Microsoft

Covers Hyper-V R2 features

Windows Server® 2008 Hyper-V™

Robert Larson and
Janique Carbone with the
Windows® Virtualization Team
at Microsoft

Resource Kit

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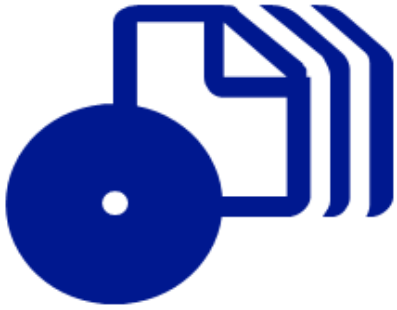

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This book is dedicated to my family, both near and far, who continue to support my endeavors.

—JSC

I dedicate this book to my two children, Alex and Xavier. They continue to inspire me every day.

—REL

Contents at a Glance

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Martin DelRe from Microsoft Press worked to make the *Windows Server 2008 Hyper-V Resource Kit* project a reality shortly after the completion of the *Microsoft Virtual Server 2005 R2 Resource Kit*. Martin, we thank you again for the opportunity that you provided to us and your assistance throughout this project.

Another thank you goes to Heather Stafford, who helped us with all contract and billing processes.

We had wonderful Microsoft Press editors that helped to guide our efforts and make certain that the book content was consistent and of high-quality. Many thanks go to Karen Szall for getting us started on the right track. Julie Hotchkiss and Megan Smith-Creed were wonderful copy editors. They did a great job in making the text clearer and more concise, as well as challenging our assumptions. Finally, we want to thank Randall Galloway, the technical editor, for his work on this book.

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In addition to the product team, we wanted to ensure that each chapter in this book was reviewed by Microsoft team members "in the field." Many field reviewers volunteered from the Microsoft Consulting Services and Customer Support Services teams, as well as Microsoft Sales. Each individual that participated in chapter reviews worked above and beyond their daily responsibilities to provide feedback and suggestions that greatly improved the book content. Thank you again for giving up some of your own time to help us and adding significant value to the resultant product.

We also had great support from Donna Becker and Tim Mueting from AMD, John Porterfield, Shane Burton, and Justin Brown from Compellent Technologies, and Trevor McGill from Sun Microsystems. As indicated in the Introduction section of this book, they provided us with hardware, their expertise, and content that allowed us to test and validate technical scenarios on real enterprise-class devices. Thank you so much for working with us under an extended timeline. We very much appreciate your support and cooperation!

And to you, the reader, thank you for purchasing this book. We have worked hard to compile and organize the content of this book such that it might be a valuable resource to help you deploy successful solutions based on Hyper-V technology. We are very interested in your comments, suggestions, and questions. Please send book-related emails to *askme@doingITvirtual.com*. We will generally respond to you within 24 hours. For additional information regarding Microsoft virtualization technology, join the Doing IT Virtual community at *http://doingitvirtual.com* and keep up with our blogs at *http://doingitvirtual.com/blogs/virtualzone/default.aspx* and *http://blogs.technet.com/roblarson*.

Best Regards,

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Introduction

Welcome to the *Windows Server 2008 Hyper-V Resource Kit*!

The *Windows Server 2008 Hyper-V Resource Kit* is a comprehensive technical resource for planning, deploying, and managing virtualization infrastructures based on Windows Server 2008 Hyper-V and Microsoft Hyper-V Server 2008.

Virtualization technology continues to evolve and change the options and speed at which IT departments can react to changing business needs by creating the basis for a powerful, flexible, and adaptable computing environment. Many organizations can draw benefits from the implementation of Hyper-V technology, including potential cost savings that can result from workload virtualization. Server consolidation, test and development infrastructure, business continuity, and branch office environments in enterprise settings are some of the principal targets of Hyper-V technology solutions. However, small and medium businesses also benefit from workload virtualization. Therefore, our purpose for this book was to provide information and tools that could be useful to a broad spectrum of IT professionals and organizations.

Within this Resource Kit, you will find in-depth information and procedures to help you manage all aspects of Windows Server 2008 Hyper-V and Hyper-V Server 2008, including manual and automated installation, security configuration, virtual machine and host-level failover clustering, virtual machine creation and migration processes, monitoring, and backup and recovery techniques. In addition, we have included guidance to assist you with all aspects of a virtualization project from the early vision and scope setting phase through the project pilot phase.

In this book, you will find numerous sidebars contributed by members of the Windows Virtualization product team, Microsoft Consulting Services, Microsoft Support Services, Microsoft Sales, and Microsoft Partners that explain Hyper-V design details, feature highlights, and best practices and optimization tips to assist you in getting the most from a Hyper-V deployment. Finally, the companion media includes sample scripts and job aids that you can use and customize to help you automate various aspects of managing Hyper-V environments.

Microsoft Partner Support

Many of the technical scenarios presented in this book were configured and tested on hardware that was provided by AMD, Compellent Technologies, Sun Microsystems, and the Microsoft Partner Solutions Center. All of these Microsoft partners repeatedly extended the loan of their equipment to accommodate our

changes in schedule, and they were all very forthcoming in answering questions and providing support when it was needed.

AMD provided us with enterprise-class hardware to support installation, failover clustering, and configuration test procedures. Donna Becker, Tim Mueting, and John McCrae from AMD worked diligently to provide us with two Dell PowerEdge 2970 servers configured with dual quad-core Opteron 2356 processors, 16 gigabytes (GB) of RAM, a Dell PERC 5/I Integrated RAID controller, and 300 GB of internal storage. The configuration was enhanced with an additional 300 GB of external, iSCSI-based storage.

Compellent Technologies, Sun Microsystems, and the Microsoft Partner Solutions Center dedicated hardware and remote access to enterprise-class servers connected to a Compellent Storage Center storage area network (SAN). John Porterfield, Shane Burton, and Justin Braun of Compellent Technologies provided their time, expertise, and assistance in assembling a hardware configuration that could be used to test additional failover clustering scenarios remotely. The configuration of the Compellent Storage Center SAN was configured with 10 terabytes of Tier-1 storage and 41 terabytes of Tier-3 storage.

John Porterfield of Compellent Technologies coordinated with Trevor McGill of Sun Microsystems to secure several servers for the duration of our tests. In particular, Sun Microsystems provided a Sun X4450 server with four quad-core Intel X7350 processors, 64 GB of RAM, four 146-GB SAS drives, and four Gigabit Ethernet network adapters, and two Sun X4150 servers with two quad-core Intel E5345 processors, 16 GB of RAM, four 146-GB SAS drives, and four Gigabit Ethernet network adapters.

Overview of Book

The four parts of this book cover the following topics:

Part I Getting Started with Windows Server 2008 Hyper-V Provides an in-depth look at the features of Windows Server 2008 Hyper-V and Microsoft Hyper-V Server 2008, as well as product architecture details.

Part II Understanding Windows Server 2008 Hyper-V Provides in-depth information and guidance on installing Window Server 2008 Hyper-V and Microsoft Hyper-V Server 2008 using advanced product features, configuring security, tuning performance, and moving from Virtual Server 2005 R2 to Hyper-V. There is also a comprehensive preview of the new features that are included in Windows Server 2008 R2 Hyper-V.

Part III Managing a Windows Server 2008 Hyper-V Infrastructure Describes how to monitor and maintain the health of a Hyper-V infrastructure using tools such as System Center Virtual Machine Manager 2008, Windows Backup Server, System Center Data Protection Manager SP1, and the Windows Server 2008 Hyper-V Management Pack for System Center Operations Manager 2007. This part of the book also contains information to help you develop scripts using the Windows Management Instrumentation (WMI) application programming interface (API) and Windows PowerShell scripting tool.

Part IV Server Virtualization Project Methodology Defines common server virtualization scenarios, basic concepts and components that compose a VDI solution, and comprehensive guidance on how to manage a virtualization project from the initial vision and scope setting phase to the pilot deployment phase.

Document Conventions

The following conventions are used in this book to highlight special features or usage.

Reader Aids

The following reader aids are used throughout this book to point out useful details.

READER AID	MEANING
Note	Underscores the importance of a specific concept or highlights a special case that might not apply to every situation.
Important	Calls attention to essential information that should not be disregarded.
Caution	Warns you that failure to take or avoid a specified action can cause serious problems for users, systems, data integrity, and so on.
On the Companion Media	Calls attention to a related script or job aid on the companion media that helps you perform a task described in the text.
Best Practice	Provides advice that the authors or the Windows Virtual Team have gained from using and deploying the products.
More Info	Contains cross-references to other critical reference material, such as the product documentation, relevant Web sites, other books, or to other sections of this book.

Sidebars

The following sidebars are used throughout this book to provide added insight, tips, and advice concerning different Hyper-V features.

SIDEBAR	MEANING
Direct from the Source	Contributed by Windows Virtualization product team experts at Microsoft to provide "from-the-source" insight into how Hyper-V works, best practices, and troubleshooting tips.
Direct from the Field	Contributed by field experts from Microsoft Consulting Services, Microsoft Customer Support Services, Microsoft Sales, and Microsoft Partners to provide "from-the-source" insight into how Hyper-V works, best practices, and troubleshooting tips.
How It Works	Provides unique glimpses of technology features and how they work.

NOTE **Sidebars are provided by individuals in the industry as examples for informational purposes only and may not represent the views of their employers. No warranties, express, implied, or statutory, are made as to the information provided in sidebars.**

Command-Line Examples

The following style conventions are used in documenting command-line examples throughout this book.

STYLE	MEANING
Bold font	Used to indicate user input (characters that you type exactly as shown).
Italic font	Used to indicate variables for which you need to supply a specific value (for example, *file_name* can refer to any valid file name).
`Monospace font`	Used for code samples and command-line output.
%SystemRoot%	Used for environment variables.

Companion Media

The companion media is a valuable addition to this book and includes the following items:

Scripts and Job Aids Sample scripts written in Visual Basic Scripting Edition (VBScript) or Windows PowerShell for the administration of different aspects of Hyper-V infrastructures. These scripts can be used either as-is or customized to meet your administrative needs. Also included are job aids referenced in the book text.

Bonus Content and Links to Resources In the Bonus Content folder, you'll find an electronic version of the Microsoft Press title *Understanding Microsoft Virtualization*. On the Links to Resources and Tools page, you'll find numerous links to helpful resources and tools identified by the authors of this resource kit.

eBook An electronic version of the entire *Windows Server 2008 Hyper-V Resource Kit* is also included on the companion media.

Full documentation of the contents and structure of the companion media can be found in the Readme.txt file on the media.

Digital Content for Digital Book Readers: If you bought a digital-only edition of this book, you can enjoy select content from the print edition's companion CD.
Visit **http://www.microsoftpressstore.com/title/9780735625174** to get your downloadable content. This content is always up-to-date and available to all readers.

System Requirements

The following are the minimum system requirements to run the companion media provided with this book:

- Windows Server 2008 or Windows Vista Service Pack 1
- Windows PowerShell 1.0 or later version (for scripts)
- Microsoft Office 2003 or later version (for job aid worksheets)
- DVD drive
- Internet connection
- Display monitor capable of 1024 × 768 resolution
- Microsoft Mouse or compatible pointing device
- Adobe Reader or PDF reader for viewing the eBook

Using the Scripts

Scripts on the companion media must be run using Cscript.exe or Windows PowerShell as the script host. You can do this in several ways:

- Type **cscript *script_name*.vbs <parameters>** at a command prompt. For a list of available parameters, type **cscript *script_name*.vbs /?** at a command prompt, or open the script using Notepad and read the comments in the script.
- Configure the default script host on the local computer to Cscript.exe so that you can run scripts by typing **script_name.vbs <parameters>** at a command prompt. To set the default script host to Cscript.exe, type **cscript //h:cscript //nologo //s** at a command prompt.
- For Windows PowerShell 1.0, open a PowerShell command window. To do this from the Run box, click Start, click Run, type powershell, and click OK. You can also start Windows PowerShell 1.0 from the Start menu. Just click Start, click All Programs, click Windows PowerShell 1.0, and then click Windows PowerShell.
- For Windows PowerShell 2.0, from the Start menu, click Start, click All Programs, click Windows PowerShell, and then click Windows PowerShell V2. Alternatively, you can click Windows PowerShell V2 ISE to open the Windows PowerShell V2 Integrated Scripting Environment.

To function as intended, most scripts on the companion media must also be run using elevated privileges. To open an admin-level command prompt in Windows Vista, click the Start button and select All Programs. Select Accessories, right-click on Command Prompt, and select Run As Administrator. (As an alternative, create a shortcut to an elevated command prompt and save the shortcut on your Quick Launch toolbar.)

Resource Kit Support Policy

Every effort has been made to ensure the accuracy of this book and the companion media content. Microsoft Press provides corrections to this book through the Web at the following location:

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CHAPTER 2

Hyper-V Overview

This chapter contains an overview of the Hyper-V features available as a role in a full installation of Windows Server 2008, as a Server Core role, and in Microsoft Hyper-V Server 2008. In order to provide a robust virtualization platform that abstracts physical hardware dependencies and scales to support numerous concurrent workloads, Hyper-V is based on a hypervisor-based architecture that enables standard services and resources to create, manage, and execute virtual machines. Hyper-V offers a standard virtual hardware environment, virtual hard disks (VHD), and virtual networks that enable virtual machine execution, storage, and communications, respectively. Integration Services (IS) and Integration Components (IC) support critical processes and enhance the performance of virtual machines. Hyper-V Manager, a Microsoft Management Console (MMC) snap-in, is available to perform Hyper-V management and virtual machine configuration functions. The Hyper-V Manager provides a primary interface to create, inspect, and configure virtual machines, virtual hard disks, and virtual networks, as well as to assign virtual machine memory and processor allocations. Hyper-V properties are also modified through the Hyper-V Manager. Virtual Machine Connection (VMC) is integrated into the Hyper-V Manager to provide remote access to virtual machines from within the console and is also available as a stand-alone application. In addition, Hyper-V offers an extensive Windows Management Instrumentation (WMI) interface that you can leverage using various scripting and development languages, including PowerShell, to programmatically and remotely control the deployment, administration, and configuration of virtual machines.

Hyper-V Background

In February 2003, Microsoft entered the virtualization arena with the acquisition of Connectix software virtualization technology. In October 2004, Microsoft released Virtual Server 2005, an enterprise infrastructure virtualization solution for the x86 platform with support for 32-bit virtual machines. Virtual Server 2005 represents a hosted virtualization architecture because it runs in conjunction with a host Windows operating system and depends on it to arbitrate hardware resource access. In November 2005, Virtual Server 2005 Release 2 (R2) was released with several performance-enhancing features, as well as support for x64 host operating systems, iSCSI connectivity, Non-Uniform Memory Access (NUMA), Pre-Execution Environment (PXE) booting, and Virtual Server host clustering. The last major release, Virtual Server 2005 R2 Service Pack 1 (SP1), occurred in June 2007. In this release, Microsoft added support for Intel VT and AMD-V processors and provided the ability to control hardware virtualization on an individual virtual machine (VM) basis. Finally, in May 2008, an update was released (KB948515) to extend Virtual Server 2005 R2 SP1 support to Windows XP SP3, Windows Vista SP1, and Windows Server 2008, both as host and guest operating systems.

In parallel with Virtual Server 2005 R2 SP1, Microsoft worked on the development of its next generation enterprise virtualization product, Windows Server 2008 Hyper-V, released in June 2008. Figure 2-1 shows the basic Hyper-V architecture, which is based on a 64-bit microkernel hypervisor, the Windows Hypervisor. The Windows Hypervisor runs directly above the hardware, enables multiple operating systems to run concurrently within partitions, and ensures strong isolation between the partitions by enforcing access policies for critical system resources such as memory and processors. Unlike Windows operating systems such as Windows Server 2003 and earlier versions, the Windows Hypervisor does not contain any third-party device drivers or code, which minimizes its attack surface and provides a more secure architecture.

> ***NOTE*** **Based on the microkernel architecture of the Windows Hypervisor, including the fact that it does not encompass Windows drivers, the Windows Hypervisor is less than 1 megabyte (MB) in size.**

In addition to the Windows Hypervisor, there are two other major elements in Hyper-V: a parent partition and child partitions. The parent partition is a special virtual machine that runs Windows Server 2008, controls the creation and management of child partitions, and maintains direct access to hardware resources. This requires that device drivers for physical devices be installed in the parent partition. Finally, the role of a child partition is to provide a virtual machine environment for the installation and execution of guest operating systems and applications.

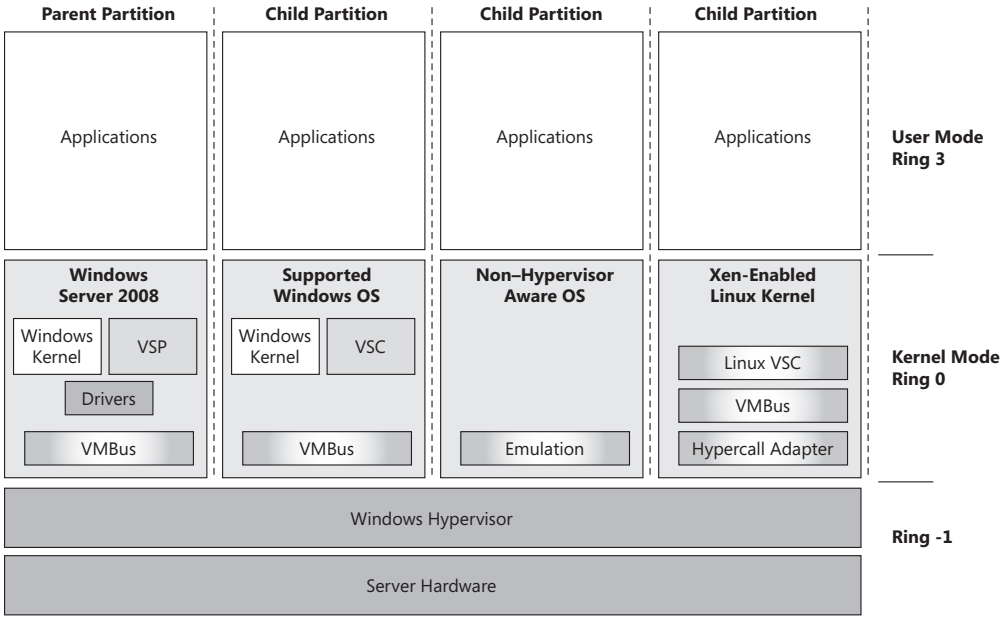

FIGURE 2-1 Basic Hyper-V architecture

Hyper-V allows high-speed communication between the parent and child partitions through the VMBus. The VMBus supports dedicated point-to-point channels for secure interpartition communications between Virtualization Service Providers (VSP) in the parent partition and Virtualization Service Clients (VSC) in the child partitions. VSPs are software components that manage input/output (I/O) requests from the VSCs in the virtual machines and channel the requests to physical hardware through the device drivers. VSCs are synthetic drivers, basically software components without physical counterparts that provide high-performance access to networking, video, storage, and human-interface devices in virtual machines. In the current release of Hyper-V, VSCs are available for a subset of Windows operating systems and for Suse Linux Enterprise Server 10, which has a Xen hypervisor-aware kernel. When running on Hyper-V, Suse Linux Enterprise Server 10 uses a Hypercall Adapter to translate Xen hypervisor calls (hypercalls) into Hyper-V hypervisor calls, enabling high-performance execution.

