Dell™ Solutions Overview 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.**

Contents

Microsoft® Windows Server™ 2008 Hyper-V™

Hyper-V is the hypervisor-based virtualization technology from Microsoft that is integrated into all Dell supported Windows Server 2008 x64 Editions operating system. As a virtualization solution, Hyper-V allows a user to take maximum advantage of server hardware by providing the capability to run multiple operating systems (on virtual machines) on a single physical server.

Windows Server 2008 introduces the concept of **roles** within the operating system. Typically, a single server operating system instance is meant for a specific task and a role defines the personality that the server will assume. The roles available in Windows Server 2008 include File Server, Active Directory, DHCP, DNS, Web IIS, etc. Hyper-V is implemented as a role in Windows Server 2008.

NOTE: To ensure the best performance and reliability, it is strongly recommended that Hyper-V role is the only role enabled.

The integration of Hyper-V as a role in Windows Server 2008 x64 offers several key advantages:

- With Hyper-V integrated into the Windows Server 2008 operating system, it is easy to leverage the benefits of virtualization without adopting a new technology

- The new 64-bit micro-kernelized hypervisor architecture leverages device driver support in Windows Server 2008 parent partition to extend support to a broad array of Dell servers, storage, and devices

- Dell OpenManage™ support in the Windows Server 2008 Parent Partition for physical server management

- Support for Symmetric Multiprocessors (SMP) in virtual machines

- Offers Virtual Machine High Availability to minimize unplanned downtime

- "Quick Migration" capability to support business continuity during planned downtime

- Robust backup capability with native support for VSS-based backup

- Easy extensibility using the standards based Windows Management Instrumentation (WMI) interfaces and APIs

This Solutions Overview Guide highlights Dell value propositions and provides an overview of Hyper-V, information on Dell hardware support for Hyper-V, and guidance on best practice information to implement Hyper-V in your environment.

For additional information after completing this document, see the following documents available at **www.dell.com/hyper-v**:

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

Operating System Editions That Support Hyper-V

The following versions of the Windows Server 2008 x64 operating system support Hyper-V as a role:

- Windows Server 2008 x64 Standard Edition
- Windows Server 2008 x64 Enterprise Edition
- Windows Server 2008 x64 Datacenter Edition

NOTE: Windows Server 2008 x64 Standard Edition does not support the Windows Failover Clustering feature that enables support for Hyper-V High Availability. Use Windows Server 2008 x64 Enterprise or Datacenter Edition for HA configurations.

Hyper-V Architecture Overview

The Hyper-V role in Windows Server 2008 is comprised of several components, including the following:

- Hypervisor
- Parent and Child partitions
- Virtual Machines and Guest Operating Systems
- Synthetic and Emulated devices
- Integration Services

The Hyper-V hypervisor is the core component of Hyper-V and is responsible for creating and managing isolated execution environments called partitions. The hypervisor sits directly on the hardware and controls access from the partitions to the physical processors.

When the Hyper-V role is enabled in Windows Server 2008, the Hyper-V hypervisor uses the virtualization extensions in the processors (Intel® VT or AMD-V™) to place itself under Windows Server 2008. When the Hyper-V hypervisor loads for the first time, it creates a partition called the **root**

partition or **parent partition**. This root partition hosts the Windows Server 2008 instance that was running on the hardware prior to enabling the Hyper-V role.

The root/parent partition is important for two main reasons:

- It controls all hardware devices, such as network, storage, and graphics adapters, and is also responsible for physical memory allocation to the partitions.

- It requests the hypervisor to create and delete partitions (referred to as **child partitions**). This activity is performed by the virtualization stack that runs in the parent partition.

Because the root and parent partitions are one and the same in Windows Server 2008 Hyper-V, all Dell solutions guides for Hyper-V will refer to it as the Parent Partition.

Unlike the parent partition, child partitions do not have access to physical hardware. When a VM is created, the VM is assigned a newly created child partition and a set of virtual devices that do not have direct access to the physical hardware. Instead I/O requests from the VM are routed through the parent partition to the physical adapters on the system.

