



# GETTING STARTED WITH MICROSOFT WINDOWS SERVER 2008 HYPER-V ON DELL SERVERS

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Microsoft® Hyper-V™ technology provides a simplified virtualization platform integrated directly into the Microsoft Windows Server® 2008 OS. This article provides an introduction to Hyper-V virtualization, discusses the overall architecture and underlying technologies, and offers guidance on best practices for deployment on Dell™ PowerEdge™ servers.

**M**icrosoft Hyper-V is a hypervisor-based virtualization technology integrated into all Dell-supported Microsoft Windows Server 2008 x64 Editions operating systems. As a virtualization platform, it enables organizations to run multiple virtual machines (VMs) on a single physical server to help take maximum advantage of hardware resources in their IT environments.

Windows Server 2008 introduced the concept of *roles* within the Windows Server OS. A single server OS instance is typically meant for a specific task, and a role defines the task the server performs: roles available in Windows Server 2008 include file server, Active Directory® server, Dynamic Host Configuration Protocol (DHCP) server, Domain Name System (DNS) server, and Internet Information Services (IIS) server. Hyper-V is also implemented as a role in Windows Server 2008, and offers several key advantages:

- Integration with the Windows Server 2008 OS, enabling organizations to easily take advantage of the benefits of virtualization in Windows Server environments without adopting a new technology
- A 64-bit micro-kernelized hypervisor architecture that leverages the existing device driver support in the Windows Server 2008 parent partition, extending support to a broad array of Dell servers, storage, and I/O devices

- Support for the Dell OpenManage™ suite in the Windows Server 2008 parent partition, helping simplify management of Dell servers
- Support for symmetric multiprocessing in VMs
- A high-availability feature for VMs to help minimize unplanned downtime, and a quick migration feature for VMs to help support business continuity during planned downtime
- Robust backup capabilities through native support for Microsoft Volume Shadow Copy Service (VSS)-based backups
- Simplified extensibility using standards-based Windows Management Instrumentation (WMI) and application programming interfaces

This article explores the basics of the Hyper-V architecture, discusses available management tools and their use, and outlines key considerations and best practices that can help administrators successfully plan and implement Hyper-V virtualization deployments on Dell servers and storage.

## UNDERSTANDING THE HYPER-V ARCHITECTURE

The Hyper-V role is supported in both full and Server Core installations of Windows Server 2008 Standard x64 Edition, Enterprise x64 Edition, and Datacenter x64 Edition. Administrators should keep in mind that

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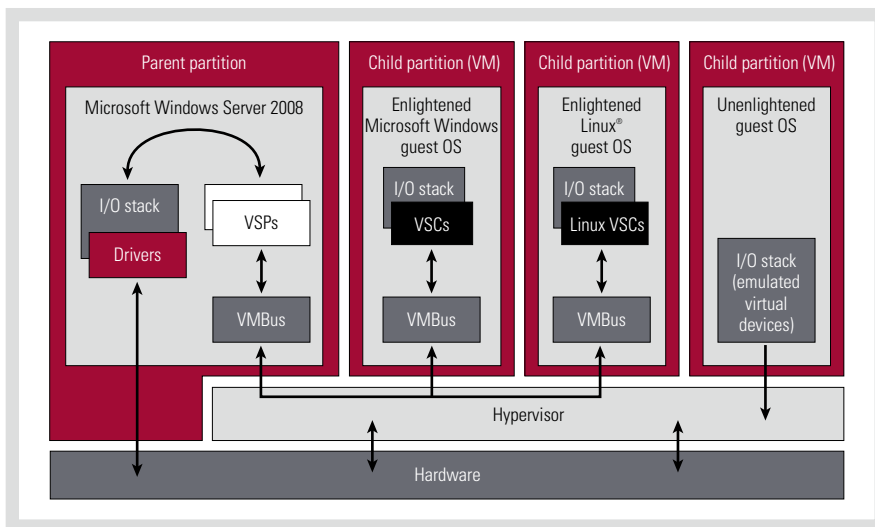