> ***MORE INFO*** **For a complete list of the Windows operating systems that support VSCs, refer to Chapter 5, "Hyper-V Advanced Features."**

Virtual machines that run guest operating systems without VSC support use emulation (or legacy) drivers to provide access to virtualized hardware devices. The parent partition monitors and intercepts I/O requests to virtualized hardware devices and channels the requests to physical hardware.

MORE INFO **For a detailed description of the Hyper-V architecture, refer to Chapter 3, "Hyper-V Architecture."**

Hyper-V Core Features

Table 2-1 summarizes the basic features found in Windows Server 2008 Hyper-V editions and Hyper-V Server 2008. Hyper-V VMs support both 32-bit and 64-bit guest operating systems and the allocation of up to four virtual processors and 64 gigabytes (GB) of memory for Hyper-V servers running on Windows Server 2008 Enterprise or Datacenter edition. In its original release, Hyper-V supported 16 processor cores and 128 virtual machines. However, a subsequent update (KB956710) increased Hyper-V support to 24 logical processors and a maximum of 192 concurrent virtual machines.

TABLE 2-1 Hyper-V Basic Features Comparison

FEATURES	MICROSOFT HYPER-V SERVER 2008	WINDOWS SERVER 2008 STANDARD	WINDOWS SERVER 2008 ENTERPRISE	WINDOWS SERVER 2008 DATACENTER
x86 Support	Guest OS Only	Guest OS Only	Guest OS Only	Guest OS Only
x64 Support	Host and Guest	Host and Guest	Host and Guest	Host and Guest
# of VMs—x64 Host	192 (Max)	192 (Max)	192 (Max)	192 (Max)
Host Memory Support	32 GB	32 GB	1 terabyte	1 terabyte
Host Processor Support	24 Cores (Max) (See Note)	24 Cores (Max) (See Note)	24 Cores (Max) (See Note)	24 Cores (Max) (See Note)
Virtual Networks	Unlimited	Unlimited	Unlimited	Unlimited
Guest VM Memory	32 GB (Max)	32 GB (Max)	64 GB (Max)	64 GB (Max)
Guest Virtual Processor	4 per VM	4 per VM	4 per VM	4 per VM
Guest Virtual NICs	4 Legacy 8 Synthetic	4 Legacy 8 Synthetic	4 Legacy 8 Synthetic	4 Legacy 8 Synthetic
Guest Storage Adapters	2 IDE 4 SCSI	2 IDE 4 SCSI	2 IDE 4 SCSI	2 IDE 4 SCSI
Guest Storage Devices	4 IDE 256 SCSI	4 IDE 256 SCSI	4 IDE 256 SCSI	4 IDE 256 SCSI
Cluster Support	N	N	Y	Y
Quick Migration	N	N	Y	Y
Included Use Licenses	None	1 Physical 1 VM	1 Physical 4 VMs	1 Physical Unlimited VMs

NOTE **If you are going to install and use Hyper-V on a physical server with 24 cores, you must download and install KB956710 for Windows Server 2008 Hyper-V from *http://support.microsoft.com/kb/956710*.**

IMPORTANT **The Windows license allows you to run one virtual machine in Windows Server 2008 Standard, four VMs in Windows Server 2008 Enterprise, and an unlimited number of VMs in Windows Server 2008 Datacenter. Because Microsoft Hyper-V Server 2008 is not a Windows edition, you do not receive any Windows licenses with it, and therefore you must have a valid Windows license for each Windows-based VM running on it.**

AMD-V and Intel VT Support

Hyper-V requires an x64 AMD-V or Intel VT processor that supports hardware-assisted virtualization and hardware-based Data Execution Prevention (DEP). You must ensure that both of these options are enabled in the Basic Input/Output System (BIOS), as they may be disabled by default. Specifically for DEP, you must enable the AMD No-Execute (NX) bit, or Intel Execute-Disable (XD) bit, which assists in preventing buffer overflow exploits. Other advantages of running on an AMD-V or Intel VT x64 platform include access to a larger address space and a higher partition density. Hyper-V does not support Itanium or x86-based systems.

NOTE **You may have to shut down and restart after you enable the AMD NX of Intel XD bit on your physical system for the change to take effect.**

Full Installation and Server Core Installation Support

Hyper-V can be installed as a role in either a full installation or a Server Core installation of 64-bit Windows Server 2008 Standard, Enterprise, and Datacenter editions. In a full installation of Windows Server 2008, you can use the Initial Configuration Tasks or the Server Manager to add the Hyper-V role to your system. The Windows Hypervisor is present and enabled only after the Hyper-V role is installed on Windows Server 2008. Furthermore, when you select and add the Hyper-V role, all of the Hyper-V components are installed on your system. This also includes Hyper-V management tools such as the Hyper-V Manager MMC snap-in and the Virtual Machine Connection application, which allows you to remotely access virtual machines. Installing the Hyper-V role in a full installation of Windows Server 2008 requires that you restart the computer before it will boot the Windows Hypervisor.

Windows Server 2008 Server Core is a new feature that allows you to install a minimal server configuration that includes only the subset of binaries that are required to run one of the supported roles. A key advantage of Server Core is the reduction in operating system

maintenance (i.e., fewer updates) and management requirements based on the smaller number of files and services included in the installation.

There are nine Server Core roles: Hyper-V, File Services, Active Directory Domain Services, Active Directory Lightweight Directory Services, DHCP Server, DNS Server, Print Services, Streaming Media Services, and Web Server. The default management interface for a Windows Server 2008 Server Core installation is a command prompt, since it does not install the Explorer shell graphical user interface (GUI). Therefore, you must rely on command-line options to enable the Hyper-V role in a Server Core installation. However, a Windows Server 2008 Server Core installation can be managed remotely using the standard MMC tools from a server with a full installation of Windows Server 2008. You can also use the Remote Server Administration Tools (RSAT) to manage your Server Core installations from 32-bit and 64-bit editions of Windows Vista Business with Service Pack 1 (SP1), Windows Vista Enterprise with SP1, and Windows Vista Ultimate with SP1.

NOTE **If you are going to install and use RSAT to manage a Windows Server 2008 Server Core installation, you must download and install KB941314 from *http://support.microsoft.com/kb/941314*.**

MORE INFO **For detailed installation procedures of the Hyper-V role in either a full installation or Server Core installation of Window Server 2008, refer to Chapter 4, "Hyper-V Installation and Configuration."**

Microsoft Hyper-V Server 2008

Microsoft Hyper-V Server 2008 is a stand-alone product based on the same virtualization architecture available in Windows Server 2008 Hyper-V. However, it has been simplified and optimized to run Hyper-V only. Similar to a Server Core installation of Windows Server 2008, it provides only a command-line user interface and can be administered remotely using the Hyper-V management tools and RSAT.

Microsoft Hyper-V Server 2008 is available as a free download from the Microsoft Web site. It is a good choice for single virtualization host deployments that do not require enterprise-class features such as high availability, and for virtual machines that need less than 32 GB of memory. You may also want to consider using Windows Hyper-V Server 2008 in non-production, development, and test environments. There is no software upgrade path from Microsoft Hyper-V Server 2008 to Windows Server 2008 Hyper-V. However, virtual machines are compatible between the two products and can be migrated using Hyper-V virtual machine export and import features, which will be discussed later in this chapter.

NOTE **If you are interested in Windows Hyper-V Server 2008, it is available for download from *http://www.microsoft.com/servers/hyper-v-server/how-to-get.mspx*.**

Microsoft Hyper-V Server 2008 includes a command-line, menu-driven configuration tool called HVConfig.cmd to permit the configuration of basic connectivity and features required to use it in a managed environment. HVConfig.cmd supports the following configuration and actions:

- Domain or workgroup membership
- Computer name
- Network settings
- Local administrators
- Windows Update settings
- Download and install Windows Updates
- Remote Desktop
- Regional and language options
- Date and time
- Log Off User
- Restart Server
- Shut Down Server
- Exit To Command Line

HVConfig.cmd actually executes a Visual Basic Script file called HVConfig.vbs that contains all the functionality. HVConfig.cmd launches every time that you log on to the system.

Access Control Using Authorization Manager

Hyper-V leverages Authorization Manager (AzMan) to provide role-based access control to Hyper-V and virtual machines. This allows you to create job definitions and translate them into a role with a limited set of operations and tasks. You can assign individual users or groups to appropriate roles, allowing them to fulfill their job responsibilities while restricting their access to only the required Hyper-V resources, operations, and tasks.

MORE INFO **For more details on how to use AzMan with Hyper-V and the types of roles that might be useful to define for Hyper-V and virtual machine management, refer to Chapter 6, "Hyper-V Security."**

Live Backup with Volume Shadow Copy Service

Volume Shadow Copy Service (VSS) support in Hyper-V provides stateful, host-side backups, eliminating the need to load an agent in each virtual machine. Any VSS-aware application, such as System Center Data Protection Manager (DPM) 2007 SP1, can leverage this functionality to provide VSS snapshot backup services if it utilizes the VSS writer interface implemented in Hyper-V. Any virtual machine running a VSS-aware guest Windows operating system (Windows Server 2003 and later) can be backed up in a live state. Any other guest operating system (Windows 2000, Linux, and so on) will need to be in saved state prior to the VSS snapshot. Because VSS snapshots are performed through an extremely fast process (they take seconds), virtual machine downtime is minimized. Additionally, with VSS support, the number of steps involved in archive or restore operations is reduced and the consistency of the data is ensured.

MORE INFO **For more details on performing live backups using VSS, refer to Chapter 13, "Hyper-V Backup and Recovery."**

High Availability Using Failover Clustering

Hyper-V supports Windows Failover Clustering to implement a high-availability strategy that can manage both unplanned and planned downtime. There are two levels at which you can implement a failover cluster with Hyper-V: at the guest operating system level, and at the virtualization host level. A guest operating system failover cluster requires cluster-aware applications running in virtual machines. In addition, you have to run an operating system in the virtual machine that supports failover clustering, such as Windows Server 2003 (for up to an 8-node cluster) or Windows Server 2008 Enterprise or Datacenter edition (for up to a 16-node cluster). The second failover cluster option consists of two or more Windows Server 2008 Hyper-V servers, each configured as a cluster node. This type of configuration allows you to provide a high-availability solution for both non-cluster-aware guest operating systems and applications that run in virtual machines.

MORE INFO **For more details on how to configure guest and host failover clusters, refer to Chapter 5.**

Quick Migration

Hyper-V also supports Quick Migration, the ability to move a virtual machine across cluster nodes without data loss and with minimal service interruption. To accomplish this, a virtual machine is placed in saved state, active memory and processor state are captured to disk, and storage resources ownership is transferred to another node in the cluster. On the new

node, the virtual machine active memory and processor state are reloaded and processing is resumed. Depending on the underlying storage and the size of the state data, the entire process can take place in a matter of seconds or minutes.

> ***MORE INFO*** **For more details on Quick Migration, refer to Chapter 14, "Server Migration Using System Center Virtual Machine Manager."**

Integration Services

In Hyper-V, Integration Services (IS) provide support for five unique components that require a secure interface between a parent and child partition. These functions are:

- Time synchronization
- Heartbeat
- Shutdown
- Key/value pair exchange
- Volume Shadow Copy Service (VSS)

Integration Services target very specific areas that enhance the functionality or management of supported guest operating systems. In addition to these services, Integration Services provide the synthetic or high-performance drivers for networking, video, storage, and human-interface devices. If you install Windows Server 2008 in a virtual machine, the Integration Services are pre-installed. However, you should update them to the latest version. For other operating systems, you should install the Integration Services after the operating system installation is complete. It is important to note that only a subset of Integration Services may be supported for some legacy or non-Windows guest operating systems.

> ***MORE INFO*** **For more details on Integration Services, refer to Chapter 3 and Chapter 5.**

Virtual Machine Import and Export

The import and export features in Hyper-V are meant to move and copy virtual machines between Hyper-V servers. These features do not provide a solution to export or import virtual machines between other virtualization applications like Virtual Server 2005 R2. In addition, you can export only a virtual machine that is in saved state or that is shut down.

Virtual Hard Disk Management

Hyper-V provides several options to manage virtual hard disks (VHD), accessible through the Hyper-V Manager console. The VHD management options include:

- **Compact** Provides the ability to shrink the size of a VHD by removing blank space that remains after data is deleted from the VHD file
- **Convert** Provides the ability to transfer a dynamically expanding VHD to a fixed-size VHD or vice versa
- **Expand** Provides the ability to increase the storage capacity of a dynamically expanding VHD or fixed-size VHD
- **Merge** Provides the ability to combine the content of a child differencing disk with the parent differencing disk
- **Reconnect** Provides the ability to reconnect a child differencing disk to the parent disk

The options that are available depend on the type of VHD that you select and also on the status of that VHD.

MORE INFO **For more details on the VHD management options, refer to Chapter 5.**

Virtual Machine Snapshots

The Hyper-V snapshot feature allows you to capture the configuration and state of a virtual machine at any particular point in time, and provides you with the ability to reload any existing snapshot within a matter of seconds. Hyper-V snapshots can be extremely useful in scenarios for which you need to make incremental changes to a virtual machine with the ability to roll back to a previous state. The Hyper-V snapshot feature is principally designed for use in test and development environments, not in a production infrastructure.

MORE INFO **For more details on virtual machine snapshots, refer to Chapter 5.**

Virtual Machine Connection

Virtual Machine Connection (VMC) is a remote administration tool provided with Hyper-V. VMC uses the Widows Remote Desktop Protocol to allow remote access to the guest operating system running in a virtual machine. It is embedded in the Hyper-V Manager MMC and is available as a stand-alone application. VMC provides access to the video frame buffer of the video machine from the moment a virtual machine is powered on so that you have access during the boot process.

MORE INFO **For more details about using VMC, refer to Chapter 11, "Hyper-V Single Server Management."**

DIRECT FROM THE SOURCE

Windows Server 2008 R2 Hyper-V Features

Vijay Tewari, Principal Program Manager
Windows Virtualization

Microsoft has made a big investment in developing Windows Server 2008 Hyper-V, a virtualization platform that provides flexibility and performance for IT organizations to consolidate their workloads. Although this book provides an excellent in-depth look at various aspects of the Hyper-V platform, Microsoft continues to enhance and evolve Hyper-V with features and capabilities. Here is a sneak peek at some capabilities of Windows Server 2008 R2 Hyper-V, the next release of the Windows Server Virtualization platform.

Live Migration of Virtual Machines

Windows Server 2008 provides Quick Migration to move VMs between hosts in a cluster with minimal service interruption. However, this capability requires pausing the virtual machine momentarily while the saved state is moved from the source to the destination node. A virtual machine in saved state does not run during this period (called the "blackout" period), in effect causing downtime for the virtual machine. In today's IT environment, downtime even for short periods is problematic. In order to address this issue, Microsoft is enhancing the Hyper-V product with the Live Migration capability. With Live Migration, there is no perceived downtime in the workloads running in the VM, and network connections to and from the migrated VM stay connected. As with Quick Migration, Live Migration will be possible between nodes within a failover cluster. In effect, the infrastructure investment made in order to use Quick Migration will be enhanced through Live Migration. In addition, Microsoft is adding Clustered Shared Volumes to failover clusters, which allow multiple VHDs for different VMs to be stored on a single Logical Unit Number (LUN). This not only simplifies management of shared storage for a cluster, it also provides a significant reduction in the blackout period for VMs moved through Live Migration.

Support for Enhanced Hardware Virtualization Features

Over the years, hardware vendors such as AMD and Intel have made significant enhancements (such as AMD-V and Intel VT) to processors and chipsets with capabilities specifically targeting virtualization. Continuing with these enhancements, AMD and Intel support Nested Page Tables (NPT) and Extended Page Tables (EPT), respectively. These capabilities improve the performance of memory address translations. Without these hardware enhancements, each time a guest page faults, it requires a context switch to the hypervisor to handle the page fault. With NPT and EPT, a guest can handle page faults directly, eliminating the need for a costly context switch to the hypervisor and reducing virtualization overhead for memory translations.

Addition and Removal of Virtual Storage

Virtualization decouples the software running on a system from the hardware and makes it convenient for IT organizations to deploy and manage their environments. With this flexibility, it is inevitable that customers also seek the ability to expand and reduce storage coupled with virtual machines. With Windows Server 2008 R2 Hyper-V, Microsoft is adding the ability to add and remove virtual hard disks from a virtual machine while it is in operation. This capability opens up a range of possibilities for backup storage solutions and so on.

Networking Enhancements

Networking vendors have also made enhancements to hardware that benefit virtualized platforms. Two such key technologies are TCP Offload Engine (TOE) and Virtual Machine Queues (VMQ).

TCP Offload Engine refers to the offloading of TCP/IP processing to the network interface card (NIC). This technology is not specific to virtualized platforms, as non-virtualized operating systems and applications can also benefit by using it. A generally well-accepted rule of thumb is that 1 Hertz (Hz) of CPU processing is required to send or receive 1 bit of TCP/IP data. For high speed NICs, the overhead associated with processing TCP/IP traffic can be substantial. Windows Server 2008 R2 Hyper-V will support offloading the TCP/IP processing from virtual machines onto supported NICs, reducing the overhead for network processing. This has the benefit to free up processor cycles for additional work.

VMQ provides multiple queues and sorting algorithms in the NIC. One or more queues can be assigned by the hypervisor to individual virtual machines. The NIC sorts incoming network traffic and places it in the appropriate queues for the virtual machines. Since this processing happens in the NIC hardware, it reduces the hypervisor overhead and again frees up processor cycles for other work.