Figure 1.   Hyper-V High-Level Architecture
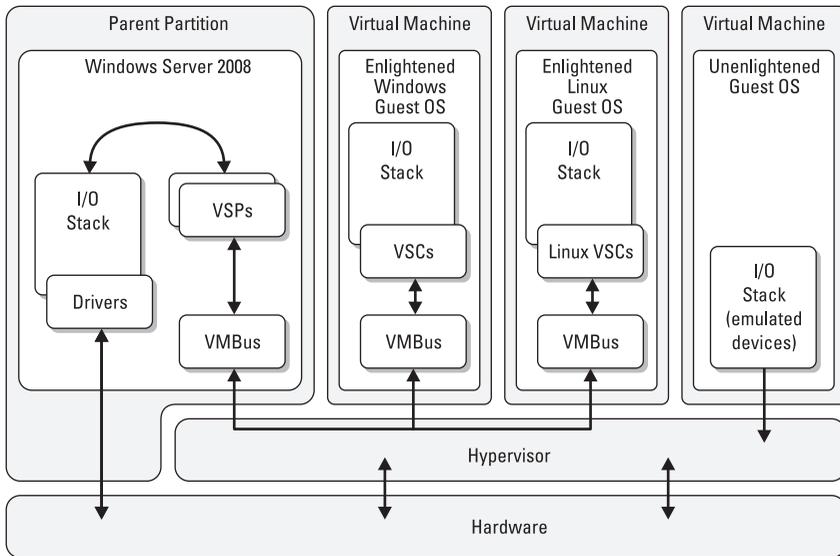
The **indirect I/O** model utilized by Hyper-V allows VMs to be independent of the specific type of hardware devices on the physical server (the device drivers for the specific hardware devices are running in the Windows Server 2008 parent partition). This architecture allows Hyper-V to leverage the broad support in Windows Server 2008 for Dell servers, storage, and I/O devices.

NOTE: It is recommended that you download the latest Dell-certified drivers available for your system at **support.dell.com**, and install the drivers in the parent partition.

Operating systems installed within the virtual machine are commonly referred to as **guest operating systems**. The virtual devices that a VM exposes to a guest operating system can be broadly categorized into two types:

• **Emulated** Virtual Devices
• **Synthetic** Virtual Devices

Emulated virtual devices are a software implementation of a typical PCI-device. To the guest operating system, an emulated device appears as a physical PCI device. **Synthetic virtual devices**, which are also implemented in software, are based on a VSP-VSC architecture unique to Hyper-V and use a

high-performance channel called the VMBUS as the communication mechanism between the different partitions. There is less processor overhead when using synthetic devices than when using emulated devices.

In general, implementations that reduce overhead and improve guest operating systems in virtual environments are referred to as **para-virtualization**, and Microsoft refers to such implementations as **enlightenments**. The synthetic device model is an example of **device enlightenment**. **Kernel enlightenments** are enhancements contained within a guest operating system's kernel that allows it to know it is running in a virtual environment. This subsequently changes the operating system's behavior to reduce the overhead traditionally associated with running an operating system within a VM. Microsoft Windows operating systems that have kernel enlightenments for Hyper-V environments include Windows Server 2008 and Windows Server 2003 R2 SP2.

The primary advantage of emulated devices is that almost all supported guest operating systems have native device driver support for the virtual devices. Current operating systems do not have native support for synthetic devices. The device drivers for synthetic devices are provided by Microsoft as part of the **Integration Services** for Hyper-V. Integration Services are available for all supported guest operating systems and are installed after the guest operating system installation is complete.

Integration Services are meant to provide better integration between child and parent partitions. Along with the drivers for synthetic devices, Integration Services also provides additional enhancements, such as mouse integration, time synchronization, support for VSS-based backup, guest operating system shutdown from the management console, etc. The Integration Services features vary according to the guest operating system.

> **NOTE:** It is recommended that the Integration Services be installed in the VM after installation of the guest operating system is complete. For more information on Integration Services, see "Appendix A: Integration Services in Hyper-V" on page 25.

For a comparison of emulated and synthetic Devices, see Table 1. For more information on the architecture of emulated and synthetic devices, refer to *Hyper-V Architecture* at **technet.microsoft.com**.

