Availability Solutions Guide for Microsoft Hyper*-V available from the Dell Support website at s**upport.dell.com**.

Software Setup

These configuration steps assume the following:

- A fresh installation of Microsoft® Windows Server® 2008 (with Hyper-V).
- You have applied the latest updates, including the Hyper-V RTM update, to the operating system.

For instructions to download the RTM Hyper-V update, see "Appendix B" on page 43.

Before You Begin

- Due to the number of network connections involved with Hyper-V deployments, you must clearly label all network connections in the Windows Server 2008 **Network Connections Manager**. It is often easier to label connections in the beginning rather than doing it during a Hyper-V rollout.
- Ensure that you are running the latest Dell-qualified network drivers for your system and network hardware. Prior to enabling the Hyper-V role, you must apply the updates that are available on the Dell Support website at **support.dell.com**.
- The internal and external virtual network configurations place a virtual adapter in the parent partition. In these configurations, the virtual adapter is a second network adapter for the parent partition. Presenting two networks to Windows Server 2008 can cause name resolution issues, and slow or incomplete network browsing.
  The best practices presented in the "Internal Virtual Network" on page 28 and "External Virtual Network" on page 31 help mitigate these issues.

Initial Setup

1. In the **Network Connections** window of the Windows Server 2008 installation, label each LAN on Motherboard (LOM) port for your system. It is recommended to use **LOM Port #1** for these LOMs. Label the first LOM **PP Mgmt #1** for P**arent Partition Management #1**.

   NOTE: The enumeration of these ports may NOT be correctly shown in the Windows Server 2008 **Network Connections** window. Verify correct mappings between the LOM numbering displayed on the back of the system and the name assigned in the Windows GUI. You may be required to plug an active network cable into the ports, one at a time, to map the physical ports to the Windows network adapters.

2. Label each port for each add-in network adapter in your system. It is recommended to use a format similar to:
   <Vendor>-<PCIe slot #>-<Port n>.
   For example, **Broadcom-PCIe Slot 4-Port 2**.

   NOTE: The slot numbers can be found on the back of the system chassis.

3. Verify that the system is using the latest qualified network adapter drivers as listed on the Dell Support website at **support.dell.com**.

4. Assign static IP addresses to each network adapter during configuration. Although it is possible to use Dynamic Host Configuration Protocol (DHCP) addressing, it is recommended to use static addresses for all system connections.

It is recommended to assign static addresses by function from different subnets to all system connections. These include:

- Parent partition management including Failover Clustering public address
- Failover Clustering private address
- iSCSI connections
  For specific requirements that may vary by storage solution, see the *Dell Storage Solutions Guide for Microsoft Hyper*-V available on the Dell Support website at **support.dell.com**

- VM networks (as needed)
- VLANs or separate network fabrics must be used to segregate network traffic

NOTE: Unlike other Windows Server 2008 clustered applications, clustered VMs do not utilize the public IP address; instead, they maintain their own addresses for each virtual network adapter in each guest operating system. The public address is used to manage the cluster.

NOTE: VLAN tagging is available on a per-VM connection basis that is configured on each network adapter of each VM, and for the parent partition that is 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. Switch-based tagging may also be used to tag traffic from all physical network adapters.

For special iSCSI network configuration best practices, see the *Dell Storage Solutions Guide for Microsoft Hyper-V* available on the Dell Support website at **support.dell.com**.

The following sections 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 must be used as needed to implement each of the different virtual network types.

Private Virtual Network

Private virtual networks are completely isolated from the parent partition and the external network. No changes are made to either environment once you complete the general installation and naming steps mentioned in the previous sections.