In addition, Microsoft is also adding support for jumbo frames that enable large send and receive payloads. A jumbo frame is an Ethernet frame with up to 9000 bytes of data payload as opposed to the traditional 1500 bytes. This reduces the overhead incurred per transferred byte. Coupled with large send offload (LSO), which is the ability of the operating system to transfer large chunks of data to the NIC to create Ethernet frames, and large receive offload (LRO), which allows the creation of a single large data buffer from multiple incoming Ethernet frames, this provides additional reductions of network processing overhead.

Power Management Enhancements

Recognizing the fact that data center power distribution and cooling infrastructure for the computing infrastructure are uppermost in IT staff minds, the next generation of the Windows Hypervisor has enhancements to reduce the power footprint of virtualized workloads. These capabilities include the use of "core parking,"

which allows the hypervisor to proactively consolidate idle workloads onto fewer cores. The unused processors can then be put into a deep sleep state, effectively reducing the power consumption of the server. In addition, the virtual management infrastructure, more specifically System Center Virtual Machine Manager (SCVMM), also can assist through optimal workload placement that reduces the overall power consumption of workloads.

Remote Desktop Connection Broker

The Remote Desktop Connection Broker creates a unified administrative experience for traditional session-based (i.e., Terminal Services) remote desktops and for virtual machine-based remote desktops in a Virtual Desktop Infrastructure (VDI). The two key deployment scenarios supported by the Remote Desktop Connection Broker are persistent (permanent) VMs and pooled VMs. Using a persistent VM, a user is assigned a dedicated VM that can be personalized and customized, and that preserves any changes made by the user. With a pooled VM, a single VM image is replicated as needed for users. User state can be stored using profiles and folder redirection, but it does not persist on the VM after the user logs off.

Host Operating System Support

The following list includes all the currently supported 64-bit host operating systems for Hyper-V:

- Windows Server 2008 Standard Edition
- Windows Server 2008 Enterprise Edition
- Windows Server 2008 Datacenter Edition
- Microsoft Hyper-V Server 2008

Guest Operating System Support

The following list includes all the supported x86 guest operating systems that can be used with Windows Server 2008 Standard, Enterprise, and Datacenter editions, as well as Microsoft Hyper-V Server 2008:

- Windows 2000 (support for one virtual processor)
  - Windows 2000 Server with SP4
  - Windows 2000 Advanced Server with SP4
- Windows Server 2003 x86 (support for one or two virtual processors)
  - Windows Server Web Edition with SP2
  - Windows Server Standard Edition with SP2

- Windows Server Enterprise Edition with SP2
- Windows Server Datacenter Edition with SP2

- Windows Server 2003 R2 x86 (support for one or two virtual processors)
  - Windows Server Web Edition with SP2
  - Windows Server Standard Edition with SP2
  - Windows Server Enterprise Edition with SP2
  - Windows Server Datacenter Edition with SP2
- Windows Server 2003 x64 (support for one or two virtual processors)
  - Windows Server Standard Edition with SP2
  - Windows Server Enterprise Edition with SP2
  - Windows Server Datacenter Edition with SP2
- Windows Server 2003 R2 x64 (support for one or two virtual processors)
  - Windows Server Standard Edition with SP2
  - Windows Server Enterprise Edition with SP2
  - Windows Server Datacenter Edition with SP2
- Windows Server 2008 x86 (support for one, two, or four virtual processors)
  - Windows Server 2008 Standard Edition
  - Windows Server 2008 Enterprise Edition
  - Windows Server 2008 Datacenter Edition
  - Windows Web Server 2008 Edition
  - Windows Server 2008 Standard Edition without Hyper-V
  - Windows Server 2008 Enterprise Edition without Hyper-V
  - Windows Server 2008 Datacenter Edition without Hyper-V
- Windows Server 2008 x64 (support for one, two, or four virtual processors)
  - Windows Server 2008 Standard Edition
  - Windows Server 2008 Enterprise Edition
  - Windows Server 2008 Datacenter Edition
  - Windows Web Server 2008 Edition
  - Windows Server 2008 Standard Edition without Hyper-V
  - Windows Server 2008 Enterprise Edition without Hyper-V
  - Windows Server 2008 Datacenter Edition without Hyper-V
- Windows HPC Server 2008 (support for one, two or four virtual processors)
- Suse Linux Enterprise Server 10 x86 (support for one virtual processor)
  - SUSE Linux Enterprise Server 10 with SP1

- SUSE Linux Enterprise Server 10 with SP2

- Suse Linux Enterprise Server 10 x64 (support for one virtual processor)
  - SUSE Linux Enterprise Server 10 with SP1
  - SUSE Linux Enterprise Server 10 with SP2
- Windows XP Professional x86
  - Windows XP Professional with SP2 (support for one virtual processor)
  - Windows XP Professional with SP3 (support for one or two virtual processors)
- Windows XP Professional x64
  - Windows XP Professional with SP2 (support for one or two virtual processors)
- Windows Vista x86 (support for one or two virtual processors)
  - Windows Vista Business Edition with SP1
  - Windows Vista Enterprise Edition with SP1
  - Windows Vista Ultimate Edition with SP1
- Windows Vista x64 (support for one or two virtual processors)
  - Windows Vista Business Edition with SP1
  - Windows Vista Enterprise Edition with SP1
  - Windows Vista Ultimate Edition with SP1

Reviewing Hyper-V

Windows Server 2008 Hyper-V and Microsoft Hyper-V Server 2008 are both hypervisor-based virtualization platforms. Hyper-V is multithreaded and concurrently runs one or more virtual machines (workloads), each in its own thread of execution. Each virtual machine presents a set of virtualized or synthetic devices to the guest operating system and applications that abstracts the underlying physical hardware, providing workload portability between dissimilar physical servers running Hyper-V.

Virtual Machine Hardware Environment

Table 2-2 lists the standard set of virtualized components that a virtual machine exposes to a guest operating system and application stack. These devices are detected and appear to be the physical hardware resources available to the running workload. When a virtual machine workload requests access to the virtualized resources, Hyper-V works in conjunction with the parent partition to translate the requested operation from the virtual hardware environment to the physical hardware, and access is achieved via the standard kernel device drivers installed in the parent partition. This approach provides virtual machine workloads the ability to run across a wide variety of server hardware without requiring any modifications to the workload configuration.

TABLE 2-2 Virtualized Hardware Components

COMPONENT	VIRTUALIZED HARDWARE
Basic input/output system (BIOS)	American Megatrends (AMI) BIOS with Intel 440BX chip set and PIIX4 ACPI including: ■ Complementary metal oxide semiconductor (CMOS) ■ Real-time clock ■ RAM and video RAM (VRAM) ■ Memory controller ■ Direct memory access (DMA) controller ■ PCI bus ■ ISA bus ■ SM bus ■ Power management ■ 8259 programmable interrupt controller (PIC) ■ Programmable interrupt timer (PIT)
Floppy disk drive	Single 1.44-MB floppy disk drive that maps to a floppy drive image.
Serial (COM) port	Dual serial ports that can be connected to local named pipes.
Printer (LPT) port	None
Mouse	Standard PS/2 Microsoft IntelliMouse pointing device mapped to the PS/2 device on the physical computer. Synthetic mouse device (requires Integration Services installation).
Keyboard	Standard PS/2 101-key Microsoft keyboard that can be mapped to a PS/2 keyboard on the physical computer. Synthetic keyboard device (requires Integration Services installation).
Network adapter (multifunction)	Up to four legacy Multiport DEC/Intel 21140 Ethernet network adapters. Up to eight synthetic network adapters (requires Integration Services installation).
Processor	Up to four processors that are the same as the physical computer processors.

COMPONENT	VIRTUALIZED HARDWARE
Memory	Up to 32 GB of RAM per virtual machine for Windows Server 2008 Hyper-V Standard Edition and Microsoft Hyper-V Server 2008. Up to 64 GB of RAM per virtual machine for Windows Server 2008 Hyper-V Enterprise and Datacenter editions.
Video card	VESA compatible emulated graphics adapter with 4 MB of VRAM, VGA, and SVGA support compliant with VESA 1.2, 2-D graphics accelerator and hardware cursor, and support for DirectX. Synthetic video adapter (requires Integration Services installation).
IDE/ATAPI storage	Dual IDE channels that support hard drives, CD-ROM or DVD-ROM drives, and ISO images. Each IDE channel supports two disks.
SCSI storage	Up to four synthetic SCSI adapters, each supporting 64 disks (requires Integration Services installation).
Sound card	None

A few limitations are imposed on virtual machine workloads based on the virtual hardware environment. Operating systems or applications that require direct access to a hardware device that is not listed in Table 2-2 cannot execute in a virtual machine. Because virtual machines expose only four CPUs to a hosted workload, applications that require symmetric multiprocessing (SMP) can be assigned one, two, or four processors in a virtual machine.

Virtual Hard Disks

Virtual hard disks (VHDs) are single file representations of a physical hard disk that encapsulate virtual machine data. Virtual hard disks reflect the same internal structure as a physical hard disk, including block allocation tables, data blocks, and sectors. Table 2-3 provides a list of virtual hard disk types available in Hyper-V.

TABLE 2-3 Virtual Hard Disk Types

DISK TYPE	DESCRIPTION
Fixed	Virtual hard disk file with all data blocks allocated on the host disk subsystem at creation time. A 10-GB fixed disk consumes 10 GB on the host physical disk where it is created.

DISK TYPE	DESCRIPTION
Dynamically Expanding	Virtual hard disk file that is preallocated with no data blocks reserved and grows as data is written until it reaches full size. A 10-GB dynamically expanding disk takes less than 2 MB initially and grows to 10 GB in 2-MB data block increments. In Hyper-V, the maximum size for this VHD type is 127 GB.
Differencing	Virtual hard disk file that is tied to an existing "parent" virtual hard disk file as an overlay. All writes are made to the differencing disk, the "child," whereas reads come from the parent and the child. Differencing disks are created as dynamically expanding disks.
Linked	A physical disk volume that you want to convert to a virtual hard disk. Linked disks exist only to perform the migration from physical to virtual hard disk.

Within a virtual machine, a virtual hard disk is represented as a physical disk. On a Hyper-V server physical disk, a virtual hard disk is stored as a file with a .vhd extension. Virtual machines connect to a virtual hard disk through a virtualized Integrated Drive Electronics (IDE) or Small Computer System Interface (SCSI) adapter. Hyper-V is responsible for mapping the virtual hard disk to the .vhd file on the physical disk. A VHD can be stored on any IDE, SCSI, iSCSI, storage area network (SAN), or Network-Attached Storage (NAS) storage system supported by the Windows Server 2008 operating system.

Virtual hard disks are created using either the Hyper-V Manager or through the WMI application programming interface (API). A virtual machine can support a maximum of 260 virtual hard disks through a combination of IDE and SCSI-connected VHDs.

NOTE **Virtual hard disk specifications are independent of the bus type used to connect to the virtual machine. However, the bus type does impose a size limitation on virtual hard disks. Virtual hard disks connected via IDE cannot exceed 127 GB. Virtual hard disks connected via SCSI cannot exceed 2040 gigabytes.**

Pass-Through Disks

Using Hyper-V, you can expose a disk to a virtual machine that is connected to the physical server without creating a volume on it. This is referred to as a pass-through disk. Pass-through disks can be physically connected to the Hyper-V server or as a LUN on a SAN. One of the advantages of pass-through disks is that they are not subject to the 2040-gigabyte size limitation that is imposed on VHDs. In contrast, pass-through disks do not support dynamically expanding VHDs, differencing VHDs, or Hyper-V snapshots.

Virtual IDE Interface

A virtual machine provides built-in primary and secondary virtual IDE interfaces. In Hyper-V, you can boot a virtual machine only from a virtual hard disk that is connected through the virtual IDE interface. Each virtual IDE interface can support two devices attached to it, for a

total of four IDE devices for every virtual machine. Either virtual hard disks or virtual CD-ROMs can be connected to an IDE interface. By default, the first virtual CD-ROM is attached to the secondary interface as the master device.

Virtual SCSI Interface

Contrary to the built-in virtual IDE interfaces exposed within the virtual machine environment, virtual SCSI interfaces are optional components that must be installed in a virtual machine before they can be used. A virtual machine supports up to four virtual SCSI adapters. Each virtual SCSI adapter can have up to 64 devices attached, for a total of 256 SCSI devices for every virtual machine.

Because virtual SCSI adapters are implemented as synthetic devices that load after the guest operating system loads, SCSI-attached VHDs cannot be used to boot a virtual machine.

iSCSI Disks

Another option to expose storage devices to a virtual machine is to install an iSCSI initiator in the guest operating system and connect directly to an iSCSI target. However, Hyper-V does not support booting from iSCSI-connected disk; therefore, you will still need to connect your boot disk through the virtual IDE interface. Using iSCSI-connected disks requires that you dedicate a NIC in the Hyper-V server for iSCSI communications.

Virtual Networks

A virtual network is a software emulation of a Layer 2 network switch with unlimited ports and a switched uplink that can connect to an external physical network through a physical network adapter or remain disconnected to create an isolated internal network. For each virtual network that you create in Hyper-V, a new software-based switch is created. In addition, each virtual network port simulates a 10-gigabit Ethernet port. Hyper-V supports an unlimited number of virtual networks with an unlimited number of ports for virtual machine connections.

Hyper-V provides three types of virtual networks: External, Private, and Internal. An external virtual network is used to provide connectivity to a physical network. When you create a new external virtual network, a virtual NIC is created in the Hyper-V parent partition with all the basic network bindings. The virtual NIC connects to a new virtual network switch, and the virtual network switch connects to the physical NIC that you select. If there are multiple physical NICs installed in a Hyper-V server, you can choose the one to bind to the new external virtual network. The physical NIC will have all network bindings removed with the exception of the Microsoft Virtual Network Switch Protocol. When a new virtual machine is connected to the external virtual network, a new network port is added to the virtual network switch.

An internal virtual network provides a means to allow virtual machines to communicate with the Hyper-V server, but it does not provide access to physical networks. In this case, a virtual NIC is again created in the Hyper-V parent partition and is connected to a port on a new virtual network switch. However, the new virtual network switch is not connected to any

of the physical NICs installed in the Hyper-V server. When a new virtual machine is connected to the internal virtual network, a new network port is added to the virtual network switch.

A private virtual network allows multiple virtual machines to communicate with each other, but not with the Hyper-V server or with any host connected on an external physical network. Essentially, when you create a new private virtual network, a new virtual network switch is created, but no virtual NIC is created in the Hyper-V parent partition. As you add new virtual machine connections to the new virtual network switch, additional network ports are added to it.

All three types of virtual network can be created through the Hyper-V Manager MMC or using WMI.

Virtual Network Adapters

There are two types of supported virtual network adapters in Hyper-V: legacy (emulated) and synthetic. A legacy network adapter emulates a virtual Multiport DEC 21140 network adapter. Using a legacy network adapter will increase the processor overhead because device access requires context switching that is not required with the synthetic network adapter. A synthetic network adapter provides higher performance because virtual machine device access requests are made through the high-speed VMBus to the parent partition. In order to use a synthetic network adapter, the guest operating system in the virtual machine must support the installation of Integration Services.

Virtual machines support a maximum of four virtual legacy network adapters and eight synthetic network adapters. Only the legacy network adapter supports the Pre-boot Execution Environment protocol (PXE), allowing virtual machines to be provisioned using standard image-deployment tools such as Windows Deployment Services (WDS) or other third-party applications. This is the case because the synthetic network adapter is loaded only after the virtual machine has booted.

When a legacy network adapter is added to a virtual machine, you can define the virtual network to connect it to or leave the virtual machine disconnected from any virtual network. Hyper-V allocates a new dynamic media access control (MAC) address to the new virtual network adapter from its pool of available addresses. It is also possible to provide a virtual network adapter with a static MAC address that is manually configured. With Hyper-V, both legacy and synthetic network adapters provide support for virtual LAN (VLAN) identification.

IMPORTANT **Although the virtual Multiport DEC 21140 network adapter defines a 10/100 megabit Ethernet interface, there is no network bandwidth limitation imposed on virtual machine workloads. If the underlying physical network adapter is capable of achieving higher network performance (for example, gigabit speed), the virtual machine workload has the ability to exceed the 100-megabit specification.**

Using the Hyper-V Manager Console

The Hyper-V Manager MMC is installed when the Hyper-V role is configured in a full installation of Microsoft Windows Server 2008. It is the default graphical user interface that allows you to manage and configure Hyper-V servers and virtual machines. It is also available for Microsoft Vista with SP1 (x86 and x64) as a download from the Microsoft Web site.

> ***NOTE*** **If you are interested in running Hyper-V Manager on Microsoft Vista with SP1, it is available for download from *http://support.microsoft.com/kb/952627*.**

The Hyper-V manager allows an administrator to manage multiple Hyper-V servers; however, it is meant to be the primary management tool only for small virtualization deployments. If you are deploying Hyper-V in a large or complex environment, you should use an enterprise-class management application like System Center Virtual Machine Manager.

You can launch Hyper-V Manager from the Start menu by selecting Hyper-V Manager from the Administrative Tools menu as shown in Figure 2-2. In a default full installation of Windows Server 2008, you can also invoke it using the Start menu Run option or from a command prompt by typing **C:\Program Files\Hyper-V\virtmgmt.msc**.

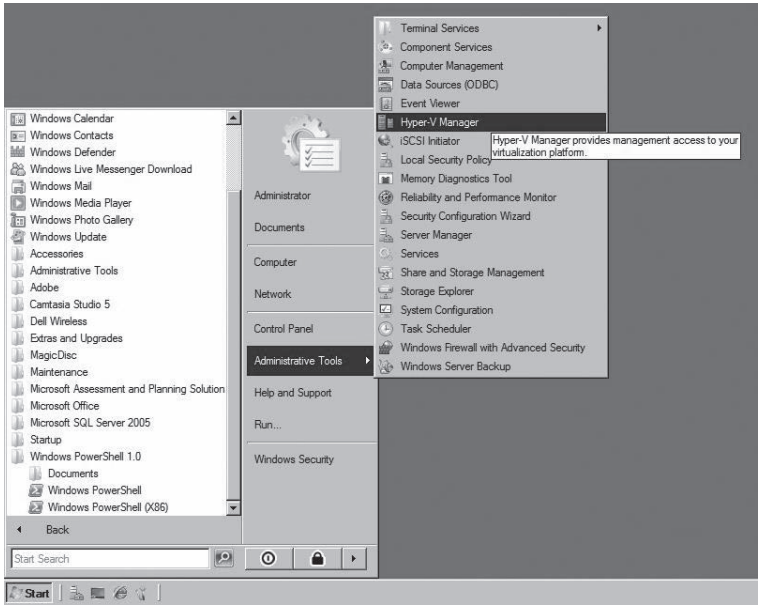

FIGURE 2-2 Launching Hyper-V Manager from the Start menu

As shown in Figure 2-3, the Hyper-V Manager console is divided into three sections. The left pane displays the tree view of managed Hyper-V servers. The center pane displays existing virtual machines and their state, as well as a tree view of existing snapshots and a minimized view of the virtual machine console when a virtual machine is selected. The right pane contains the list of actions available to manage the Hyper-V servers and virtual machines. The list of virtual machine actions is displayed only after a virtual machine is created or added on the Hyper-V server.