Table 1.   Emulated Devices and Synthetic Devices Overview

Emulated Devices	• Emulated devices in Hyper-V VMs include:
	  – Legacy network adapter
	  – IDE controller
	  – COM ports
	
	• All supported guest operating systems have device drivers for emulated devices
	
	• Software emulation of a PCI device
	
	• Emulated devices are required for certain configurations:
	  – IDE controller is required as boot controller for VMs
	  – Legacy network adapter is required for VM PXE boot
	
	• Performance of Emulated devices is lower than Synthetic devices. Performance of certain devices may be improved by installing the Integration Services. For example, the IDE controller will switch to a synthetic mode after the Integration Services are installed

Synthetic Devices	• Synthetic devices in Hyper-V VMs include:
	  – SCSI controller
	  – Network adapter
	
	• Guest operating systems do not have native support for synthetic device drivers. Drivers are installed as part of the Integration Services.
	
	• Leverages the high-performance VSP-VSC shared memory model to provide better performance for guest operating systems

Hyper-V Virtual Machine Components

A VM consists of the following files:

- An XML file that contains the VM configuration information
- A BIN file for storing the VM memory state during suspend/save operations

- A VSV file for storing the VM running state during suspend/save operations
- A VHD file (virtual hard disk)

✍ **NOTE:** For more information on VHDs and other options for VM disks, see the *Dell Storage Solutions Guide for Microsoft Hyper-V* at **www.dell.com/hyper-v**.

Supported Guest Operating Systems

For a list of supported guest operating systems in Hyper-V, see the **Supported Guest OS** list at **www.microsoft.com/hyper-v**.

✍ **NOTE:** Microsoft only provides Integration Components for guest operating systems that are formally supported for Hyper-V.

Supported Hardware

For the latest information on supported hardware for Hyper-V, see the Dell website at **www.dell.com/hyper-v**.

Dell Systems

Table 2.   Supported Dell Systems

System Model	Processor	Socket	Remark
PowerEdge™ M905	AMD	4	
PowerEdge R905	AMD	4	
PowerEdge R900	Intel	4	
PowerEdge 6950	AMD	4	
PowerEdge 6800	Intel	4	Only with select processors[a]
PowerEdge 6850	Intel	4	Only with select processors[a]
PowerEdge M805	AMD	2	
PowerEdge R805	AMD	2	
PowerEdge M600	Intel	2	
PowerEdge M605	AMD	2	
PowerEdge 2970	AMD	2	

System Model	Processor	Socket	Remark
PowerEdge 1950 I/II/III	Intel	2	
PowerEdge 2900 I/II/III	Intel	2	
PowerEdge 2950 I/II/III	Intel	2	
PowerEdge T605	AMD	2	
PowerEdge 1900	Intel	2	
PowerEdge 1955	Intel	2	
PowerEdge SC1435	AMD	2	
PowerEdge R300	Intel	1	Only with Xeon®
PowerEdge T300	Intel	1	Only with Xeon
PowerEdge R200	Intel	1	Only with Xeon
PowerEdge T105	AMD	1	
PowerEdge T100	Intel	1	Only with Xeon
PowerEdge 1430	Intel	1	Only with Xeon
PowerEdge 840	Intel	1	Only with Xeon
PowerEdge 860	Intel	1	Only with Xeon
PowerEdge SC440	Intel	1	Only with Xeon

[a] PowerEdge 6800 and PowerEdge 6850 systems having Intel processors with processor ID F48 support Hyper-V. The Processor ID information is available in **System BIOS Setup**→ **CPU Information**. Press <F2> during boot to access the system **BIOS Setup**.

NOTE: Download the latest BIOS version from the Dell Support website at support.dell.com.

Dell Storage Arrays and Enclosures

Table 3. Supported Dell Storage

Models	Type
Dell EqualLogic™ PS Series	iSCSI Storage Array
Dell	EMC CX4 Series™	Fiber Channel and iSCSI Arrays
Dell	EMC CX3 Series	Fiber Channel and iSCSI Arrays

Models	Type
Dell	EMC CX300/500/700	Fiber Channel Arrays
Dell	EMC AX4-5i/AX4-5F	Fiber Channel and iSCSI Arrays
Dell	EMC AX150/AX150i	Fiber Channel and iSCSI Arrays
Dell PowerVault MD3000i	iSCSI Storage Array
Dell PowerVault™ MD3000	SAS Storage Array
Dell PowerVault MD1000	SAS Storage Enclosure
Dell PowerVault MD1120	SAS Storage Enclosure

For more information on Dell Storage support for Hyper-V, see the *Dell Storage Solutions Guide for Microsoft Hyper-V* at **www.dell.com/hyper-v**.