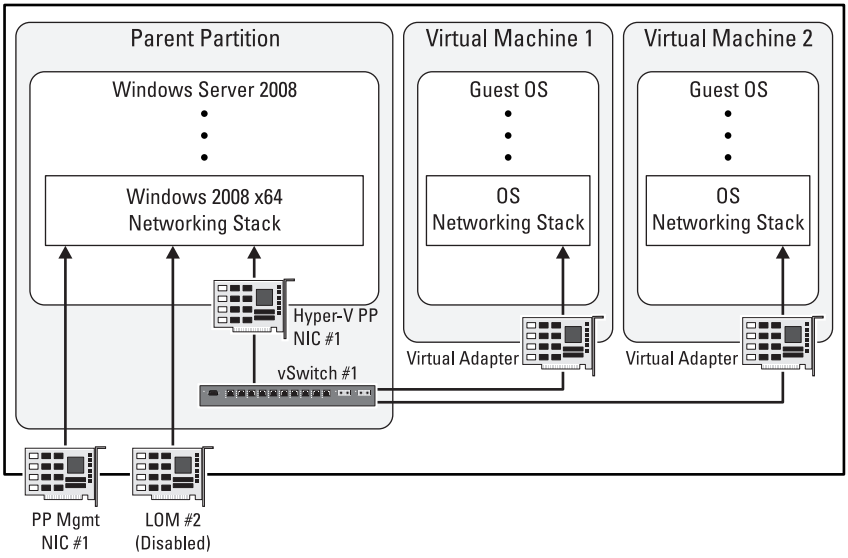
Internal Virtual Network

The following steps are the best practice recommendations for configuring the internal virtual network configurations within Hyper-V. These steps assume that you have already performed the general installation and naming steps mentioned in the previous sections.

The following steps modify the default configuration of the Windows Server 2008 parent partition network settings. You need to perform these steps because an additional virtual network adapter is added to the parent partition when the internal virtual network is implemented. These changes include:

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

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



Configuring the Virtual Network

1. On the **Create Virtual Networks** screen, enable the Hyper-V role when prompted, but do not select any network adapters.
   Continue with the installation, rebooting as required. You require multiple reboots. The installation continues when you login.
2. Launch the **Hyper-V Manager** by navigating to **Administrative Tools→ Hyper-V Manager**, and select your system.
3. Under **Actions** on the right pane, select **Virtual Network Manager**. In the **Name** field, enter a name for the virtual switch.
   Example, **vSwitch #1 (Internal)**
4. Ensure that **Internal** is selected. Click **Add**.
5. Click **OK** to finalize the virtual network configuration.
6. Close the **Hyper-V Manager** window.
   A virtual switch named **vSwitch #1 (Internal)** is created.

Configuring the Network

1. Open **Network Connections**.

   NOTE: The **Device Name** field now shows **vSwitch #1 (Internal)**, indicating that the new parent partition network adapter is 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, the status field changes.
2. Re-name the new parent partition virtual network adapter to **Hyper-V PP NIC #1**.
3. Go to **Network Connections→ Advanced→ Advanced Settings.** Modify the adapter binding order to ensure that **PP Mgmt NIC #1** is listed at the top in the **Connections** window.

   NOTE: The network adapter labeled **Hyper-V PP NIC #1** must appear second.

4 Go to **Network Connection→ Hyper-V PP NIC #1 properties→ IP v4 properties→ IP settings→ Advanced→ IP Settings.** Set the metric for **Hyper-V PP NIC #1** to **9999**.
This setting ensures that the parent partition traffic does 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 prevents the system from registering the connection in DNS. Only the **PP Mgmt NIC #1 NIC** is 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

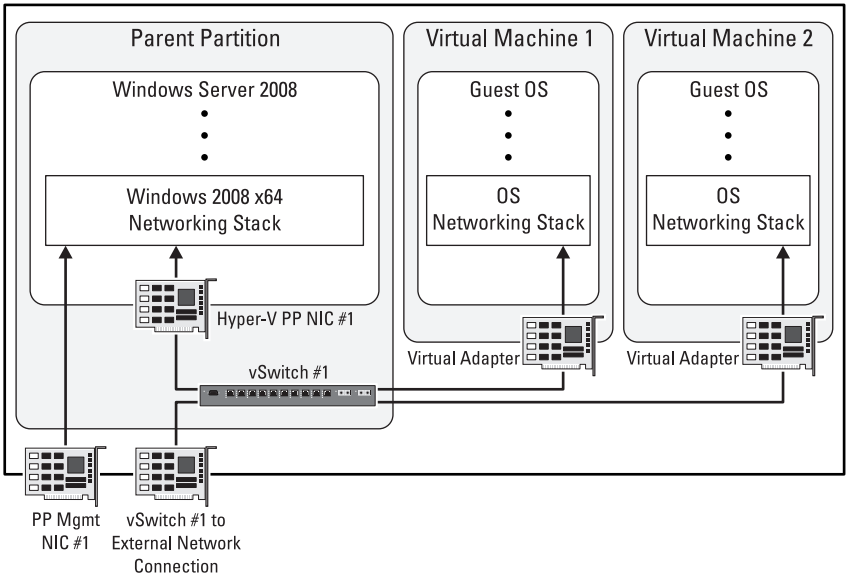
The following steps are best practice recommendations for configuring the external virtual network configurations within Hyper-V. These steps assume you have already performed the general installation and naming steps mentioned in the previous sections.