Figure 1. High-level Microsoft Hyper-V architecture

Windows Server 2008 Standard x64 Edition does not offer high-availability features; for highly available configurations with Hyper-V, they should use Windows Server 2008 Enterprise x64 Edition or Datacenter x64 Edition.<sup>1</sup> Dell supports Hyper-V on many servers, including the latest PowerEdge R805, PowerEdge R900, PowerEdge R905, PowerEdge M600, PowerEdge M605, PowerEdge M805, and PowerEdge M905 servers, which have been specifically designed to support virtualization workloads, as well as a broad range of previous-generation servers.<sup>2</sup>

The core component of the Hyper-V architecture is the hypervisor, which creates and manages isolated execution environments called partitions. The hypervisor sits directly on the hardware and controls access from the partitions to the physical processors. The Hyper-V server role in Windows Server 2008 also comprises several other key components, including parent and child partitions, synthetic and emulated devices, and integration services (see Figure 1).

### Parent and child partitions

When the Hyper-V role is enabled, the hypervisor uses the virtualization extensions

in the processors—Intel® Virtualization Technology (Intel VT) or AMD Virtualization™ (AMD-V™) technology—to place itself under the OS. When the hypervisor loads for the first time, it creates a partition called the parent partition (or root partition), which hosts the Windows Server 2008 instance that had previously been running directly on the hardware. This partition is important for two main reasons. First, it controls hardware devices such as the network, storage, and graphics adapters and allocates physical memory to other partitions. Second, it makes requests to the hypervisor to create and delete child partitions, an

activity performed by the virtualization stack that runs in the parent partition.

Child partitions, unlike the parent partition, do not have access to the physical hardware. When a VM is created, it is assigned a newly created child partition and a set of virtual devices. I/O from the VM is routed through the parent partition to the physical hardware. This indirect I/O model enables VMs to be independent of the specific hardware devices on the physical server, and enables Hyper-V to take advantage of the broad support in Windows Server 2008 for Dell servers, storage, and I/O devices. Best practices strongly recommend downloading and installing the latest Dell-certified drivers for Windows Server 2008 x64 Editions in the parent partition. These drivers are available for download at [support.dell.com](http://support.dell.com).

### Emulated and synthetic virtual devices

The virtual devices that a VM exposes to its guest OS fall into two broad types: emulated and synthetic (see Figure 2). Emulated virtual devices are software implementations of typical PCI devices, and to the guest OS, these devices appear to be physical PCI devices. Synthetic virtual devices, which are also implemented in software, use an architecture specific to Hyper-V based on

<b>Emulated devices</b>	<ul style="list-style-type: none"> <li>Can include IDE controllers, legacy network adapters, and COM ports</li> <li>Take advantage of native device drivers in supported guest operating systems</li> <li>Typically provide lower performance than synthetic devices; however, certain emulated devices such as IDE controllers can switch to synthetic mode after Hyper-V integration services have been installed, which helps increase performance</li> <li>Are required for certain configurations; for example, an IDE controller is required as a boot controller for VMs, and a legacy network adapter is required for VM Preboot Execution Environment (PXE) boot</li> </ul>
<b>Synthetic devices</b>	<ul style="list-style-type: none"> <li>Can include SCSI controllers and network adapters</li> <li>Do not have native device drivers in guest operating systems; drivers are instead installed as part of Hyper-V integration services</li> <li>Use the high-performance VSP/VSC shared memory model, helping provide higher performance than emulated devices</li> </ul>

Figure 2. Emulated and synthetic virtual devices in Microsoft Hyper-V

<sup>1</sup> For more information on high-availability features in Hyper-V, see "Highly Available Virtualization with Microsoft Hyper-V and SCVMM 2008," by Ray Weinstein and Burk Buechler, in Dell Power Solutions, November 2008, [DELL.COM/Downloads/Global/Power/ps4q08-20080452-Buechler.pdf](http://DELL.COM/Downloads/Global/Power/ps4q08-20080452-Buechler.pdf).