Dell Network and Storage Adapters

Hyper-V supports all storage and network adapters that are supported by Dell on Windows Server 2008 x64 Editions.

Getting Started With Microsoft Hyper-V

Hardware Requirements for Hyper-V Support on Dell PowerEdge Systems

Processor Requirements for Hyper-V

The following processor features are required to configure Hyper-V:

- x64 compatibility
- Data Execution Prevention (DEP) support

    NOTE: By default, DEP is enabled on Dell systems. It may be referred to as **Execute Disable** in the BIOS setup of certain PowerEdge servers.

- Hardware-assisted virtualization (Intel VT or AMD-V)

Enabling Hardware-Assisted Virtualization

✐ **NOTE:** By default, hardware-assisted virtualization is enabled on the Dell PowerEdge T105.

1 Press <F2> in the **POST** screen to go to the BIOS setup.

2 Navigate to the **CPU Information** section.

3 Press <Enter> and navigate to **Virtualization Technology**.

4 Select **Enabled** by toggling the left and right arrow keys.

5 Save the selection and exit the BIOS setup.

Upgrading to Hyper-V RTM

The RTM version of Windows Server 2008 x64 Editions only has a Beta version of Hyper-V. It is required to upgrade the Hyper-V Beta version to the Hyper-V RTM version. Download and install the Hyper-V RTM bits from the *Microsoft KB article KB950050* at **support.microsoft.com**.

✐ **NOTE:** Dell PowerEdge servers that were factory installed with Windows Server 2008 x64 Editions since August 20th 2008 already have the Hyper-V RTM update pre-applied.

✐ **NOTE:** Hyper-V support on systems with larger than 16 logical processors requires an update to be applied on the system. For more information, refer to KB956710 at download.microsoft.com.

Enabling the Hyper-V Role

Windows Server 2008 x64 (Full Installation)

1 Ensure that the required hardware features are enabled in the system BIOS.

2 Log on to the Windows Server 2008 x64 edition operating system using an account with administrator privileges.

3 Click **Start→Administrative Tools→Server Manager**.

4 Click **Add Roles**.

The **Add Roles Wizard** appears.

5 Select **Hyper-V**, and then click **Next**.

The **Create Virtual Networks** page appears.

6 Do not select a network adapter.

The **Hyper-V Role Wizard** recommends that a network adapter be chosen at this step. However, the name of the virtual network created at this time cannot be changed later and hence will not allow you to configure your system as per Dell's best practices for Hyper-V. For more information, refer to the *Dell Networking Solutions Guide for Microsoft Hyper-V* at **www.dell.com/hyper-v**.

7 Follow the instructions on the screen to complete the role installation.

A Hyper-V Manager MMC console may be used either locally or remotely to manage the virtual environment on this system.

Managing Hyper-V

A Windows Server 2008 system with Hyper-V enabled can be managed either locally or remotely using **Hyper-V Manager** console.

Hyper-V Manager Console

The Hyper-V Manager console provides basic management capabilities for a Hyper-V environment. Capabilities include:

- Creating and managing virtual machines, virtual networks, and virtual hard disks
- Export/Import of virtual machines
- Snapshot of virtual machines

✎ **NOTE:** VM snapshots are not equivalent to backing up a virtual machine. The snapshot capability available in the Hyper-V Manager is meant to take point-in-time state of a virtual machine and is primarily meant for test and development scenarios when a VM's state may need to be rolled back to a previous state.

A single **Hyper-V Manager** instance can connect to multiple Hyper-V hosts. However, each host and the virtual machines on each host are managed independent of the other hosts. For managing Hyper-V Cluster environments, the **Failover Cluster** console is required.

The **Hyper-V Manager MMC** console is available locally (under Administrative Tools) when the Hyper-V Role is enabled. The **Hyper-V Manager MMC** console is also available for install as a standalone management console on Windows Server 2008 x86 Editions and Windows Vista to enable remote management of a Hyper-V host.

Setting up the standalone **Hyper-V Manager** console on Windows Server 2008:

1 Install the KB950050 Hyper-V update for Windows Server 2008. This update has to be applied even on the system that is only running the **Hyper-V Manager** console.

