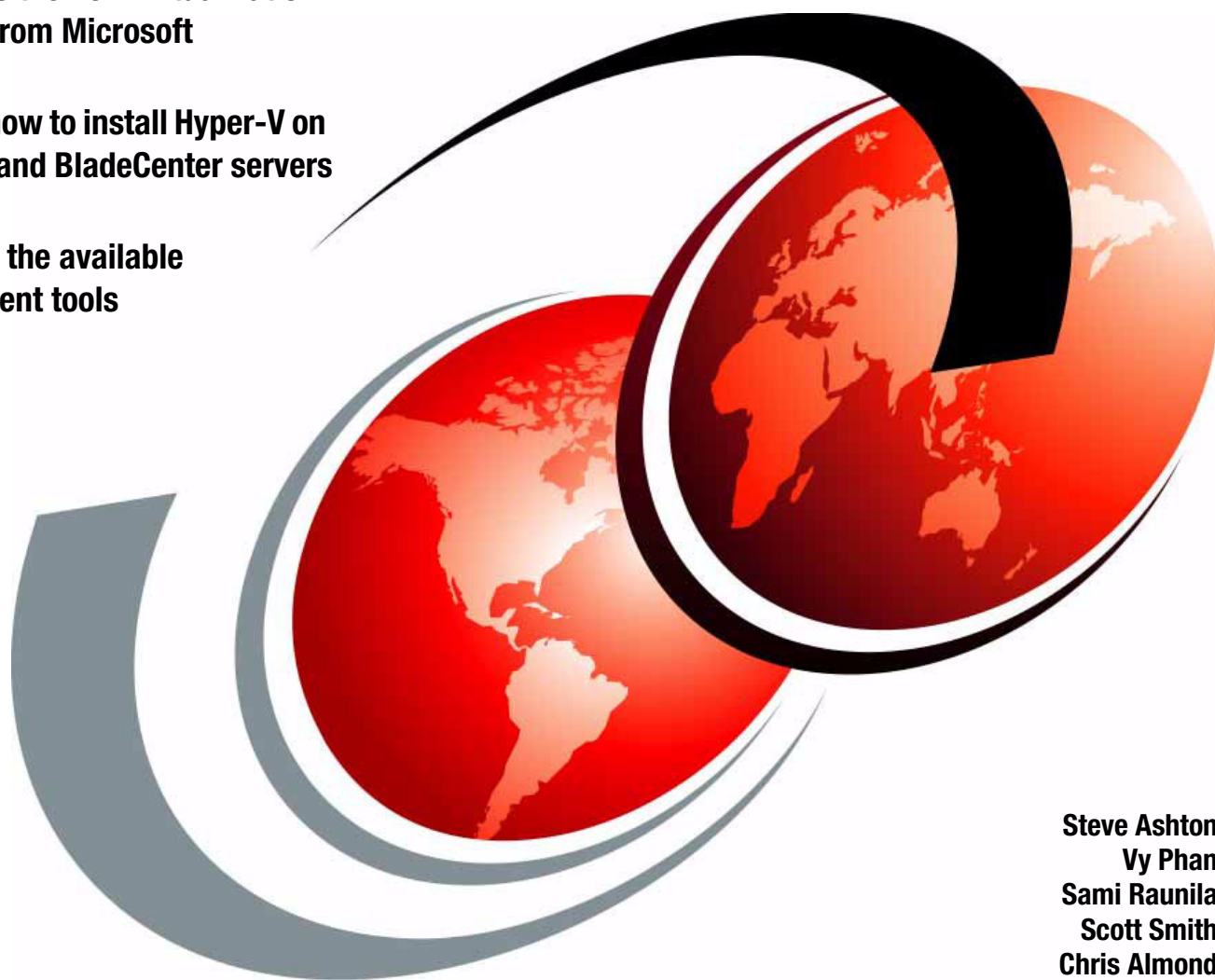# Implementing Microsoft Hyper-V on IBM System x and IBM BladeCenter

Introduces the new virtualization platform from Microsoft

Explains how to install Hyper-V on System x and BladeCenter servers

Describes the available management tools

Steve Ashton
Vy Phan
Sami Raunila
Scott Smith
Chris Almond

Redpaper

ibm.com/redbooks

IBM

International Technical Support Organization

**Implementing Microsoft Hyper-V on
IBM System x and IBM BladeCenter**

June 2009

Note: Before using this information and the product it supports, read the information in "Notices" on page v.

First Edition (June 2009)

This edition applies to Microsoft Hyper-V Server 2008 and Microsoft Windows Server 2008.

Contents

iii

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive, Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:

This information contains sample application programs in source language, which illustrate programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs.

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation in the United States, other countries, or both. These and other IBM trademarked terms are marked on their first occurrence in this information with the appropriate symbol (® or ™), indicating US registered or common law trademarks owned by IBM at the time this information was published. Such trademarks may also be registered or common law trademarks in other countries. A current list of IBM trademarks is available on the Web at http://www.ibm.com/legal/copytrade.shtml

The following terms are trademarks of the International Business Machines Corporation in the United States, other countries, or both:

BladeCenter®	Redpapers™	System x®
FlashCopy®	Redbooks (logo) ®	System z®
IBM®	System i®	z/VM®
POWER®	System p®	
Redbooks®	System Storage™	

The following terms are trademarks of other companies:

Advanced Micro Devices, AMD, AMD-V, the AMD Arrow logo, and combinations thereof, are trademarks of Advanced Micro Devices, Inc.

SUSE, the Novell logo, and the N logo are registered trademarks of Novell, Inc. in the United States and other countries.

Red Hat, and the Shadowman logo are trademarks or registered trademarks of Red Hat, Inc. in the U.S. and other countries.

VMware, the VMware "boxes" logo and design are registered trademarks or trademarks of VMware, Inc. in the United States and/or other jurisdictions.

Java, Solaris, Sun, and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both.

Active Directory, BitLocker, Hyper-V, Microsoft, MSDN, SQL Server, Windows Media, Windows PowerShell, Windows Server, Windows Vista, Windows, and the Windows logo are trademarks of Microsoft Corporation in the United States, other countries, or both.

Intel, Pentium 4, Pentium, Intel logo, Intel Inside logo, and Intel Centrino logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States, other countries, or both.

Linux is a trademark of Linus Torvalds in the United States, other countries, or both.

Other company, product, or service names may be trademarks or service marks of others.

Preface

Microsoft® Hyper-V™ is the next-generation server virtualization technology. This technology is available either as a feature of Windows® Server 2008 or as a separate free download in the form of the Hyper-V Server.

In this IBM® Redpapers™ publication, we introduce Hyper-V and describe its features. We explain how to install and use the product to create virtual machines and introduces the tools that you can use to manage the virtual machines that run on Hyper-V. In addition, we introduce high availability features such as clustering and migration.

The paper is suitable for IT specialists who want to learn what Hyper-V offers and how to install, configure, and manage the product.

The team that wrote this paper

This paper was produced by a team of specialists from around the world working at the International Technical Support Organization (ITSO).

Steve Ashton is the IBM Server Systems Operations Account Manager for a large IBM customer in the United Kingdom.

Vy Phan is an IBM Software Engineer working in the IBM Center for Microsoft Technology in Kirkland, WA, near the Microsoft Redmond campus. She has been working with testing and validation of software on the IBM System x® and BladeCenter® servers since 2006, particularly virtualization software from Microsoft and VMware®. She has also worked on VMware logo certification for the System x and BladeCenter servers.

Sami Raunila is an infrastructure IT Architect who is currently working in IBM Global Technology Services. He specializes in client infrastructure design, IT optimization, and server consolidation. Sami is also a team leader for Enterprise Services for Microsoft Technologies team and has been working in the IT business since 2001.

Scott Smith is a Systems Engineer and Infrastructure Architect on Microsoft Server Virtualization technologies at IBM in Kirkland, Washington.

The production of this paper was managed by Chris Almond, an ITSO Project Leader and IT Architect based in Austin, Texas.

Thanks to the following people from IBM for their contributions to this project:

► Greg Kelleher, Modular Systems Platform Microsoft Offerings Manager
► Vinay Kulkarni, Systems Software Development IBM System x Performance

From the International Technical Support Organization:

► Tamikia Barrow
► Linda Robinson
► David Watts

Become a published author

Join us for a two- to six-week residency program! Help write a book dealing with specific products or solutions, while getting hands-on experience with leading-edge technologies. You will have the opportunity to team with IBM technical professionals, Business Partners, and Clients.

Your efforts will help increase product acceptance and customer satisfaction. As a bonus, you will develop a network of contacts in IBM development labs, and increase your productivity and marketability.

Find out more about the residency program, browse the residency index, and apply online at:

ibm.com/redbooks/residencies.html

Comments welcome

Your comments are important to us!

We want our papers to be as helpful as possible. Send us your comments about this paper or other IBM Redbooks® publications in one of the following ways:

► Use the online **Contact us** review Redbooks form found at:

   ibm.com/redbooks

► Send your comments in an e-mail to:

   redbooks@us.ibm.com

► Mail your comments to:

   IBM Corporation, International Technical Support Organization
   Dept. HYTD Mail Station P099
   2455 South Road
   Poughkeepsie, NY 12601-5400

Introduction

Hyper-V is the next-generation server virtualization technology from Microsoft,[1] replacing Microsoft Virtual Server. This technology is available in the following ways:

- ► As a stand-alone product called *Hyper-V Server 2008*
- ► Embedded into all of the three editions of Windows Server® 2008

In addition, when using Windows Server 2008, you can choose to install the full Windows Server product with all services and a graphical interface. Alternatively, you choose to install only the core services and the Hyper-V feature with only a text interface. The latter method is referred to in this paper as a *Server Core* installation.

This chapter includes the following topics:

---

[1] Portions of this paper are from Microsoft Corporation. Used with Permission.

1.1 Comparing the versions

Table 1-1 compares the four ways in which Hyper-V is available to customers.

Table 1-1   Comparison of the ways in which Hyper-V is available

Virtualization needs	Microsoft Hyper-V Server 2008	Feature of Windows Server 2008 Standard[a]	Feature of Windows Server 2008 Enterprise[a]	Feature of Windows Server 2008 Data Center[a]
Server consolidation	Yes	Yes	Yes	Yes
Test and development	Yes	Yes	Yes	Yes
Mixed operating system virtualization (Linux® and Windows)	Yes	Yes	Yes	Yes
Local GUI		Yes	Yes	Yes
High availability - clustering			Yes	Yes
Quick migration			Yes	Yes
Large memory support (host operating system) > 32 GB RAM			Yes	Yes
Support for > 4 processors (host operating system)			Yes	Yes
Ability to add additional server roles		Yes	Yes	Yes
Guest virtualization rights included in the host server license	None; each Windows guest virtual machine (VM) requires a license	1 physical + 1 VM[b]	1 physical + 4 VMs[b]	1 physical + unlimited VMs[c]

a. This refers to both the full Windows Server installation and the Server Core installation.
b. Each additional Windows guest VM requires a license.
c. Windows Server Data Center is licensed on a "per processor" basis and does not require additional Windows Server licenses for guest VMs.

For further information about Hyper-V Server beyond this paper, see the Microsoft Hyper-V Server 2008 page at the following address:

http://www.microsoft.com/servers/hyper-v-server/

For information about Windows Server 2008, see the Windows Server 2008 page at the following address:

http://www.microsoft.com/windowsserver2008/

1.2 Benefits

Hyper-V includes the following benefits:

► Quick migration

   Quick migration enables the movement of running VMs from one host to other host servers with minimal downtime.

► High availability

   Hyper-V includes support for host-to-host connectivity (two or more hosts, 16 maximum) and enables you to cluster all VMs running on a host.

► Server Core role

   Hyper-V is now available as a role in a Server Core installation of Windows Server 2008. Windows Server 2008 can be installed in GUI mode and Server Core mode. Hyper-V is available as a role in either of these modes, regardless of the installation method that is chosen.

   Note that Hyper-V is *not* automatically installed. You must select the Hyper-V feature to install it.

   Hyper-V Server is available at no charge on the Web. It installs with a limited core that includes only the services that are needed to support Hyper-V. A small text-based console is also provided.

► Integrated into Server Manager

   Hyper-V is integrated into Server Manager by default and customers can now enable the role within Server Manager. Hyper-V is one of many roles that can be added to a base installation of Windows Server 2008 by using Server Manager. (Other traditional roles include Dynamic Host Configuration Protocol (DHCP) and Internet Information Server (IIS).)

► Live Backups with Volume Shadow Copy Services (VSS)

   Hyper-V includes support for VSS to enable you to take Live Backups of running VMs in terms of snapshots.

► Virtual hard disk (VHD) tools

   Hyper-V also includes support for VHD tools to enable compaction, expansion, and inspection of VHDs that are created with Hyper-V.

► VM manageability

   With VM manageability, customers can easily import or export VM settings to take backups of configurations and clone the VM characteristics across different hosts.

► Remote management

   Hyper-V supports remote management and provides a Hyper-V Microsoft Management Console (MMC) only installation option for a separate management node. Another option is by using Remote Desktop Protocol (RDP) to connect to the machine console over the network.

► Increased virtual Small Computer System Interface (SCSI) support

   Hyper-V now includes support for up to four virtual SCSI controllers per VM enabling broader disk support.

► Increased memory support

   Hyper-V supports up to 64 GB of memory per VM.

- ► Quick reset

  Hyper-V provides administrators the option to quickly reset check boxes and delete saved credentials that are used to connect to VMs.

As stated earlier in this chapter, Hyper-V is available as a standalone product, a Hyper-V Server, or integrated into three editions of Windows Server 2008.

Usage of Hyper-V integrated into Windows Server 2008 includes the following benefits:

- ► It provides the use of a GUI. This is the biggest benefit for most virtualization users and is not included in Hyper-V Server.
- ► Standardizing on full Windows Server 2008 installations only simplifies systems management, because each Windows Server 2008 system has all of the same tools and consoles as every other server.
- ► Full installation reduces IT administrator training, because Hyper-V Server is a new environment that can have a steeper learning curve.

However, running Hyper-V Server over the Hyper-V feature of Windows Server 2008 includes the following benefits:

- ► Reduced attack surface

  Because Hyper-V Server installations are minimal, fewer applications run on the server, which decreases the attack surface.
- ► Reduced management

  Because fewer applications and services are installed on a server running Hyper-V Server, there is less to manage.
- ► Less disk space required

  Hyper-V Server requires only about 1 GB of disk space to install and approximately 2 GB for operations after the installation.
- ► Hyper-V Server supports all of the Windows infrastructure roles:
  - – DHCP
  - – Domain Name System (DNS)
  - – File and print
  - – Active Directory® Domain Services (AD DS)
  - – Read-only Domain Controller (RODC)
  - – Active Directory Lightweight Directory Services (AD LDS)
  - – Windows Media® Services (WMS)
  - – Internet Information Server 7.0

  A full Windows Server 2008 installation must be chosen when the server will host applications such as SQL Server® and Exchange.

1.3 Hyper-V terminology

In this section, we define Hyper-V-related terminology. The following list of terms helps to define some components or functions in a Hyper-V system:

Parent partition   In Hyper-V, the partition that manages the configuration of the hypervisor and system resources. All operating systems that run on a hypervisor server have allocated hardware resources that include RAM, CPU, and other system components. When the Hyper-V role is configured and the server is rebooted, the Windows Server 2008

	installation that was the native operating system on the system becomes the operating system in the parent partition of the Hyper-V server.
Child partition	An isolated environment on a Hyper-V server that is configured to hold a guest operating system and to provide hardware resources to that operating system.
Hyper-V host	The physical server that is hosting Hyper-V and the operating system running inside the parent partition.
Hyper-V virtual machine	
	The Hyper-V configuration information and the data that is used to boot and run a Hyper-V child partition. This includes the configuration information to create the child partition and the VHD files or pass-through disks that contain its data.
Passthrough disk	A storage device that is exposed in disk management as a physical disk assigned for exclusive use by a Hyper-V guest. The Hyper-V guest mounts the disk and uses it similar to a locally connected storage device.
Virtual hard disk (VHD)	
	A file that is connected to by a Hyper-V child partition that is exposed to the operating system as a storage device (disk). The `.vhd` file is on a storage device that is mounted by the parent partition and can be a direct attached storage device, or storage that is connected to over a storage area network (SAN), network-attached storage (NAS), or Server Message Block (SMB).

For a more detailed and up to date list, see the Microsoft Developer Network (MSDN®) page at the following address:

http://blogs.msdn.com/virtual_pc_guy/archive/2008/02/25/hyper-v-terminology.aspx

1.4 Different types of virtualization architectures

The characteristics of current computer hardware virtualization technology vary significantly. In this section, we introduce the three basic types of virtualization products available.

Central to virtualization is the Virtual Machine Manager (VMM). The VMM is responsible for monitoring and enforcing policy on the VMs for which it is responsible. This means that the VMM keeps track of everything that happens inside of a VM. When necessary, it provides resources, redirects the VM to resources, or denies access to resources.

Type-1 virtualization architecture

Figure 1-1 shows the type-1 architecture.

```
┌─────────────────────────────────────────────┐
│  ┌──────────┐  ┌──────────┐  ┌──────────┐   │
│  │Operating │  │Operating │  │Operating │   │
│  │ System   │  │ System   │  │ System   │   │
│  │          │  │          │  │          │   │
│  │ ┌──────┐ │  │ ┌──────┐ │  │ ┌──────┐ │   │
│  │ │Appli-│ │  │ │Appli-│ │  │ │Appli-│ │   │
│  │ │cation│ │  │ │cation│ │  │ │cation│ │   │
│  │ └──────┘ │  │ └──────┘ │  │ └──────┘ │   │
│  └──────────┘  └──────────┘  └──────────┘   │
│  ┌─────────────────────────────────────┐   │
│  │            Hypervisor                │   │
│  └─────────────────────────────────────┘   │
│  ┌─────────────────────────────────────┐   │
│  │            SMP Server                │   │
│  └─────────────────────────────────────┘   │
└─────────────────────────────────────────────┘
```
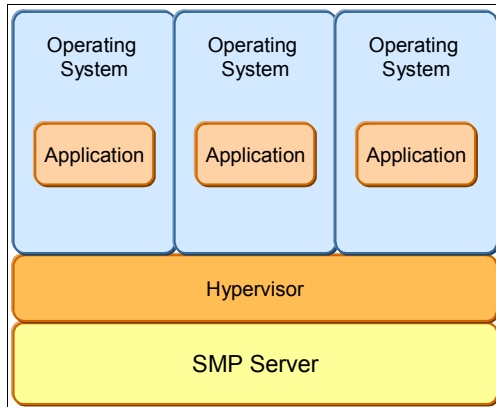
Figure 1-1   Type-1 architecture

Type 1 hypervisors are typically the preferred approach because they can achieve higher virtualization efficiency by dealing directly with the hardware. Type-1 hypervisors provide higher performance efficiency, availability, and security. Microsoft Hyper-V, VMware ESX, and Xen are examples of Type-1 architectures.

Type-2 virtualization architecture

Figure 1-2 shows the Type-2 architecture. The Type-1 and Type-2 VMM architectures are the two approaches that are most widely used today.
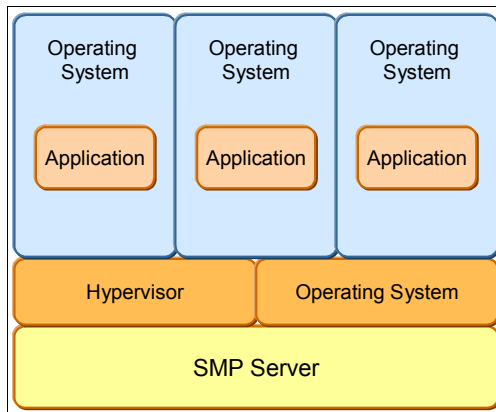
```
┌─────────────────────────────────────────────┐
│  ┌──────────┐  ┌──────────┐  ┌──────────┐   │
│  │Operating │  │Operating │  │Operating │   │
│  │ System   │  │ System   │  │ System   │   │
│  │          │  │          │  │          │   │
│  │ ┌──────┐ │  │ ┌──────┐ │  │ ┌──────┐ │   │
│  │ │Appli-│ │  │ │Appli-│ │  │ │Appli-│ │   │
│  │ │cation│ │  │ │cation│ │  │ │cation│ │   │
│  │ └──────┘ │  │ └──────┘ │  │ └──────┘ │   │
│  └──────────┘  └──────────┘  └──────────┘   │
│  ┌───────────────┐  ┌──────────────────┐    │
│  │  Hypervisor   │  │ Operating System │    │
│  └───────────────┘  └──────────────────┘    │
│  ┌─────────────────────────────────────┐   │
│  │            SMP Server                │   │
│  └─────────────────────────────────────┘   │
└─────────────────────────────────────────────┘
```

Figure 1-2   Type-2 architecture

The Type-2 VMM is a stage where the VMM runs alongside the host operating system and helps to create VMs on top. Examples of the Type-2 VMM are Microsoft Virtual Server, Microsoft Virtual PC, VMware Workstation, and VMware Player. This kind if implementation is applicable in scenarios where VMs are not heavily loaded or resource-intensive.

Type-2 hypervisors are used mainly on client systems where efficiency is less critical. Type-2 hypervisors are also used mainly on systems where support for a broad range of I/O devices is important and can be provided by the host operating system.

Application virtualization architecture

A third VMM architecture is exemplified by Java™ virtual machines (JVMs) or .NET architecture and can be considered more of an application framework than a hypervisor (Figure 1-3). Here, the goal of virtualization is to create a runtime environment within which the process can execute a set of instructions without relying on the host system. In this case, the isolation is for the different processes. It allows a single application to run on different operating systems without having to worry about operating system dependencies. This is not actually a server virtualization category.
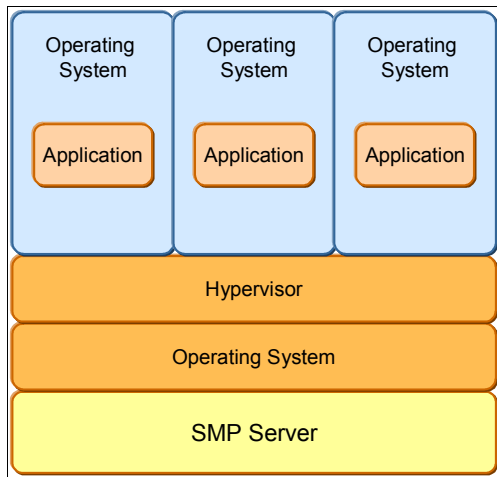
Figure 1-3   Application framework architecture

Table 1-2 lists some of the hypervisors that are available and the IBM systems on which they run.

Table 1-2   Available hypervisors

Hypervisor	Hypervisor type	IBM systems that run hypervisor
Microsoft Hyper-V	Type 1	IBM System x and BladeCenter
POWER®	Type 1	IBM System i® and System p®
Processor Resource/System Manager	Type 1	IBM System z®
VMware ESX	Type 1	System x and BladeCenter
Xen	Type 1	System x and BladeCenter
z/VM®	Type 1	System z
VMware Server	Type 2	System x and BladeCenter
Microsoft Virtual Server	Type 2	System x and BladeCenter
Microsoft Virtual PC	Type 2	System x and BladeCenter
VMware Player	Type 2	System x and BladeCenter
VMware Workstation	Type 2	System x and BladeCenter

For more details about Hyper-V architecture, see the article at the following address from the MSDN:

http://msdn.microsoft.com/en-us/library/cc768520.aspx

1.5 Windows hypervisor

Ensuring that there is strong separation between multiple operating systems is done by creating virtual processors, memory, timers, and interrupt controllers. Operating systems use these virtual resources just as they might use their physical counterparts.