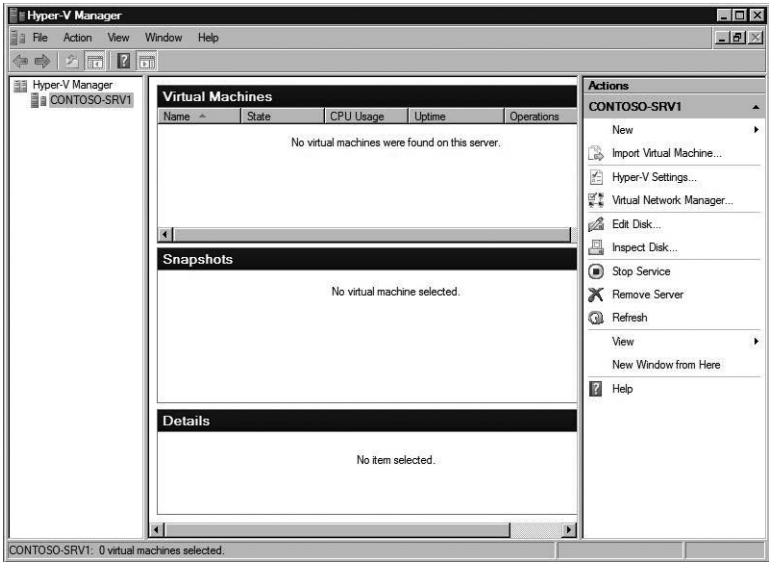

FIGURE 2-3 Hyper-V Manager default view

Managing Multiple Hyper-V Servers

Although the Hyper-V Manager allows only a single Hyper-V server to be managed at a time, it is a simple matter to connect to and switch the management focus to a different Hyper-V server. Figure 2-4 shows the Select Computer dialog box that is displayed when you right-click Hyper-V Manager in the left tree view pane and select Connect To Server. This dialog box is where you can specify the name or IP address of a Hyper-V server that you would like to manage.

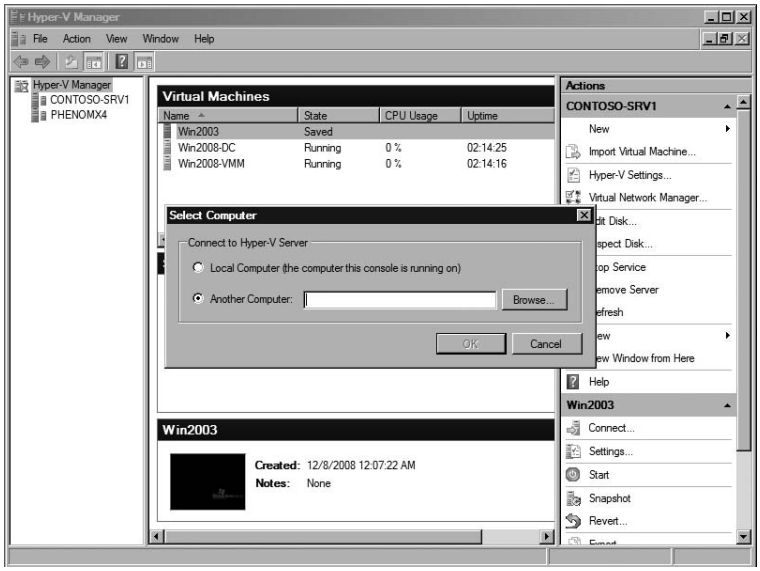

FIGURE 2-4 Hyper-V Manager server selection

In this dialog box, you also have the option to select Another Computer and browse for Hyper-V servers that you want to manage from your console.

Managing Virtual Machines

The Hyper-V Manager allows you to create, delete, export and import, or configure virtual machines on the managed Hyper-V server. You manage the virtual machines by selecting the desired management option and then providing or changing information through simple wizards.

Creating Virtual Machines

In order to create a new virtual machine, you can select the New option directly under the Hyper-V server name in the Actions pane and then choose the Virtual Machine menu option, as shown in Figure 2-5.

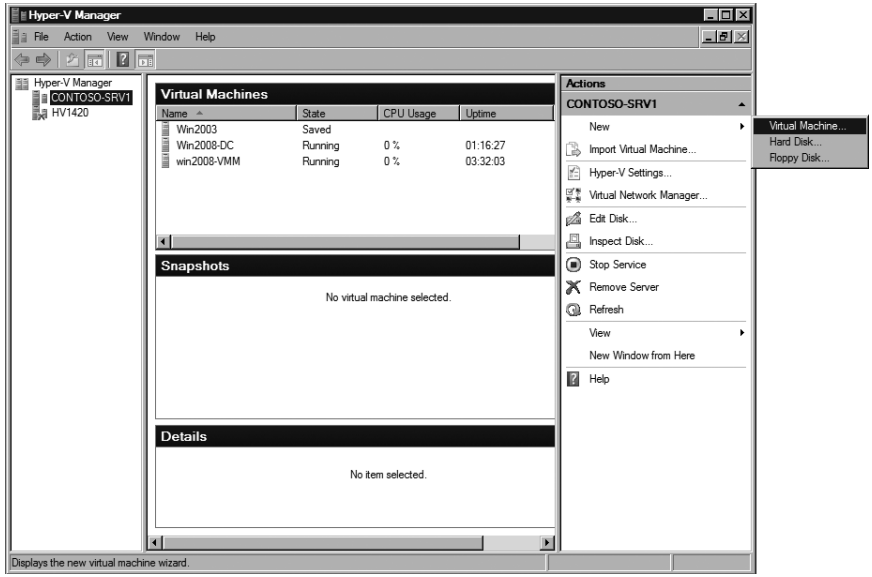

FIGURE 2-5 Creating a new virtual machine in Hyper-V Manager

Hyper-V provides the New Virtual Machine Wizard, shown in Figure 2-6, to guide you through the process of configuring and creating a new virtual machine.

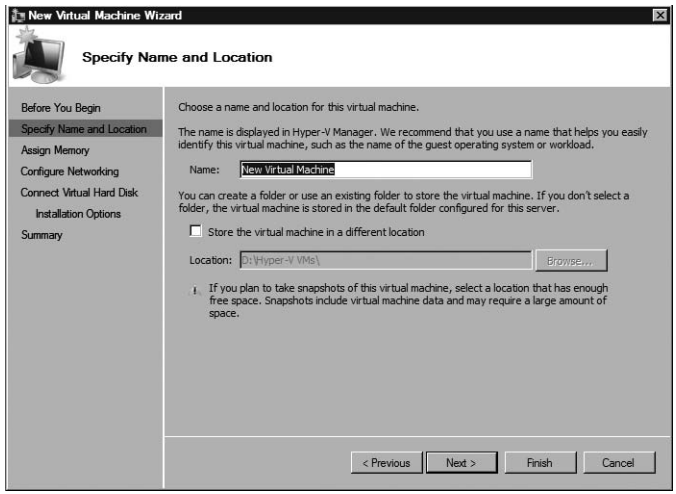

FIGURE 2-6 Hyper-V Manager New Virtual Machine Wizard

The wizard gathers basic information about the new virtual machine configuration, including the virtual machine name and storage location, memory to assign to the virtual machine, the virtual network to connect to the virtual machine, and whether you want to create a new virtual hard disk, use an existing virtual hard disk, or attach a virtual hard disk at a later time. Finally, you can specify the guest operating system installation options that include install-

ing the guest operating system later, installing the guest operating system from a boot CD or DVD-ROM, installing the guest operating system from a boot floppy disk, or installing a guest operating system from a network-based installation server. When you have made your selections, you will have an opportunity to review the settings and select whether or not to start the virtual machine after it is created.

When the information in the wizard is submitted to Hyper-V, a new virtual machine configuration file (.xml) that contains the settings information is created. The new virtual machine is registered and visible in the Hyper-V Manager; a new virtual hard disk is created, if specified; and a virtual network adapter is connected to the virtual machine. The new virtual machine is then ready to boot and install a new operating system or load an existing operating system.

Virtual Machine Export and Import

If you want to export a virtual machine, right-click the virtual machine in Hyper-V Manager or select the Export option from the Actions pane. You will then see the Export Virtual Machine dialog box shown in Figure 2-7. It is important to note that you can export only a virtual machine that is in a saved state or is powered off.

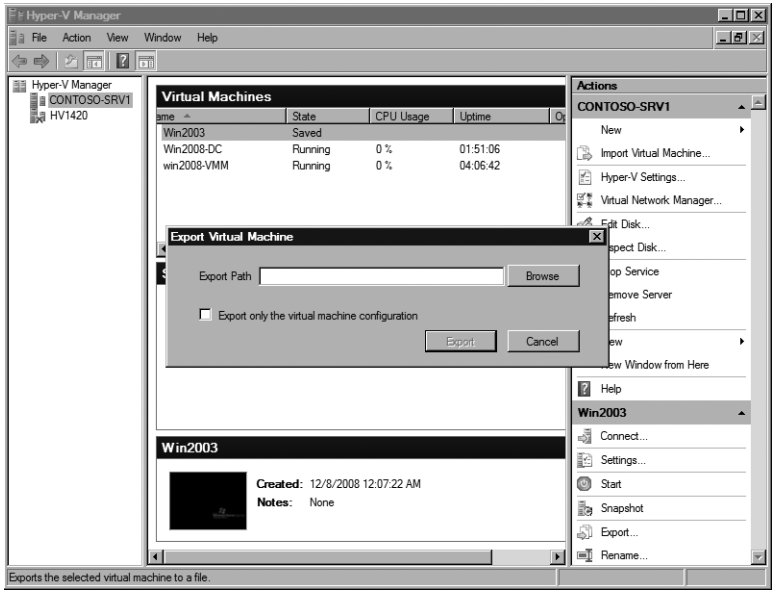

FIGURE 2-7 The Export Virtual Machine dialog box in Hyper-V Manager

In the Export Virtual Machine dialog box, you can browse to specify the location to save the virtual machine export files. There is also an option to export only the virtual machine configuration file (.exp), but not other files, such as saved state files or VHDs.

After you have moved or copied the virtual machine export files and you are ready to import the virtual machine into Hyper-V, select the Import Virtual Machine option from the

Actions pane under the server name. As shown in Figure 2-8, you must enter the path to the export files in the Import Virtual Machine dialog box or browse to select it.

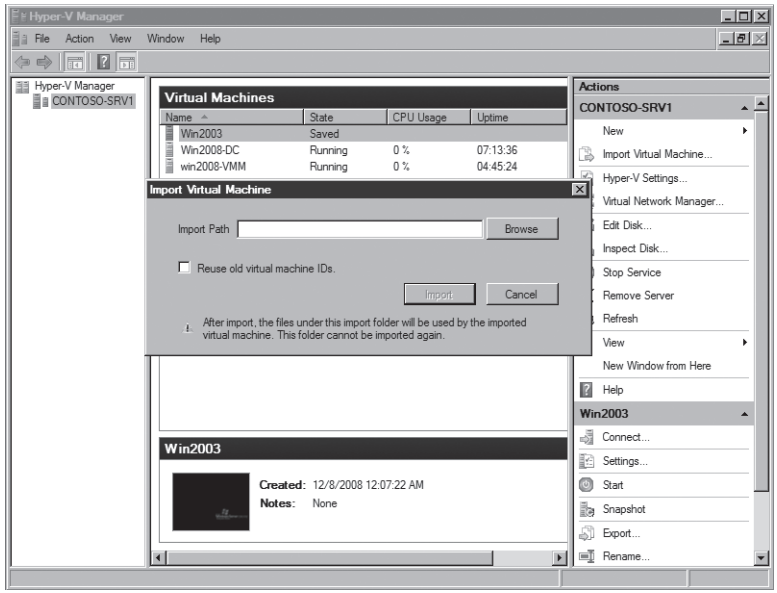

FIGURE 2-8 The Import Virtual Machine dialog box in Hyper-V Manager

You also need to decide whether or not to reuse the VM ID, which is the Global Unique Identifier (GUID) assigned when a new VM is created. If you are making a copy of an existing virtual machine, you should generate a new virtual machine ID and will leave this option unchecked. If you are moving a virtual machine or restoring a backup copy of a virtual machine, then you should reuse the old virtual machine ID.

> ***NOTE*** **If you select to reuse the old virtual machine ID and the original virtual machine is still present on the Hyper-V server, the import operation will fail because the virtual machine ID has to be unique.**

When you import a virtual machine, it will be left in the import path location, and it will not be possible to move the virtual machine after import. Therefore, you should ensure that you move the exported virtual machine files to the destination storage location before you import the virtual machine.

Virtual Machine Snapshots

The Hyper-V snapshot feature allows you to capture the configuration and state of a virtual machine at any point in time and return it to that state without noticeable interruption. Hyper-V allows you to create a snapshot whether the virtual machine is running, in saved state, or powered off.

In order to create a snapshot of a virtual machine in Hyper-V Manager, right-click the virtual machine and select the Snapshot option from the menu, as shown in Figure 2-9.

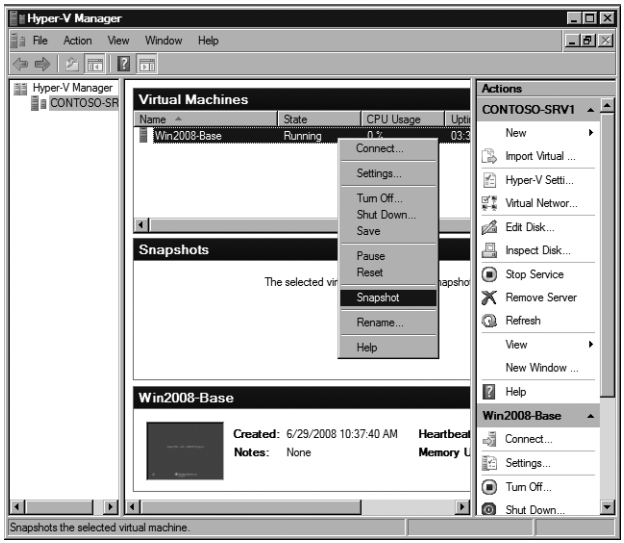

FIGURE 2-9 Creating a virtual machine snapshot using the Hyper-V Manager console

Figure 2-10 illustrates the changes in the Hyper-V Manager console when the snapshot completes. The Snapshots section in the center pane now displays a tree structure that reflects the virtual machine snapshot hierarchy. The root node of the tree is the snapshot that was just created and includes the creation time stamp. Under the root node, there is a child named Now that represents the running version of the virtual machine.

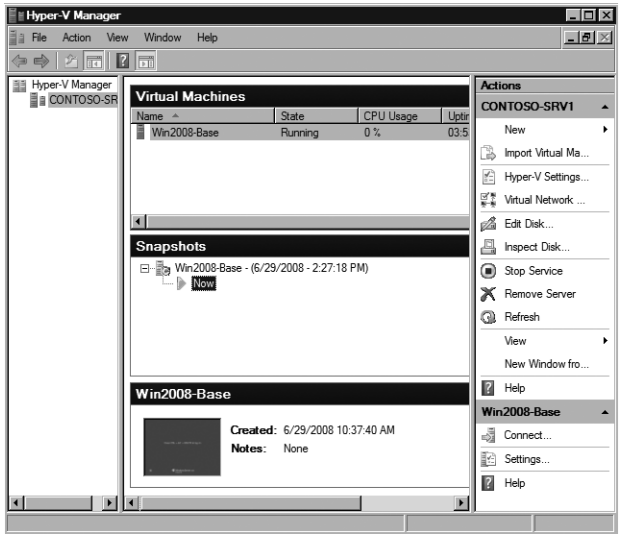

FIGURE 2-10 Snapshot display in the Hyper-V Manager console

As you make changes to the configuration of a virtual machine, you can create and save additional snapshots. Figure 2-11 shows that another snapshot was generated after the initial one, and they are displayed in a parent and child hierarchy that also reflects the relationship of the differencing disks that are created for each snapshot to capture changes to the virtual machine operating system, applications, and data.

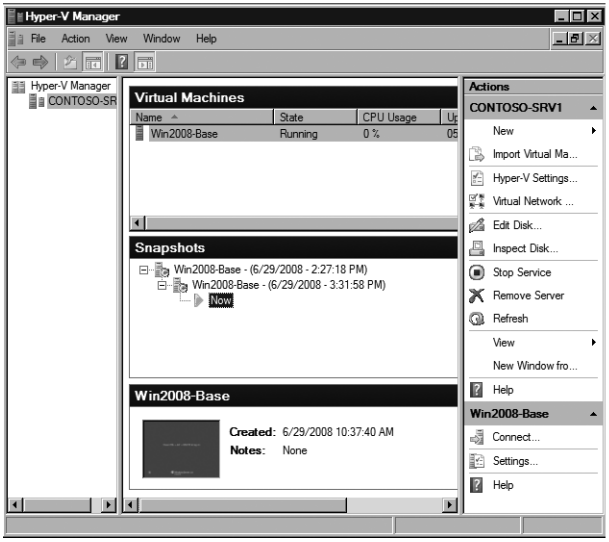

FIGURE 2-11 Snapshot hierarchy display in the Hyper-V Manager console

If after making a series of changes to a virtual machine, you decide that you want to reload the previous snapshot, use the Hyper-V Revert option, as shown in Figure 2-12. After the Revert option is applied to a virtual machine, the resulting configuration and state of the virtual machine are returned to the settings saved in the snapshot files.

If you want to reload a snapshot that is two or more levels higher than the running virtual machine (represented by the Now marker in the Snapshot pane), you can right-click the snapshot and choose the Apply option from the menu, as shown in Figure 2-13.