2 On the remote Windows Server 2008 system (32-bit or x64), open **Server Manager** (servermanager.msc), and click on **Add Features Wizard.**

3 Under **Select Features→Role Administration Tools**, select **Hyper-V Tools**.

4 Proceed with the installation of the feature.

5 After installation is complete, the **Hyper-V Manager MMC** console is available under **Administrative Tools**.

Setting up the standalone **Hyper-V Manager** console on Windows Vista:

1 To install the **Hyper-V Manager MMC** console on Vista, download the appropriate 32-bit or x64 bits for KB952627.

2 After this **Hyper-V Manager** is installed, launch an MMC console (**Start →Run** and type MMC) and then choose to add the **Hyper-V Manager** snap-in to the MMC console.

> ![note icon] **NOTE:** It is also recommended to install the Remote Server Administration Tools (RSAT) for Windows Vista to enable the management of the other server components such as Computer Management, Windows Firewall, etc. RSAT is available for download from the Microsoft website. Separate packages are available for x86 and x64 versions for Vista.

Hyper-V on Windows Server 2008 Server Core

This section provides guidance on enabling the Hyper-V Role on Server Core and configuring the Server Core system to be remotely managed using the **Hyper-V Manager MMC** console.

Enabling the Hyper-V Role

1 Ensure that the required hardware features are enabled in the system BIOS.

2 Log on to the Windows Server 2008 x64 Server Core operating system using an account with administrator privileges.

3 Make sure that Hyper-V RTM bits (KB950050 from **support.microsoft.com**) are downloaded to the Server Core system.

   Run the command `wusa.exe Windows6.0-KB950050-x64.msu /quiet` at the command prompt to install the Hyper-V RTM update.

   When prompted, reboot the system.

   > *NOTE:* Hyper-V support on systems with larger than 16 logical processors requires an update to be applied on the system. For more information, refer to KB956710 at **download.microsoft.com**.

4 To enable the Hyper-V Role, run the command start `/w ocsetup Microsoft-Hyper-V` at the command prompt.

5 When prompted, restart the system.

   On reboot, the Hyper-V Role installation is complete.

Enabling Server Core for Remote Management

After a new installation of Server Core, certain actions are required before a server is ready to be managed remotely. The recommended actions include:

Renaming the Server

1 At the command prompt, type `netdom renamecomputer %computername% /newname:<new_computername>`

2 At the command prompt, type `shutdown /r /t 0`

Configuring Network Settings

Configure the network settings as required for the configuration:

1 To set the static IP address

   ```
   netsh interface ip set address "<adapter name>"
   static <IP address> mask=<subnet mask> gateway=
   <gateway>
   ```

2 To rename network adapter names

```
netsh interface set interface name="<adapter
name>" newname="<new name>"
```

Joining the Server to a Domain

1 At the command prompt, type netdom join %computername%
/domain:<domain> /userd:<username> /password:*

2 At the command prompt, type shutdown /r /t 0

Before the Server Core system can be managed remotely, certain default security settings have to be changed. Refer to *Server Core Installation Option of Windows Server 2008 Step-By-Step Guide* at **http://technet.microsoft.com** for specific information on changing firewall setting for the following commonly required management tools:

- Enabling Remote Desktop access
- Enabling Remote Administration
- Enabling Remote Computer Management
- Remote Windows Firewall
- Enabling Remote Device Management

Planning a Hyper-V Deployment

A Hyper-V deployment requires very careful planning to ensure that the deployment can meet the current goals and can scale for future growth. This section discusses a few of the important aspects involved in ensuring a successful deployment.

Hardware Sizing for Hyper-V Hosts

The *Hyper-V Planning and Deployment Guide* available for download from **www.microsoft.com** provides a very good overview of the capabilities of Hyper-V and also provides generic deployment considerations. The sections below highlight the additional important considerations.

Prior to moving workloads from a physical to a virtual environment, it is strongly recommended that the behavior of the workloads on the existing physical servers be evaluated over a period of time. The behavior of the workloads has to be tracking across a typical utilization cycle to obtain the

peak, average, and low utilization metrics. The information from this virtualization assessment effort will assist in sizing the virtual machines. Dell offers consulting services to assist with these efforts.