The following steps modify the default configuration of the Windows Server 2008 parent partition network settings. 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 include:

- Renaming a parent partition virtual network adapter.
- Disabling network adapter power management.
- Modifying the adapter binding order so that the dedicated parent partition physical network adapter is preferred.

- Modifying the adapter metric values to ensure that 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)



Configuring the External Virtual Network

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

1. On the **Create Virtual Networks** screen, enable the Hyper-V role when prompted, but do not select any network adapters.
   Continue with the installation, rebooting as required. You require multiple reboots. Installation continues when you login.
2. Launch the **Hyper-V Manager** by navigating to **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.
   For example: `vSwitch #1 (External)`
4. Ensure **External** is selected, and click **Add**. Select the physical network adapter or LOM to be connected to the virtual switch.
   For this example, the second LOM is selected and modified as needed based on the available hardware.

   NOTE: While configuring the new virtual network, you may configure a parent partition VLAN. 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 that 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.

Configuring the Network

1 Open Network Connections.

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

2 Re-name the new parent partition virtual network adapter to `Hyper-V PP NIC #1`.

3 Make the following changes to the physical network adapter providing external connectivity to the virtual switch LOM #2:

– Re-name the network adapter to: `vSwitch #1 to External Network Connection`.

– Disable power management for this network adapter by navigating to **Network Adapter Properties→Configure→Power Management** and unselecting **Allow the computer to turn off this device to save power**.

– 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, set it to **Auto**.

NOTE: Incorrectly setting the speed and duplex may cause your system and VMs 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` must appear last in the list. Navigate to **Network Connections→ Advanced→ Advanced Settings** to access the adapter settings.

5 Set the metric for `Hyper-V PP NIC #1` to `9999` by navigating to **Network Connection→ Hyper-V PP NIC #1 properties→ IP v4 properties→ IP settings→ Advanced→ IP Settings**. This setting ensures that the parent partition traffic does 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 prevents the system from registering this connection in DNS. Only the `PP Mgmt NIC #1` network adapter must be allowed to register in DNS to further prevent this network adapter from handling any traffic besides VM 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.

NOTE: The step 9 is optional.

9 Create a static DNS entry for the secondary parent partition (`Hyper-V PP NIC #1`). This provides a secondary address for accessing the parent partition if the primary address (`PP Mgmt NIC #1`) is not available. The static DNS name must NOT be the same as the name of the server.

The **Network Connections** window displays 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

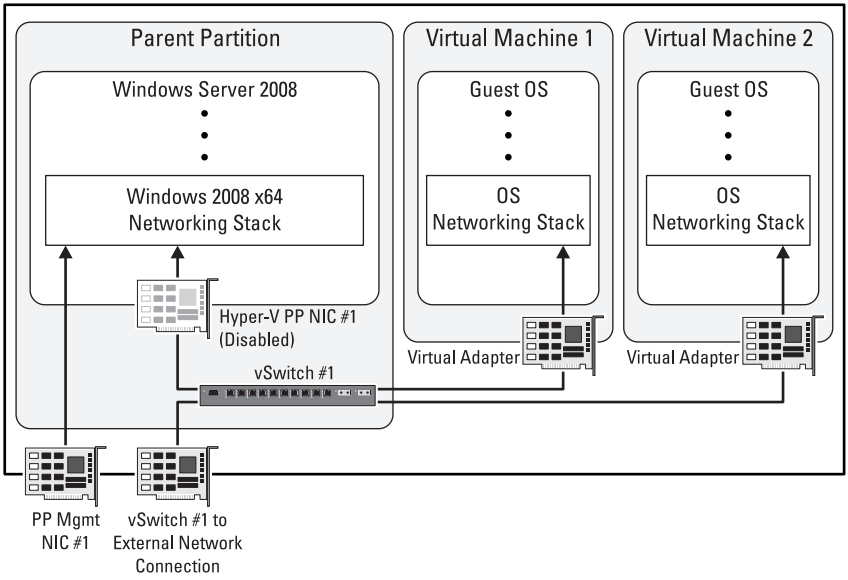
The following steps represent the best practice recommendations for configuring a dedicated virtual network within Hyper-V. These steps assume you have already performed the general installation and naming steps mentioned in the previous sections.

The following steps modify the default configuration of the Windows Server 2008 parent partition network settings. These changes include:

- Re-naming 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 is 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)



Configuring the Dedicated Virtual Network

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

1. On the **Create Virtual Networks** screen, enable the Hyper-V role when prompted, but do not select any network adapters.
   Continue with the installation, rebooting as required. You require multiple reboots. The installation continue when you login.
2. Launch the Hyper-V Manager by navigating to **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 Ensure **External** is selected, and click **Add**. Select the physical network adapter or LOM to be connected to the virtual switch. For example, the second LOM is selected and modified as needed based on the hardware available.