The Windows hypervisor in Hyper-V performs the following tasks:

► Creates logical partitions
► Manages memory and processor scheduling for guest operating systems
► Provides mechanisms to virtualize input/output and communicate among partitions
► Enforces memory access rules
► Enforces policy for CPU usage
► Exposes a simple programmatic interface known as *hypercalls*

Because it uses the microkernelized approach, the Windows hypervisor is fairly small (less than 1 MB in size). This minimal footprint helps to improve the overall security of the system. Figure 1-4 compares the microkernelized kernel that is used in Hyper-V with a monolithic hypervisor. A monolithic hypervisor is an architecture that has its own operating system kernel and driver model, and requires driver support from the hardware vendors. An example is VMware ESX.
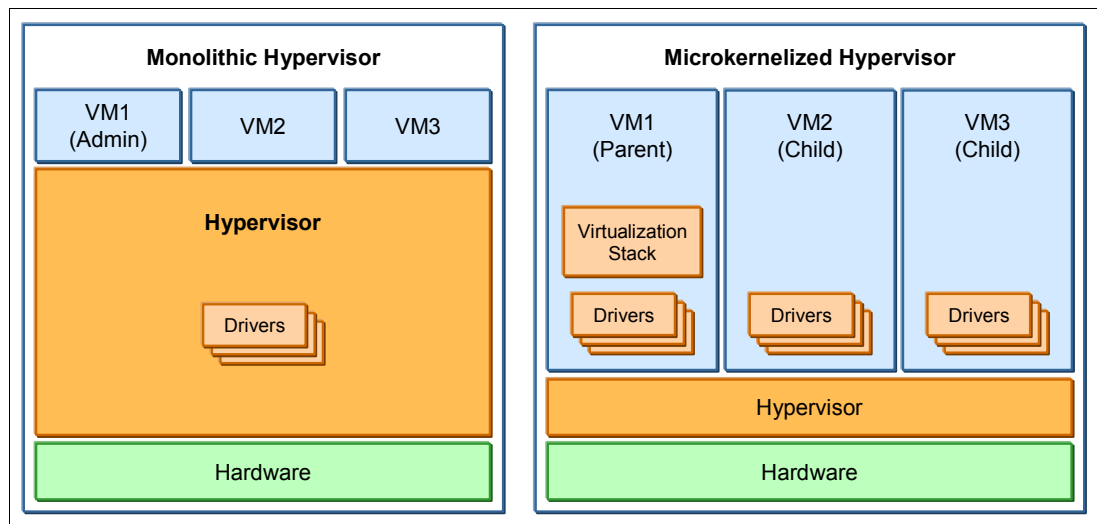

Figure 1-4   Comparing a monolithic hypervisor with a microkernelized hypervisor

A monolithic hypervisor has the following features:

► Is simpler than a modern kernel, but is still complex
► Contains its own drivers model

A microkernelized hypervisor has the following features:

► Simple partitioning functionality

► Small trusted computing base (TCB), which is the portion of code that is allowed to run in privileged mode

► No third-party drivers

► Drivers that run within guests

One of the requirements for running Hyper-V is having a x64 platform that has Intel® VT or AMD™-V™ technologies. x64 technology enables access to a larger address space and

support for systems with more memory. This way allows many more VMs on one host. Intel VT and AMD-V are hardware-assisted virtualization solutions that provide a layer in the ring architecture that helps to keep the execution environment of the hypervisor separate from the rest of the system. Intel VT and AMD-V technology also allow Hyper-V to run an unmodified guest operating system without a significant decrease in emulation performance.

1.6 Hyper-V Server 2008

Hyper-V Server is a dedicated standalone product. It is available for download at no charge from Microsoft at the following address:

http://www.microsoft.com/servers/hyper-v-server

Hyper-V Server 2008 supports up to four processor sockets and 32 GB or RAM. Hyper-V Server 2008 contains only the Windows hypervisor and the virtualization components. It cannot be used in any other purpose.

Some of the constraints are the scalability and performance aspects. There is no high availability, nor are quick migration features available in this product. Performance constraints are almost equal with Windows Server 2008 except that Windows Server can be used for other purposes and is available.

Microsoft Hyper-V Server uses the same VM model as Windows Server 2008 with Hyper-V enabled. Therefore, there is no need to re-tool your management infrastructure.

Hyper-V Server provides the following support:

► VHD format

  To move a VM from Hyper-V Server to a Windows Server 2008 Hyper-V environment (or vice versa), simply export the VM and import it on the other host by using the standard management tools.

► BitLocker™ support

  Hyper-V Server can take advantage of BitLocker technology to encrypt a Hyper-V Server so that, even if the hardware is stolen and the hard disks are removed, the data is inaccessible. This is particularly useful for branch offices or environments where physical security is a concern.

► Live Backup support

  Hyper-V Server includes native support for Volume Shadow Services so that it can provide Live Backup of running VMs without downtime.

► Flexible hardware support

  Hyper-V Server uses the Windows Server driver model and is compatible with a wide variety of server hardware and driver support for newer peripherals such as a 10 Gb Ethernet.

► Flexible storage

  Hyper-V Server offers flexible storage support, such as the following examples:

  – Direct Attach Storage (DAS) protocols: SATA, eSATA, PATA, SAS, SCSI, USB, Firewire
  – SAN protocols: iSCSI, Fibre Channel, SAS
  – NAS

► Virtual machine snapshots

  Hyper-V Server fully supports VM snapshots.

▶ VSP, VSC, and VMBUS

Both Hyper-V Server and Windows Server 2008 fully use the VSP, VPC, and VMBus driver architecture for high performance I/O. There is no conversion when moving VMs between Microsoft Hyper-V and Windows Server 2008.

Hyper-V Server offers the following support on the parent partition:

▶ Support for systems with up to 4 processors
▶ Support for systems with up to 32 GB of physical memory
▶ Support for up to 128 VMs

Hyper-V Server offers the following support for VMs:

▶ 32-bit (x86) and 64-bit (x64) VMs

▶ Up to 4 virtual processors per VM

▶ Up to 31 GB memory for all running VMs (1 GB is reserved for Hyper-V Server parent partition.)

1.7 Windows Server 2008: Server Core installation

As we mentioned earlier, you can install Windows Server 2008 either with all services and a graphical interface, or you can install the "Server Core" with primarily a textual interface and only the needed services. You select whether you want the normal full installation of Windows Server 2008 or the core installation early in the installation process.

> **Important:** The type of installation that you choose is final. There is no option to upgrade from a core installation to a full installation or to perform the reverse.

Hyper-V is not installed by default. You must use the command line to install Hyper-V and any other subsystems and features that you require.

> **Tip:** The Server Core installation of Windows Server 2008 and Hyper-V Server 2008 look similar in that they both have a text-only interface. However, the Server Core installation has more features as listed in Table 1-1 on page 2. Hyper-V Server 2008 is actually a subset of the Server Core installation, with Hyper-V already enabled.

The following graphical tools remain in the core version:

▶ Notepad (although a slightly cut-down version)
▶ Task manager
▶ Time zone, time, and date applet
▶ Regional settings applet

All other features are managed by using either the command line interface or the remote management toolset.

The following arguments favor a Server Core installation over a full Windows Server installation:

- ► More secure

  A stripped down operating system runs fewer applications. Consequently, there are fewer opportunities to exploit weaknesses in these applications.

- ► Less maintenance

  Fewer components to maintain (patch) can lead to less planned downtime. Microsoft claims 40% fewer patches, where other options show slightly less but still significant reductions.

- ► Lower resource overhead

  There is a smaller memory and disk footprint. This argument is not particularly significant given the percentage of savings on modern hardware configurations.

- ► Less chance of software bugs.

  This argument seems self-evident because there are fewer running components. However, there is a counter to this. If the core installation is primarily used under Hyper-V, which is already only a minor subset of Windows 2008 installations, then the population of core users is significantly smaller than those running the full fat version. If you are in a smaller user community, by inference, there is less user testing and consequently a greater risk of encountering an error that is specific to your environment.

The Server Core version has the following issues:

- ► Some system management tools might not install or function correctly under a core installation.

  To be installable in the core installation, systems management tools must offer an unattended or command-line installation option. Additionally a number of APIs are not available under the core installation. It might be worthwhile to check with your software vendor if their product has been tested under this environment.

- ► Lack of familiarity

  The Windows 2008 full version requires no additional training over its 2003 parent. The look and feel of the toolsets are intuitive to the person who is using them. The core version, even if only initially, requires the person who is installing it to consult the manual.

1.8 Integration components

Hyper-V was built to provide strong boundaries between various instances running on one server. To enable interaction between the guest operating system and the host operating system and to supply additional functionality for supported guest operating systems, Hyper-V provides integration components.

The Hyper-V integration components have the following features:

- ► Time synchronization
- ► Volume Shadow Copy Service
- ► Heartbeat functionality
- ► Guest shutdown
- ► Key value pair exchange (used to access the registry of a guest operating system)
- ► Operating system identification

1.9 Scalability on System x

By using the microkernelized hypervisor architecture, Hyper-V has low CPU overhead, which leaves plenty of room to virtualize workloads. By enabling VMs to take advantage of the powerful features of the System x hardware, such as multicore technology, disk access, and greater memory, Hyper-V improves scalability and performance of the virtualization platform.

Combined with the rest of the Windows Server 2008 capabilities, with Hyper-V, you can consolidate most workloads on a single system. It can also help you balance 64-bit technology adoption with continued support for 32-bit workloads that are already used throughout your environment.

The fact that Hyper-V requires a 64-bit host system with hardware-assisted virtualization helps ensure that the host system has access to a large pool of memory resources. Hyper-V can support up to 1 TB of memory on the host, with up to 64 GB of memory per VM (with Windows Server 2008 Enterprise and Data Center Editions). This support is key for those who plan to virtualize memory-intensive workloads such as Exchange Server and SQL Server.

> **More information:** For more information about tuning SQL Server 2008 on System x hardware, see the IBM Redpapers publication *Running Microsoft SQL Server 2008 on the IBM System x3950 M2*, REDP-4476.

With the installation of fix KB956710,[2] Hyper-V also supports up to 24 logical processors on the host system. This makes Hyper-V scalable to most commodity two-socket and four-socket systems with multiple cores. You can also create a VM with up to four virtual processors to support workloads that require or take advantage of multi-processor capabilities.

When planning scalability options with Hyper-V, clustering solutions are available for certain Hyper-V implementations. Implementing Hyper-V scale-out solutions are not out of scope, but are harder to implement because of the slower response of Quick Migration and the Microsoft shared-nothing storage model used in clustering.

1.10 High availability on System x

Hyper-V has a low CPU overhead, leaving plenty of room to virtualize workloads. By enabling VMs to take advantage of powerful features and hardware, such as multicore technology, improved disk access, and greater memory, Hyper-V improves scalability and performance of the virtualization platform.

Consolidating servers through Hyper-V also enables those servers to use robust networking support, including virtual local area network (VLAN), Network Address Translation (NAT), and Network Access Protection (NAP) policies (quarantine). As a Windows Server 2008 feature, Hyper-V works well with other Windows Server features, such as BitLocker and Windows PowerShell™.

---

[2] Patch number KB956710 was released shortly after general availability to support six-core processors, taking the total logical processor count to 24 supported cores. For more information, see the following address:
http://support.microsoft.com/kb/956710

1.11 Guest operating systems in Hyper-V

The following operating systems can be installed as guests running under Hyper-V:

- ► Windows Server 2008 x86/x64
- ► Windows Server 2003 x86/x64 SP2
- ► Windows 2000 Server SP4 and Advance Server SP4 x86/x64
- ► Windows HPC Server 2008
- ► SUSE® Linux Enterprise Server 10 SP1/SP2 x86/x64
- ► Windows Vista® SP1 (excluding Home Edition)
- ► Windows XP Professional SP2/SP3/X64
- ► Red Hat® Enterprise Linux
- ► Sun™ Solaris™

For a complete list of supported guest operating systems, see the following address:

http://support.microsoft.com/kb/954958

Additional software, called *Integration Services*, can be installed on the following guest operating systems to provide driver support and performance enhancements:

- ► Windows Server 2008
- ► Windows Server 2003 SP2
- ► Windows XP SP3
- ► Windows Vista SP1
- ► Linux SUSE SP1/SP2

We describe Integration Services in 2.5.3, "Installing Integration Services on the guest" on page 54.

2

Installing and configuring Hyper-V

In this chapter, we explain the different ways to set up a virtualization environment by using Microsoft Hyper-V.

This chapter includes the following topics:

- ► 2.1, "System hardware requirements" on page 16
- ► 2.2, "Installing Hyper-V in Windows Server 2008: Server Core" on page 16
- ► 2.3, "Installing Hyper-V in Windows Server 2008: Full installation" on page 23
- ► 2.4, "Installing Hyper-V Server" on page 32
- ► 2.5, "Creating a virtual environment by using Hyper-V" on page 44

2.1 System hardware requirements

To run Hyper-V, you must have the following hardware requirements:

- ► Processors: These include virtualization hardware assists from Intel (Intel VT) or AMD (AMD-V). To enable Intel VT, enter System Setup and navigate to **Advanced Options** → **CPU Options** and select the **Enable Intel Virtualization Technology** option. AMD-V is always enabled.
- ► Processor cores: Minimum of 4 processor cores
- ► Memory: A minimum of 16 GB of RAM
- ► Ethernet: At least one physical network adapter.
- ► Disk space: One volume with at least 50 GB of disk space and one volume with at least 20 GB of space.
- ► BIOS: Enable the Data Execution Prevention option in System Setup. Navigate to **Advanced Options** → **CPU Options** and select the **Enable Processor Execute Disable Bit** option. Ensure that you are running the latest version of BIOS.

Server hardware is certified by Microsoft to run Hyper-V. To review the list of servers that are certified, go to the Windows Server Catalog at the following address:

http://go.microsoft.com/fwlink/?LinkID=111228

Select **Hyper-V** and **IBM** from the categories on the left side.

2.2 Installing Hyper-V in Windows Server 2008: Server Core

The Server Core option on Windows Server 2008 provides a subset of the features of Windows Server 2008 to help run supported server roles, including Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), Active Directory, and Hyper-V, without the overhead of the full Windows installation. With the Server Core installation, the Windows setup program installs the files that are needed for the supported server roles.

The benefits of enabling Hyper-V on a Server Core installation are that it helps reduce the *attack surface* (the scope of interfaces, services APIs and protocols that a hacker might use to attempt to gain entry into the software). As a result, it reduces management requirements and maintenance.

Microsoft provides management tools to remotely manage the Hyper-V role and virtual machines (VMs). Hyper-V servers can be managed from Windows Vista or other Windows Server 2008 systems (both x86 and x64). You can download the management tools from the following address:

http://support.microsoft.com/kb/952627

2.2.1 Windows Server 2008 core installation

The recommended way to install Windows Server 2008 on an IBM System x or BladeCenter server is to use IBM ServerGuide, which ships as a DVD with your server. Alternatively, you can download ServerGuide from the following address:

http://www.ibm.com/support/docview.wss?uid=psg1SERV-GUIDE

To use the ServerGuide DVD to configure and install all drivers needed for your systems and to launch the installation of the operating system:

1. Insert the ServerGuide DVD, start the server, and boot the ServerGuide disk.

2. Choose the language you want to use.

3. Accept the license agreement.

4. In the Welcome to Server Guide window, select the version of Microsoft Windows Server 2008 that you want to install. We selected **Microsoft Windows Server 2008 x64 Enterprise Edition**. Select **Perform Server Core Installation**.

5. Set the date and time.

6. Optional: If your server includes a RAID controller, configure the RAID arrays as prompted.

7. Create and format a partition for Windows Server 2008. Select the type and size for the boot partition.

8. Confirm your server configuration and hardware settings. ServerGuide copies files to your hard disk in preparation for the operating system installation.

9. After the file copy process is complete, insert the Windows Server 2008 DVD when prompted and click **Next**.

10. Follow the guide to install the Server Core installation of Windows Server 2008.

2.2.2 Post installation steps

After completing the installation of Windows Server 2008, you must perform the following tasks, which are explained in the sections that follow:

► Setting the administrative password
► Setting the server's computer name
► Setting the IP address of a network controller
► Activating the server
► Joining the server to a domain
► Enabling Remote Desktop for administration

Setting the administrative password
To set the administrative password:

1. At the login page, press Ctrl+Alt+Del.
2. For user name, type `Administrator`, and for password, leave it blank.
3. When prompted by the system, type a new password and press Enter.

Setting the server's computer name

To change the computer name for the system, type the following command:

```
netdom renamecomputer %computername% /NewName:<new name>
```

In this command, `<new name>` is the name you want to change to. In the example in Figure 2-1, the new name is `CORESERVER`.

```
Microsoft Windows [Version 6.0.6001]
Copyright (c) 2006 Microsoft Corporation. All rights reserved.

C:\Windows\system32>netdom renamecomputer %computername% /NewName:CORESERVER
This operation will rename the computer WINDOWS-84GEBH6
to CORESERVER.

Certain services, such as the Certificate Authority, rely on a fixed machine
name. If any services of this type are running on WINDOWS-84GEBH6,
then a computer name change would have an adverse impact.

Do you want to proceed (Y or N)?
y
```

Figure 2-1   Changing the computer name

Setting the IP address of a network controller

When setting the IP address of a specific network controller, you must know its ID.

1. To set the IP address of a specific network controller, enter the following command:

   ```
   netsh interface ipv4 show interfaces
   ```

   Figure 2-2 shows the output.

```
C:\Users\Administrator>netsh interface ipv4 show interfaces

Idx  Met   MTU    State        Name
---  ---  -----  -----------  ----------------
  2   20   1500  connected    Local Area Connection
  1   50 4292967295  connected    Loopback Pseudo-Interface 1
  3   20   1500  connected    Local Area Connection 2
```

Figure 2-2   Determining the IDs of the network interfaces

2. Change the IP address of the selected controller to a static address:

   ```
   netsh interface ipv4 set address name="<ID>" source=static address=<StaticIP>
   mask=<SubnetMask> gateway=<DefaultGateway>
   ```

   Note the following explanation:

   – `<ID>` is the number that corresponds to the network adapter that you want to change from the output of the **show interfaces** command in Figure 2-2.

   – `<StaticIP>`, `<SubnetMask>` and `<DefaultGateway>` are the parameters you want to set.

   In our lab, we used the command shown in Figure 2-3.

```
C:\Users\Administrator>netsh interface ipv4 set address name="2"
source=static address=9.42.170.242 mask=255.255.254.0 gateway=9.42.170.1
```

Figure 2-3   Command to set the IP address of interface 2

3. Specify a DNS server by entering the following command:

```
netsh interface ipv4 add dnsserver name="<ID>" address=<DNSIP> index=1
```

In our lab, we entered the command shown in Figure 2-4.

```
C:\Users\Administrator>netsh interface ipv4 add dnsserver name="2"
address=9.42.170.241 index=1
```

Figure 2-4   Command to set the DNS server of interface 2

Activating the server

To active the server, enter the following command:

```
slmgr.vbs -ato
```

This command does not return any text, as shown in Figure 2-5.

```
C:\>slmgr.vbs -ato
```

Figure 2-5   Activating the server

Joining the server to a domain

Join a domain by entering the following command:

```
netdom join <computerName> /domain:<DomainName> /userd:<username> /passwordd:*
```

Syntax: The parameter is **passwordd:*** with "dd" and not `password:*` with just one "d."

In our lab, we used the command in Figure 2-6.

```
C:\Users\Administrator>netdom join CORESERVER /domain:test-itsolab.local
/userid:Administrator /passwordd:*
Type the password associated with the domain user:

The computer needs to be restarted in order to complete the operation.

The command completed successfully.
```

Figure 2-6   Joining a domain

Reboot the server to complete the operation by entering the following command:

```
shutdown /r /t 0
```

Enabling Remote Desktop for administration

To enable Remote Desktop to allow remote administration, configure the firewall by using the command shown in Figure 2-7.

> **Note:** The group names in the command are case sensitive.

```
C:\Users\Administrator>netsh advfirewall firewall set rule group="Windows Management
Instrumentation <WMI>" new enable=yes

Updated 4 rule(s).
Ok.
C:\Users\Administrator>netsh advfirewall set rule group="Remote Administration" new
enable=yes

Updated 3 rule(s).
Ok.
C:\Users\Administrator>
```

Figure 2-7   Configuring the firewall for remote administration

2.2.3 Installing the Hyper-V role

Hyper-V is certified to run on specific IBM System x and BladeCenter models as explained in 2.1, "System hardware requirements" on page 16. As an aid, you can confirm the operating system version and architecture by using the following commands:

```
wmic OS get OperatingSystemSKU
wmic OS get OSArchitecture
```

Figure 2-8 shows an example of the output of these commands.

```
C:\>wmic OS get OperatingSystemSKU
OperatingSystemSKU
14

C:\>wmic OS get OSArchitecture
OSArchitecture
64-bit
```

Figure 2-8   Sample output of the commands to confirm that the operating system is installed

The output of the `OperatingSystemSKU` command is a number:

- ► 12 = Windows Server 2008 Data Center Edition Server Core
- ► 13 = Windows Server 2008 Standard Edition Server Core
- ► 14 = Windows Server 2008 Enterprise Edition Server Core

The `OSArchitecture` command confirms that the operating system is 64-bit. Hyper-V requires x64 (64-bit) support.

To install Hyper-V on Windows Server 2008 Server Core:

1. Install Windows Server 2008 fix KB950050:

   ```
   wusa 100208-Windows6.0-KB950050-x64.msu /quiet /norestart
   ```

   Note: This update must be installed on all Hyper-V installations. It replaces beta components that were included in the general availability (GA) release of Windows Server 2008 with the updates that were made available after the GA of Hyper-V.

2. Confirm that the update package is installed on the system:

   ```
   wmic qfe list
   ```

   Figure 2-9 shows the output of this command, which indicates that KB950050 is installed.

   ```
   C:\Users\Administrator>wmic qfe list
   Caption                                     CSName      Descritpion  FixComments
   HotFixID  InstalledDate  InstalledBy                                 InstalledOn
   Name  ServicePackInEffect  Status
   http://support.microsoft.com/?kbid=950050  CORESERVER  Update
   KB950050                 S-1-5-21-3636808658-2890314771-1900119241-500
   01c945af0c362719
   ```

   Figure 2-9   Output of the wmic command showing that KB950050 is installed

3. Install the Hyper-V role:

   ```
   start /w ocsetup Microsoft-Hyper-V
   ```

4. After a few moments, when you are prompted to restart the server, in the Windows Package Manager window (Figure 2-10), click **Yes**.
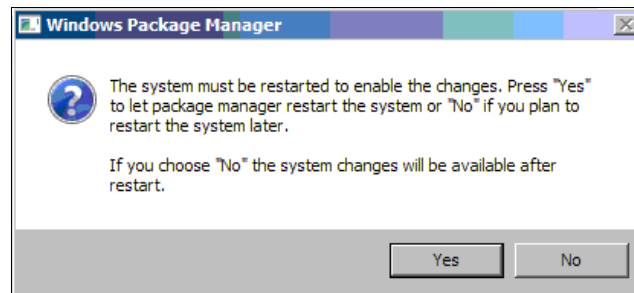
Figure 2-10   Selecting the option to restart the server

5. Add the domain administrator (or another user) to the Distributed COM Users group to enable remote management of Hyper-V:

   ```
   net localgroup "Distributed COM Users" /add test-itsolab.local\administrator
   ```

   Figure 2-11 shows the output of this command.