<sup>2</sup> For a list of supported hardware for Hyper-V, see "Dell Solutions Overview Guide for Microsoft Hyper-V," by Dell Inc., September 2008, available at [support.dell.com/support/edocs/software/hyperv](http://support.dell.com/support/edocs/software/hyperv). For a list of recommended hardware for Hyper-V, see "Dell | Microsoft Windows Server 2008 Hyper-V Reference Architecture," by Dell Inc., September 2008, [DELL.COM/Downloads/Global/Solutions/dell\\_hyper-v\\_reference\\_architecture\\_v1.0.pdf](http://DELL.COM/Downloads/Global/Solutions/dell_hyper-v_reference_architecture_v1.0.pdf).

virtualization service providers (VSPs) and virtualization service clients (VSCs), and utilize a high-performance VMBus channel as the communication mechanism between the different partitions. This approach means that synthetic devices require less overhead than emulated devices.<sup>3</sup>

In general, this type of implementation that helps reduce overhead and enhance guest OS performance in virtualized environments is referred to as paravirtualization; Microsoft uses the term *enlightenment*. The synthetic device model is an example of *device enlightenment*. Hyper-V can also incorporate *kernel enlightenments*, which enhance a guest OS kernel so that it is aware of whether it is running in a virtualized environment, and can change its behavior to help reduce the overhead traditionally associated with running an OS within a VM. Microsoft Windows® operating systems that incorporate kernel enlightenments for Hyper-V environments include Windows Server 2008 and Windows Server 2003 with Service Pack 2.

### Integration services

One of the primary advantages of emulated virtual devices is that all supported guest operating systems include native device driver support for these devices. This is not the case with synthetic virtual devices, however: Microsoft provides device drivers for synthetic devices in all supported guest operating systems, and administrators must install these drivers in each VM after the guest OS installation is complete. Microsoft delivers these device drivers through Hyper-V integration services.

Hyper-V integration services are designed to enhance integration between parent and child partitions. In addition to the device drivers for synthetic devices, these services also provide enhancements such as mouse integration, time synchronization, support for VSS-based backups of VMs, and the ability to shut down guest operating systems from the management console. Available features vary depending on the guest OS. Dell strongly recommends that administrators install the integration components within VMs after the guest OS installation is complete.

### MANAGING HYPER-V ENVIRONMENTS

Administrators can use two primary tools to manage Hyper-V environments: the built-in Hyper-V Manager console, which provides basic management capabilities, or Microsoft System Center Virtual Machine Manager (SCVMM) 2008, which provides advanced enterprise-class features.

### Hyper-V Manager

Hyper-V Manager is a Microsoft Management Console (MMC) snap-in that enables administrators to perform basic management tasks in Hyper-V environments, including creating and managing VMs, virtual networks, and virtual hard disks; importing and exporting VMs; and creating snapshots of VMs (see Figure 3). When using Hyper-V Manager to create VM snapshots, administrators should keep in mind that doing so is not equivalent to backing up a VM. The snapshot feature is designed to capture the VM state at a particular point in time, and is intended primarily for test and development use when administrators may need to roll back a VM to a previous state.

A single Hyper-V Manager instance can connect to multiple Hyper-V hosts. However, in this case, each host and the VMs on each host are managed independently of the other hosts. For advanced enterprise-class capabilities, administrators should typically use SCVMM 2008.