NOTE: While configuring the new virtual network, you may configure a parent partition VLAN. It is important to note that setting this parameter only affects the parent partition connection. You can configure VMs to other VLANs or no VLANs as needed without affecting parent partition traffic. Verify that 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.

Configuring the Network

1 Close the **Hyper-V Manager** window, and open **Network Connections**.

NOTE: The LOM selected in the **Virtual Network Manager** changes its status to **Enabled**. This indicates that 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 is added. This is a new virtual network adapter that is added to the parent partition to replace the LOM that is lost when connected to the virtual switch.

2 Re-name the new parent partition virtual network adapter to `Stub Hyper-V PP NIC #1`.

3 Make the following changes to the physical network adapter providing external connectivity to the virtual switch LOM #2:

- Re-name 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 VMs to lose connectivity.

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

NOTE: These steps assume that the network adapter (`Stub Hyper-V PP NIC #1`) is never turned on and becomes active in the parent partition. If this cannot be guaranteed, you must perform the network configuration steps in "External Virtual Network" on page 31 section, and disable the network adapter as a final step instead of the steps given here.

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

5 Disable any unused network adapters.

The **Network Connections** window displays the following settings:

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

Disabled (1)

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

Enabled (1)

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

Setting Up the VM and Configuring the Guest Operating System.

The following represent Dell's best practices for setting up and configuring VMs 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 assume that the VMs 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.

Setting up the VM Network Environment

When a VM is created, Hyper-V, by default, presents the VM with a synthetic virtual network adapter. This adapter tightly integrates with the Hyper-V VMBus, as discussed in "The Virtual Network Architecture for Hyper-V Server 2008" on page 9, 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. For more information on the driver installation, see "Setting Up the Network Driver for the Guest Operating System" on page 40.

In all situations, except special situations such as PXE booting, you must use the higher performing synthetic network adapter instead of the legacy network adapter. When used in conjunction with the Integration Services discussed in "Setting Up the Network Driver for the Guest Operating System" on page 40, the synthetic network adapter offers the best performance.

Setting Up the Network Driver for the Guest Operating System

As mentioned earlier, Hyper-V offers a Legacy Network Adapter and a Synthetic Network Adapter for VMs. 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 operating systems. A device driver for the 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 "Appendix B" on page 43.

For more information on Integration Services installation, see the *Dell Solutions Overview Guide* for Microsoft Hyper-V available from the Dell Support website at **support.dell.com**.

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Appendix A

Best Practices for Administering Network Adapter Drivers

This section provides instructions to install or upgrade the network adapter driver of a system running Microsoft® Hyper-V® Server 2008.

Installing Network Adapter Drivers

NOTE: It is recommended to use the latest drivers for your Dell™ PowerEdge™ system by downloading them from the Dell Support website at **support.dell.com**.

If you have installed the Microsoft® Windows Server® 2008 x64 operating system using the media provided by Dell, the onboard and add-in network adapters are operational with basic features. However, for full functionality of the network adapter, download and install the latest available drivers from the Dell Support website at **support.dell.com**.

Reinstalling or Upgrading Network Adapter Drivers

NOTE: It is recommended to record all network-related settings such as IP addresses, subnet masks, and gateways, and Hyper-V virtual networking settings or mappings, prior to reinstalling or upgrading network adapter drivers and software.

You may upgrade drivers at any time to ensure maximum network adapter feature support. Updated drivers may contain new features, functionality, and bug fixes that help improve your system performance.

When you uninstall any network adapter driver, the network adapter is reset to default settings and disassociated from all virtual switches. After you re-install the driver, you must re-configure all settings and virtual switches.

When you uninstall network adapter drivers from a system running Hyper-V, all virtual networks connected to the physical network adapters become **Internal** type. The external connections are uninstalled.

After you re-install the network adapter driver, follow the steps below to reconnect the virtual switch to the external network:

1. Select the virtual network in the **Virtual Network Manager**.
2. Change the connection type to **External.**
3. Select a valid physical network adapter or the physical network adapter that was previously connected to the virtual network.

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Appendix B

References

- Dell Solutions for Windows Server 2008 Hyper-V available from the Dell and Microsoft- Virtualization Solutions for Today and Tomorrow website at **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 (a.k.a 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**
- *Dell High Availability Solutions Guide for Microsoft Hyper-V* from **support.dell.com**.

Glossary

CHILD PARTITION — Any partitian (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 is 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.mspx**

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