For a list of Dell PowerEdge servers that are recommended by Dell for hosting virtualization workloads, go to **www.dell.com/servers**.

Processor Considerations

Hyper-V is currently supported on systems with up to 24 logical processors. With multi-core processors, choosing physical processors depends on many factors including the type of workload, number of sockets on the Dell PowerEdge server, CPU utilization goals, and power consumption requirements.

NOTE: Hyper-V support on systems with larger than 16 logical processors requires an update to be applied on the system. For more information, refer to KB956710 at download.microsoft.com.

The number of virtual processors to be assigned to a specific virtual machine depends on the requirements of the workload that runs on the guest operating system. Windows Server 2008 Hyper-V allows up to 4 virtual processors to be assigned to a specific VM (support varies for different guest operating systems). In Hyper-V, virtual processors in VMs do not have a one-to-one mapping with the logical processors on the server. The Hyper-V hypervisor handles the scheduling of virtual processors on any available logical processors. The general guidance is that when the virtual workload is highly processor intensive, using multiple virtual processors in a VM might be effective since more physical processors will be used. Since use of multiple virtual processors also adds additional overhead, careful planning is required in determining the virtual processor allocation to VMs.

For more in-depth information, refer to the *Performance Tuning Guidelines for Windows Server 2008* document at **http://www.microsoft.com**.

As mentioned earlier, Hyper-V has the following requirements for the physical processors:

- Support for x64 extensions
- Support for DEP
- Support for Virtualization Extensions (Intel VT or AMD V)

NOTE: All the current (as of September 2008) shipping Dual-socket and Quad-socket Dell PowerEdge servers meet all of the above processor requirements.

If the Hyper-V hosts will be part of a Hyper-V Host Cluster configuration, Dell strongly recommends that all the processors on all the Hyper-V hosts that are part of that configuration be identical. If not, there is a possibility that migrations of virtual machines between Hyper-V hosts will be unsuccessful. For more information, refer to the *Dell High Availability Solutions Guide for Microsoft Hyper-V*.

Based on the engineering evaluations, Dell recommends that dual-socket or quad-socket based PowerEdge servers for all virtualization workloads. Dell provides customers with the choice of many multi-core processors for use on PowerEdge servers.

Memory Considerations

Virtualization workloads are memory intensive. This is especially true when one of the goals for the virtualization deployment is consolidation. The amount of memory allocated to a specific virtual machine is dependent on the workload running on the guest operating system. In a physical to virtual migration deployment, the information obtained from the aforementioned virtualization assessment will provide very useful information on sizing the memory for the virtual machines. It should be noted that a guest operating system only has access to the amount of memory that has been allocated to that virtual machine. In Windows Server 2008 Hyper-V, changing the memory configuration requires the virtual machine to be powered-off.

Once the amount of memory for the virtual machines is known, the memory requirements for the physical server can be determined. It is strongly recommended that when the Hyper-V role is configured, no other roles be enabled in the parent partition. However, the parent partition should have sufficient memory to provide management capabilities and virtual device functionality for child partitions as well as for managing the physical devices on the server.

The general guidance on the amount of physical memory is the total of the following:

- For the parent partition: 2GB of physical memory is recommended
- For each child partition: Amount of physical memory allocated to each VM + 32MB memory overhead for the first 1GB of memory allocated to the VM + 8MB memory overhead for each additional 1GB of memory allocated to a VM

If additional virtual machines may possibly migrate (either planned or unplanned) to the server, then memory (per the sizing guidance above) should be reserved for those virtual machines. Failure to do so may result in virtual machines being unable to start on the server or degraded performance for all virtual machines on the server.

For additional information, refer to the *Performance Tuning Guidelines for Windows Server 2008* document at **http://www.microsoft.com**.

Networking Considerations

Refer to the *Dell Network Solutions Guide for Microsoft Hyper-V* for information on sizing the network requirements for a Hyper-V deployment. It provides guidance on the number of network adapters required and recommended for various configurations including Failover Clustering and iSCSI storage.

Storage Considerations

Refer to the *Dell Storage Solutions Guide for Microsoft Hyper-V* for recommendations on storage sizing for all virtual machine files including VHDs and Passthrough disks. It also provides guidance on choosing the right kind of virtual storage disk as well as the appropriate back-end storage enclosure or storage arrays.