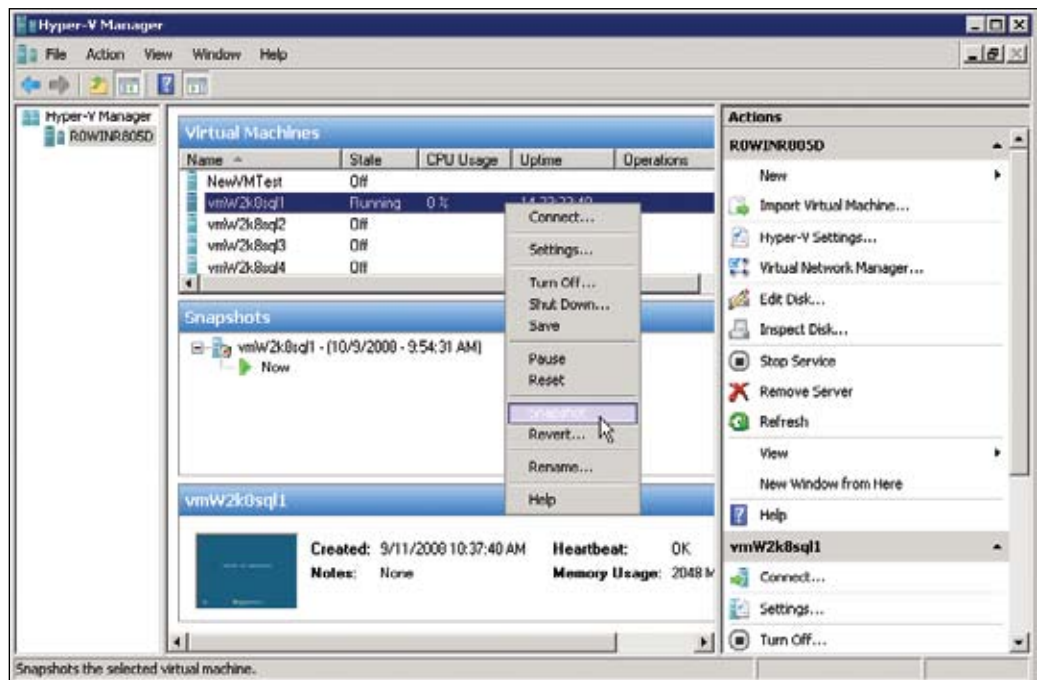


Figure 3. Microsoft Hyper-V Manager console

<sup>3</sup> For more information on emulated and synthetic devices, see "Hyper-V Architecture," by Microsoft Corporation, msdn.microsoft.com/en-us/library/cc768520.aspx.

When the Hyper-V role is enabled, administrators can launch the Hyper-V Manager console locally from Control Panel > Administrative Tools. They can also install it as a stand-alone management console on 32-bit and 64-bit editions of the Windows Server 2008 OS and Windows Vista® OS to enable remote management of Hyper-V hosts that are running either a full or Server Core installation of Windows Server 2008.

### **Microsoft System Center Virtual Machine Manager 2008**

SCVMM 2008 is an enterprise-class management software suite that enables administrators to easily and effectively manage both physical and virtualized environments (including both Microsoft Hyper-V and VMware® ESX platforms) from a single management console, helping to significantly simplify management of the overall IT infrastructure. SCVMM 2008 integrates with the Dell OpenManage suite through Microsoft System Center Operations Manager (SCOM) 2007 to offer proactive management of Hyper-V hosts. SCVMM 2008 includes built-in support for physical-to-virtual and virtual-to-virtual migrations, works with failover clustering to support high-availability and quick migration features for VMs, and provides simplified automation through the Microsoft Windows PowerShell™ command-line shell.

The integration between SCVMM 2008, Dell OpenManage, and SCOM 2007 (or Microsoft System Center Essentials) helps further simplify the management of virtualized environments based on Dell servers and storage. This integration is based on Performance and Resource Optimization (PRO) capabilities that allow information to pass from SCOM 2007 to SCVMM 2008 and actions to be

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driven from SCVMM 2008 on SCOM 2007. Dell plans to provide this capability for a wide variety of scenarios in a PRO Pack in the next version of the Dell Management Pack.<sup>4</sup>

### **PLANNING HYPER-V DEPLOYMENTS**

Hyper-V deployments require careful planning to help ensure that they can both meet current goals and scale for future growth. Key considerations include understanding the hardware utilization behavior of existing applications for consolidation and sizing the processors, memory, network, and storage requirements for the new virtualization solutions.