   ```
   C:\>net localgroup "Distributed COM Users" /add test-itsolab.local\administrator
   The command completed successfully.
   ```

   Figure 2-11   Adding the domain administrator to the Distributed COM Users group

6. Enable Remote Desktop Protocol (RDP) connections (Remote Desktop Connection) to the server:

```
cscript c:\windows\system32\scregedit.wsf /ar 0
```

This command is the Server Core script equivalent of **regedit**. The **/ar 0** parameter is used to enable RDP connections to the server. Figure 2-12 shows the output of this command.

```
C:\>cscript c:\windows\system32\scregedit.wsf /ar 0
Microsoft (R) Windows Script Host Version 5.7
Copyright (C) Microsoft Corporation. All rights reserved.

Registry has been updated
```

Figure 2-12   Adding the domain administrator to the Distributed COM Users group

Hyper-V is now installed, and you can manage Hyper-V from a remote system.

To manage Hyper-V from a Windows Vista SP1 system (32-bit or x64), you must first install fix KB941314 on that system. This fix installs the Microsoft Remote Server Administrative Tool package so that you can remotely manage roles and features in Windows Server 2008 from a computer running Windows Vista with Service Pack 1. For download information, see the following address:

http://support.microsoft.com/kb/941314

After you install the fix, you can connect to the remote server:

1. Click **Control Panel** → **Administrative Tools** → **Hyper-V Manager**.

2. Click **Action** → **Connect**.

3. Enter the computer name of the system running Hyper-V core (Figure 2-13).
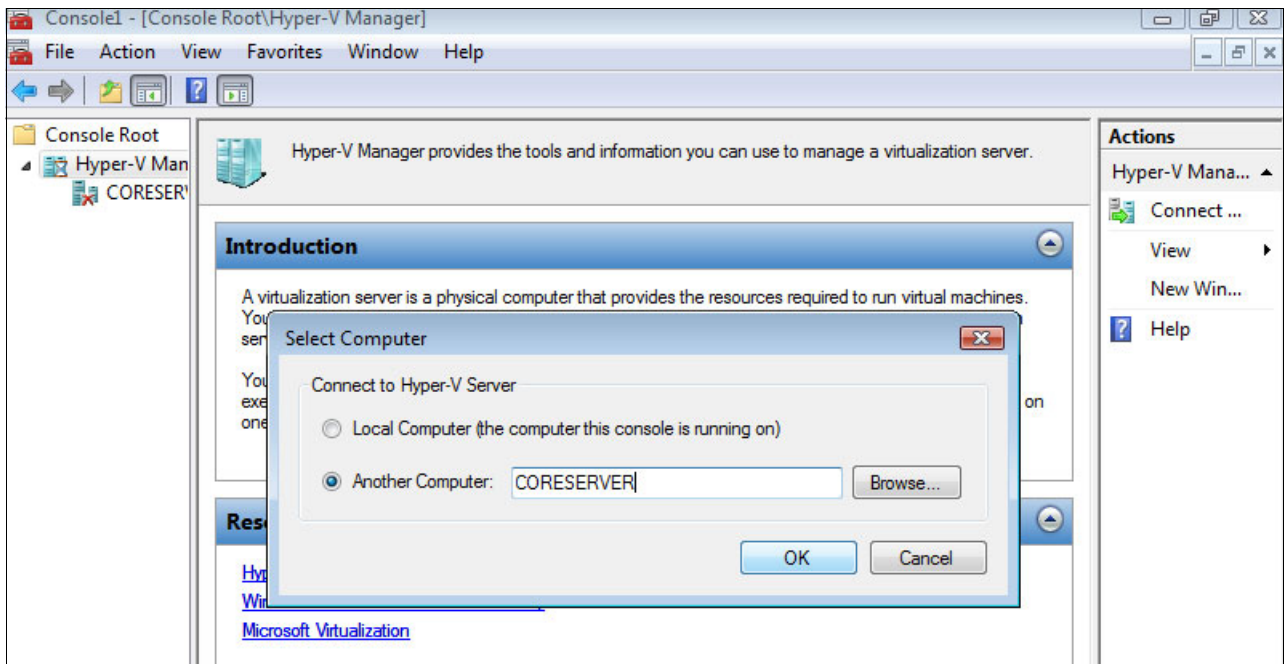
Figure 2-13   Connecting to the remote server running Hyper-V

Now that the installation is complete, you can begin setting up the virtualization environment by using Hyper-V Manager as described in 2.5, "Creating a virtual environment by using Hyper-V" on page 44.

2.3 Installing Hyper-V in Windows Server 2008: Full installation

In this section, we describe the installation of Microsoft Windows 2008, Enterprise Edition, including Hyper-V, on an IBM System x3850 M2. The installation involves the following tasks, which are explained in the sections that follow:

1. Installing the base operating system by using IBM ServerGuide
2. Applying Microsoft updates
3. Adding the Hyper-V role to a server

2.3.1 Installing the base operating system by using IBM ServerGuide

The IBM ServerGuide tool simplifies the installation of an operating system, such as Windows Server 2008, on an IBM System x or BladeCenter server. ServerGuide includes all the necessary drivers (including boot drivers) and allows you to configure, for example, RAID arrays (if the server has a RAID controller). ServerGuide does not include the operating system itself. You must have the installation media and a valid license.

IBM ServerGuide ships on a CD with your server. However, we recommend that you download the latest version from the following address:

http://www.ibm.com/support/docview.wss?uid=psg1SERV-GUIDE

To install Windows Server 2008, Enterprise Edition, by using ServerGuide:

1. Boot the server from the ServerGuide disk.

2. Set the keyboard layout and accept the ServerGuide license.

3. In the operating system selection panel (Figure 2-14), select the operating system that you want to install. Since we are installing the full version (not the Server Core installation), leave the **Perform Server Core Installation** check box as cleared. Also ensure that the **No HyperV** option is clear. Click **Next**.
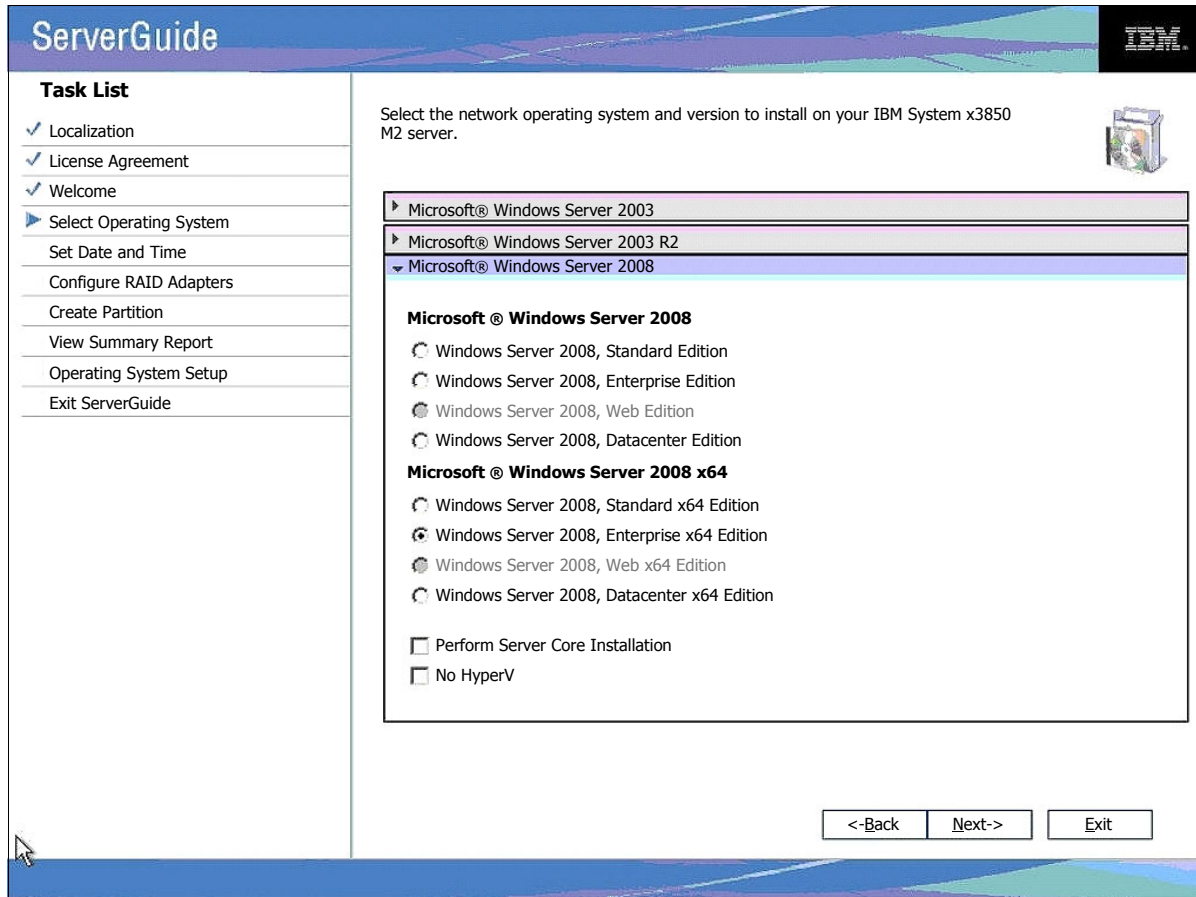

Figure 2-14   ServerGuide operating system selection panel

4. Continue with the next panels, setting the date and time, setting the RAID configuration, and creating and formatting the operating system partition. Click **Next** on the respective panels.

5. When the ServerGuide process shows a summary of your selected settings (Figure 2-15), click **Next** to begin the installation process. ServerGuide starts by copying the appropriate device drivers to the hard disk partition.
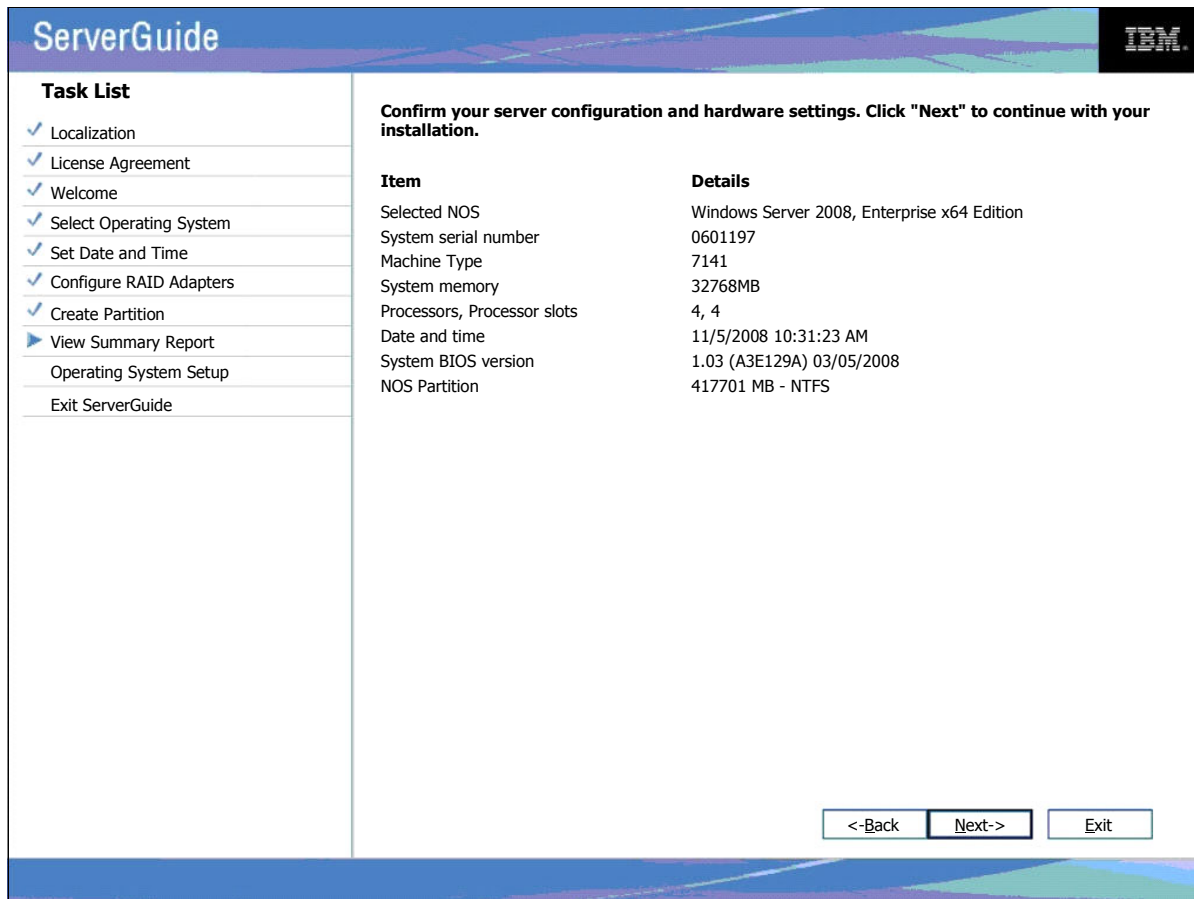
Figure 2-15   ServerGuide summary panel prior to beginning the operating system installation

6. When prompted, remove the ServerGuide CD and insert the Windows Server 2008 DVD. The process then verifies the operating system installation media and launches the Windows installation process.

7. Select the Windows language and preferences (Figure 2-16). Click **Next**.
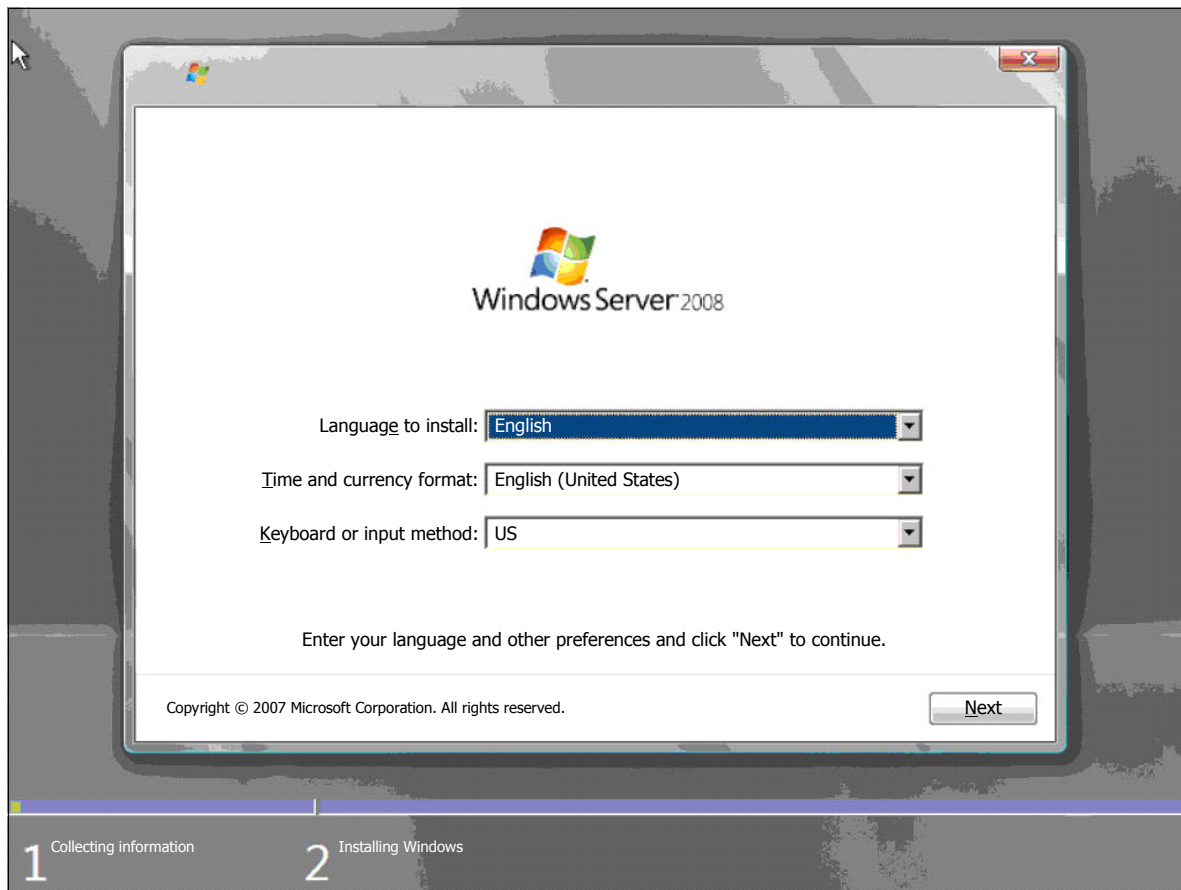
Figure 2-16   Windows Server 2008 installation - national language selection

8. In the Microsoft license terms acceptance panel, accept the license terms to initiate the main Windows installation process. The necessary Windows installation files are copied to the disk drive in preparation for an unattended installation of the operating system.

9. After the files are copied, in the final ServerGuide window (Figure 2-17), click **Next**.
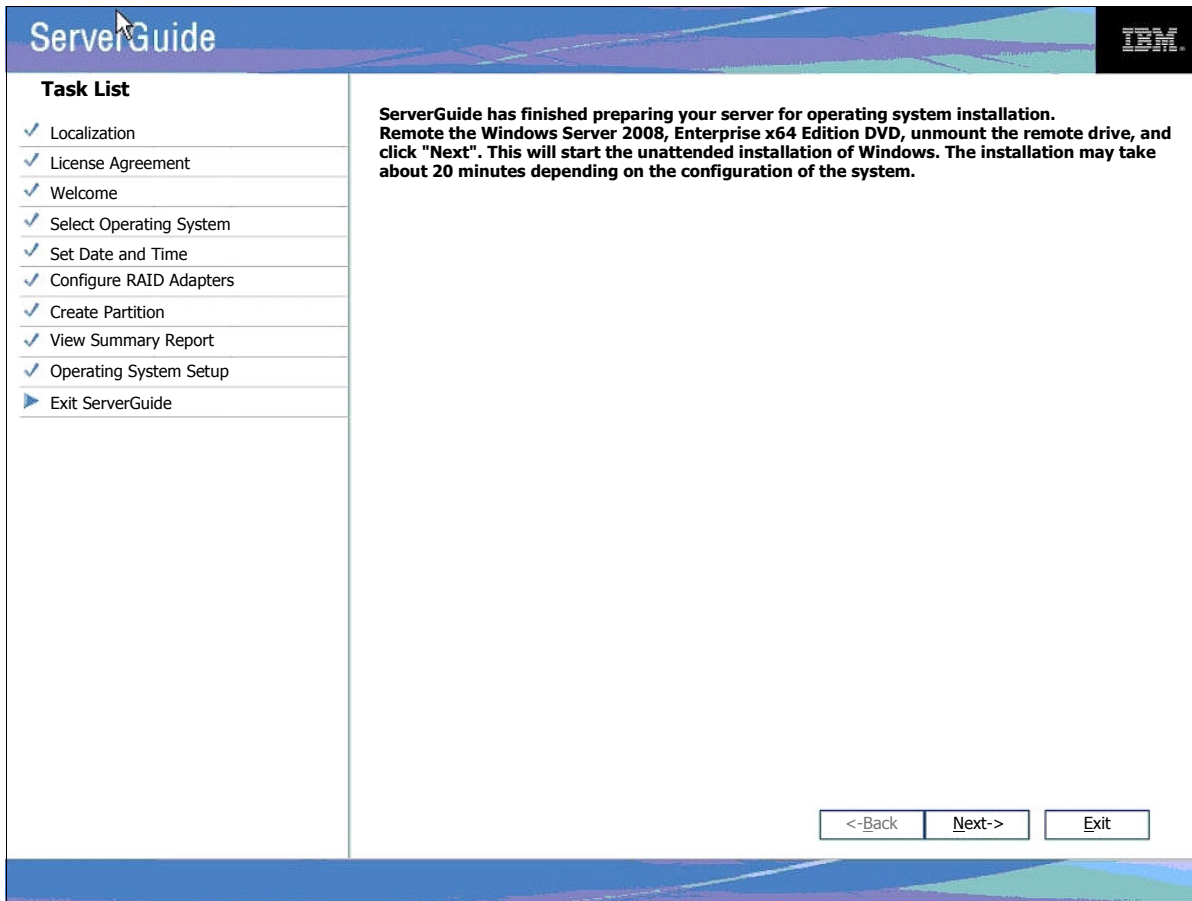
Figure 2-17   ServerGuide installation complete

The operating system installation is now complete, and no further action is required until the initial configuration task panel (Figure 2-18).
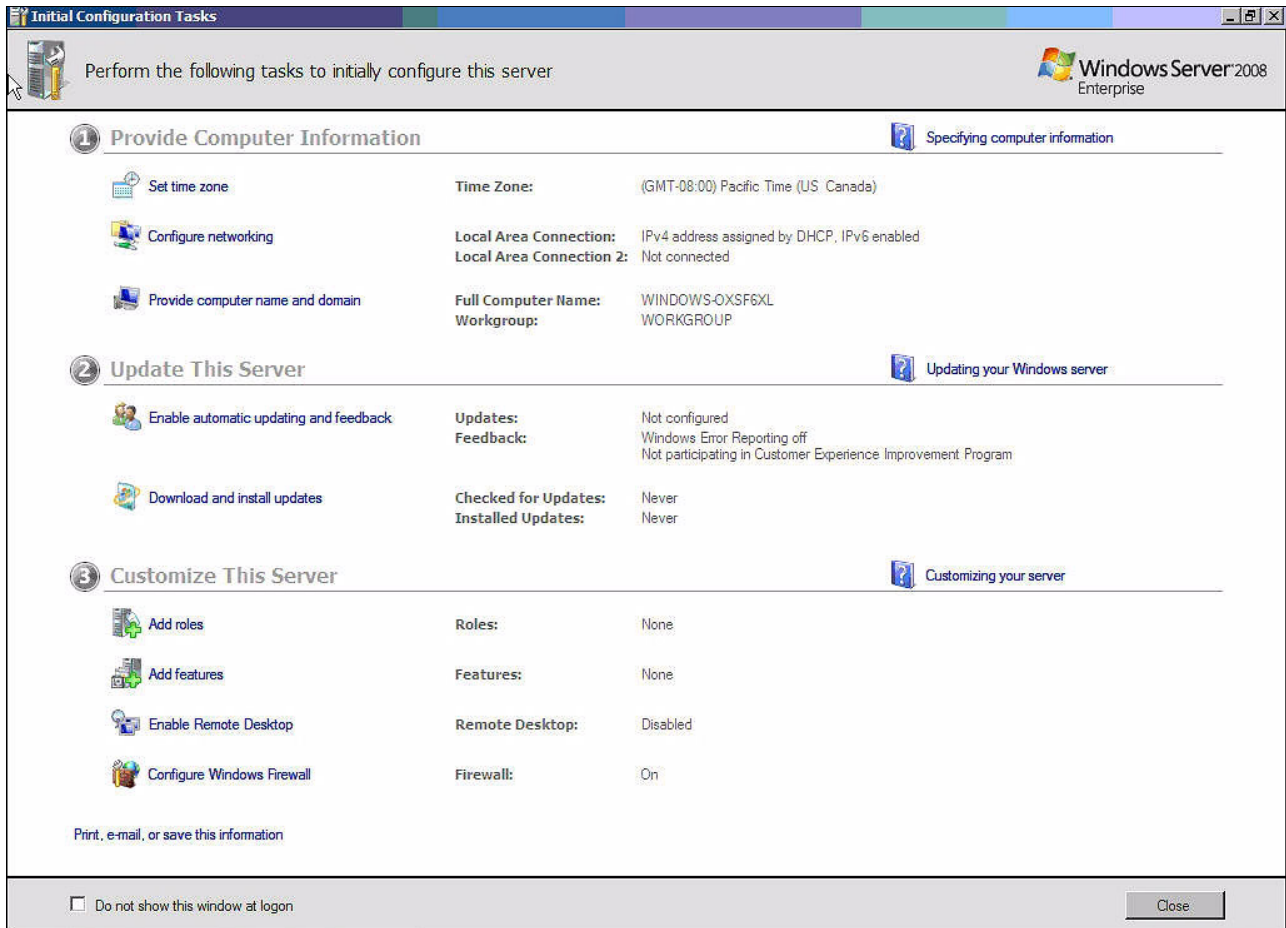
Figure 2-18   Windows Server 2008 initial configuration window

This completes the installation of the basic operating system.