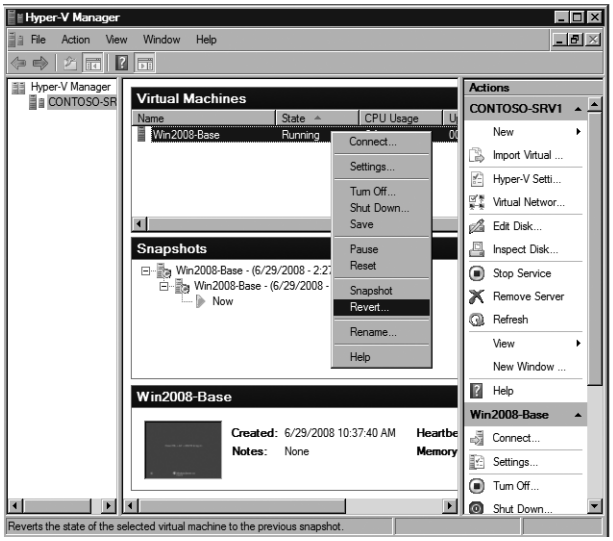

FIGURE 2-12 The Snapshot Revert Option in the Hyper-V Manager console

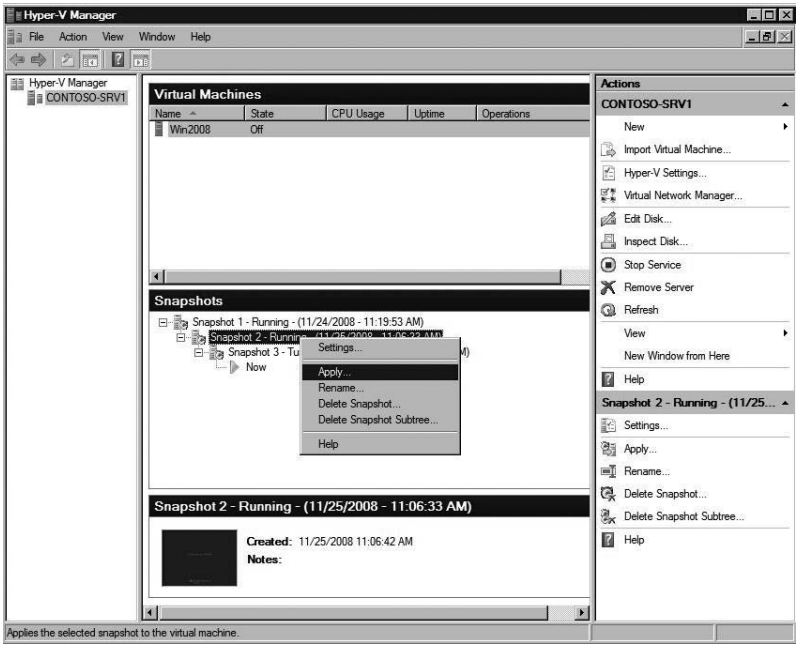

FIGURE 2-13 The Snapshot Apply option in the Hyper-V Manager console

If you decide that you no longer need a snapshot or snapshot subtree, Hyper-V provides two different Delete options (shown in Figure 2-14) to permanently remove one or more snapshots from the snapshot hierarchy.

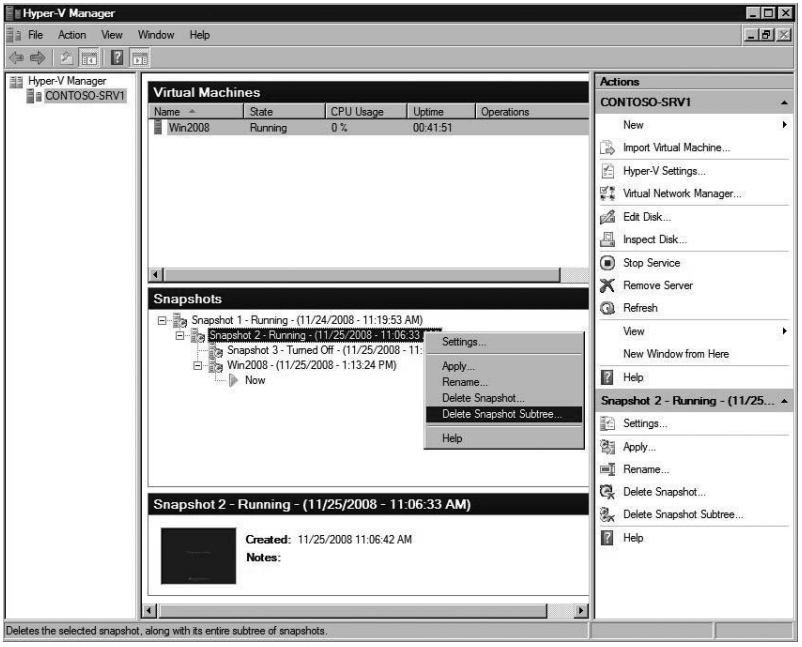

FIGURE 2-14 The Delete Snapshot and Delete Snapshot Subtree options in the Hyper-V Manager console

You can choose to delete a single snapshot or a snapshot subtree, as you can see in the shortcut menu shown in Figure 2-14. Deleting a single snapshot will not affect other snapshots in the hierarchy; however, it will immediately delete the configuration file and save state files associated with the snapshot. Deleting a snapshot subtree immediately deletes the configuration and save state files associated with all the snapshots in the subtree.

Virtual Machine State

Virtual machine state can be changed through the Hyper-V Manager. Figure 2-15 shows the menu options that are available after you right-click a running virtual machine. The menu options will differ based on the state of a virtual machine. For example, if a virtual machine is in the Off or Saved state, the Start option will appear on the menu.

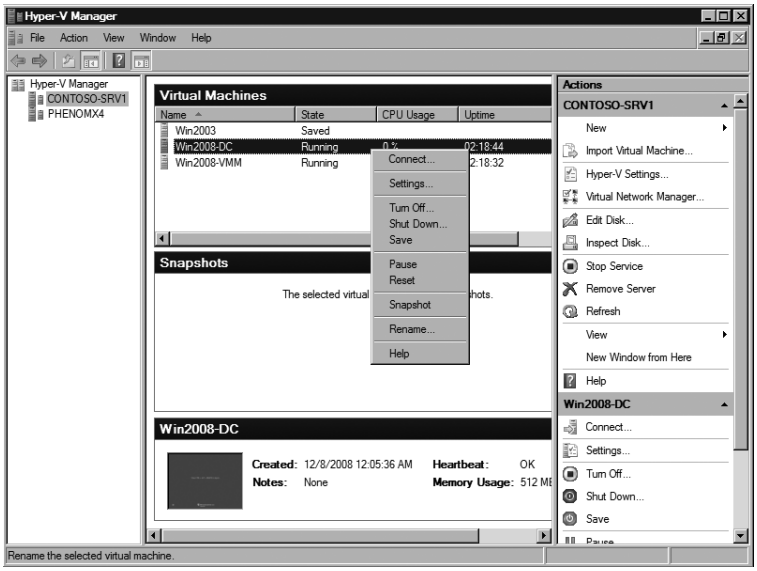

FIGURE 2-15 Running virtual machine state change options

The virtual machine state options that you can change through the Hyper-V Manager are:

- **Start** Power on and boot a virtual machine
- **Turn Off** Noncontrolled power-off of a virtual machine (equivalent to pulling the power cord on a physical computer)
- **Shut Down** Controlled power-off of a virtual machine (requires Integration Services support)
- **Save** Stop virtual machine processing and save the memory and processor state to file
- **Pause** Suspend virtual machine processing
- **Resume** Restart virtual machine processing after pausing it
- **Reset** Noncontrolled restart of a virtual machine (equivalent to pushing the reset button on a physical computer)

Managing Virtual Machine Configurations

As shown in Figure 2-16, you can right-click a virtual machine and select Settings from the menu options to access the virtual machine settings in Hyper-V Manager.

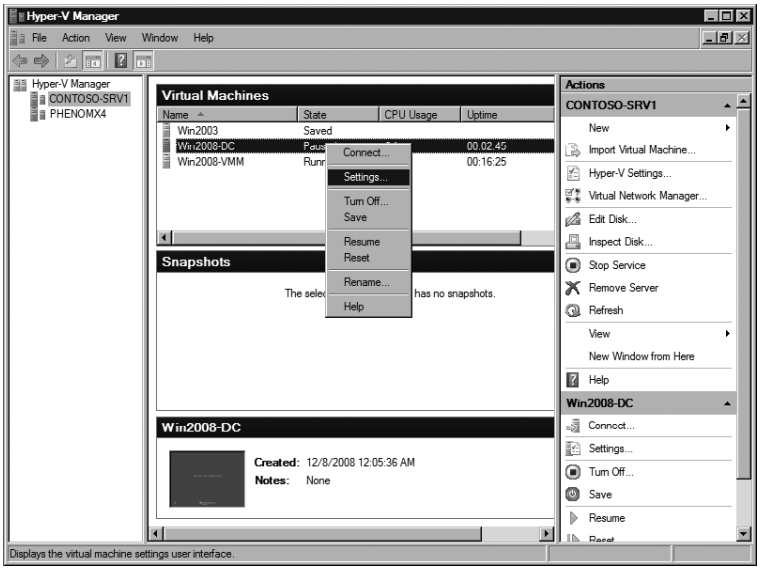

FIGURE 2-16 The virtual machine Settings option

Figure 2-17 shows an example of the virtual machine settings dialog box. The virtual machine hardware and management settings are displayed in the pane at left, divided by major component. The pane on the right displays the options that are available for each virtual machine hardware and management component.

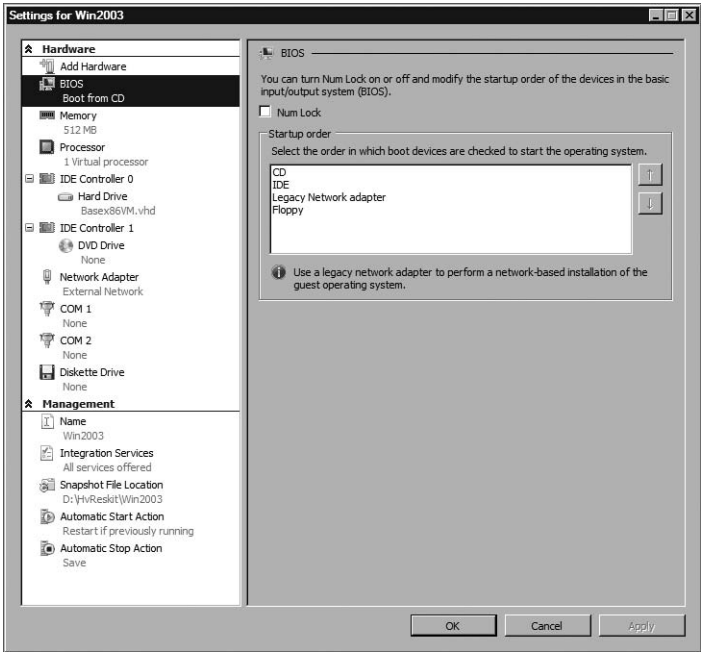

FIGURE 2-17 An example of the virtual machine settings dialog box

Table 2-4 provides a list of virtual machine hardware configuration options and a description of the changes associated with each component.

TABLE 2-4 Virtual Machine Hardware Configuration Options

CONFIGURATION OPTION	DESCRIPTION
Add Hardware	Allows the addition of synthetic SCSI controllers, synthetic network adapters, and legacy (emulated) network adapters to a virtual machine.
BIOS	Allows the configuration of the Num Lock state (on or off), and the startup order of the devices (CD, IDE, legacy network adapter, floppy) at boot time.
Memory	Allows the specification of the virtual machine memory allocation.
Processor	Allows the specification of the virtual machine logical processor allocation, resource control, and processor functionality.
IDE Controller 0	Allows the addition of virtual hard drives or DVD drives attached to the virtual machine through IDE Controller 0.
Hard Drive	Allows the configuration of which virtual IDE or SCSI controller a hard drive is connected to and the position (location) where it is connected. Also provides access to the virtual hard drive management tools (compact, convert, expand, and so on), and allows the configuration of pass-through disks. Finally, allows removal of hard drives from the virtual machine.
IDE Controller 1	Allows the addition of virtual hard drives or DVD drives attached to the virtual machine through IDE Controller 1.
CD/DVD	Allows IDE-based CD/DVD drives to be attached to the virtual machine. The CD or DVD can be in the form of an ISO image or physical CD/DVD drive installed on the host. In addition, allows removal of CD/DVD drives from the virtual machine.
SCSI Controller	Allows the addition of virtual hard drives to the virtual machine that are connected using a SCSI Controller.
Legacy Network Adapter	Allows the addition, configuration, and removal of virtual network cards installed in the virtual machine. For each network adapter, you have options to specify the virtual network connection and whether the network adapter MAC address is assigned dynamically or statically. In addition, you can configure and enable virtual LAN (VLAN) identification.

CONFIGURATION OPTION	DESCRIPTION
Network Adapter	Allows the addition, configuration, and removal of synthetic network cards installed in the virtual machine. For each network adapter, you have options to specify the virtual network connection and whether the network adapter MAC address is assigned dynamically or statically. In addition, you can configure and enable virtual LAN (VLAN) identification.
COM 1 and Com 2 Ports	Allows for the connection of COM ports to or the disconnection of COM ports from the virtual machine. COM ports can connect to a named pipe on the local or remote computer.
Diskette Drive	Allows the virtual floppy disk drive to connect to an existing floppy disk image.

Table 2-5 provides a list of virtual machine management configuration options and a description of the changes that are associated with each component.

TABLE 2-5 Virtual Machine Management Configuration Options

CONFIGURATION OPTION	DESCRIPTION
Name	Allows the specification of a name for the virtual machine and a set of electronic notes about the virtual machine.
Integration Services	Allows the selection of the Integration Services components that Hyper-V will support for the virtual machine.
Snapshot File Location	Allows specification of the folder location used to store the snapshot files.
Automatic Start Action	Allows the configuration of the virtual machine start up action when the Hyper-V server starts. The action can be set to take no action, to start automatically if the virtual machine was running when the service stopped, or to always start the virtual machine automatically. In addition, there is an option to configure an automatic start delay to reduce resource contention between virtual machines.
Automatic Stop Action	Allows the configuration of the virtual machine stop action when the Hyper-V server shuts down. The action can be set to save the virtual machine state (saved state), turn off the virtual machine, or shut down the guest operating system. The Integrations Services component must be supported by the guest operating system.

Managing Virtual Hard Disks

The Hyper-V Manager allows you to create, inspect, and edit virtual hard disks and virtual floppy disks on the managed Hyper-V server. Just as a virtual hard disk is a single file representation of a physical hard disk, a virtual floppy disk is a single file representation of a physical floppy disk.

Creating Virtual Hard Disks

Virtual hard disk files are a main component of a virtual machine, encapsulating the guest operating system and application data. Within Hyper-V Manager, a virtual hard disk can be created separately from a virtual machine by clicking the New option in the Actions pane and selecting the Hard Disk option from the menu. Figure 2-18 shows the New Virtual Hard Disk Wizard that is launched. To create a virtual hard disk, you must define the virtual hard disk type (dynamically expanding, fixed size, or differencing), specify a name and storage location for the new VHD, and define the size of the new VHD. Optionally, you can specify to copy the contents of a physical disk to the new VHD.

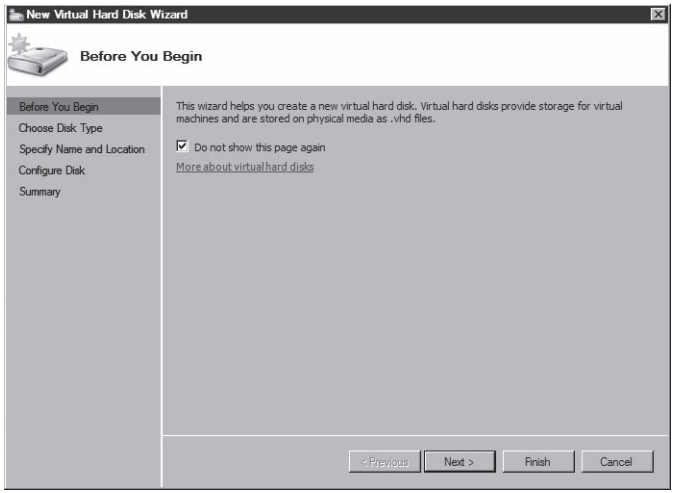

FIGURE 2-18 Creating a new virtual hard disk in Hyper-V Manager

NOTE **Details for each virtual hard disk type are provided in Chapter 3 and Chapter 5.**

A virtual machine exposes a single virtual floppy drive to the guest operating system. A virtual machine does not allow the removal of the virtual floppy drive, nor does it support additional floppy drives to be connected. Hyper-V Manager allows only the creation of a 1.44-MB virtual floppy disk. The virtual floppy disk is created by clicking the New option in the Actions pane, selecting the Floppy Disk menu option, and then specifying the file name and storage location for the new virtual floppy disk.

Inspecting and Editing Virtual Hard Disks

If you select the Inspect Disk option in the Actions pane, Hyper-V Manager will prompt you to identify the targeted virtual hard disk. Hyper-V opens the virtual hard disk, obtains the current and maximum size settings as well as the virtual hard disk type, and displays the information, as shown in Figure 2-19.

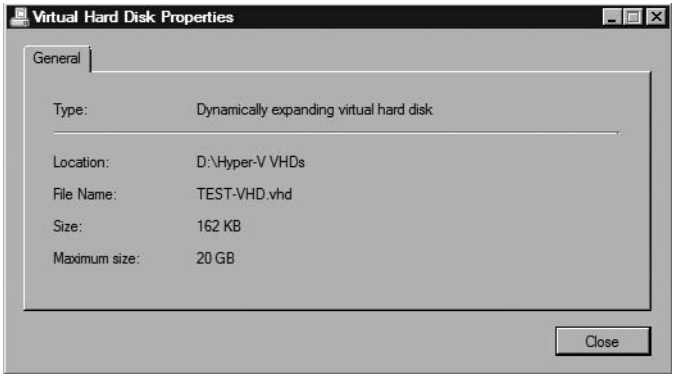

FIGURE 2-19 Inspecting a virtual hard disk in Hyper-V Manager

If you select the Edit Disk option in the Actions pane, Hyper-V Manager will launch the Edit Virtual Hard Disk Wizard shown in Figure 2-20.