Components of a Hyper-V Solution

An actual Hyper-V deployment involves multiple servers, shared storage, and networking components. Careful consideration is essential in ensuring that the configuration provides the best performance for the virtual machine workloads.

Figure 2.   Sample Dell Hyper-V Deployment
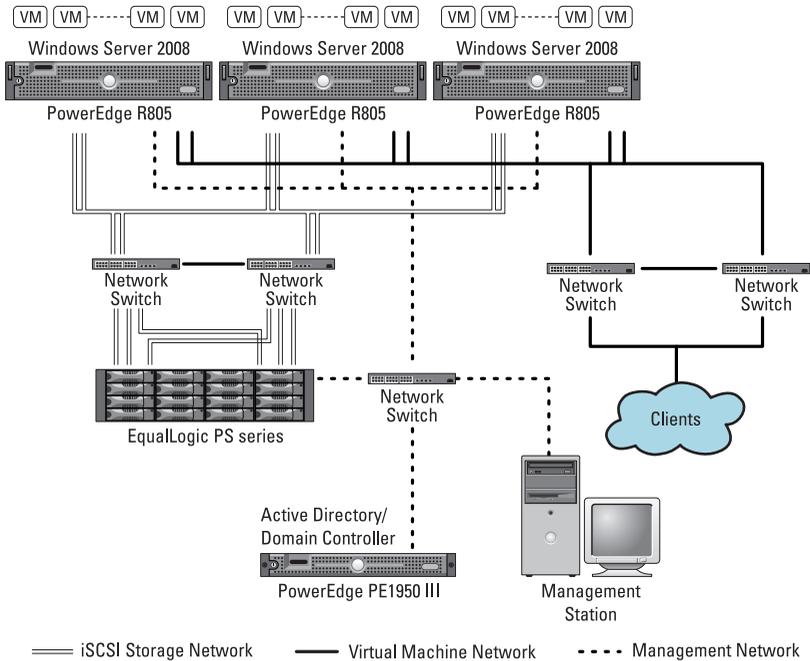
Figure 2 shows a typical Dell solution that encompasses the following components:

- **Windows Server 2008 Hyper-V**: Dell PowerEdge servers running Windows Server 2008 Hyper-V. The latest generation Dell PowerEdge servers such as the PowerEdge R905 referenced above were specifically designed to support virtualized workloads such as Hyper-V. For a full list of Dell PowerEdge servers recommended for virtualization, go to **www.dell.com/servers**. It is strongly recommended to install Dell OpenManage Server Administrator (OMSA) systems management software within the parent partition on each of the physical Dell PowerEdge servers

- **Virtual machine storage**: To employ such features as Virtual Machine Quick Migration and Virtual Machine High Availability, VMs have to be storage be stored on external storage arrays such as the Dell EqualLogic PS5500 series shown above. Dell supports a wide array of storage options including the Dell PowerVault, Dell EqualLogic, and Dell EMC arrays

- **Infrastructure Support**: A typical deployment will also require server to host key infrastructure roles such as Microsoft Active Directory, DNS, DHCP, and Windows Deployment Server.

- **Remote Management Station**: A management station is essential is be able to effectively manage the virtualized infrastructure. Because the management station is mostly only running the client software that will communicate with the server components, the management station can be a Dell client platform such as a laptop or workstation. The typical management clients will include:

  - Hyper-V Manager MMC (or other enterprise-class virtualization management solution)

  - Dell IT Assistant (1-many manager for servers running OMSA)

  - Failover Cluster Management Console

  - Storage management client software (e.g. Modular Disk Storage Manager, EMC Navisphere Manager, EqualLogic Group Manager)

Networking Best Practices

The Hyper-V virtualization technology is enabled from within the Windows kernel, which greatly improves performance and increases integration of the virtualization layer (hypervisor) with other Windows components. The changes to networking is probably the most significant and requires the most understanding before you begin your Hyper-V deployment.

For best practice information on network configurations on Dell servers hosting Hyper-V environments, see the *Dell Networking Solutions Guide for Microsoft Hyper-V* at **www.dell.com/hyper-v**.

Storage Best Practices

Many virtualization features such as Quick Migration, High Availability, and Failover Clustering are dependent on the existence of shared storage among the servers in the virtualized environment. Decisions about how to design and configure storage software and storage hardware affect the performance of virtual machines.