2.3.2 Applying Microsoft updates

It is prudent to apply the latest Hyper-V related updates to the system before adding the role to the machine. The required update at the time at which this paper was written was KB950050. The KB950050 update must be installed on all Hyper-V installations. It replaces beta components that were included in the GA release Windows Server 2008 with the updates that were made available after GA of Hyper-V.

You can download the KB950050 update from the following address:

http://support.microsoft.com/kb/950050

Additionally, download and review the latest Hyper-V release notes from the following address:

http://www.microsoft.com/downloads/details.aspx?FamilyID=3ed582f0-f844-40ba-b692-2 30845af1149&displaylang=en

2.3.3 Adding the Hyper-V role to a server

Adding the Hyper-V role to a server can be initiated from either the Initial Configuration Tasks window (Figure 2-18 on page 28) or the Server Manager. The Server Manager can be started by entering `ServerManager.msc` at a command prompt. Both panels have an "Add Roles" section.

You must have local administrator privileges to add a roles to a server. To add a role:

1. Click **Add roles**.

2. In the Before You Begin panel, click **Next**.

3. In the Select Server Roles panel (Figure 2-19), select **Hyper-V**. Click **Next**.
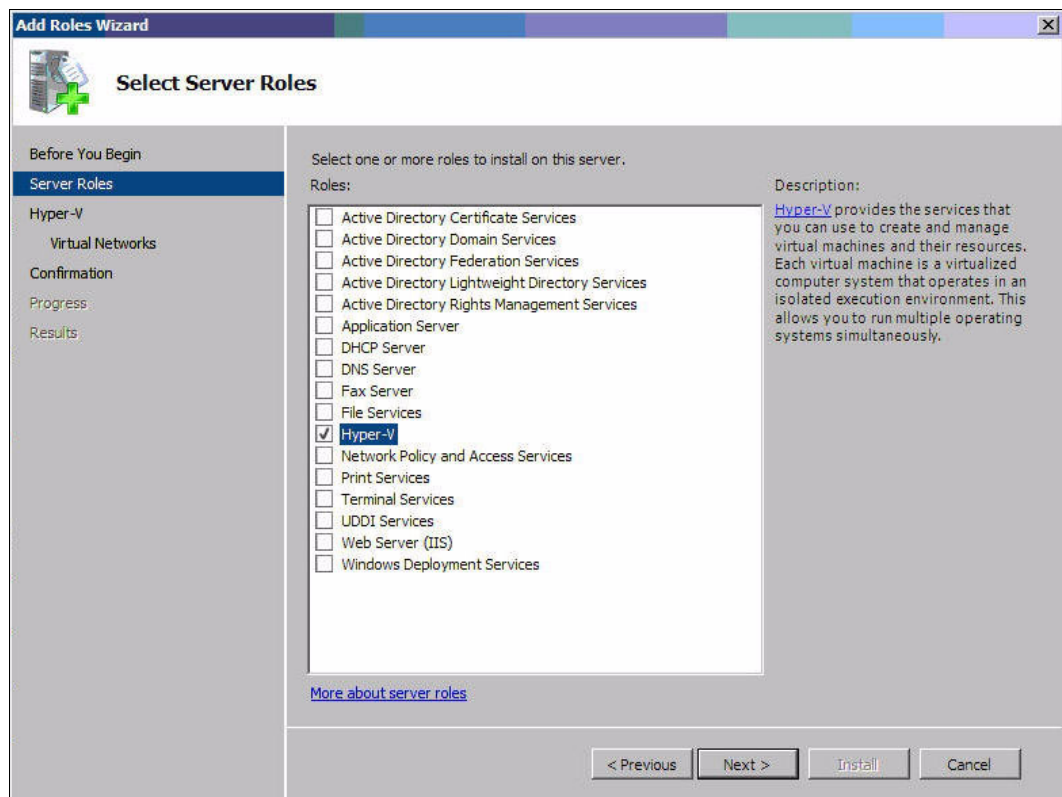
Figure 2-19   Select Server Roles panel

4. In the next panel (Figure 2-20), which summarizes the Hyper-V role and indicates that you might have to select some BIOS features, click **Next**. There is no need to select BIOS features because no BIOS modifications were required when installing Hyper-v on the IBM x3850 M2.
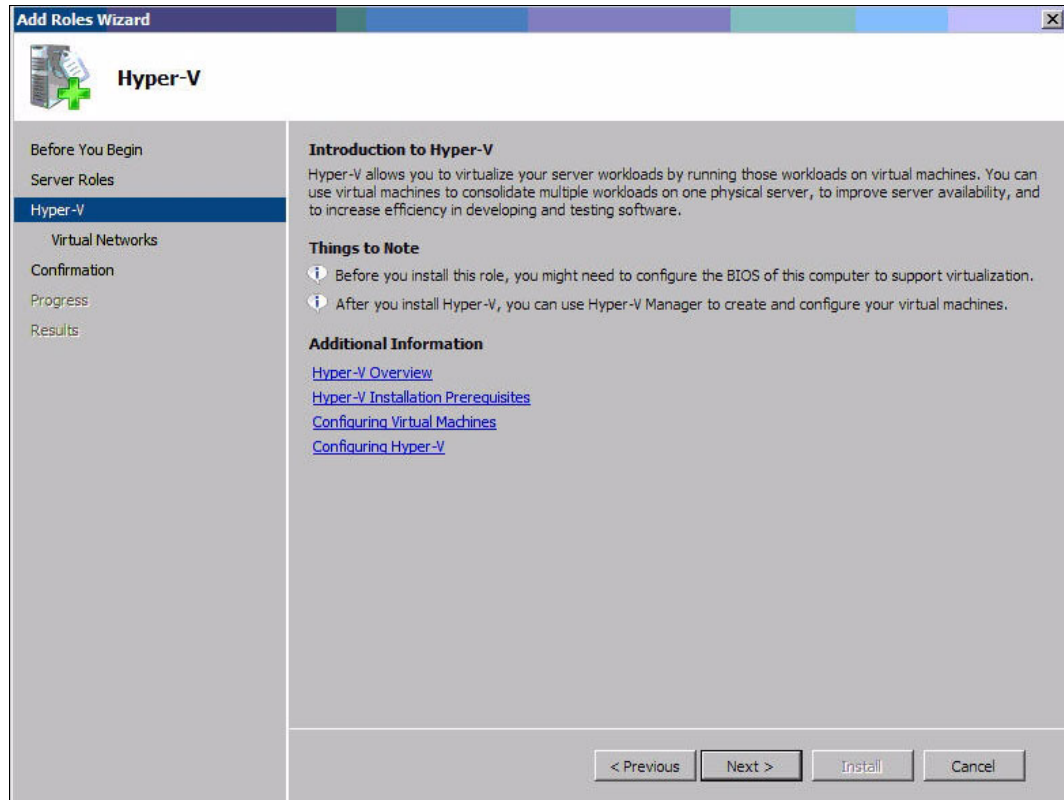
Figure 2-20   Hyper-V introduction panel

5. In the next panel (Figure 2-21), select the network cards to create virtual networks and for use by the Hyper-V guests. Microsoft recommends (as stated in the panel) that you reserve one card for remote access, and not for virtual networking. Click **Next**.
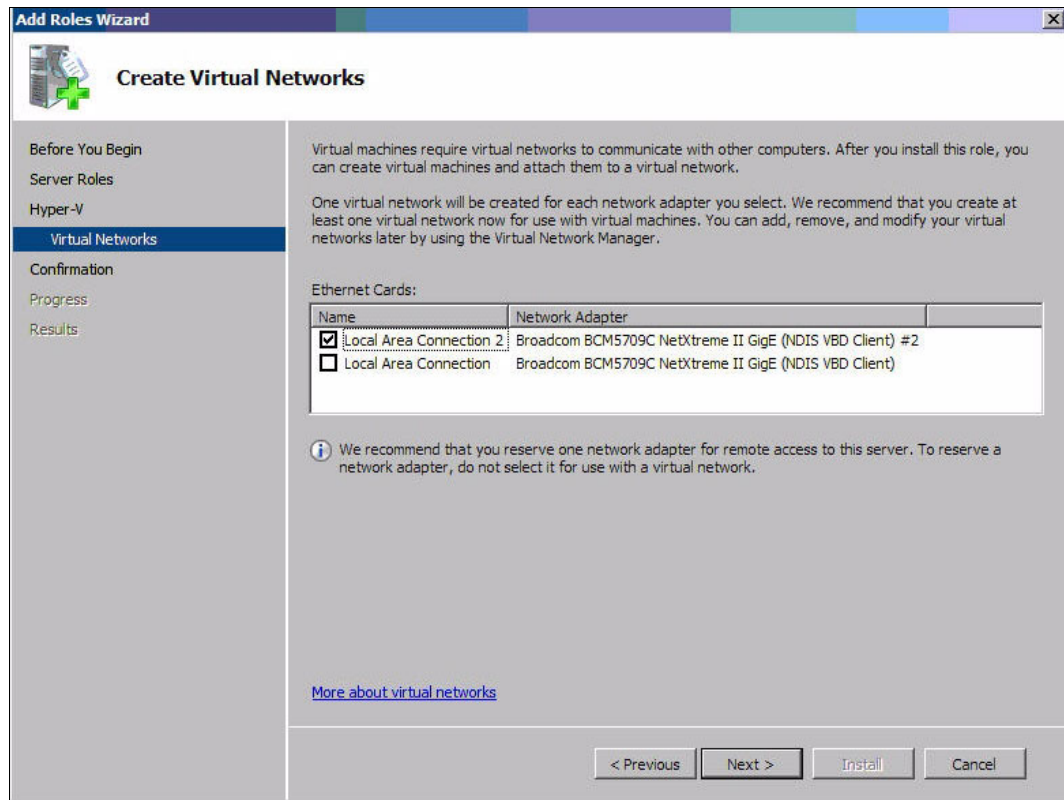
Figure 2-21   Creating virtual networks

6. In the confirmation panel, click **Install** to start the Hyper-V installation process.
7. After the installation is complete, reboot the server as prompted.

At the end of the process, the Hyper-V role is displayed in the list of installed roles in Server Manager, as shown in Figure 2-22.
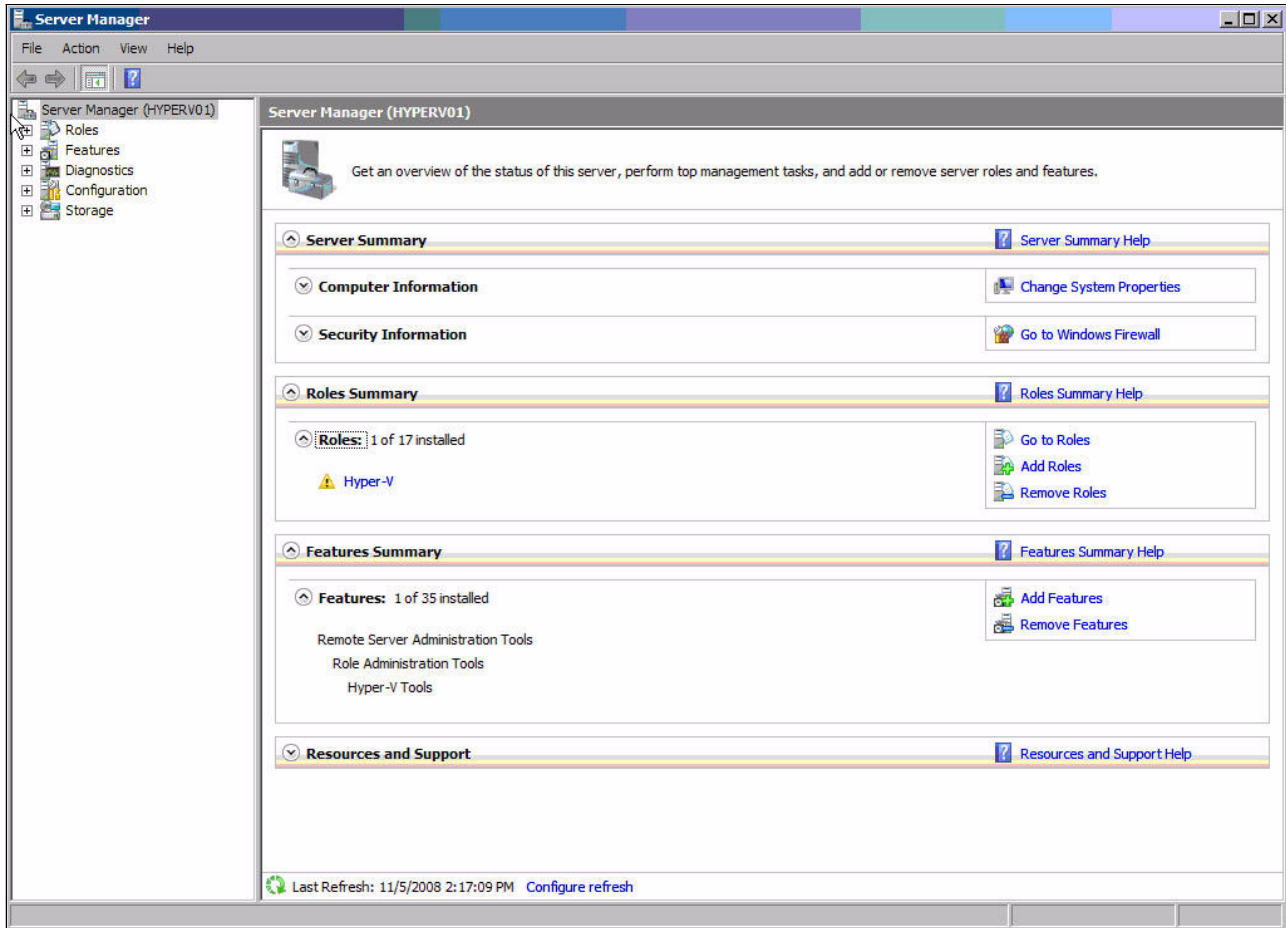
Figure 2-22   Server Manager showing that Hyper-V is now installed

Now that the installation is complete, you can begin setting up the virtualization environment as explained in the following section.

2.4 Installing Hyper-V Server

As we explained in Chapter 1, "Introduction" on page 1, Hyper-V Server 2008 is available as a free download from the Microsoft Web site. Hyper-V Server 2008 is a subset of Windows Server 2008 Standard Edition and can only be installed in console (Server Core) form.

Hyper-V Server 2008 can only be a hypervisor and cannot take on any of the other traditional server roles such as Active Directory, DHCP, DNS, and so on. In addition, Hyper-V Server 2008 has the following limitations among others:

► Supports a maximum of 32 GB or RAM
► Four sockets of CPU
► No clustering support or Quick Migration

2.4.1 Downloading and installing Hyper-V Server

You can download Hyper-V Server from the following address:

http://www.microsoft.com/servers/hyper-v-server/

After you have the image and burn it to a DVD, insert the DVD into the desired system and boot up the system. Then complete the following steps:

1. Select the language option and confirm your selection.
2. Select **Start Install**.
3. Accept the license terms and conditions.
4. Select **Disk Partition for Installation**.

The installation begins and completes with no further input.

At the login window, enter a new administrative password for the system. You must set the administrative password after the operating system completes the installation.

1. Press Ctrl+Alt+Del.
2. Type Administrator but no password.
3. When the system prompts you for a new password (Figure 2-23), enter the password.
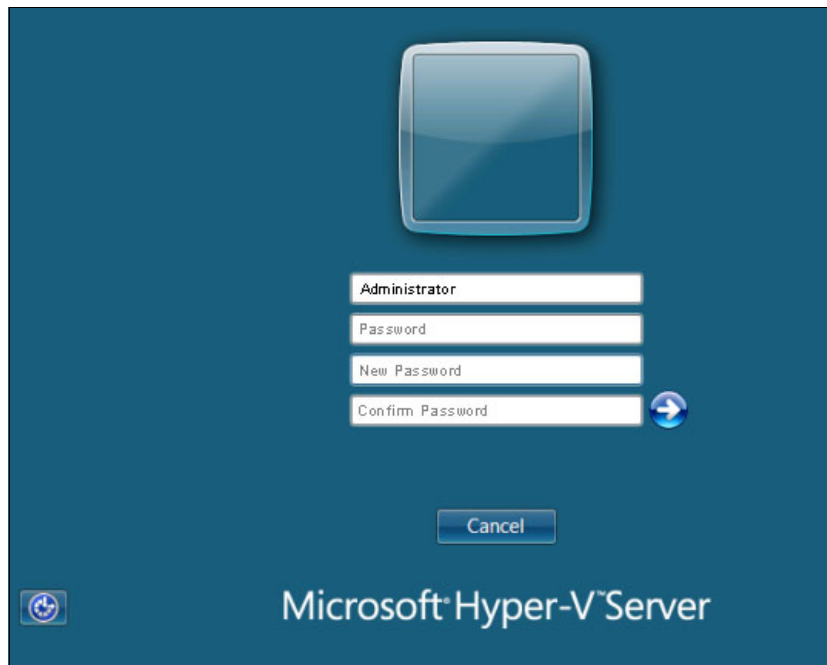

Figure 2-23   Prompt for a new administrator password

When you log on to Hyper-V Server, it looks similar to a Server Core installation of Windows Server 2008, but there is one key difference. It has both a command line console and a command prompt as shown in Figure 2-24. We review these options and remote management options later in this chapter.
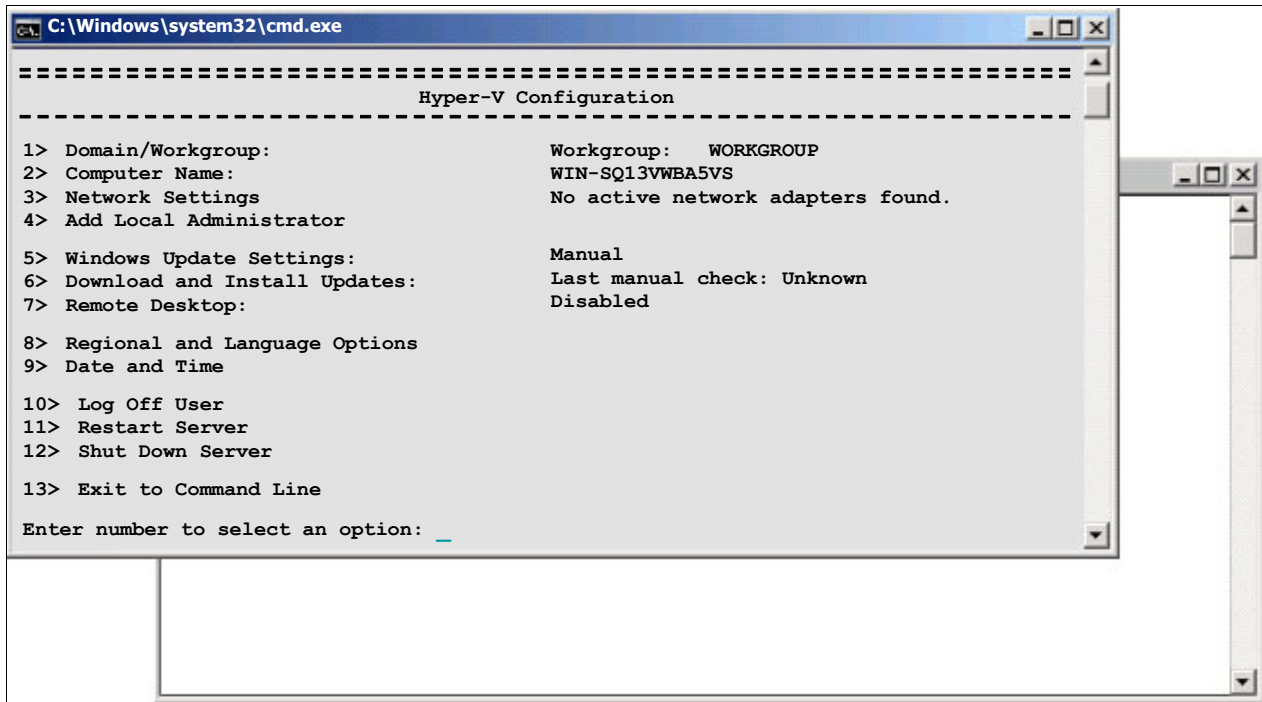
```
C:\Windows\system32\cmd.exe                                                  _ □ ×
================================================================
                        Hyper-V Configuration
----------------------------------------------------------------
1> Domain/Workgroup:                  Workgroup:   WORKGROUP
2> Computer Name:                     WIN-SQ13VWBA5VS
3> Network Settings                   No active network adapters found.
4> Add Local Administrator

5> Windows Update Settings:           Manual
6> Download and Install Updates:      Last manual check: Unknown
7> Remote Desktop:                    Disabled

8> Regional and Language Options
9> Date and Time

10> Log Off User
11> Restart Server
12> Shut Down Server

13> Exit to Command Line

Enter number to select an option: _
```

Figure 2-24   The console window and command prompt of the main user interface for Hyper-V Server

2.4.2 Console management

Management of Hyper-V Server must be done by using either the Hyper-V Configuration console (`hvconfig console`) that is presented when you log in (Figure 2-24), the command line, or remotely. By using the console and command line, you can make the initial system settings that are necessary to configure your system and allow it to be managed remotely.

The command console starts automatically when you log in. The command console provides the administrator with basic setup and configuration options that are most commonly used. To use a command in the console, simply select the number of the item that you want to execute and enter it at the prompt. You are then prompted though that change and return to the console when it is completed.

The following options are available as shown in Figure 2-24:

► Domain/Workgroup (to join a domain)
► Computer Name (to change your computer name)
► Network Settings (for you to set your host network addresses)
► Add Local Administrator
► Windows Update Settings
► Download and Install Updates
► Remote Desktop (settings)
► Regional and Language Options
► Date and Time (for the system)
► Log Off User
► Restart Server

- ► Shut Down Server
- ► Exit to Command Line

All other changes to the system, including the setup, configuration, and managing of VMs, must be done remotely or by using the command line.