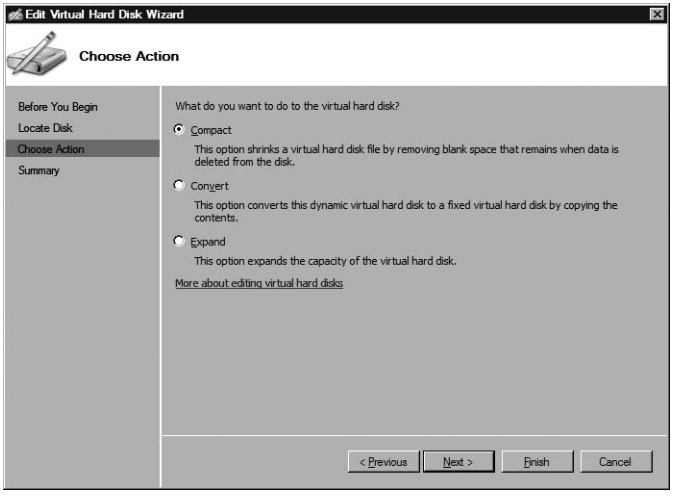

FIGURE 2-20 Hyper-V Manager Edit Virtual Hard Disk Wizard

After you select the targeted virtual hard disk and depending on the type of VHD that it is, a list of potential actions is displayed. Table 2-6 contains the list of potential actions that are available for each type of virtual hard disk.

TABLE 2-6 Virtual Hard Disk Edit Actions by VHD Type

ACTION	VHD TYPE	DESCRIPTION
Compact	Dynamically Expanding Differencing	Compact a dynamically expanding disk to regain unused space.
Convert	Dynamically Expanding Fixed Size	Convert a dynamically expanding disk to a fixed-size disk, or a fixed-size disk to a dynamically expanding disk.
Expand	Dynamically Expanding Fixed Size	Increase the storage size of the virtual hard disks.
Merge	Differencing	Merge the changes in a child disk into the parent disk or merge the parent and child disks into a new virtual hard disk.
Reconnect	Differencing	Reconnect a child differencing disk to a parent virtual hard disk.

Managing Virtual Networks

The Hyper-V Manager allows the creation, addition, and configuration of virtual networks on the managed Hyper-V server. Virtual networks allow virtual machines to connect to each other, the host, and other physical or virtual machines on a physical network.

Creating Virtual Networks

To create a new virtual network, click the Virtual Network Manager menu option in the Hyper-V Manager Actions pane. Hyper-V Manager launches the Virtual Network Manager shown in Figure 2-21.

To create a new virtual network, you must select one from the three types available: External, Internal, and Private. An external virtual network provides virtual machine connectivity to external physical networks. This type of virtual network must be bound to a physical network adapter installed in the Hyper-V server. An internal virtual network provides connectivity between virtual machines and the Hyper-V server but does not provide access to any physical networks. In other words, no packets from any attached virtual machines or the Hyper-V server are transmitted on a physical network. A private virtual network is even more restrictive than an internal one, as it provides connectivity only between virtual machines. There is no access to any physical networks or to the Hyper-V server.

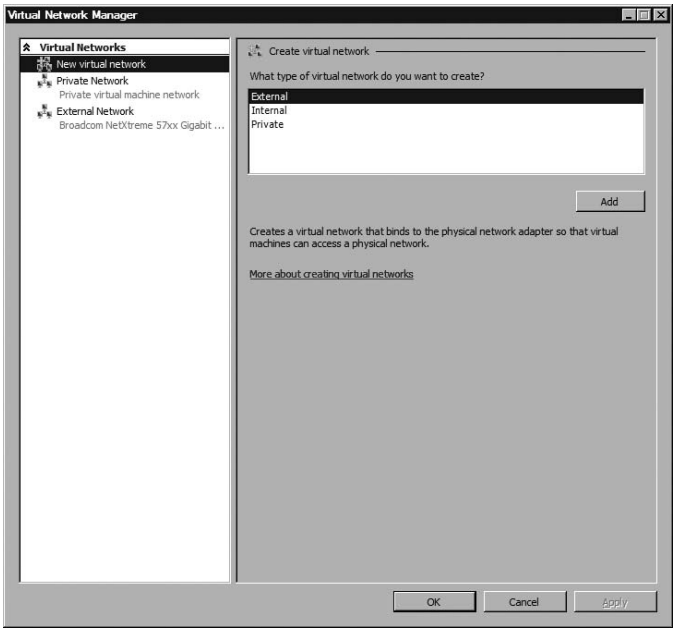

FIGURE 2-21 The Virtual Network Manager in Hyper-V Manager

If you choose to add a new External virtual network, you will have to specify a name for the new virtual network and select the physical network adapter to bind the virtual network. As shown in Figure 2-22, there is a drop-down menu in the New Virtual Network pane that allows you to choose the desired physical network adapter from the list of available adapters.

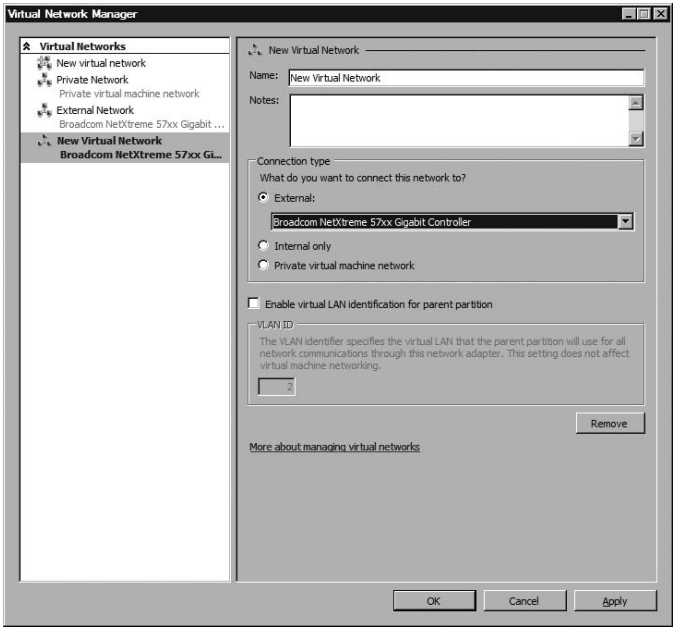

FIGURE 2-22 Virtual network configuration parameters in Virtual Network Manager

If you select a new Internal or Private virtual network, you would choose the Internal Only or Private Virtual Machine Network options in the Connection Type section, respectively.

If you select a new External or Internal virtual network, you can also choose to enable and configure a virtual LAN identifier (VLAN ID). A VLAN ID can be used to isolate the network traffic from different virtual machines connected to the same virtual network. Virtual machines with the same VLAN ID can communicate with each other but not with any other system configured with a different VLAN ID. VLANs are not supported for Private virtual networks.

Virtual Machine Connection Application

You can remotely access a virtual machine using the Virtual Machine Connection (VMC) application that is embedded in the Hyper-V Manager. As shown in Figure 2-23, to launch the VMC and connect to a virtual machine, double-click the thumbnail at the bottom of the Hyper-V Manager center pane or right-click the name of a virtual machine and select the Connect option from the shortcut menu.

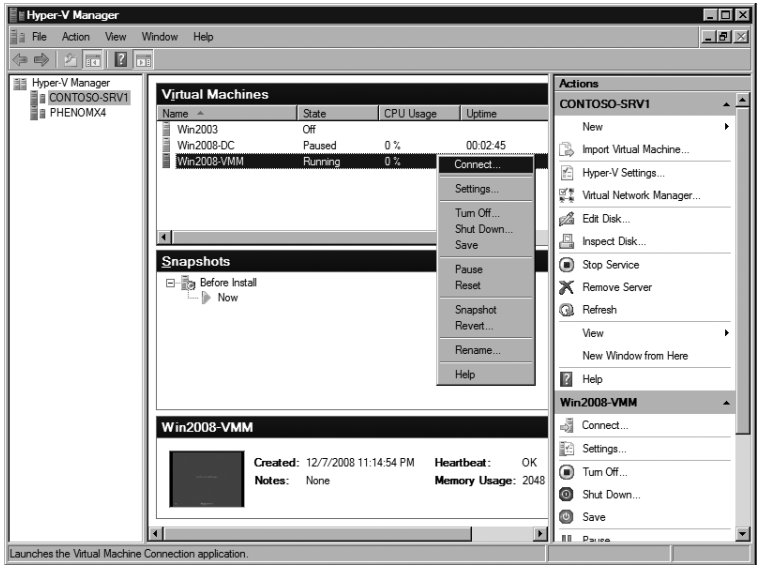

FIGURE 2-23 Connection to a virtual machine using VMC in Hyper-V Manager

VMC essentially frames a remote desktop session within a Hyper-V specific GUI and allows connection to a virtual machine for administrative or functional purposes. An example of a VMC is shown in Figure 2-24. The VMC GUI provides much of the functionality available in Hyper-V Manager to manage virtual machines. This includes providing actions to change the virtual machine state (e.g., Start, Turn Off, Save, and so on), access virtual machine settings, manage snapshots, manipulate the bindings of the virtual DVD and floppy disk drives to different media, and provide an option to install Integration Services.

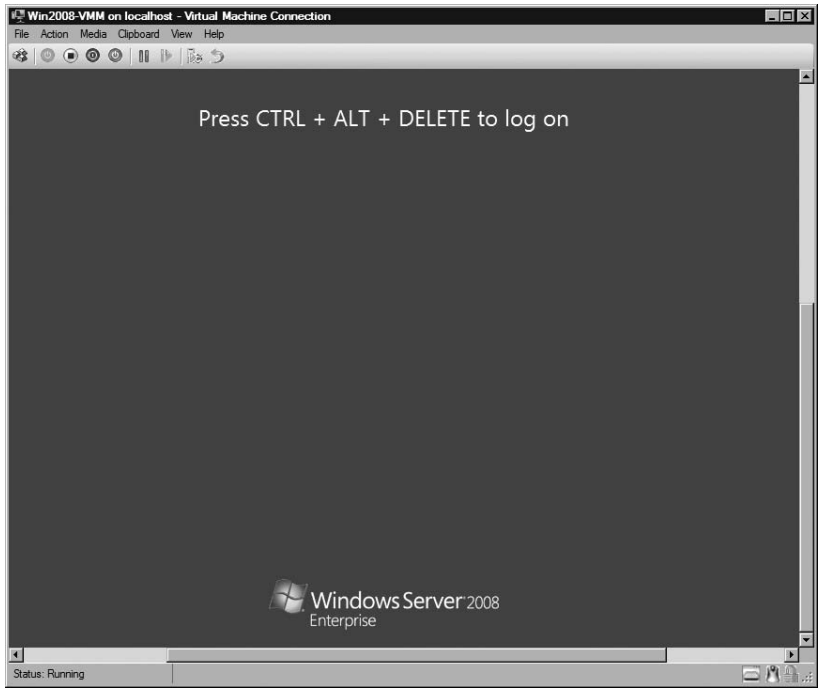

FIGURE 2-24 VMC view

The VMC allows client remote access and interaction with a virtual machine from the moment the virtual machine is powered on.

Managing Hyper-V Settings

The Hyper-V Manager also provides the ability to configure Hyper-V settings. Figure 2-25 shows the Hyper-V Settings dialog box that is displayed when you select the Hyper-V Settings option in the Actions pane menu.

There are two sets of Hyper-V settings that you can modify: Server and User. The Server settings allow you to specify the default folder location to store the virtual hard disk files and virtual machine configuration files. The User settings provide several options. The Keyboard component allows you to set the focus of Windows key combinations to either the physical server or a virtual machine. The Mouse Release Key provides you with a way to set the key combinations to use when Integration Services are not installed or supported in the guest operating system. The User Credentials allow you to specify whether the Virtual Machine Connection should automatically use your default credentials to connect to a running virtual machine. The Delete Saved Credentials component allows you to delete the credentials that you used to connect to a running virtual machine. Finally, the Reset Check Boxes feature allows you to restore default settings for Hyper-V confirmation messages and wizard pages hidden by selecting certain check boxes.

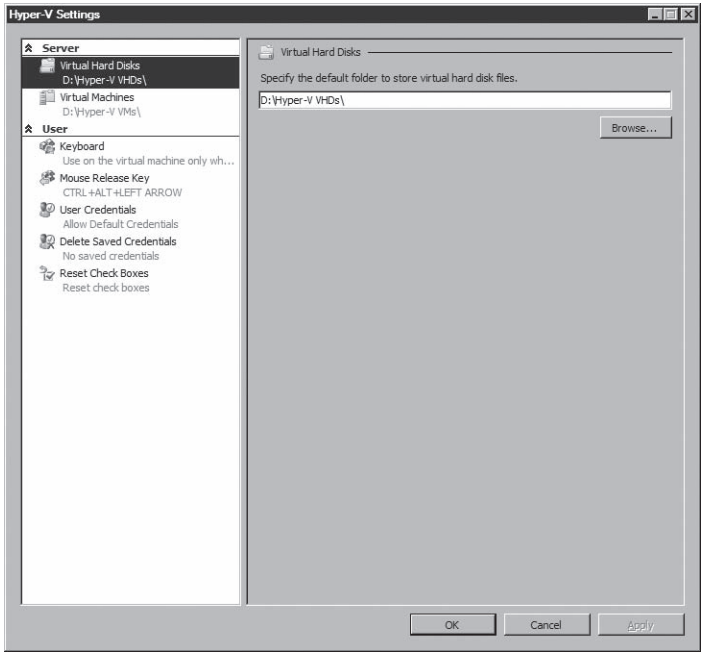

FIGURE 2-25 Hyper-V settings

Outlining the WMI API

Hyper-V provides an extensive and powerful WMI API that can be used to programmatically control and monitor Hyper-V as well as automate deployment and management of virtual machines. All of the features offered in Hyper-V Manager can be reproduced as scripts that leverage this development interface.

Scripts and self-developed applications can be created using a variety of languages, including C#, Perl, C++, or Visual Basic, to name just a few popular alternatives. Scripts can be executed using Microsoft Windows PowerShell, which provides you with the ability to run commands in a Windows Shell and immediately see the results.

> ***NOTE*** **The Hyper-V WMI API is discussed in detail in Chapter 16, "Hyper-V Management Using Windows PowerShell." Chapter 16 contains many scripts that you can use or modify to use in your environment.**

Summary

Hyper-V provides many features, including virtual machines that expose a standard virtual hardware environment to their guest operating system and applications. Becoming familiar with the virtual hardware environment and new synthetic device model in Hyper-V is crucial to making competent decisions concerning physical workloads that can successfully be redeployed as virtual machines.

Creation, inspection, and configuration of the main components of virtual machines, including virtual hard disks and virtual networks, can be accomplished through the Hyper-V Manager. You can also use the Hyper-V Manager to configure Hyper-V Settings.

Use the Virtual Machine Connection application from within Hyper-V (or as a stand-alone application) to access and manipulate virtual machines remotely from the moment they become active. If you anticipate having or already have a significant deployment of Hyper-V servers and virtual machines, leverage the WMI API to programmatically control the deployment, administration, and configuration of Hyper-V servers and virtual machines, or use System Center Virtual Machine Manager.

Additional Resources

The following resources contain additional information related to the topics in this chapter:

- Microsoft Technet Blog, "Can I run Hyper-V on my machine?" available at *http://blogs.technet.com/apawar/archive/2008/11/11/can-i-run-hyper-v-on-my-machine.aspx*
- Microsoft Technet Blog, Windows Virtualization Team Blog, available at *http://blogs.technet.com/virtualization/default.aspx*
- Microsoft Web site, "Virtualization with Hyper-V: Technical Resources," available at *http://www.microsoft.com/windowsserver2008/en/us/hyperv-technical-resources.aspx*
- Microsoft Web site, "Microsoft Hyper-V Server 2008 Configuration Guide," available at *http://www.microsoft.com/downloads/details.aspx?FamilyId=E1E111C9-FA69-4B4D-8963-1DD87804C04F&displaylang=en*

CHAPTER 8

Moving from Virtual Server 2005 R2 to Hyper-V

Moving from Virtual Server 2005 R2 SP1 to Hyper-V involves migrating both the Virtual Server host and the virtual machines. Because of the change in architecture, it is not a simple process—you can't perform an upgrade in place to make this move. Rather, the host and virtual machine migrations must be done separately. It is not a terribly difficult process, but the multiple steps involved in the migration must be performed in the correct order. This chapter will provide you with guidance about what should be moved, how to move it, when to move it, and other important considerations you need to be aware of during the process.

Considerations Before Migrating a Virtual Server 2005 R2 Host to Hyper-V

Virtual Server 2005 R2 SP1 is a hosted virtualization solution that runs on top of the operating system, and Hyper-V is a hypervisor that runs under the operating system. Because this is a significant change in architecture between Virtual Server 2005 R2 SP1 and Hyper-V, there is no option to perform an in-place upgrade of a Virtual Server 2005 R2 SP1 to Hyper-V.

The goal of the migration should be to get the Virtual Server host and virtual machines migrated with minimum impact and downtime. The best way to accomplish this is to migrate to new server hardware. This allows you to install Windows Server 2008

and the Hyper-V role or Microsoft Hyper-V Server 2008, configure the machine for the migration, and properly optimize the configuration following the guidelines provided in Chapter 7, "Hyper-V Best Practices and Optimization." After you have optimized the installation, the virtual machines can be migrated from the Virtual Server 2005 R2 SP1 server to the new Hyper-V server.

Maintaining Virtual Server 2005 R2 Hosts

Although you might be tempted to migrate off all Virtual Server 2005 R2 SP1 hosts, it is a good idea to keep Virtual Server around for certain guest operating systems. Virtual Server 2005 R2 SP1 provides support for the following guest operating systems that Hyper-V does not support:

- Windows NT Server 4.0 with Service Pack 6a
- Windows XP SP2 (for Virtual Server 2005 R2 only)
- OS/2 4.5
- Red Hat Enterprise Linux 2.1 (update 7)
- Red Hat Enterprise Linux 3.0 (update 8)
- Red Hat Enterprise Linux 4.0 (update 4)
- Red Hat Enterprise Linux 5.0
- Red Hat Linux 9.0
- SuSE Linux 9.3
- SuSE Linux 10.0
- SuSE Linux 10.1
- SuSE Linux 10.2

If you have virtual machines running any of these guest operating systems, we would recommend keeping them on Virtual Server instead of moving them to Hyper-V.

Wireless Networking Support

Virtual Server 2005 R2 SP1 provides support for wireless networks to be used for binding virtual networks. Hyper-V does not implement direct attachment of external virtual networks to wireless network adapters because Hyper-V adheres strictly to the 802.11 specifications, and those specifications do not allow wireless networks to modify the MAC address.

Server Hardware Support

You must evaluate your hardware before upgrading to Hyper-V to manage your virtual machines. The hardware you are planning to use for the Hyper-V server must be 64-bit and must provide hardware virtualization extensions enabled for the Hyper-V installation to be completed successfully. Since you cannot upgrade an existing Virtual Server 2005 R2 SP1

server directly to Hyper-V, either you must provide new server hardware, or the existing hardware must meet the recommended minimum Hyper-V hardware specifications to be reused.