#### **Hardware**

Microsoft’s “Hyper-V Planning and Deployment Guide”<sup>5</sup> provides an overview of the capabilities of Hyper-V and generic deployment considerations. Before migrating workloads from a physical to a virtualized environment, best practices strongly recommend evaluating workload behavior on the existing physical servers over a period of time. Administrators should track this behavior across a typical utilization cycle to obtain the peak, average, and low utilization metrics; this assessment can then help appropriately size the VMs. Dell Infrastructure Consulting Services also offers workload assessment services to help with these efforts.<sup>6</sup>

#### **Processors**

In environments using multi-core processors, choosing physical processors can depend on many factors, including the type of workload, number of sockets in the server, processor utilization goals, and power consumption requirements. Hyper-V requires 64-bit processors that support Data Execution Prevention (DEP) and virtualization extensions (Intel VT or AMD-V). As of September 2008, all currently shipping two- and four-socket Dell PowerEdge servers meet these requirements. Based on the engineering evaluations, Dell recommends using two- or four-socket PowerEdge servers for all virtualization workloads.

The number of virtual processors to be assigned to a specific VM typically depends on the requirements of the workload running in the guest OS. Windows Server 2008 Hyper-V supports up to four virtual processors per VM, depending on the specific guest OS. Administrators should keep in mind that the virtual processors in VMs do not have a one-to-one mapping with the logical processors in the server. The Hyper-V hypervisor handles the scheduling of virtual processors on available logical processors. In general, when the virtual workload is highly processor intensive, using multiple virtual processors in a VM might help increase performance by enabling additional physical processors to be used; however, using multiple virtual processors can also create additional overhead.<sup>7</sup>

<sup>4</sup> For more information on PRO capabilities, visit [www.microsoft.com/systemcenter/virtualmachinemanager/en/us/whats-new.aspx](http://www.microsoft.com/systemcenter/virtualmachinemanager/en/us/whats-new.aspx).

<sup>5</sup> Available at [www.microsoft.com/downloads/details.aspx?FamilyID=5DA4058E-72CC-4B8D-BBB1-5E16A136EF42](http://www.microsoft.com/downloads/details.aspx?FamilyID=5DA4058E-72CC-4B8D-BBB1-5E16A136EF42).

<sup>6</sup> For more information, see the Dell Services offerings at [DELL.COM/Hyper-V](http://DELL.COM/Hyper-V).

<sup>7</sup> For more information, see the “Performance Tuning for Virtualization Servers” section in “Performance Tuning Guidelines for Windows Server 2008,” by Microsoft Corporation, June 9, 2008, [www.microsoft.com/whdc/system/sysperf/perf\\_tun\\_srv.msp](http://www.microsoft.com/whdc/system/sysperf/perf_tun_srv.msp).