If you close the console, you can open it again by typing the following command:

`hvconfig`

If you accidentally close all of the console windows, you can open new ones by running Windows Task Manager:

1. Press Ctrl+Alt+Del and click **Start Task Manager**.

2. To open a new command prompt window, click **File** → **New Task (Run)**.

3. In the Create New Task window (Figure 2-25), enter `cmd`.
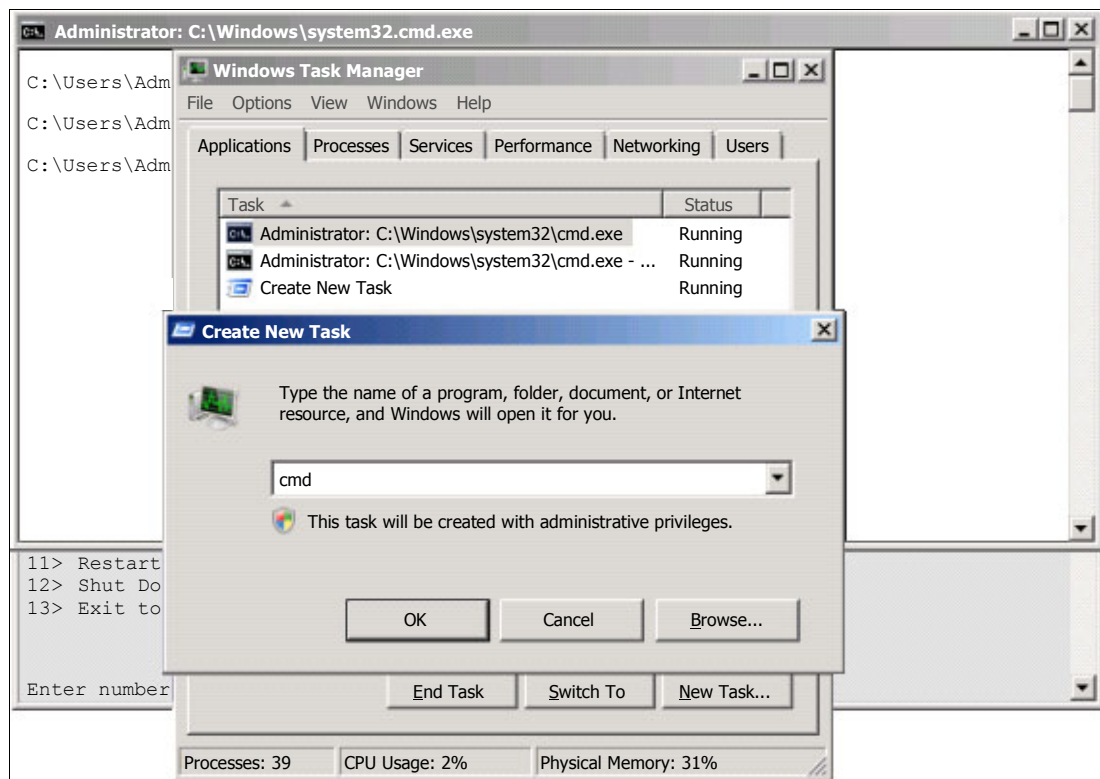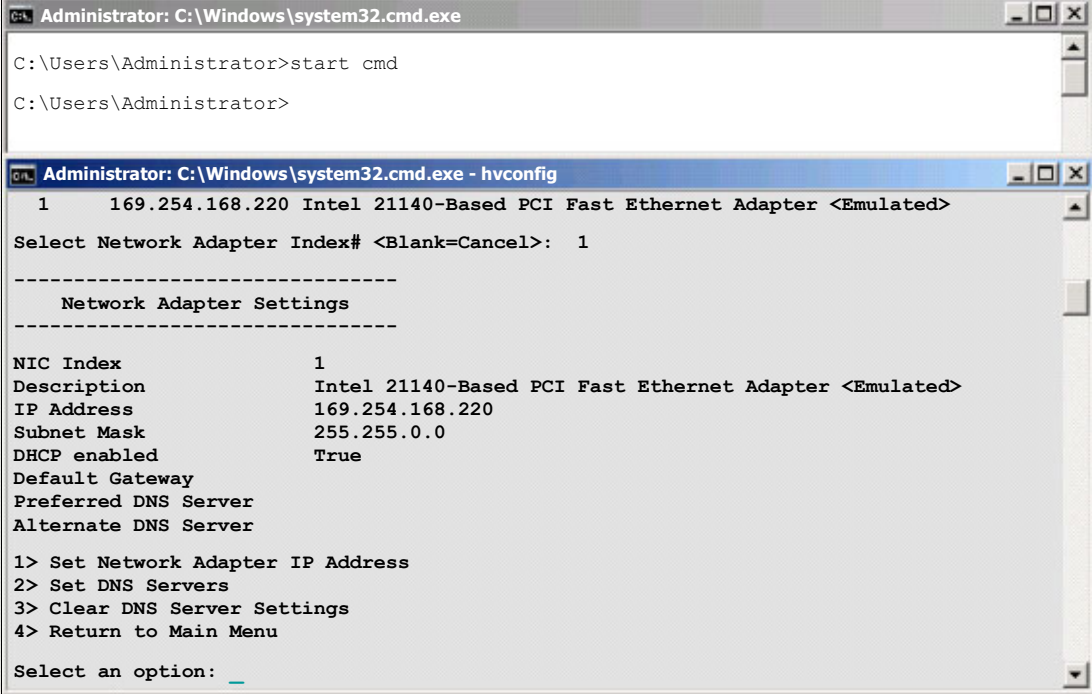
Figure 2-25   Opening a new command prompt window

Setting an IP address for a host partition

By using the console utility, you can view and configure your network interfaces. If using static IP addresses, make sure that you also set your DNS and Gateway addresses.

When possible, leave one network interface for dedicated host management and one or more dedicated for Hyper-V guest VMs. Figure 2-26 shows the options to configure a network interface.

```
Administrator: C:\Windows\system32.cmd.exe                                    _ □ ×

C:\Users\Administrator>start cmd

C:\Users\Administrator>
```

```
Administrator: C:\Windows\system32.cmd.exe - hvconfig                         _ □ ×
   1     169.254.168.220 Intel 21140-Based PCI Fast Ethernet Adapter <Emulated>

Select Network Adapter Index# <Blank=Cancel>:  1

-------------------------------
    Network Adapter Settings
-------------------------------

NIC Index                 1
Description               Intel 21140-Based PCI Fast Ethernet Adapter <Emulated>
IP Address                169.254.168.220
Subnet Mask               255.255.0.0
DHCP enabled              True
Default Gateway
Preferred DNS Server
Alternate DNS Server

1> Set Network Adapter IP Address
2> Set DNS Servers
3> Clear DNS Server Settings
4> Return to Main Menu

Select an option: _
```

Figure 2-26   Configuring a network interface

Running Windows Update

To spare you the frustration of running into issues that have been found and fixed, run Windows Update to ensure that all applicable patches are on your host server.

To start Windows Update manually, from the Hyper-V Configuration window, type 6 for Download and Install Updates (Figure 2-24 on page 34). You can also configure the settings for Windows Update by typing option 5 from the menu.

If you have a firewall that must be authenticated through, try a command line FTP or TELNET connection to a known site (Figure 2-27). Several third-party tools are available on the Web that you can use to perform this action.

```
C:\Windows\System32\cscript.exe                                    _ □ ×

Microsoft <R> Windows Script Host Version 5.7
Copyright <C> Microsoft Corporation. All rights reserved.

Searching for updates...

List of applicable items on the machine:

There are no applicable updates.

Press return to continue..._
```

```
      Media State. . . . . . . . . . . : Media disconnected
      Connection-specific DNS Suffix . : uswa.ibm.com

11> Restart Server
12> Shut Down Server

13> Exit to Command Line

Enter number to select an option:_
```

Figure 2-27   Running Windows Update manually

Setting a host computer name

By using the console, you can change the host computer name (Figure 2-28). You must do this before you join any domain to reduce chances of errors and confusion.

```
Administrator: C:\Windows\system32\cmd.exe                              _ | □ | X |

  C:\Windows\System32\cmd.exe                                          _ | □ | X |
                          Hyper-V Configuration
     ---------------------------------------------------------------------
     1> Domain/Workgroup:                        Workgroup:  WORKGROUP
     2> Computer Name:                           HYPERVSVR
     3> Network Settings
     4> Add Local Administrator
Tu
     5> Windows Update Settings:                 Manual
     6> Download and Install Updates:            Last manual check: 4/13/2009 2:23:27 PM
     7> Remote Desktop:                          Disabled

Tu   8> Regional and Language Options
     9> Date and Time

     10> Log Off User
     11> Restart Server
Tu   12> Shut Down Server

     13> Exit to Command Line

     Enter number to select an option: 2
C:
     Enter new computer name <Blank=Cancel>: _
```

Figure 2-28   Setting a new computer name

Joining the host computer to a domain

Hyper-V Server 2008 can also be a member of a domain. Once again, the console is used to join the host to the specified domain (Figure 2-29). Reboot the server when the operation is completed.

```
Administrator: C:\Windows\system32\cmd.exe                              _ | □ | X |
C:
     C:\Windows\System32\cmd.exe                                       _ | □ | X |
     1> Domain/Workgroup:                        Workgroup:  WORKGROUP
     2> Computer Name:                           WIN-SQ13VWBA5VS
     3> Network Settings
     4> Add Local Administrator

     5> Windows Update Settings:                 Manual
     6> Download and Install Updates:            Last manual check: Unknown
     7> Remote Desktop:                          Disabled

     8> Regional and Language Options
     9> Date and Time

     10> Log Off User
     11> Restart Server
     12> Shut Down Server

     13> Exit to Command Line

     Enter number to select an option: 1

     Change Domain/Workgroup Membership

     Join <D>omain or <W>orkgroup? <Blank=Cancel>: _
```

Figure 2-29   Changing the domain membership

2.4.3 Using the command line

Windows Server 2008 has deep command-line support. Because Hyper-V Server is based on Windows Server 2008, it can take advantage of all the command-line tools that are available. Multiple books and online resources are available to assist you in managing your system by using a command line.

The following subset of commands includes the ones that are most useful for making basic changes to the system to allow remote management of your Hyper-V Server 2008 system.

To see a list of drivers installed on your system, type the following command:

```
sc query type=driver
```

To perform an INF installation of a driver, type the following command:

```
pnputil –i –a <driver.inf>
```

To see your systems IP address, type the following command:

```
ipconfig /all
```

To configure the firewall to support remote management by using Microsoft Management Console (MMC), type the following command:

```
netsh advfirewall firewall set rule group="Remote Administration" new enable=yes
```

To discover a list of available server roles, type the following command:

```
oclist
```

To start a service, type the following command:

```
net start <service name>
```

To stop a service, type the following command:

```
net stop <service name>
```

2.4.4 Setting up for remote management

Certain tasks must be completed remotely, such as validating your driver versions and managing your VMs. You must complete the following tasks, as explained in the following sections, to properly enable your host platform to allow remote management:

1. Opening the firewall sufficiently to allow the Hyper-V Manager MMC to connect and operate remotely.

2. Enabling remote access to the PnP interface on the host platform.

Opening the firewall settings in Hyper-V Server 2008
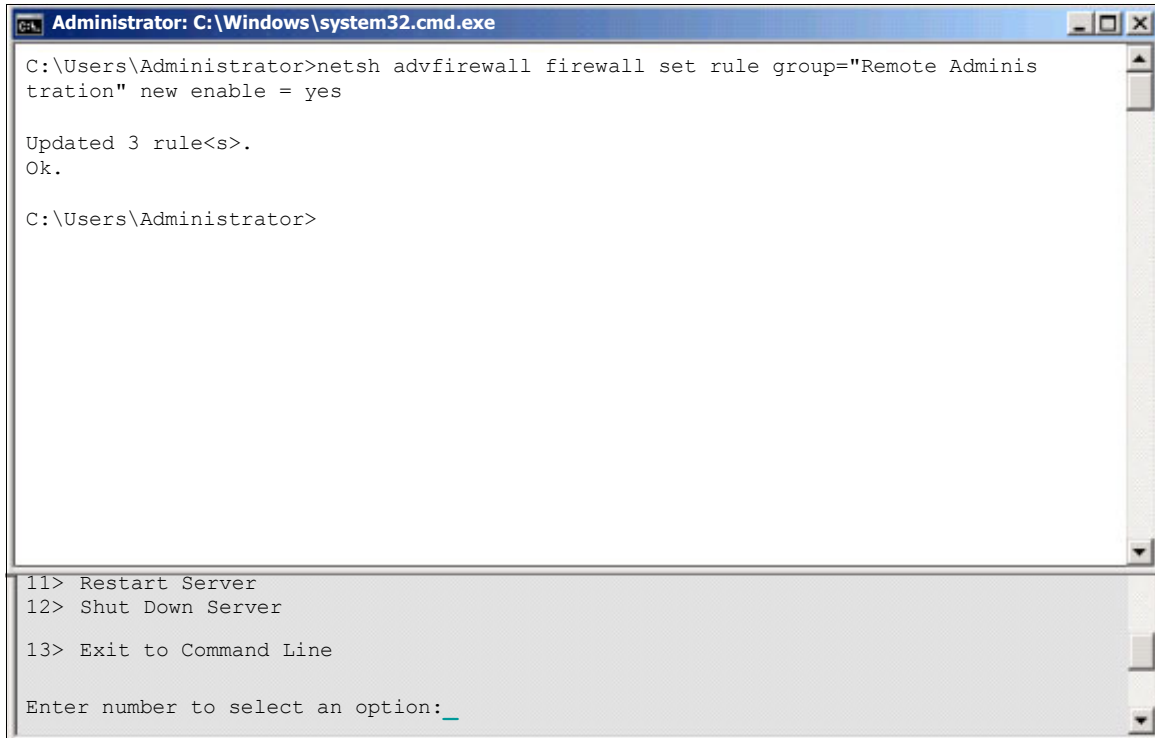
To open the firewall settings to support remote management of Hyper-V with an MMC snap-in, enter the following command:

```
netsh advfirewall firewall set rule group="Remote Administration" new enable=yes
```

By entering this command, three rules were successfully updated as shown in Figure 2-30.

Alternatively, although not recommended, you can completely disable the firewall by typing the following command:

```
Netsh firewall set opmode mode=DISABLE profile=ALL
```



```
Administrator: C:\Windows\system32.cmd.exe                                    _ □ X

C:\Users\Administrator>netsh advfirewall firewall set rule group="Remote Adminis
tration" new enable = yes

Updated 3 rule<s>.
Ok.

C:\Users\Administrator>




11> Restart Server
12> Shut Down Server

13> Exit to Command Line

Enter number to select an option:_
```

Figure 2-30   Configuring the firewall to allow remote management

Enabling remote access to the PnP interface in Hyper-V Server 2008

After configuring the Windows Firewall, remote access to the PnP interface must also be enabled. This can be done from a Windows Server 2008 system (full GUI installation) or a Windows Vista system.

From the remote system, open the Local Group Policy editor MMC snap-in and establish a connection to the system running Hyper-V Server. Navigate to **Computer Configuration** → **Administrative Templates** → **System** → **Device Installation** (Figure 2-31 on page 41). Enable the **Allow remote access to the PnP interface** setting.
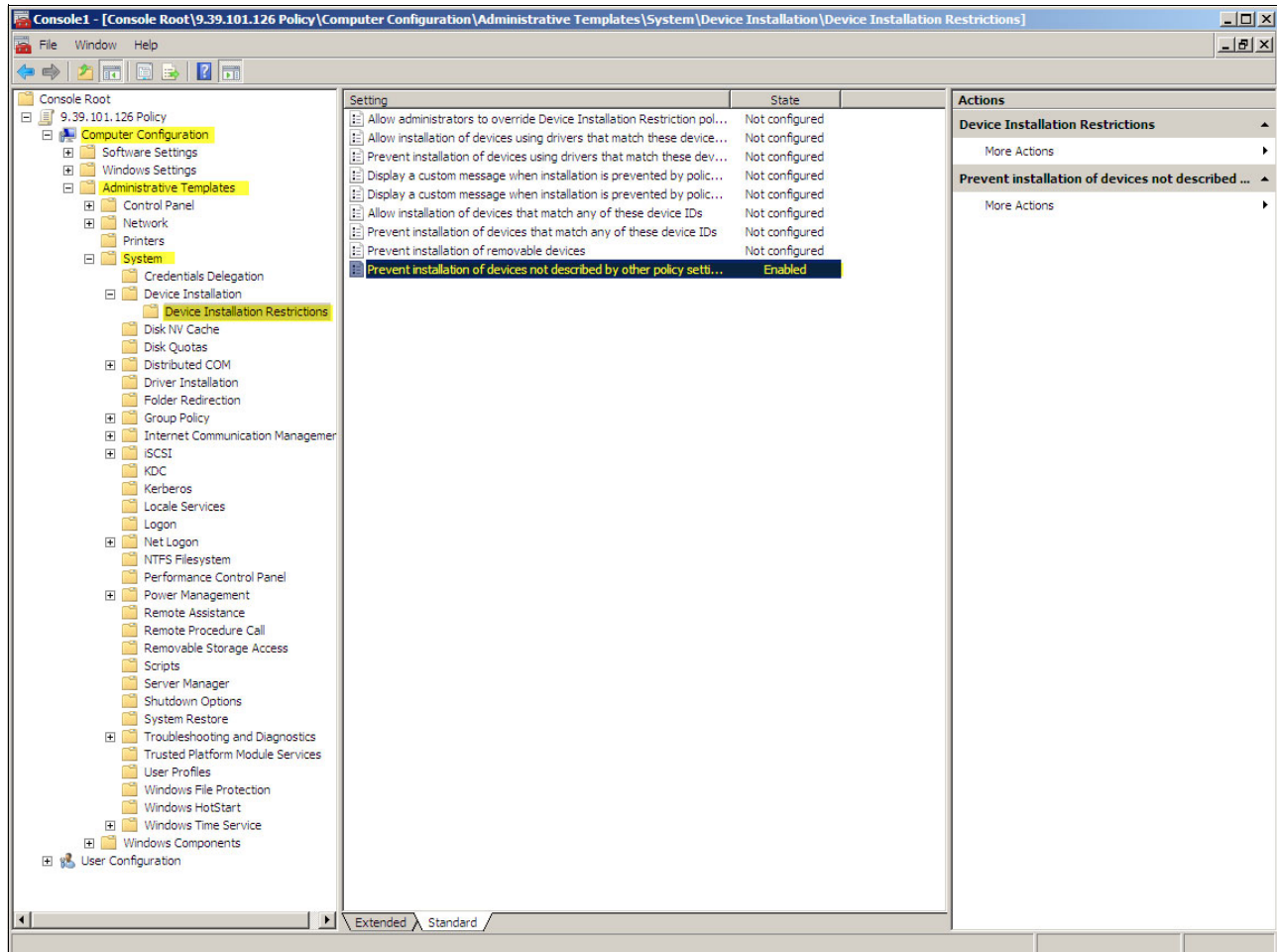
Figure 2-31   Allowing remote access to the PnP system

You must reboot the Hyper-V server to enable this policy.

If you have trouble locating the console snap-in:

1. Click **Start** → **Run**.

2. Enter `mmc`.

3. When the MMC framework is running, click **File** → **Add/Remove Snap-in** (or Ctrl+M), and select **Group Policy Object**.

4. When prompted, specify the remote Hyper-V server.

If you are having permission problems accessing your server, make sure that Microsoft Updates have been installed and that you are logging into an account with administrator privileges on the Hyper-V Server. If necessary, you can use the Hyper-V Configuration console to create or add an account to the local administrator group.

2.4.5 Applying the IBM updates

Your must have installed the latest available drivers on your host server. When doing this installation, you must determine what is currently installed when the operating system first starts and what are the latest drivers available on the Web.

Determining the driver level

A quick and easy way to see installed devices and driver versions is to use the Device Manager. However, because Hyper-V is based on a core installation, again, you must do this remotely by using MMC.

After completing the steps to enable remote access to the PnP interface on a Hyper-V Server, start a basic MMC framework again. Press Ctrl+M to select Device Manager and select the remote Hyper-V Server system.

Device Manager operates in a read-only mode, but from here, you can traverse the Hyper-V Server system devices, and see the respective driver levels (Figure 2-32). You can compare them against the latest driver levels that are available on the IBM support site.
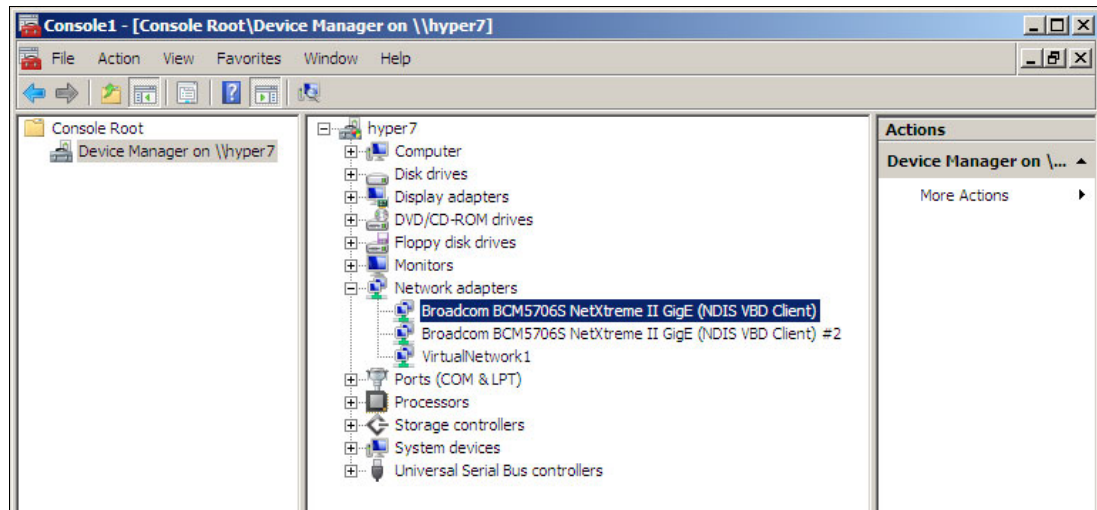
Figure 2-32   Viewing the devices on the remote Hyper-V Server system by using Device Manager

IBM update site

You must download and apply the latest drivers for the devices on your system from the IBM Support Web site. You can find the driver matrix for System x servers at the following address:

http://www.ibm.com/support/docview.wss?uid=psg1MIGR-4JTS2T

Downloading and running updates

After you compile a list of drivers for your system, download the packages and place them in a temporary directory on your host system. If the download is an executable (.exe) file, then run that .exe file to launch the installer or to unpack the installation package. When the package starts, follow the instructions to install or update the driver.