Minimizing Downtime

When you migrate virtual machines from Virtual Server to Hyper-V, the virtual machines must be powered off for the migration. This will cause a period of downtime for the individual virtual machines. In addition, depending on the approach you take during the migration of the Virtual Server host, the host also could experience downtime that will result in downtime for all the virtual machines. Therefore, you should determine how much downtime is acceptable for the host and the virtual machines before you choose the host migration approach.

Migrating a Virtual Server 2005 R2 Host to Hyper-V

Migrating from Virtual Server 2005 R2 SP1 to Hyper-V is a multistep process, but the steps may vary based on the current configuration of your Virtual Server host. From previous chapters, you know that to run Hyper-V, you must have either Windows Server 2008 64-bit or Microsoft Hyper-V Server 2008. Unless the current Virtual Server 2005 R2 SP1 installation is running on the Windows Server 2008 64-bit operating system, you will first need to create a new installation of Windows Server 2008 x64 or Microsoft Hyper-V Server 2008.

If the Virtual Server host is currently running on Windows Server 2008 x64, it is possible to back up the host, uninstall Virtual Server, install the Hyper-V role, and then migrate the virtual machines. This method allows you to use the same hardware during the migration without having to copy virtual machine files to another computer, but it requires the existing Virtual Server and the virtual machines to be taken offline, so users will experience downtime. It also means that if something goes wrong, the recovery process will not be quick or painless. To minimize downtime on the host and the virtual machines, a better approach is to build a new Hyper-V server and migrate the virtual machines to the new server. You will gain several advantages by using this approach:

- The flexibility to migrate virtual machines when needed
- The ability to size the hardware to meet the requirements
- No downtime for the existing Virtual Server host
- The consolidation of multiple Virtual Server hosts to a single Hyper-V server or cluster of hosts

In addition, if something goes wrong during the migration process, the virtual machines still exist on the Virtual Server host and can be rebooted quickly.

The host migration process discussed in the following sections focuses on the side-by-side migration approach versus the migrate-in-place approach. The steps in the process include developing the specification for the Hyper-V server hardware, building the Hyper-V servers, and migrating the configuration. When you have completed the migration, you will be able to add any new features or capabilities available in Hyper-V.

Developing the Hyper-V Server Specification

The first step in the process is discovering and documenting the configuration of the Virtual Server 2005 R2 SP1 environment so that you can determine the minimum required Hyper-V hardware configuration. This involves determining the current hardware specification for memory, disk storage, networking, and processor. In addition, collect the number of virtual networks currently configured on the Virtual Server host. When you have collected this information, you can start developing the Hyper-V server specification. Use the following guidelines to determine the specification.

Hyper-V memory configuration should include memory reserved for the parent partition—typically a minimum of 1 gigabyte (GB) of RAM, virtual machine memory—the size of the memory of each virtual machine plus overhead calculated by adding 32 MB for the first gigabyte (GB) of RAM and then 8 MB for each additional gigabyte of RAM, and memory for the predicted number of concurrent VMConnect.exe sessions on the host at 20 MB each. It is always a good idea to add additional memory for expansion for temporary purposes (1 to 2 GB of RAM). At a minimum, you should make sure the Hyper-V server has as much memory as the current Virtual Server host.

Disk storage can involve many choices, including disk drive speed, disk drive size, RAID configuration, controller cards, and so on. Focusing on just the amount of storage you will need, the server requires space for the parent partition operating system; space for each virtual machine's virtual hard disk (VHD), the maximum defined size of the VHD; space for saved-state files, which will vary based on the amount of RAM in the virtual machine; space for snapshots, which will vary based on the number of snapshots planned; and space for additional files such as CD or DVD images. At a minimum, you will need the amount of storage space that is currently used on the Virtual Server host, plus additional space for snapshots if you plan to use them.

Networking configuration involves the needs of the parent partition, interfaces for iSCSI communications, interfaces for clustering if the Hyper-V server is a member of a host cluster, and interfaces for the required number of virtual networks. The Hyper-V server should include a minimum of one 1-gigabit Ethernet card reserved for parent partition management purposes, one 1-gigabit Ethernet card for iSCSI communications (if iSCSI will be used), two 1-gigabit Ethernet cards for cluster communications (if a member of a host cluster), and one 1-gigabit Ethernet card for each required external virtual network.

> ***NOTE*** **Virtual Server allowed multiple virtual networks to be configured to a single network interface card, but Hyper-V allows only a single virtual network to be bound to a network interface card.**

Processor configuration involves the needs of the parent partition, each virtual machine, and reserve for unexpected peaks in performance. The Hyper-V parent partition should have a minimum of one processor core reserved for its use to manage shared parent partition resources; each virtual machine should have a minimum of a single processor core; and a re-

serve amount of processing (one or more cores) should be included for peaks in performance and possible expansion. Virtual machines in Virtual Server 2005 R2 SP1 could have only a single processor. With Hyper-V, each virtual machine can have up to four virtual processors (depending on the operating system). If any virtual machines currently running under Virtual Server are utilizing high amounts of processing power, there is an opportunity to add virtual processors during the migration. Be sure to account for any additional processors you may need during the sizing process.

Installing Hyper-V

When you have identified the Hyper-V configuration you will require and have purchased and assembled the hardware, you are ready to install Hyper-V on the system. Chapter 4, "Hyper-V Installation and Configuration," goes into detail about how to install Hyper-V on the hardware and outlines the post-installation configuration changes that you should make.

Migrating Virtual Networks

After you have completed the default installation and optimization, you are ready to migrate the current configuration of the Virtual Server 2005 R2 SP1 virtual networks to the Hyper-V server. This is a manual process and involves recreating the required virtual networks that existed on the Virtual Server host on the Hyper-V server. In order to do this, you must determine the mapping of the existing virtual networks to physical adapters or loopback adapters (in the case of internal networks). When you have identified the mapping, collect the TCP/IP settings for the network adapter so that the subnet can be identified. This will allow you to determine which physical network adapter must be used in the Hyper-V server when the external virtual networks are recreated or how many internal or private virtual networks must be created.

The next step is recreating the external virtual networks on the new Hyper-V server to the correct physical network adapter using the mapping you identified. Although the virtual network name does not have to be the same as it was on the Virtual Server host, it is a good idea to use the same name to minimize any confusion. After the external virtual networks are completed, recreate any required internal or private virtual networks.

> ***NOTE*** **You no longer have to add a loopback adapter to get guest-to-parent partition communications internal to the Hyper-V server. An internal network provides this functionality. For each Virtual Server network that was created using a loopback adapter, create an internal virtual network in Hyper-V.**

If the Hyper-V server was configured with additional physical network adapters to expand the number of available external virtual networks, now is the time to configure these. Remember to use the established naming convention for virtual networks.

BEST PRACTICE **Dedicate a network adapter for parent partition communications by not binding it to any external virtual network.**

BEST PRACTICE **For any external virtual network you create, you must disable the parent partition virtual LAN adapter that was created so that the external virtual network is dedicated for virtual machine communications only.**

Considerations Before Migrating Virtual Machines

Hyper-V does not provide the ability to import virtual machines that exist on a Virtual Server 2005 R2 SP1 host; you must migrate the virtual machines manually. The building blocks of a virtual machine in Virtual Server 2005 R2 SP1 and Hyper-V are basically the same, a virtual hard disk and a configuration file. The virtual hard disk has not changed and can be easily migrated from Virtual Server to Hyper-V. The configuration file has completely changed, however, and Microsoft does not provide a tool to migrate the settings from the old format to the new format.

Boot Disk Configuration

Virtual Server 2005 R2 SP1 virtual machines could be attached to the virtual SCSI adapter and the virtual machine would boot in this configuration (it was a recommended configuration for best performance). This was possible because the SCSI adapter was emulated and available at boot time. Hyper-V virtual machines cannot boot from the SCSI adapter, however, because it is synthetic, and synthetic devices are not available immediately at boot time. Therefore, virtual machines that are currently configured to boot from SCSI in Virtual Server must be converted to boot from IDE as part of the migration to Hyper-V.

NOTE **Unlike Virtual Server IDE–attached virtual hard disks, IDE-attached virtual hard disks in Hyper-V perform almost on par with SCSI-attached virtual hard disks.**

Virtual Machine Additions

Virtual Server 2005 R2 SP1 uses enhanced drivers to provide emulated devices and to improve performance in a virtual machine. Hyper-V uses something similar to provide synthetic devices and performance enhancements to virtual machines. The architecture and interfaces between these two technologies are not compatible; therefore, you must remove Virtual Machine Additions as part of the process of migration to Hyper-V. Although it is possible to remove the additions after you have migrated the virtual machines to Hyper-V, your ability to do this depends on the version of Virtual Machine Additions that is installed. The better

approach, which will work regardless of the version installed, is to uninstall Virtual Machine Additions prior to migrating to Hyper-V.

Undo Disks

The Undo disk feature in Virtual Server 2005 R2 has been removed in Hyper-V and replaced with a more powerful feature called *snapshots*. You cannot migrate Undo disks to Hyper-V; they must be discarded or committed prior to migrating the virtual machine hard disk to Hyper-V.

Saved States

Virtual Server 2005 R2 SP1 and Hyper-V both have the ability to save the state of a running virtual machine to disk. The concept is similar to hibernation. In Virtual Server 2005 R2, the saved state file was a single file (.vsv) that contained the contents of memory and information on running processes, threads, and the processor stack. Hyper-V has split the save state file into two parts: the memory contents (.bin) and the stack and process information (.vsv). Because of this change, saved states cannot be migrated and must be merged or discarded before the migration can occur.

Hardware Abstraction Layer Differences

Virtual machines running in Virtual Server 2005 R2 can have only a single virtual processor. Hyper-V provides the ability for a virtual machine to be configured with up to four virtual processors. This presents an issue with hardware abstraction layer (HAL) compatibility. Hyper-V virtual machines require a multiprocessor Advanced Configuration and Power Interface (ACPI) HAL. Virtual Server 2005 R2 virtual machines can have APCI or non-ACPI HALs based on how they were created and what version of additions are loaded. Regardless of which HAL the existing virtual machine has, the HAL must be changed during the migration of the virtual machine to Hyper-V. For instructions on changing the HAL for Vista and Windows 2008 virtual machines, go to *http://technet.microsoft.com/en-us/library/dd296684.aspx*.

Differencing Disks

Both Hyper-V and Virtual Server 2005 R2 support differencing disks, and the technology has not changed. Differencing disks require that the parent and the child retain the same relative path when they are moved on the same machine or between machines. The relative path to the parent VHD is stored in the disk header of the child VHD. If a child VHD is copied and the parent is not, or if the relative path is not maintained between the two files, the child VHD will not have all the information it requires and the differencing disk will not be usable.

> ***NOTE*** **During migration, you may want to modify the directory structure of how the virtual machines are stored. If the directory structure change breaks the differencing disk relative path, you can repair the virtual hard disk using the Inspect Disk feature in the Hyper-V Manager MMC console.**

Shared SCSI Virtual Machine Clusters

Virtual Server 2005 R2 virtual machine–emulated SCSI controllers provided a mode called shared SCSI (a parallel SCSI bus). Enabling shared SCSI on the controller allowed a Windows Server 2003 cluster to be built between virtual machines. Hyper-V has switched to a synthetic SCSI controller and removed the ability to put the SCSI controller into parallel SCSI bus mode. You can still create a cluster between virtual machines in Hyper-V, but you must use an iSCSI Initiator to attach remote iSCSI LUNs to the virtual machines. Virtual Server–based virtual machine clusters must be manually migrated to Hyper-V.

Migrating Virtual Machines

The following sections will guide you through a process that will enable you to migrate virtual machines from Virtual Server 2005 R2 SP1 to Hyper-V. Not all of the steps provided in the process will be required for your Virtual Server installation, depending on what features you are using from Virtual Server. The process includes the following tasks:

- Determine compatibility with Hyper-V.
- Convert SCSI boot to IDE boot.
- Remove Virtual Server Additions.
- Remove network interface cards.
- Commit or discard all Undo drives.
- Merge or discard saved states.
- Merge all differential disks.
- Check the hardware abstraction layer (HAL).
- Copy the virtual hard disk to the new Hyper-V server.
- Create a new virtual machine using existing VHD.
- Install Integration Services.

Determine Compatibility

Before you migrate a virtual machine, you should determine if it contains a supported operating system, and if the applications running in the virtual machine are supported by the independent software vendor (ISV) for production use on Hyper-V. Compare the operating system with the Hyper-V–supported guest operating systems and be sure to match product versions and service pack levels.

Convert SCSI Boot to IDE Boot

We have already discussed that Hyper-V does not support booting from the synthetic SCSI controller. So before you can migrate a Virtual Server 2005 R2 virtual machine that currently boots from a SCSI adapter to Hyper-V, you must convert it to boot from the IDE controller. Follow these steps to migrate the boot disk from a SCSI controller to an IDE controller:

1. Launch the Virtual Server Administrative Web console.
2. Select Configure from the Virtual Machines menu and then select the virtual machine name from the list.
3. From the Configuration menu options, select Hard Disks to display the Virtual Hard Disk Properties page, which shows the current configuration of all the hard disks for the virtual machine (see Figure 8-1).

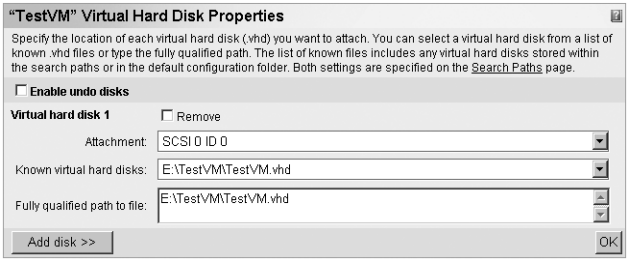

FIGURE 8-1 Virtual Hard Disk Properties page

4. To convert the virtual hard disk so that it boots from the primary IDE controller (ID 0) instead of the SCSI controller (ID 0), select Primary Channel (0) from the Attachment drop-down list, as shown in Figure 8-2.

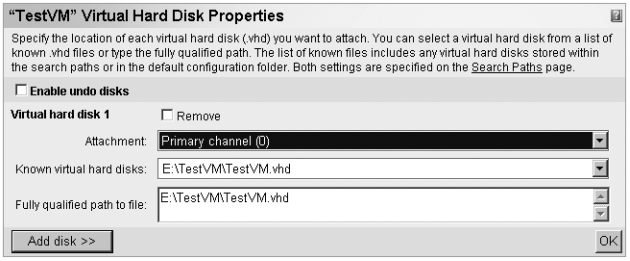

FIGURE 8-2 Virtual hard disk with Primary IDE channel (0) selected

5. To save the change, click OK.

DIRECT FROM THE SOURCE

Migrate VHD from SCSI to IDE Controller

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If you standardized attaching VHDs to SCSI controllers as most people did for performance reasons, manually migrating them to IDE controllers can be time-consuming. Following is a script that can help automate that process. Save this script as SCSI2IDE.vbs and run it with a command-line option to indicate the virtual machine for which you want to reconfigure the boot disk to use IDE instead of SCSI.

ON THE COMPANION MEDIA **This script is included on this book's companion media, in the \Scripts\Chapter 8 folder.**

```
Option Explicit

dim id, rtn
dim objVS, objVM, objHardDisk
dim colArgs, colVMs
dim hdskConnections
dim objhdskConnection
dim strFile

Set objVS = CreateObject("VirtualServer.Application")
set colVMs = objVS.VirtualMachines
set colArgs = wscript.Arguments

id = 0

For Each objVM in colVMs
   If objVM.Name = colArgs.item(0) then
      set hdskConnections = objVM.HardDiskConnections
      For Each objhdskConnection In hdskConnections
         set objHardDisk = objhdskConnection.HardDisk
         strFile = objHardDisk.File
         wscript.echo "VM Disk File" & strFile
         If objhdskConnection.BusType = 1 Then
            rtn = objhdskConnection.SetBusLocation (0,0,id)
            id = id+1
         End If
      Next
   End if
Next
```

NOTE **You should make sure all the virtual machines are powered off on the Virtual Server host prior to running the previous script.**

Remove Virtual Machine Additions

Virtual Server 2005 R2 SP1 Virtual Machine Additions are not compatible with the Hyper-V architecture and will not work properly with it. Although it is possible to remove Virtual Machine Additions version 13.813 or newer from within a migrated virtual machine, a less risky approach is to remove the additions prior to migrating the virtual machine.

Follow these steps to remove Virtual Machine Additions:

1. Power on the virtual machine and log in with administrative privileges.
2. In the virtual machine, open Control Panel and then double-click Add Or Remove Programs or Programs And Features (depending on the operating system version).
3. Select Virtual Machine Additions and then select Remove, or right-click and select Uninstall (depending on the operating system version).
4. Click Yes in the confirmation dialog box that appears.
5. After you have successfully removed Virtual Machine Additions, restart the virtual machine.

Remove Emulated Network Interface Cards

Virtual Server 2005 R2 SP1 virtual machines have a single network interface card installed inside the virtual machine by default. The network interface card emulates an Intel 21140 adapter. In Hyper-V, the default networking interface card is not the legacy network adapter (which also emulates an Intel 21140 adapter), but instead is the synthetic network adapter. If you attempt to move a virtual machine with the emulated Intel 21140 adapter still installed, the network adapter will become a hidden device. You can install Hyper-V Integration Services and all will seem to be fine, but if the emulated Intel 21140 adapter had a static IP address assigned, any attempt you make to reassign that static IP address to the new synthetic network adapter will result in a warning box that says the IP address is already in use.

Follow these steps to remove the network adapter from the virtual machine:

1. Power on the virtual machine.
2. Log in with administrative permissions.
3. Open Control Panel and double-click Device Manager.
4. Expand the Network Adapters node.
5. Right-click the Intel 21140 adapter listed and select Uninstall.
6. Shut down the virtual machine.

When you migrate the virtual machine to Hyper-V, a synthetic adapter will be installed. The network adapter might not function until you install the Integration Services, however.

NOTE **The synthetic network adapter in Hyper-V does not support boot from pre-execution environment (PXE). To enable PXE boot, you must use a legacy adapter.**

Commit or Discard Undo Disks

Virtual Server 2005 R2 provided a disk mode that would write all changes to a separate file. This mode, called Undo, allowed you to perform what-if changes to the disk without fear that the changes had to be permanent. Undo disks were not very flexible if you needed to perform multiple what-if scenarios, however, so in Hyper-V the technology was replaced with snapshots. This means that any Undo disks in Virtual Server virtual machines must be discarded or committed to the virtual hard disk prior to migrating it to Hyper-V.