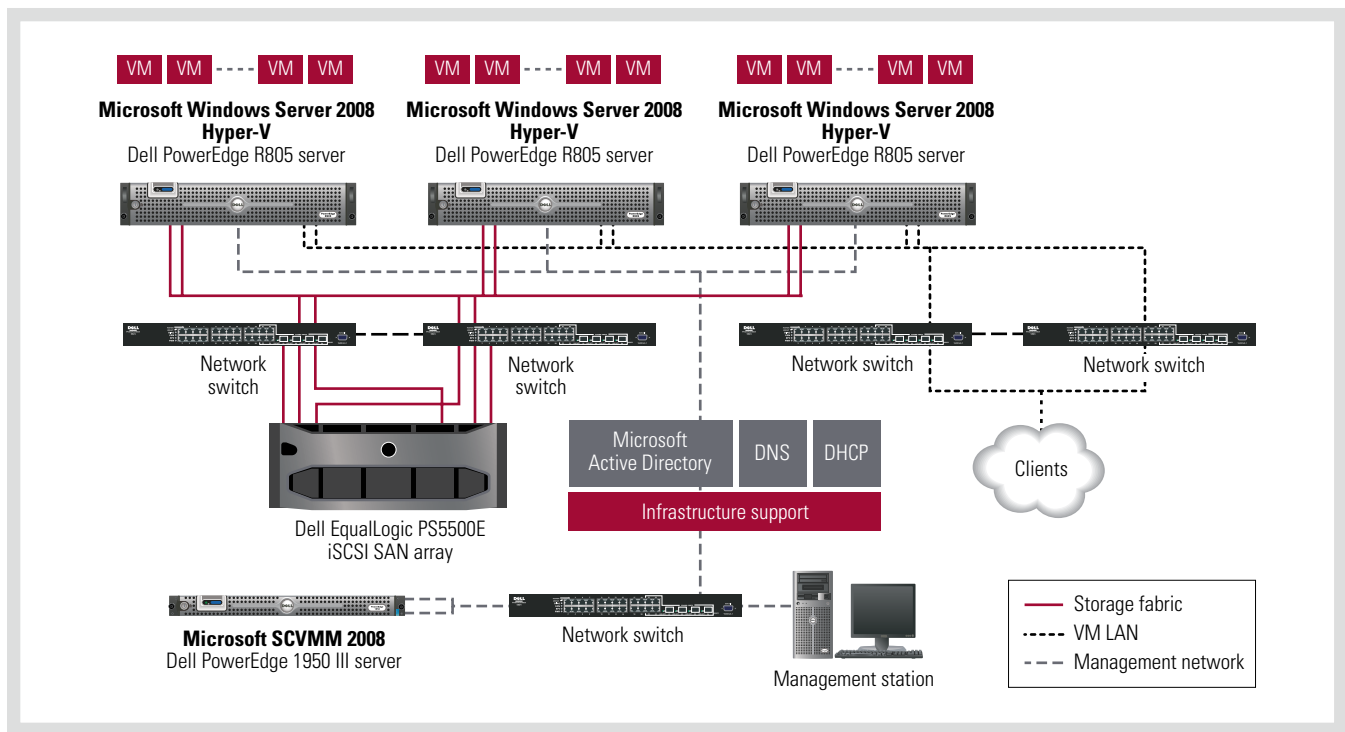


Figure 4. Example Microsoft Hyper-V deployment using Dell servers, storage, and switches

If the Hyper-V hosts will be part of a Hyper-V host cluster configuration, Dell strongly recommends that all processors on all Hyper-V hosts in the cluster be identical. If they are not identical, VM migrations between Hyper-V hosts may be unsuccessful.<sup>8</sup>

### Memory

Virtualization workloads are memory intensive—especially when one of the goals of the virtualization deployment is consolidation. The amount of memory allocated to a specific VM depends on the workload running on the guest OS. For a physical-to-virtual migration, the information obtained from the workload assessment can provide useful information on sizing VM memory. Administrators should keep in mind that a guest OS only has access to the amount of memory that has been allocated to the VM. In Windows Server 2008 Hyper-V, changing the memory configuration of a VM requires powering it down.

After administrators have determined the amount of memory to allocate to the VMs, they can then determine the memory requirements for the physical server. Best practices strongly recommend that when administrators configure the Hyper-V server role, they should not enable any other roles in the parent partition. However, the parent partition should have sufficient memory to provide management capabilities and virtual device functionality for child partitions and to manage the physical devices on the server. In general, the amount of physical memory should be the total of the following:

- **Parent partition:** 2 GB of physical memory
- **Each child partition:** Amount of physical memory allocated to each VM, plus 32 MB of overhead for the first 1 GB of memory allocated to the VM, plus 8 MB of overhead for each additional 1 GB of memory allocated to the VM

If additional VMs may possibly migrate to the server, memory should be reserved for those VMs as well.