Figure 2-33 shows the Broadcom driver being updated.
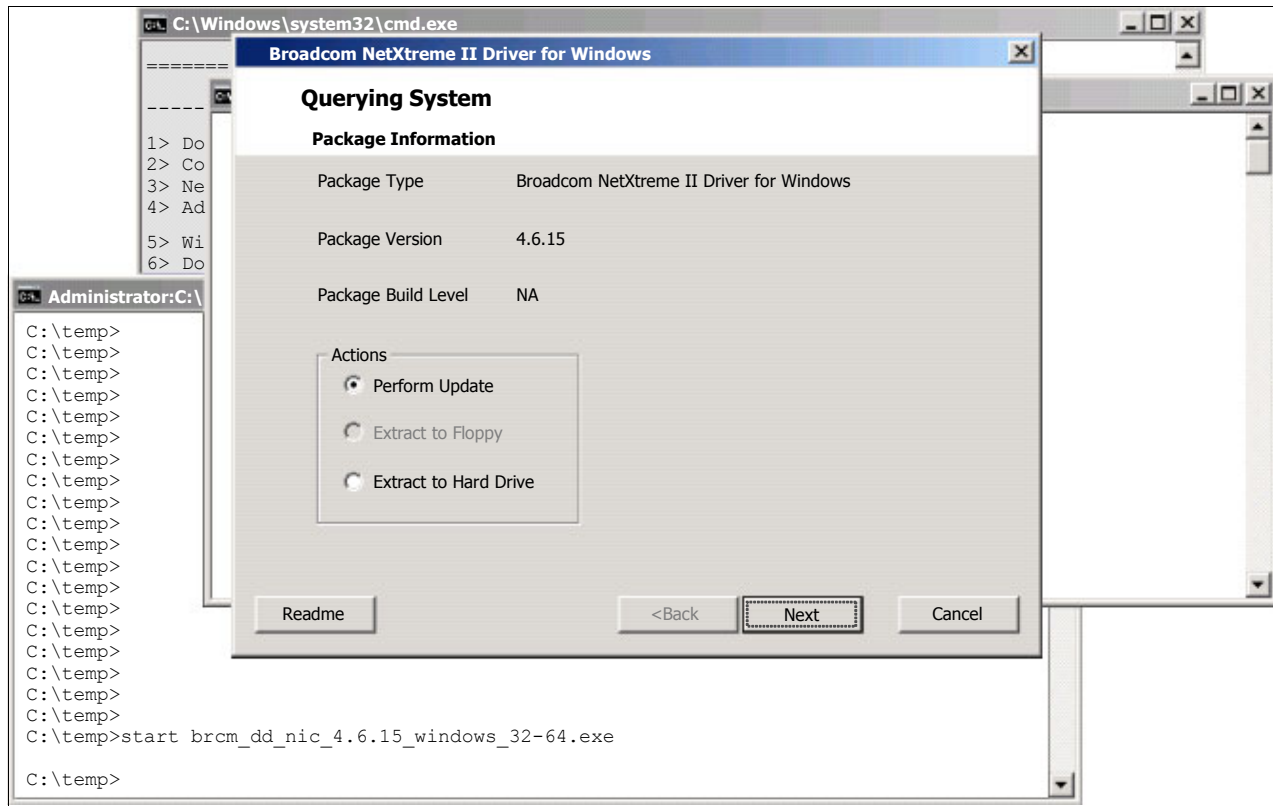
Figure 2-33   Updating the Broadcom driver

If the downloaded update is simply an update to a driver (that is, without a `setup.exe` installer), you can enter the following command to perform an INF installation of the driver:

```
pnputil –i –a <driver.inf>
```

2.4.6 Managing the Hyper-V Server 2008 platform

The management of Hyper-V Server 2008 is limited to the basic management tool included with Windows Server 2008. This tool is an MMC snap-in and can be used to create host settings for your VM, as well as create, configure, and manage your VMs. An alternate management tool is System Center Virtual Machine Manager, which we describe in 3.2, "Microsoft System Center Virtual Machine Manager" on page 65.

Managing Hyper-V Server

A remote system must be used manage and administer the virtual environments of your Hyper-V systems. The Hyper-V Manager MMC (Figure 2-34) can be run on any Windows Server 2008 installed with the GUI or a Windows Vista system that has the Hyper-V Remote Management tools installed (available for download on the Web). We discuss this further in 3.1, "Hyper-V Manager" on page 64.
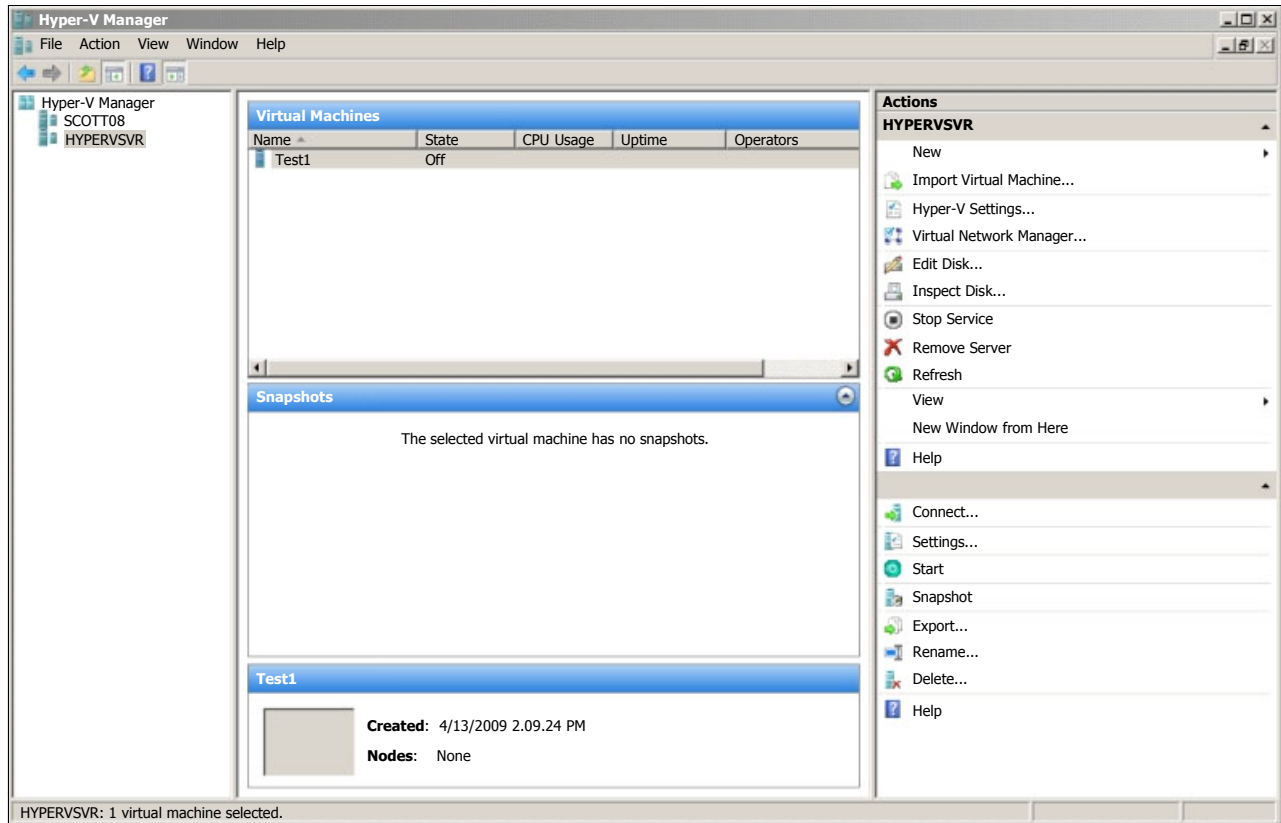
Figure 2-34   Hyper-V Manager

2.5 Creating a virtual environment by using Hyper-V

Now that the operating system is installed, you can create a virtualization environment, which includes creating a VM, creating a virtual network, and so on.

Creating a virtual environment involves the following tasks, which are explained in the sections that follow:

1. Creating an initial virtual machine
2. Installing a guest operating system
3. Installing Integration Services on the guest
4. Installing a virtual network
5. Adding a virtual network adapter to a guest
6. Configuring a firewall for remote administration
7. Associating the Hyper-V administrator role with an AD group

2.5.1 Creating an initial virtual machine

Virtual machines are created by using the Hyper-V Manager. To access the Hyper-V Manager, you can use either of the following options:

► Select **Start** → **Administrative Tools** → **Hyper-V Manager**.
► Run `servermanager.msc` and then navigate to **Roles** → **Hyper-V** → **Hyper-V Manager**.

Figure 2-35 shows the window that opens.
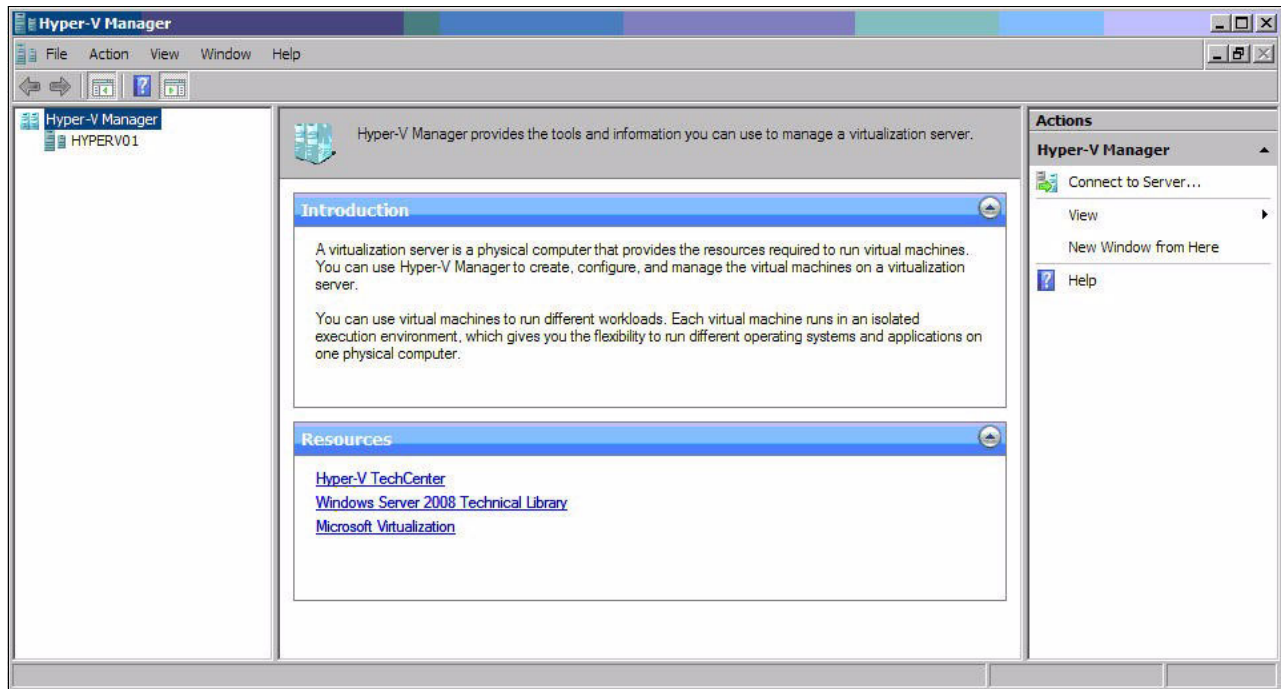
Figure 2-35   Hyper-V Manager

Either connect to the specific Hyper-V server from the action pane on the right side or click the specific server in the tree in the left pane (if listed).

To create a new VM on the selected server:

1. Click **New** → **Virtual Machine** to launch the New Virtual Machine wizard.

2. In the Before You Begin panel, review the information and click **Next**.

3. In the Specify Name and Location panel (Figure 2-36), enter the name of the new VM and the location of the VM files.

The folder for the location of the VM file should be considered primarily for performance. Significant amounts of free space can be consumed by VM snapshots, which are also placed by default at this location. However, their location can be modified later in the VM properties.

Click **Next**.
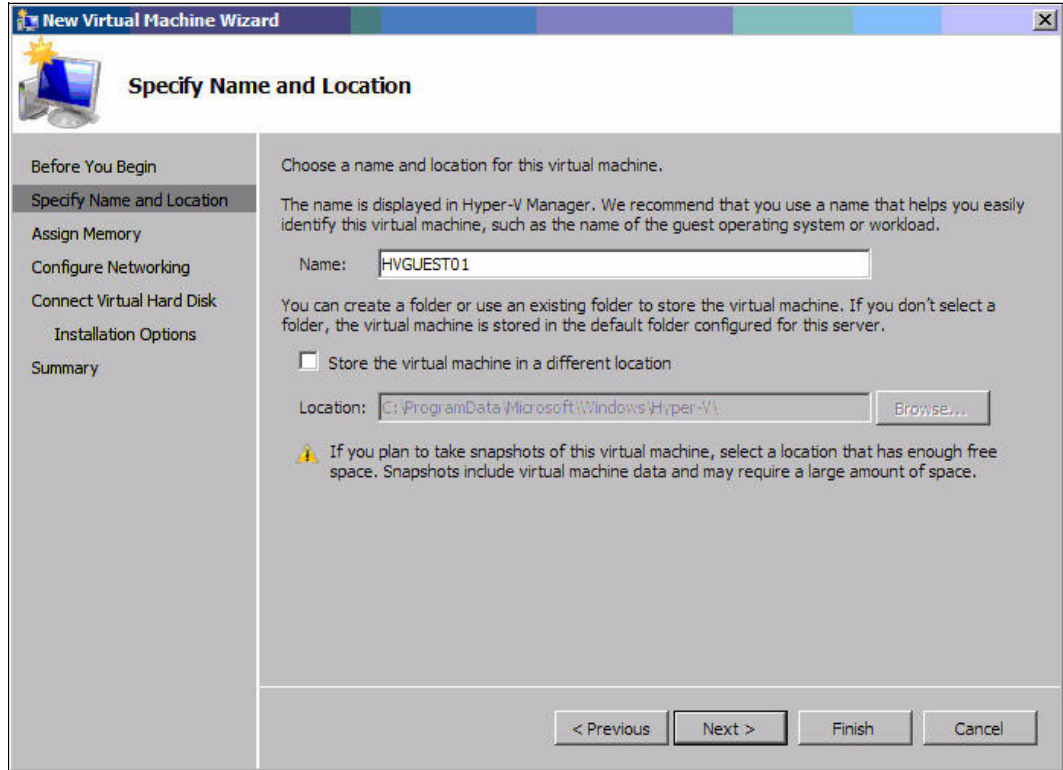
Figure 2-36   New Virtual Machine Wizard - Name and location

4. In the Assign Memory panel (Figure 2-37), select the amount of memory to allocate to the VM.

By default, 512 MB is allocated to a VM. However, for a Windows Vista guest, consider increasing this value to 1 GB or more for Windows Server 2008.

Click **Next**.
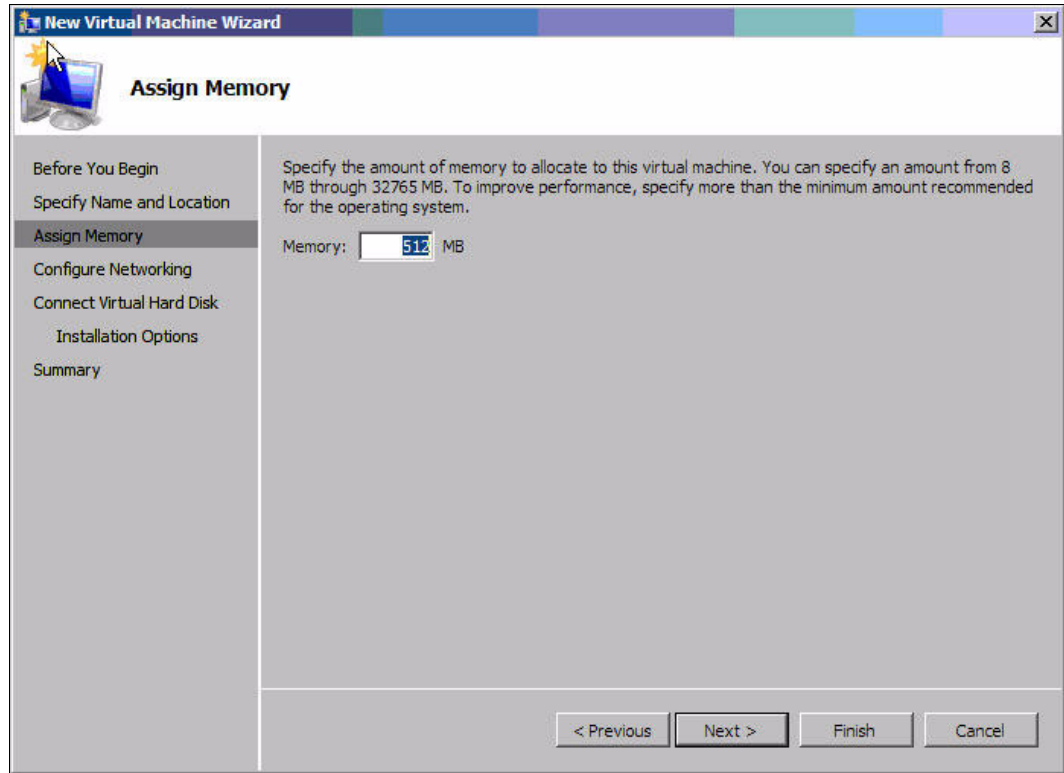
Figure 2-37   New Virtual Machine Wizard - Memory

5. In the Configure Networking panel (Figure 2-38), specify the network adapter to use with this VM. The adapters listed are the ones that you selected in the panel shown in Figure 2-21 on page 31. Click **Next**.
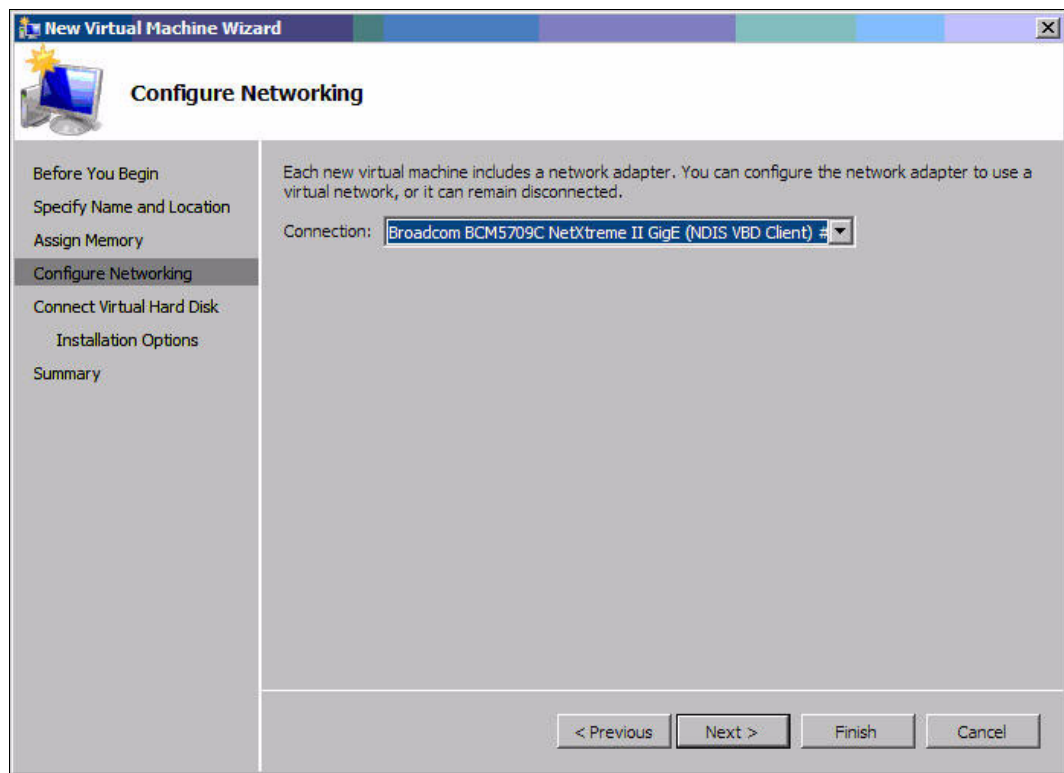
Figure 2-38   New Virtual Machine Wizard - Networking

6. In the Connect Virtual Hard Disk panel (Figure 2-39), specify the virtual hard disk to assign to the VM. You can either create a new virtual disk or select an existing one. The default allocation is 127 GB. Click **Next**.
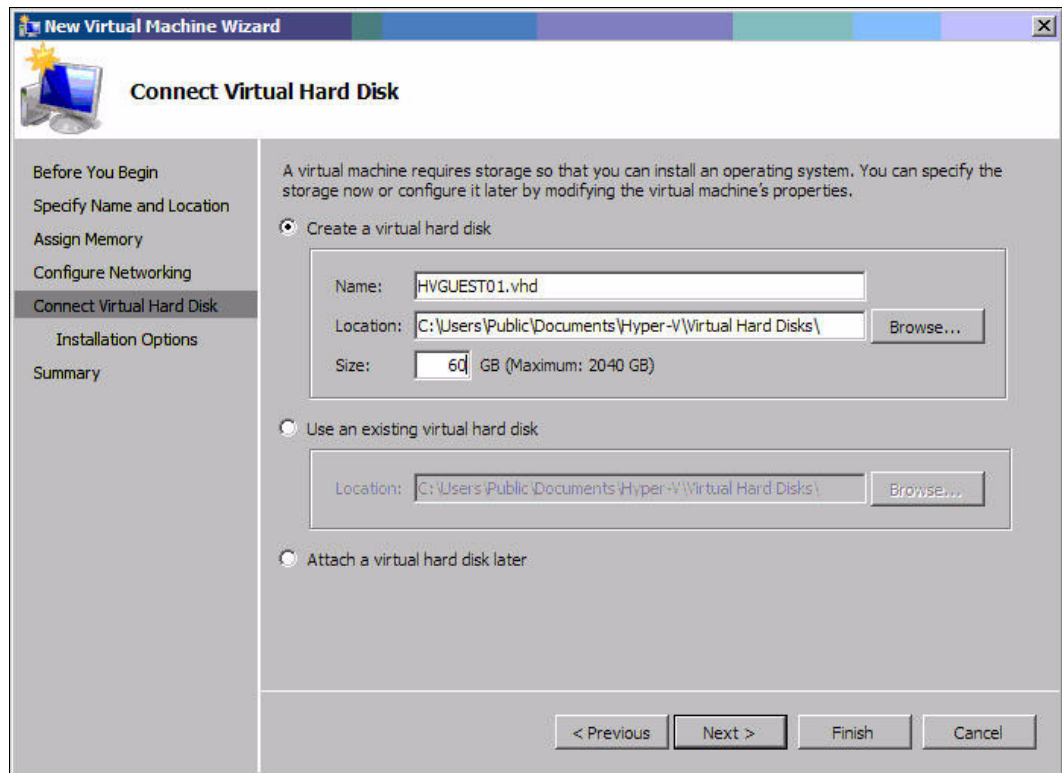
Figure 2-39   New Virtual Machine Wizard - Virtual hard disks

7. In the Installation Options panel (Figure 2-40), specify whether to install the operating system on the VM now or later. In our example, we install the operating system now by selecting the drive letter where the optical drive is.

Our drive D: is really the local optical drive on our remote management workstation. It is mapped as D: by using the Remote Supervisor Adapter II remote media feature of the x3850 M2 server.