If a virtual machine is configured to use Undo disks but does not currently have an active Undo disk, then you do not need to perform any additional steps. If you do need to commit or discard an Undo disk, the procedures are slightly different depending on whether the virtual machine is currently powered on or not.

Follow these instructions for committing or discarding the Undo disks for a virtual machine that is currently powered on:

1. Shut down the virtual machine.
2. Select Turn Off Virtual Machine And Commit Undo Disks to commit the Undo disk if you want to merge the current changes into the virtual hard disk, or select Turn Off Virtual Machine And Discard Undo Disks to discard the changes to the Undo disk if you do not want to merge the changes.

Follow these instructions for committing or discarding the Undo disks for a virtual machine that is currently powered off:

1. Launch the Virtual Server 2005 Administration Web site.
2. On the Master Status page, find the appropriate virtual machine in the list of virtual machines and click the arrow to display the actions menu.
3. Figure 8-3 displays the menu options available. Select Merge Undo Disks or Discard Undo Disks from the menu.

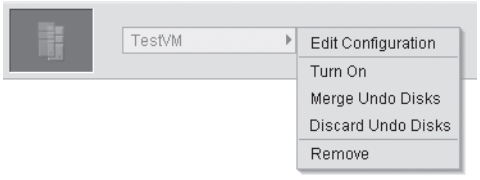

FIGURE 8-3 Undo Disk actions menu for a virtual machine

Restore or Discard Saved States

Virtual Server 2005 R2 saved states are not compatible with Hyper-V saved states, so the virtual machine must be powered on and shut down properly, or the saved state must be discarded. If the virtual machine is currently powered on, perform a shutdown from within the virtual machine and do not select to save the state.

Follow these instructions for discarding the saved state for a virtual machine that is currently powered off:

1. Launch the Virtual Server 2005 Administration Web site.
2. On the Master Status page, find the appropriate virtual machine in the list of virtual machines and click the arrow to the display the actions menu.
3. Figure 8-4 displays the menu options available. Select Restore From Saved State or Discard Saved State from the menu.

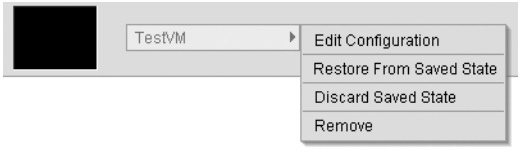

FIGURE 8-4 Saved State actions menu for a virtual machine

4. If you select to restore the saved state, after the virtual machine is restored, perform a shutdown.
5. If you select to discard the saved state, then no further actions are required.

Merge Differential Disks

Differential disks allow you to save space by creating a dependent chain of virtual hard disks. This eliminates the need to duplicate copies of data. If you are migrating all virtual machines that contain differencing disks from a Virtual Server 2005 R2 host to the same Hyper-V server, then you do not have to merge the differencing disks. You will need to maintain the same relative path on both hosts, however, or you will need to repair the parent-child links.

If you are planning to migrate virtual machines that depend on the same differencing disk to different Hyper-V servers, then you must merge the differencing disks to break the dependency.

Follow these instructions for merging a virtual machine differencing disk:

1. Shut down the virtual machine with the differencing disk.
2. Launch the Virtual Server 2005 Administration Web site.
3. On the Master Status page, select Inspect Disk from the Virtual Disks menu.
4. Specify the virtual hard disk that has a parent that needs to be merged (as shown in Figure 8-5) and click Inspect.

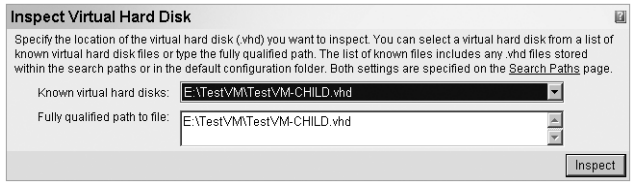

FIGURE 8-5 Inspect Virtual Hard Disk page

5. The Properties and Actions will be displayed as shown in Figure 8-6. Select Merge Virtual Hard Disk from the Actions menu to merge the parent and child virtual hard disks.

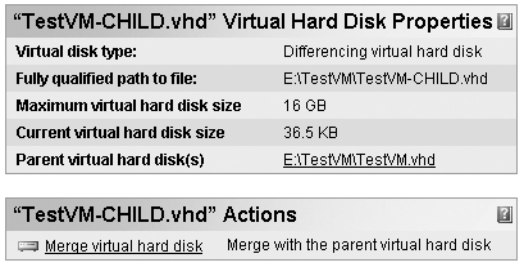

FIGURE 8-6 Differencing disk Properties And Actions page

6. The Merge Virtual Hard Disk page is displayed (as shown in Figure 8-7). Select Merge To New Virtual Hard Disk and specify the full path to the new virtual hard disk that will be created as a result of the merge operation. Optionally, you can specify the type of virtual hard disk to be created—dynamic or fixed.

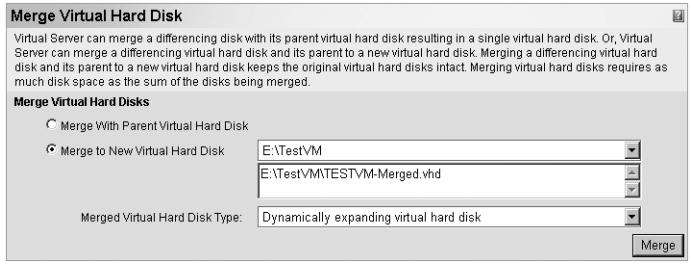

FIGURE 8-7 Merge Virtual Hard Disk options page

7. When you have selected all the appropriate options, click Merge.

The resulting merged virtual hard disk is the file that you will migrate to the Hyper-V server.

Check the Hardware Abstraction Layer

Hyper-V uses a multiprocessor APCI hardware abstraction layer (HAL). Although you would probably be prompted for the upgrade of HAL when you install Integration Services, it is best to prepare the machine for HAL detection prior to the migration so that it properly detects and updates the HAL.

Follow these steps to change the HAL prior to migrating the virtual machine:

1. Power on the virtual machine.
2. Log in with administrative permissions.
3. Run the System Configuration utility (MSConfig.exe) by clicking Start, clicking Run, typing **msconfig**, and then clicking OK.
4. Click the Boot tab and then select Advanced Options.
5. Select the Detect HAL check box, click OK, and then shut down the virtual machine.

Complete the Migration

After you have performed all the required pre-migration steps, the last tasks involve copying the virtual hard disk from the Virtual Server 2005 R2 server to the new Hyper-V server and creating a new virtual machine using that virtual hard disk.

Follow these steps to create a new virtual machine:

1. On the Hyper-V server, create a folder to hold the new virtual machine on a drive other than the system drive. Use the name of the virtual machine as the folder name (for example, D:\VMs\NEWVM).
2. Copy the virtual hard disk from the Virtual Server 2005 R2 host to the new directory.
3. Open the Hyper-V Manager MMC console.
4. Select New from the Actions menu and then select Virtual Machine. The New Virtual Machine Wizard will start. Click Next.
5. Specify the name of the virtual machine (use the same name as the directory you created) in the Name text box.
6. Select the check box that says Store The Virtual Machine In A Different Location and enter the path to the directory above the virtual machine folder you created (that is, enter D:\VMs for the example shown previously) in the Location text box, as shown in Figure 8-8. Click Next.

   This will allow the wizard to use the directory you created for all the virtual machine files.

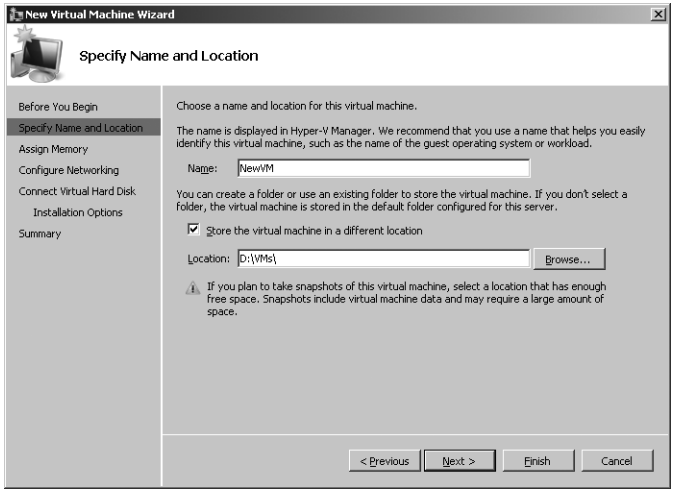

FIGURE 8-8 Specify name and location to store the new virtual machine

7. On the Assign Memory page, specify the amount of RAM the virtual machine requires and click Next.
8. On the Configure Networking page, select a virtual network to attach to the virtual machine and click Next.
9. On the Connect Virtual Hard Disk page (shown in Figure 8-9), select the Use An Existing Virtual Hard Disk option, and specify the path to the virtual hard disk (such as D:\VMs\NEWVM.VHD), and then click Next.

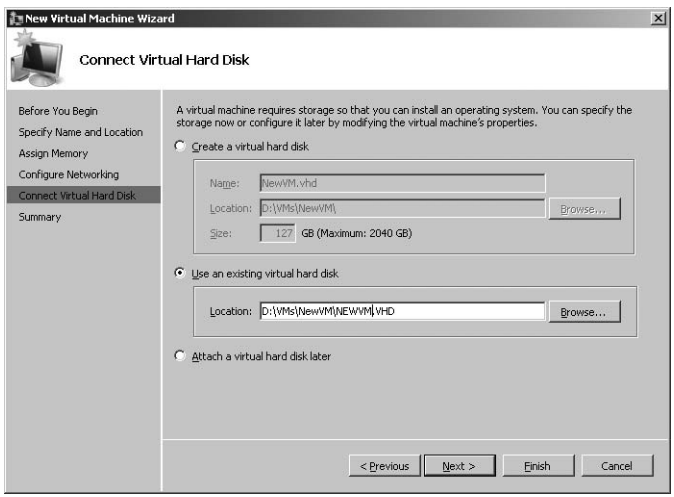

FIGURE 8-9 Connect Virtual Hard Disk page

10. On the Completing The New Virtual Machine Wizard page, click Start The Virtual Machine After It Is Created and then click Finish.

The virtual machine will power on.

11. At the login screen that will display after the virtual machine is booted, log in with administrative permissions.
12. On the VMConnect Actions menu, click Insert Integration Services Setup Disk. This should start the installation of Integration Services for the virtual machine. Complete the installation and reboot the virtual machine.

    The virtual machine is now migrated to Hyper-V.

DIRECT FROM THE SOURCE

VMC to Hyper-V Migration Tool

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Migrating a virtual machine from Virtual Server to Hyper-V requires changes to the virtual machine prior to migration, migration of the virtual hard disk to the Hyper-V server, creation of a new virtual machine using the migrated virtual hard disk, and modification of the configuration of the virtual machine. Although you can perform the migration step manually, the VMC to Hyper-V tool, also called VMC2HV, is able to import the complete Virtual Server virtual machine configuration to Hyper-V, and it will allow you to modify the virtual machine configuration in one step.

VMC2HV can be used both locally and remotely. In the local scenario, the tool runs on the Hyper-V server, which limits its use to systems running Windows Server 2008 with graphical user interface, because it needs the .NET Framework to operate. For server core installations of Windows Server 2008 and Hyper-V Server 2008, it can be used from a remote installation of Windows Server 2008 or Windows Vista with the .NET Framework installed.

To use the tool with as little effort as possible, the recommendation is to copy the VMC and virtual hard disk file(s) to the Hyper-V server in a folder with the name of the new virtual machine. For example, you could copy the files Machine1.vmc and Machine1.vhd to a folder at D:\vm\machine1. When the tool imports the file Machine1 with a Virtual Machine Path to D:\vm, it will use the folder D:\vm\machine1 and will create the new virtual machine in that folder. This way, all the files belonging to Machine1 will be contained in the same folder.

Upon import, VMC2HV reads the configuration file and displays all properties. Properties that no longer exist in Hyper-V are ignored, and you can set new properties in Hyper-V manually. Figure 8-10 shows the tool with a remote connection after importing a VMC file.

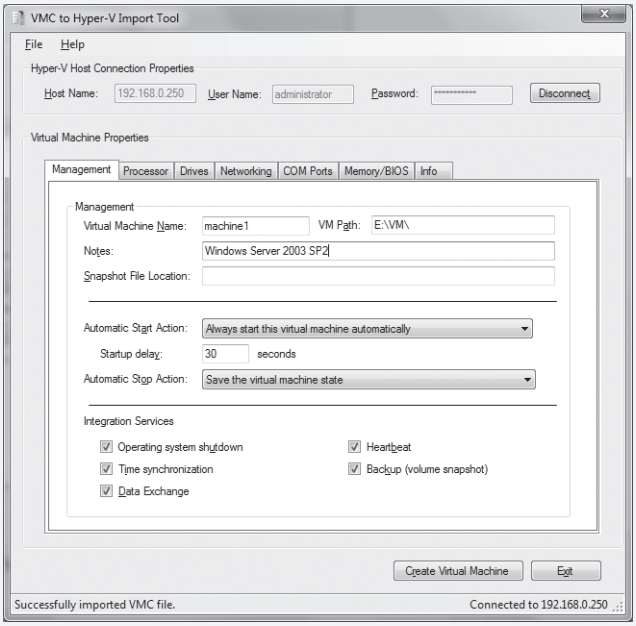

FIGURE 8-10 VMC2HV opening page

The tool shows several tabs related to the Virtual Machine Properties. The Processor tab allows you to specify the number of logical CPUs, the Resource Control, and Processor Functionality. The Drives tab (shown in Figure 8-11) shows the virtual disk drives such as floppy drives, CD/DVD ROM drives, and virtual hard disks, as well as their locations (IDE/SCSI and device ID).

In the case of a virtual machine that booted from SCSI under Virtual Server, the VMC2HV tool offers you the option to swap the SCSI disk at location 0 with IDE at location 0.

The Networking tab (shown in Figure 8-12) shows the number of network adapters and allows you to set them to Legacy; under Virtual Server, an adapter is always an emulated Dec/Intel adapter. By default, VMC2HV creates a synthetic adapter (which is also the default with Hyper-V). The tool also allows you to specify which virtual network and which VLAN you want the adapter to connect to.

Special features include recognizing the guest operating system and limiting the number of logical processors, if applicable (according to support policy), and warning you if the virtual hard disks cannot be found at the current location. Any new paths for virtual hard disks can be edited using the VMC2HV tool, which is available as a download from *http://blogs.technet.com/matthts/*.

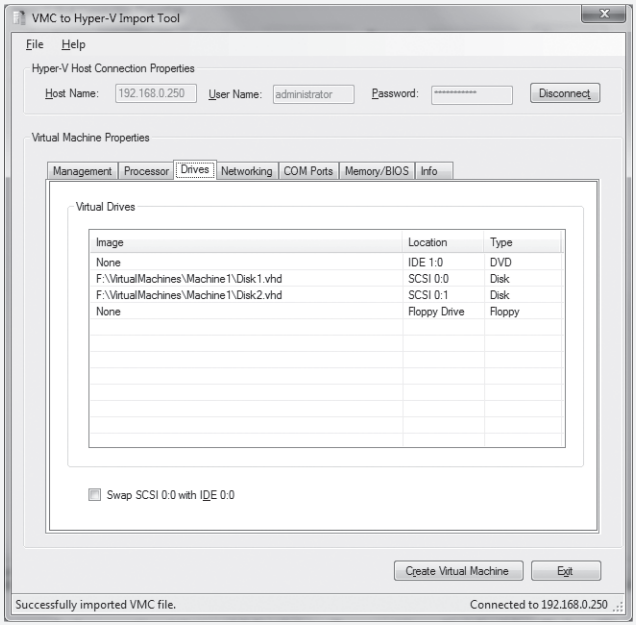

FIGURE 8-11 The Drives tab of Virtual Machine Properties in VMC2HV

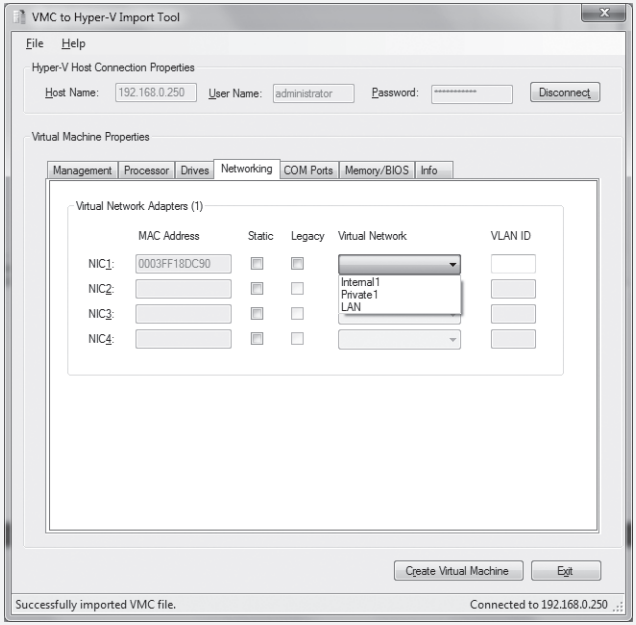

FIGURE 8-12 The Networking tab of Virtual Machine Properties in VMC2HV

Summary

Migrating virtual machines from Virtual Server 2005 R2 to Hyper-V involves migrating both the configuration of the host and the virtual machines themselves. In this chapter, we discussed what you need to consider prior to migrating the host and the virtual machines. A key decision you must make before migrating the host involves determining if there are any virtual machines using operating systems that are not supported on Hyper-V, in which case you should maintain a Virtual Server host.

The chapter provided you with the important considerations and the steps for preparing the virtual machine hard disk for migration. These included dealing with hardware differences (SCSI controllers, network adapters, and HAL), cleaning up the virtual hard disk (Undo, saved state, and differencing disks), and removing Virtual Machine Additions. After the host is migrated, you learned that you can create a new virtual machine using the existing virtual hard disk, and then you must install Integration Services to provide support for synthetic devices and improve performance.

Additional Resources

The following resources contain additional information related to the topics in this chapter.

- Virtual Machine Migration Guide, a resource with information about how to migrate Virtual Server 205 R2 virtual machines to Hyper-V, available at *http://technet.microsoft.com/en-us/library/dd296684.aspx*
- VMC2HV Migration Tool, a resource for simplifying the migration process, available at *http://blogs.technet.com/matthts/*

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