### Networking and storage

Administrators must consider several factors when designing the network configuration and choosing the storage hardware for a Hyper-V deployment. For example, the requirements change significantly depending on whether the deployment is a highly available environment (as recommended by Dell) or a stand-alone virtualized environment. For a list of supported storage arrays and in-depth information on planning network and storage deployments, see the Dell solutions guides for Hyper-V available at [support.dell.com/support/edocs/software/hyperv](http://support.dell.com/support/edocs/software/hyperv).

### Example deployment

An actual Hyper-V deployment involves multiple servers, shared storage, and networking components; careful consideration is essential to help ensure that


<sup>8</sup> For more information, see "Dell High Availability Solutions Guide for Microsoft Hyper-V," by Dell Inc., September 2008, available at [support.dell.com/support/edocs/software/hyperv](http://support.dell.com/support/edocs/software/hyperv).

the configuration provides the highest level of performance for VM workloads. Figure 4 shows an example Dell Hyper-V deployment. This type of deployment would include several key components:

- **Windows Server 2008 Hyper-V:** Tenth-generation Dell PowerEdge servers are specifically designed to support virtualization platforms like Hyper-V. Dell strongly recommends installing Dell OpenManage Server Administrator (OMSA) systems management software in the parent partition of each PowerEdge server.
- **VM storage:** To support Hyper-V high-availability and quick migration features for VMs, the VMs must be stored on external storage such as the Dell EqualLogic™ 5500E Internet SCSI (iSCSI) storage area network (SAN) array shown in Figure 4. Dell supports a wide array of storage options in Hyper-V environments, including Dell PowerVault™, Dell EqualLogic, and Dell/EMC arrays.<sup>9</sup>
- **SCVMM 2008:** Administrators can configure SCVMM 2008 in multiple ways depending on the implementation requirements. A basic configuration would run SCVMM 2008 on a stand-alone PowerEdge server using local disks as storage. Attaching a storage enclosure to the stand-alone server hosting SCVMM 2008 is recommended if the deployment requires a relatively large library server. The library server is a capability built into SCVMM 2008 for storing .vhd templates, inactive VM files, ISO images, and so on.
- **Infrastructure support:** Typical deployments require a server to host key infrastructure roles such as Active Directory Domain Services, DNS, and DHCP. A Windows-based domain controller is required for SCVMM 2008 to support its key capabilities.
- **Management station:** A management station is essential to help administrators

effectively manage the virtualized infrastructure. Because the management station primarily runs client software that communicates with the server components, the management station can be a Dell client platform such as a Dell Latitude™ laptop or Dell Precision™ workstation. Typical management stations include the Hyper-V Manager MMC console, the SCVMM 2008 Administration Console, and Dell OpenManage IT Assistant, which provides one-to-many management for PowerEdge servers running OMSA.

### DEPLOYING SIMPLE, POWERFUL VIRTUALIZATION

Microsoft Hyper-V technology is designed to provide a simple yet powerful virtualization platform integrated directly into the Windows Server 2008 OS. By taking advantage of architectural enhancements, using appropriate management tools, and following Dell best practices for planning and implementing Hyper-V on Dell server and storage hardware, administrators can help ensure successful Hyper-V deployments in their environments. 

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#### QUICK LINKS

**Dell and Microsoft Hyper-V:**  
[DELL.COM/Hyper-V](http://DELL.COM/Hyper-V)

**Dell solutions guides for Microsoft Hyper-V:**  
[support.dell.com/support/edocs/software/hyperv](http://support.dell.com/support/edocs/software/hyperv)

**Dell Virtualization Advisor tool:**  
[advisors.dell.com/advisorweb/advisor.aspx?advisor=c82c3ec8-c94f-4602-9a41-c20382db1cd0](http://advisors.dell.com/advisorweb/advisor.aspx?advisor=c82c3ec8-c94f-4602-9a41-c20382db1cd0)

<sup>9</sup> For more information, see "Dell Storage Solutions Guide for Microsoft Hyper-V," by Dell Inc., September 2008, available at [support.dell.com/support/edocs/software/hyperv](http://support.dell.com/support/edocs/software/hyperv).