Click **Next**.
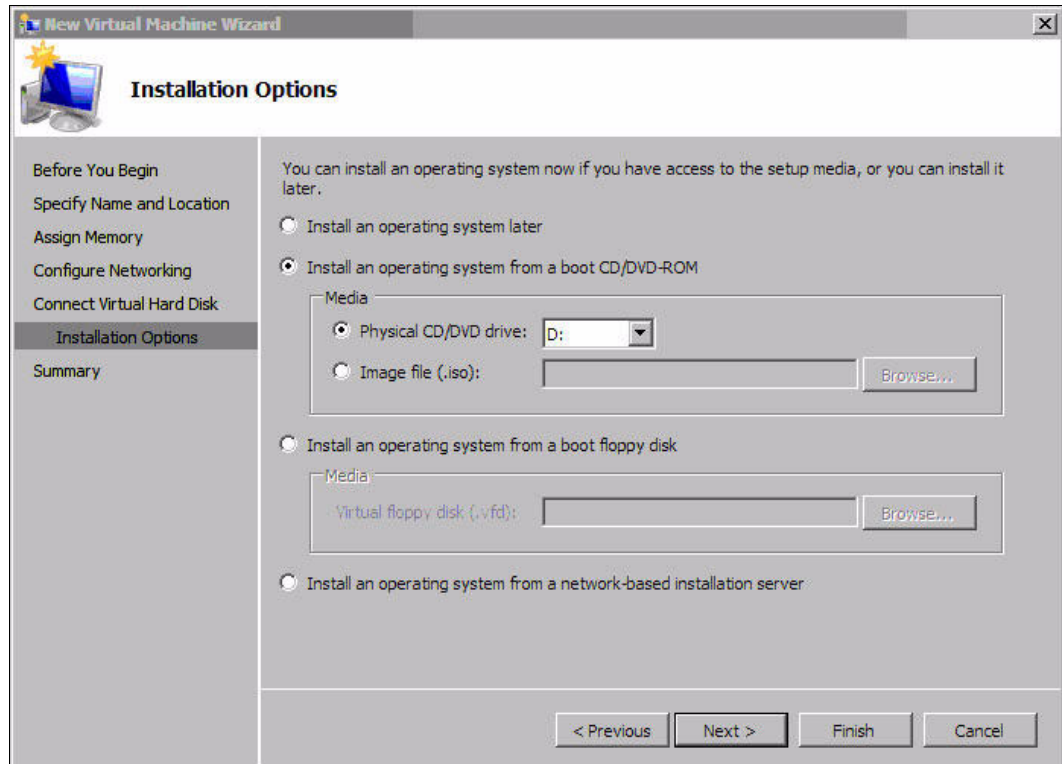
Figure 2-40   New Virtual Machine Wizard - Installation options

8. In the summary panel (Figure 2-41), review the choices that you made in the wizard. Click **Finish** to create the VM. The operating system that you selected in step 7 on page 50 is installed when the VM is started, as we describe in the next section.
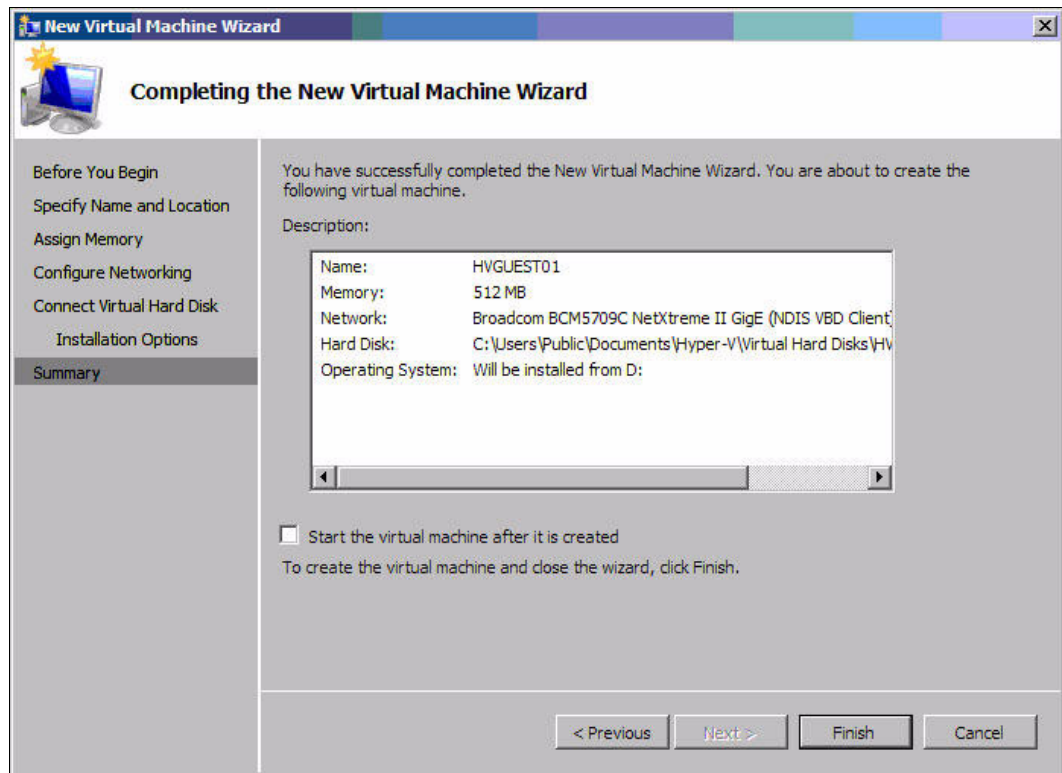
Figure 2-41   New Virtual Machine Wizard - Summary

2.5.2 Installing a guest operating system

Installation of a guest operating system is a straightforward process. When you start the VM, it attempts to boot as though it were residing on real hardware.

To install a guest operating system, start Hyper-V Manager. Highlight the required VM, right-click, and select **Start** (Figure 2-42).
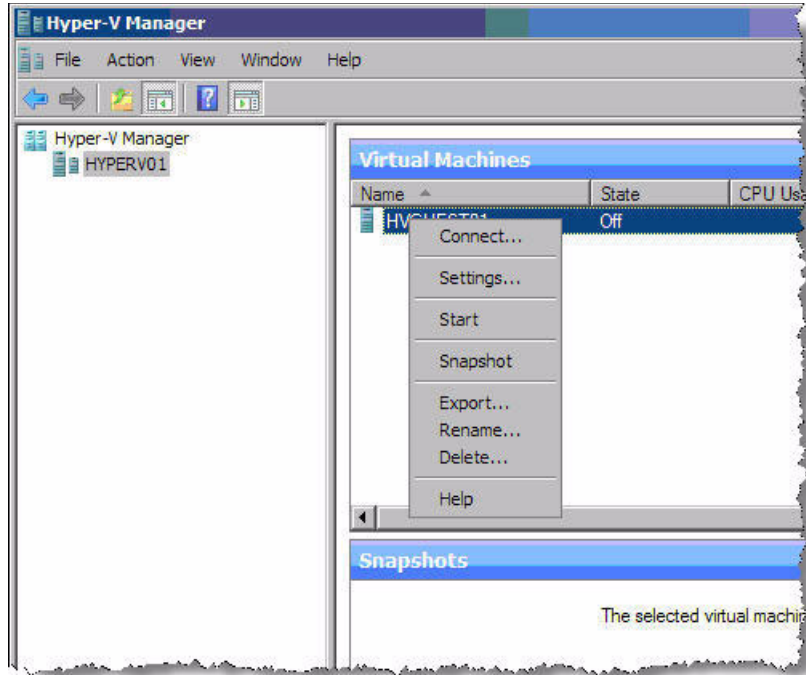
Figure 2-42   Starting the virtual machine

A new window opens showing the console of the VM (Figure 2-43).
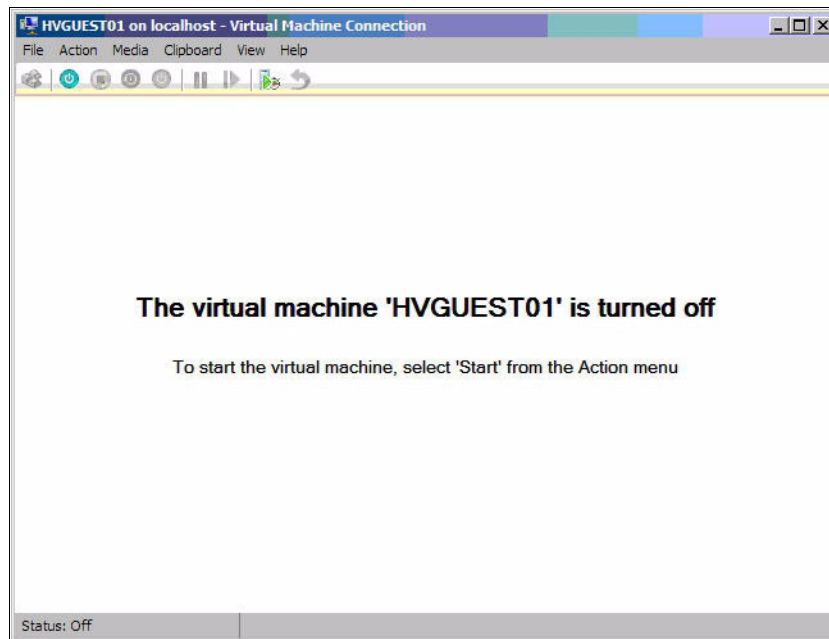
Figure 2-43   Starting the virtual machine

Assuming that you mapped suitable installation media (ISO or CD/DVD), the guest operating system installation proceeds (Figure 2-44).
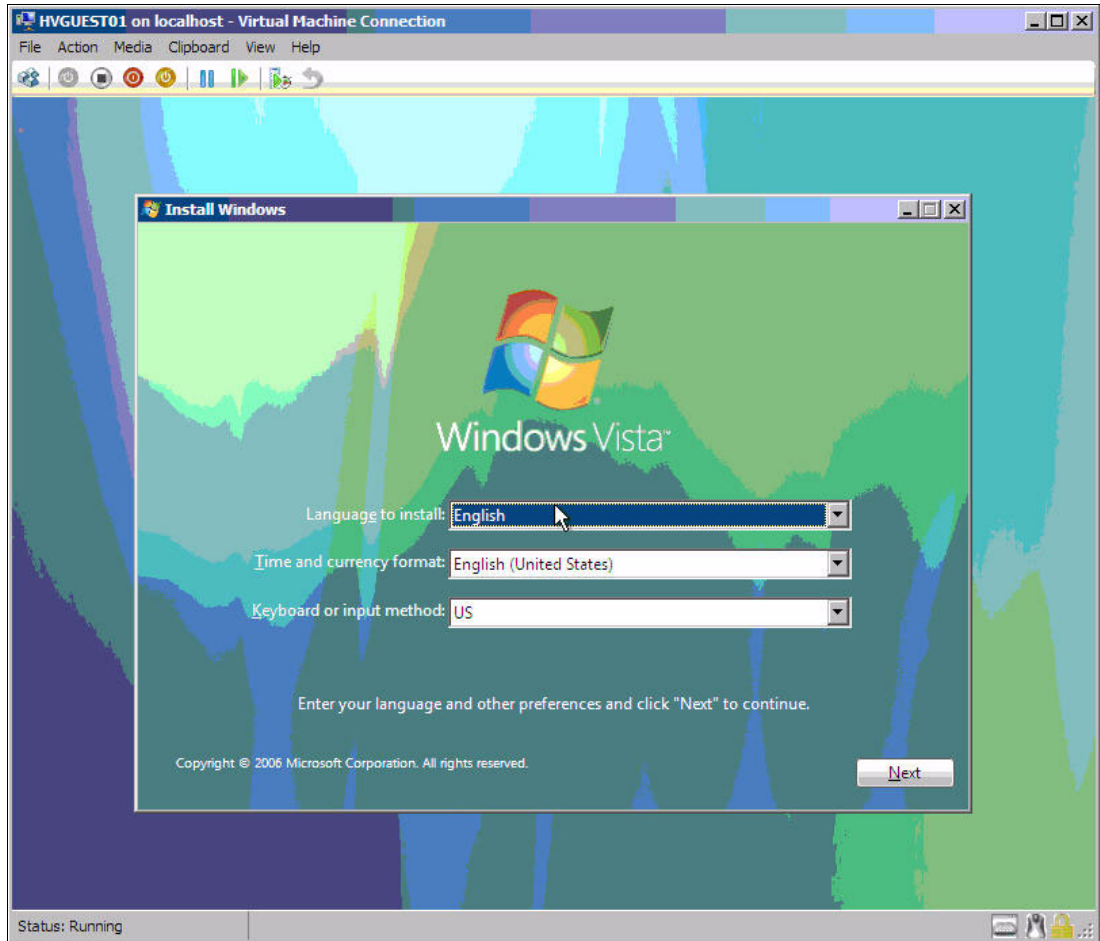
Figure 2-44   Booting the VM to installation media

The standard installation procedure continues to install the guest operating system, which is Windows Vista in our example.

Tip: If you are using RDP/Terminal Services or Remote Supervisor Adapter II to access the host desktop, you might lose the ability to use the mouse within the VM connection. This behavior is documented in the release notes. However, the fact that the use of the mouse in this mode seems to return after Integration Services is installed is omitted from the release notes.

2.5.3 Installing Integration Services on the guest

Integration Services provides updated drivers to the guest operating system. These drivers proved extra features to the guest and performance enhancements. The features provided depend on the version of guest operating system. The features are enabled or disabled by selecting check boxes in the VM properties (Figure 2-45).
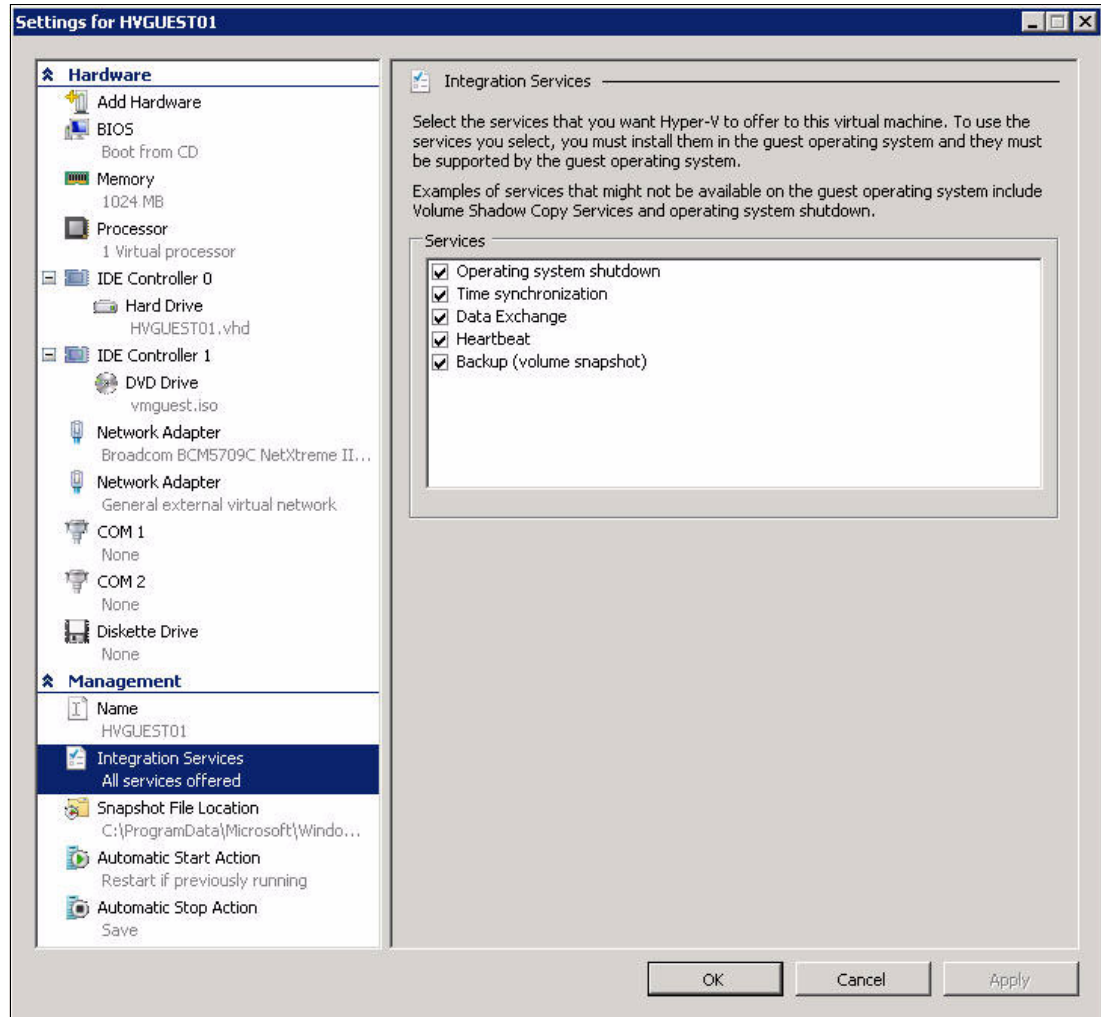
Figure 2-45   Properties of the VM related to Integration Services

To install the Integration Services software, from the guest machine console window, click
Action → **Insert Integration Services Setup Disk** (Figure 2-46). This has the effect of
mounting a virtual optical drive to the VM. If Autorun is not enabled, you might have to select
the CD to start the installation.
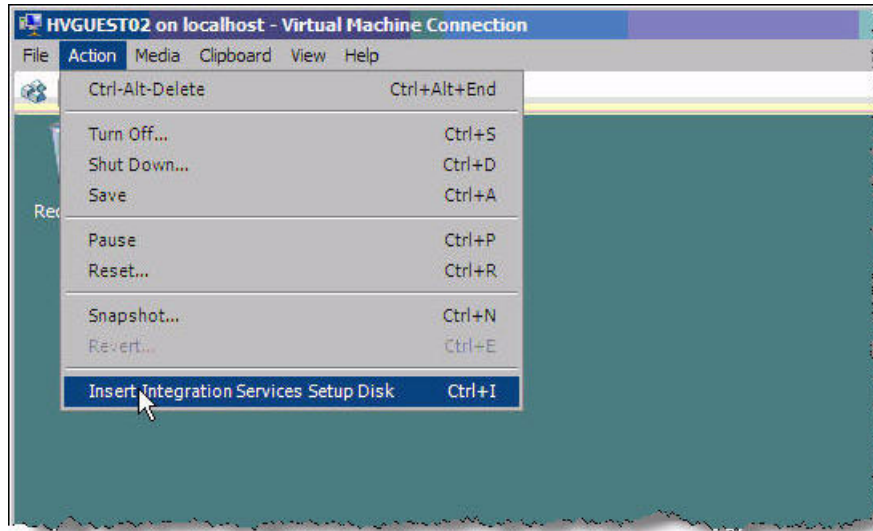
Figure 2-46   Installing Integration Services

SP1 for Windows Vista: Windows Vista requires SP1 to support Integration Services. If
you attempt to install Integration Services on a system without SP1, you might receive the
following message:

```
The specified program requires a newer version of Windows
```

If your SP1 media is remote, you might have to install an *existing network adapter* to the
VM to temporarily gain network access. After the service pack is applied and Integration
Services is installed, you can replace adapter with a higher performing network adapter.

2.5.4 Installing a virtual network

To install the virtual network, in the Virtual Network Manager window (Figure 2-47), under Virtual Networks in the left pane, select **New virtual network**. In the right pane, for type of virtual network, select **External**. Click **OK**.
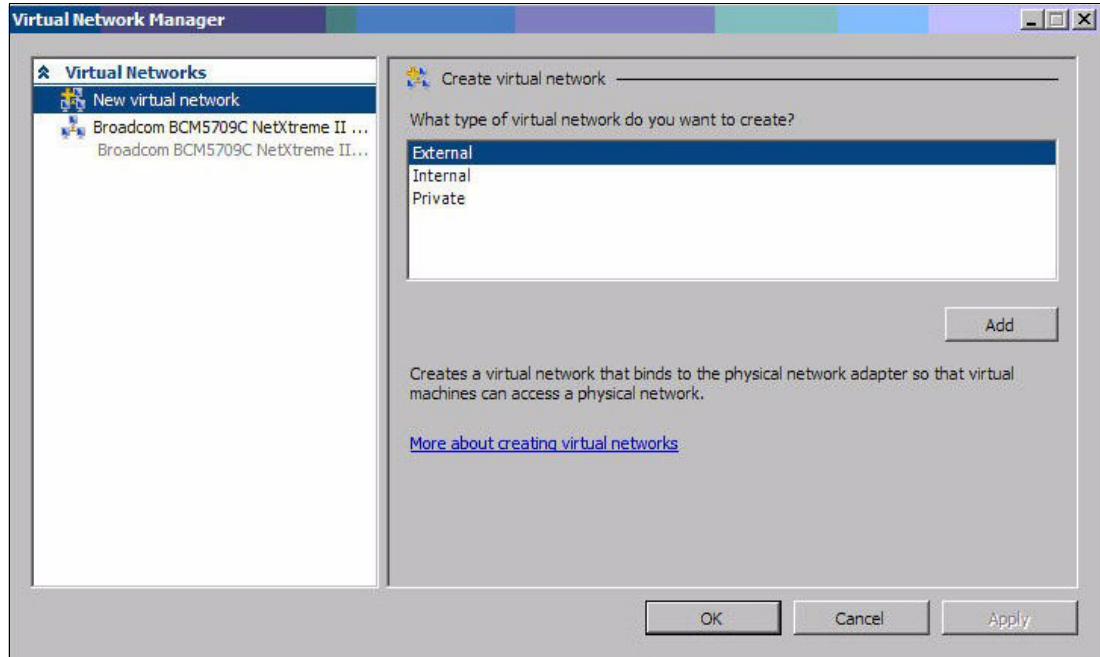
Figure 2-47   Creating a new virtual network

Notice the warning message about temporarily losing connectivity (Figure 2-48).
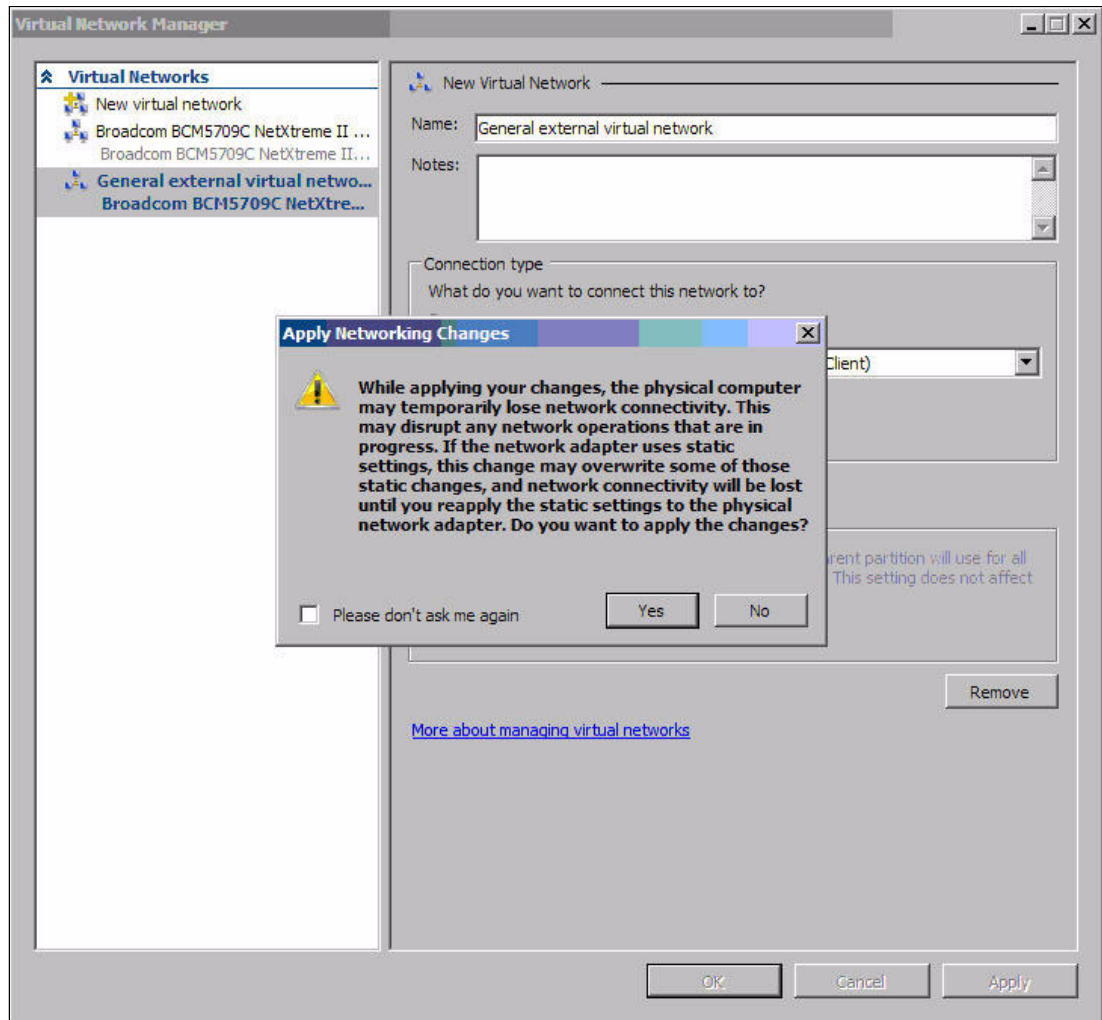