For an overview of the storage options available in Hyper-V and Dell-supported solutions, see the *Dell Storage Solutions Guide for Microsoft Hyper-V* at **www.dell.com/hyper-v**.

Clustering Best Practices

High Availability in Hyper-V is achieved by leveraging the clustering capability in Windows operating systems. Failover Clustering reduces the possibility of any single point of failure in your virtualization environment causing your workloads to become unavailable.

For information on implementing High Availability with Hyper-V and best practices for configuring High Availability on Dell hardware, see the *Dell High Availability Solutions Guide for Microsoft Hyper-V* at **www.dell.com/hyper-v**.

Dell Virtualization Advisor Tool for Hyper-V

In addition to the guidance provided in the solution guides, Dell has developed a **Virtualization Advisor** tool that provides general guidance for hardware configurations for Hyper-V deployments. This online tool recommends a virtual infrastructure based either on new workload requirements or based on the existing physical environment for consolidation scenarios. The tool is meant for customers that have a familiarity with virtualization and the input provided into the tool is utilized to determine server, storage, and networking requirements for the virtualized solution. The output of the advisor tool is a customized list of Dell supported hardware to meet those requirements. The virtualization advisor tool is available at **http://www.dell.com/hyper-v**.

Appendix A: Integration Services in Hyper-V

As mentioned in the introductory section of this solutions guide, Integration Services are meant to provide better integration between child and parent partitions. The components available with the Integration Services enable the following:

- Installs device drivers for Synthetic devices (SCSI controller, Network Controller)
- Installs Fastpath filter driver that allows the emulated IDE controller to switch to synthetic mode
- Installs mouse integration drivers
- Enables time synchronization between child and parent
- Enables the VSS-based backup of virtual machines to be initiated from the parent partition
- Enables guest OS shutdown to be initiated from the virtualization management consoles

It is strongly recommended that Integration Services be installed on all Hyper-V virtual machines to get the best performance and enhanced feature functionality. Microsoft makes available Integration Services for all supported guest operating systems. It is packaged into a CD image and can be installed on guest operating systems by mounting the CD ISO image on the virtual machine. When using the **Virtual Machine Connection** window to connect to a virtual machine, this can be done via **Action→Insert Integration Services Setup Disk** on the Windows guest operating system.

NOTE: The scope of functionality enabled by Integration Services is operating system specific. For example, the Integration Components for certain guest operating systems such as Windows XP Professional SP2 and earlier do not have support for Synthetic SCSI devices. Refer to Microsoft documentation at **www.microsoft.com/hyper-v** for scope of support for the guest operating systems.

The Integration Components for supported Linux operating systems are currently available from the **http://connect.microsoft.com** website under the Linux Integration Services for Hyper-V Connection Program. For the latest information on integration services, refer to **www.microsoft.com/hyper-v**.

Appendix B: Installing Windows Server 2008 on Virtual Machines

A Dell PowerEdge server that was purchased with a factory installation of Windows Server 2008 will include a Dell customized Windows Server 2008 re-installation DVD media. During a re-installation of the operating system using this Dell DVD media on that specific Dell PowerEdge server, the installation wizard does not prompt for a license key. However, when the same DVD media is used to install a guest operating system, the installation wizard will prompt for a license key. For information on obtaining a license key for virtual environments, refer to the *Windows Server 2008 - Installation on Virtual Machines* document at **www.dell.com/windowsserver2008**.

Appendix C: Known Issues and Resolutions

For information about current known issues, see
http://support.dell.com/support/edocs/software/ws2k8/en/Hyper-V/IIG.pdf.

Appendix D: 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 Hyper-V*
  - *Dell Networking Solutions Guide for Hyper-V*
  - *Dell Storage Solutions Guide for Hyper-V*
  - *Dell Virtualization Reference Architecture for Hyper-V*
- *Hyper-V Getting Started Guide* at **technet.microsoft.com**
- *Hyper-V Planning and Deployment Guide* at **download.microsoft.com**
- *Getting Started with Microsoft Hyper-V* at **download.microsoft.com**
- *Server Core Installation Option of Windows Server 2008 Step-By-Step Guide* at **technet.microsoft.com**
- *Performance Tuning Guidelines for Windows Server 2008* at **http://www.microsoft.com**