Figure 2-48   Temporary loss of connectivity

2.5.5 Adding a virtual network adapter to a guest

In the properties for the VM, add a virtual network adapter to the guest (Figure 2-49). In the left pane, expand **Hardware** → **IDE Controller 1** and select **Network Adapter General external virtual network**. In the right pane, select the network. For MAC address, select **Dynamic**. Click **Apply** and then click **OK**.
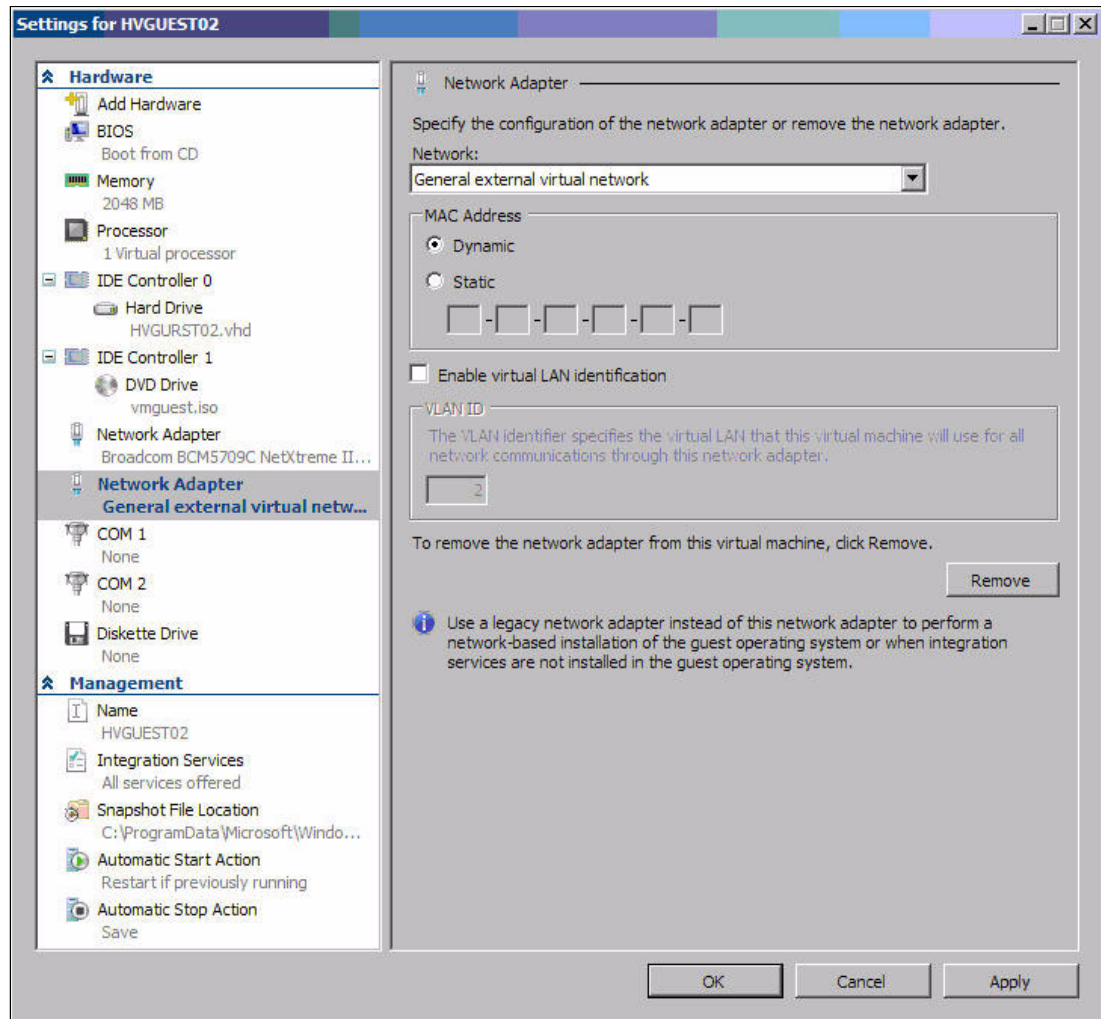
Figure 2-49   Adding the virtual network adapter

2.5.6 Configuring a firewall for remote administration

To configure the firewall for remote administration, enter the following command (Figure 2-50):

```
netsh advfirewall firewall set rule group="Windows Management Instrumentation
(WMI)" new enable=yes
```
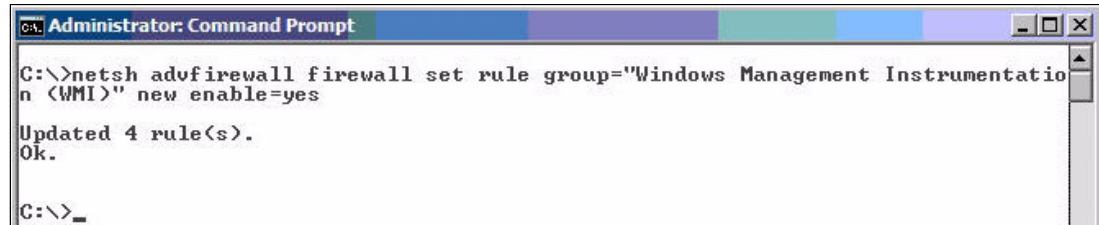

Figure 2-50   Configuring a firewall for remote administration

You can verify this rule by using the Windows Firewall with Advanced Security window (Figure 2-51).
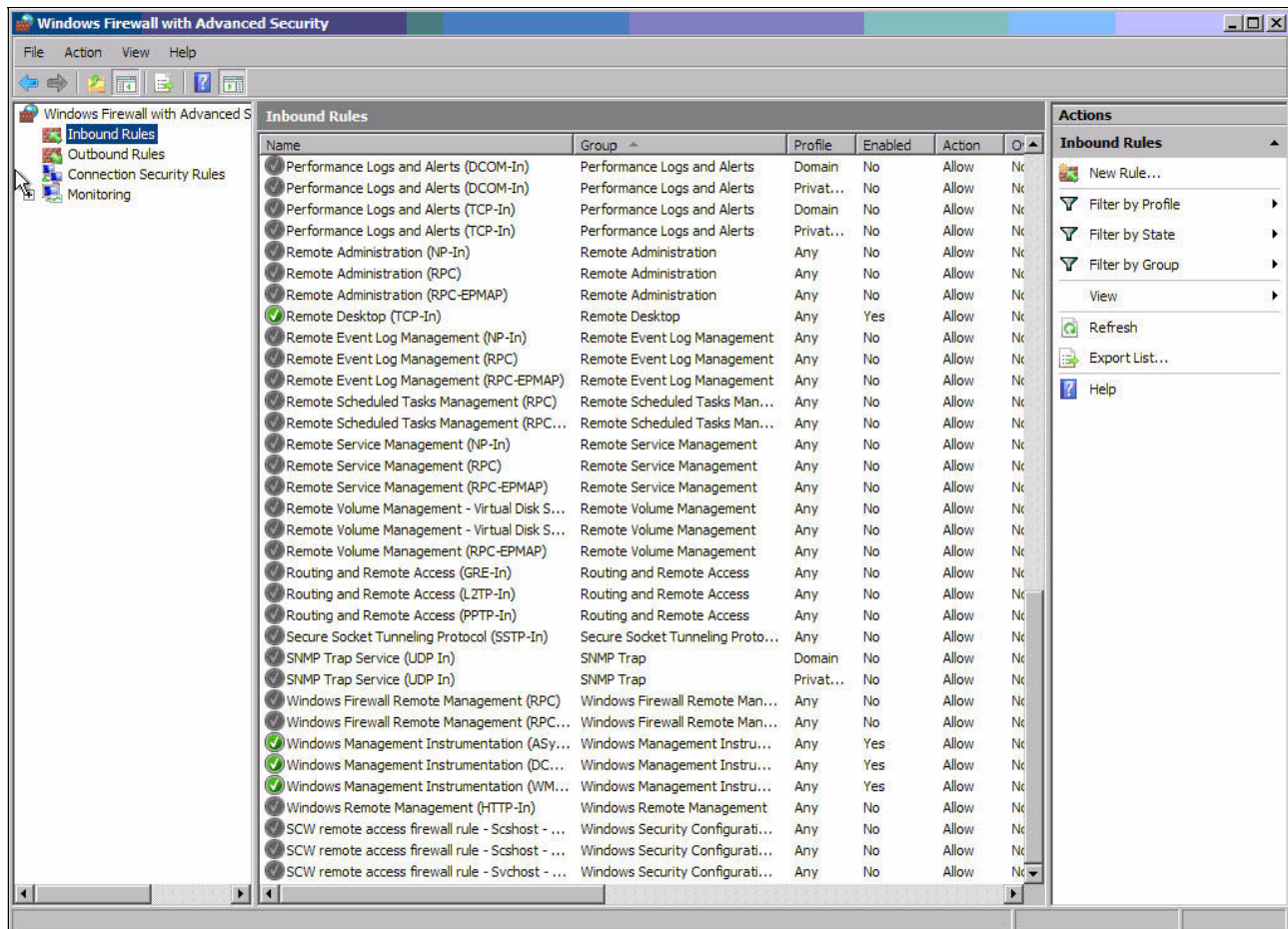
Figure 2-51   Verifying the firewall rules

2.5.7 Associating the Hyper-V administrator role with an AD group

By default, the only users with the authority to administer VMs are the members of the local Administrators group. In most situations, place this authority in a separate group to allow greater granularity of roles.

In our example, the authority to administer VMs is given to the AD group called *Hyper-V Administrators* from the ITSO test labs AD domain. This task is performed within the Authority Manager snap-in.

To associate the administrator role with an AD group:

1. Load the snap-in by entering **azman.msc** at a command prompt.
2. Right-click **Authorization Manager** and click **Open Authorization store**.
3. In the Open Authorization Store window (Figure 2-52), ensure that **XML file** is selected and the name is typed in the Store name field. Click **OK**.
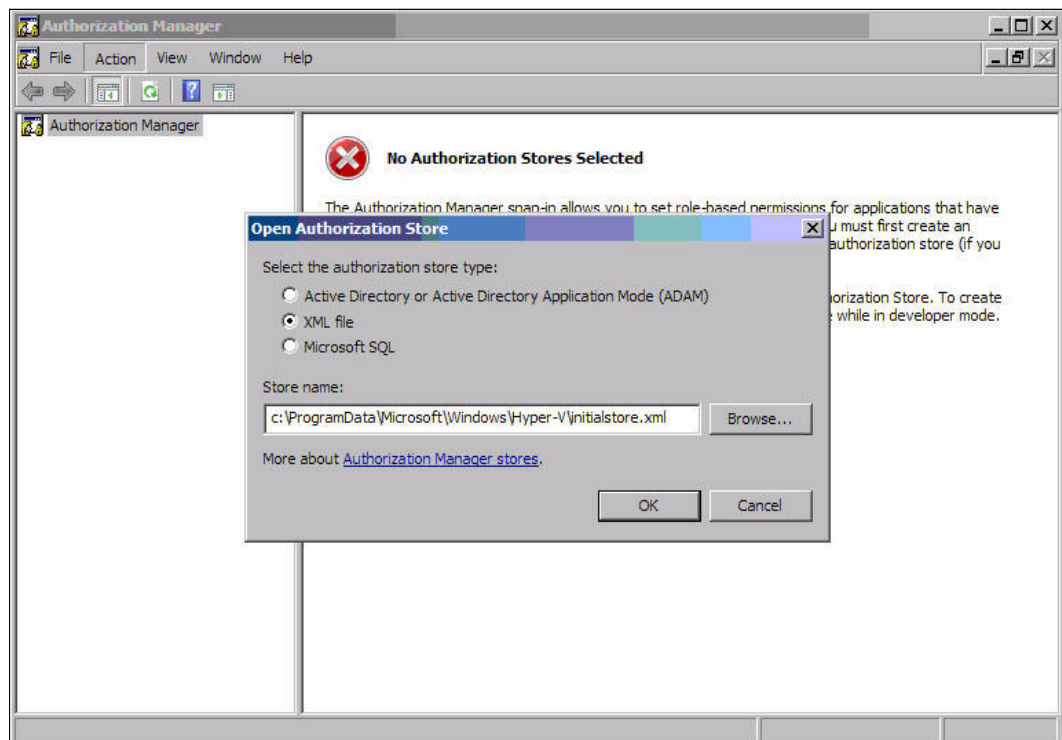

Figure 2-52   Open Authorization Store window

If you are modifying a local store, enter the following as the store name:

```
c:\ProgramData\Microsoft\Windows\Hyper-V\initalstore.xml
```

Enter the following name if you are modifying a remote store for a remote computer where `remote computer` is the computer name:

```
remote computer ProgramData\Microsoft\Windows\Hyper-V\initalstore.xml
```

> **Tip:** In many cases, ProgramData is a hidden folder and is not displayed if you attempt to simply browse to it.

4. Expand **Hyper-V services** → **Role Assignments**. Right-click **Administrator** and select **Assign Users and Groups** → **From Windows and Active Directory** (Figure 2-53).
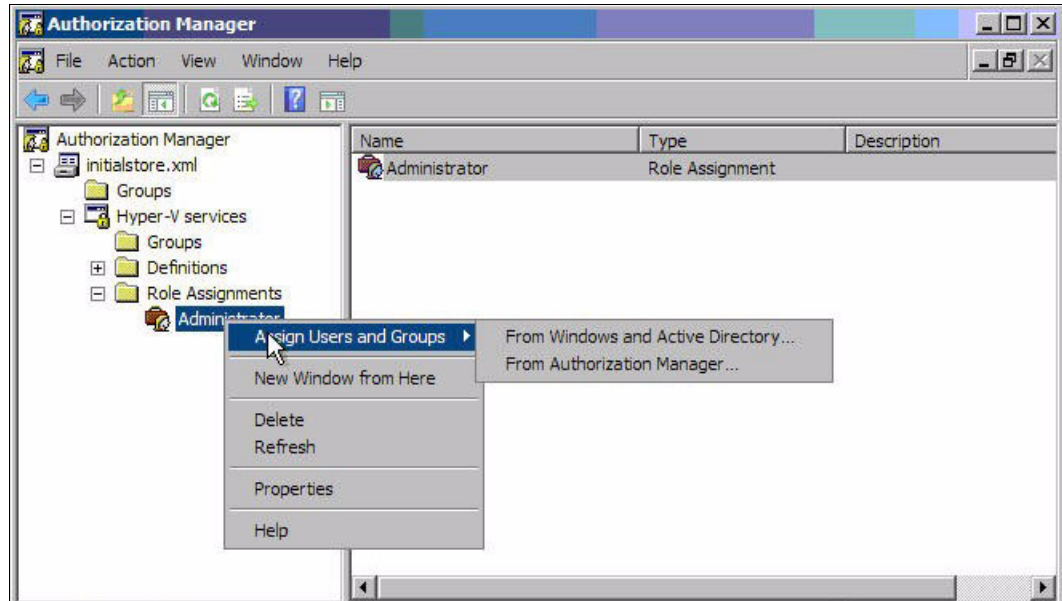

Figure 2-53   Assigning users

5. In the Select Users, Computers, and Groups window, select your new administrative group. We added **Hyper-V Administrators**, which is now displayed in the list in Figure 2-54.
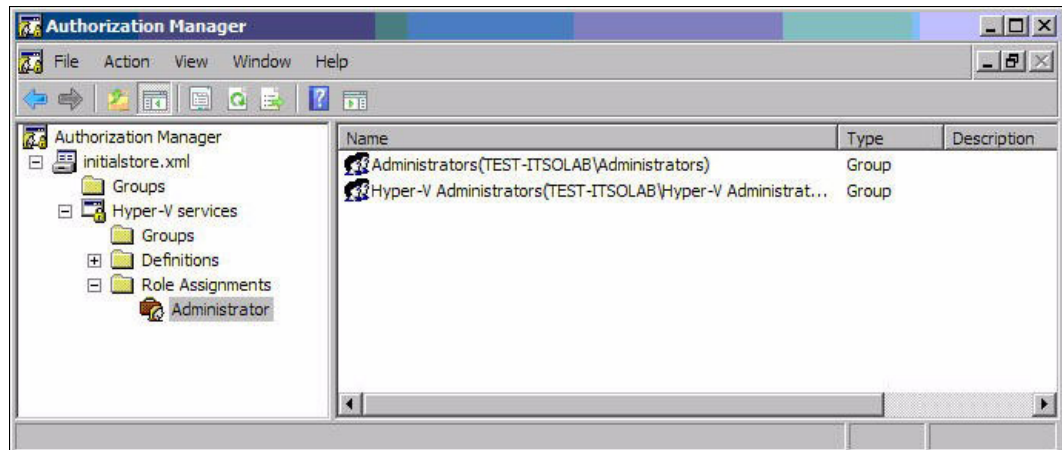

Figure 2-54   Hyper-V Administrators group added

3

System management tools

In this chapter, we provide an overview of Hyper-V-related system management.

This chapter includes the following topics:

3.1 Hyper-V Manager

Hyper-V Manager is a Microsoft Management Console (MMC)-based tool for administering the Hyper-V feature in Windows Server 2008 or Hyper-V Server 2008. By using this tool, you can manage and interact with an installation of Hyper-V from your Windows Vista computer in the same manner that you do on a full installation of Windows Server 2008. Note that you must have Vista SP1 installed to use Hyper-V Manager.

Hyper-V Manager is available for download from the Microsoft Web site as part of the Windows Vista Service Pack 1 Management Tools update from the following address:

http://support.microsoft.com/?kbid=952627

Installing the Hyper-V management tools creates a shortcut for the MMC snap-in under the "Administrative Tools" folder. However, this folder is not displayed in Windows Vista by default. You must enable this folder under the Start Menu properties for it to display:

1. Right-click the **Start** button and click **Properties**.

2. Click the **Start Menu** tab and click the active **Customize** button.

3. Scroll down the list to **System administrative tools** and click **Display on the All Programs menu and the Start menu**.

4. Click **OK**.

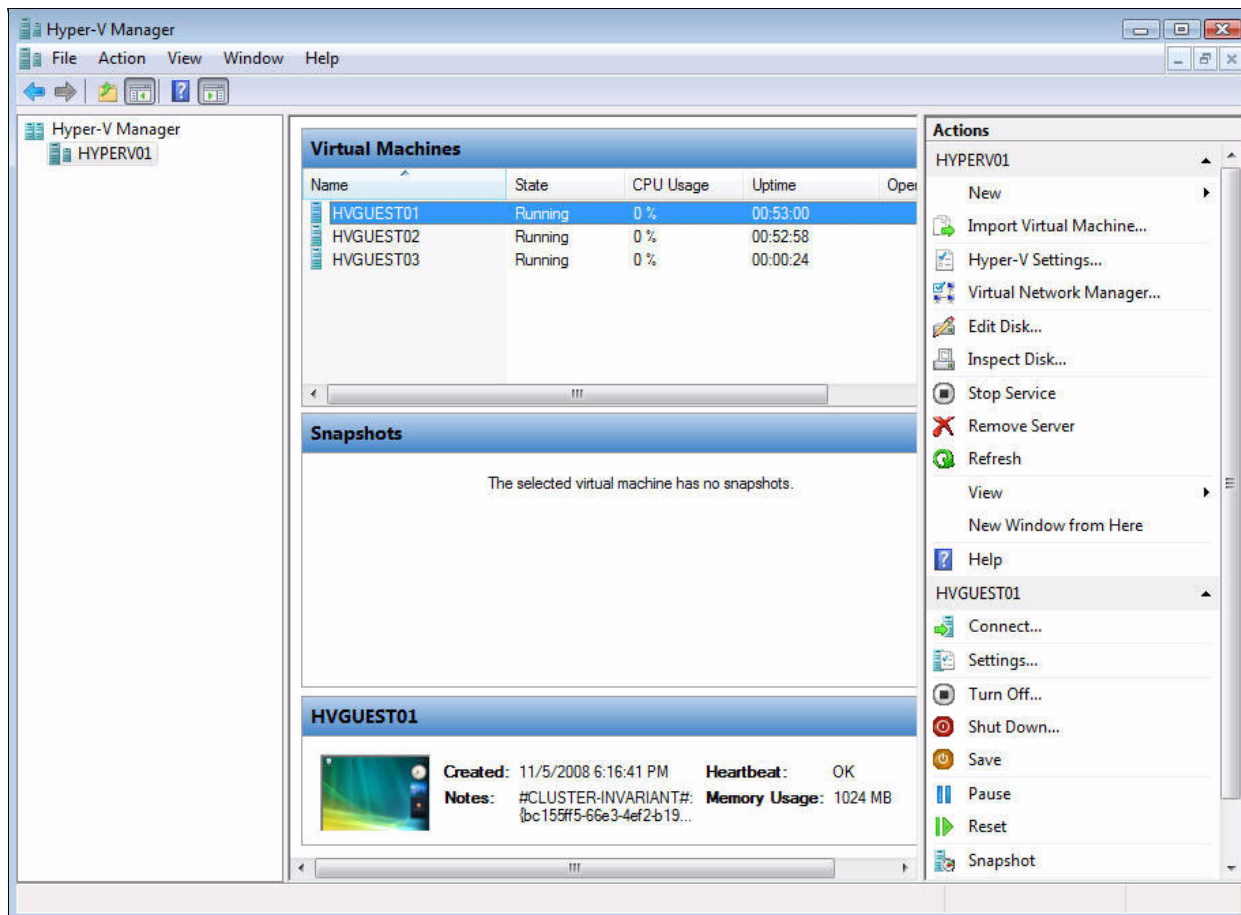When you start Hyper-V Manager, you see a window like the example in Figure 3-1.

Figure 3-1   Hyper-V Manager

With Hyper-V Manager, you can create, delete, and manage virtual machines (VMs) hosted on a single server. With one look, you can see all Hyper-V enabled machines on the left side and related VMs in the center section. By using the action bar on the right side, you can perform actions to the VMs or to the Hyper-V server.

3.2 Microsoft System Center Virtual Machine Manager

Microsoft System Center Virtual Machine Manager (SCVMM), or simply *Virtual Machine Manager* (VMM), is a management solution for the virtualized data center. VMM enables physical server utilization, centralized management of VM infrastructure, and rapid provisioning of new VMs by the administrator and authorized users. VMM provides a solution for managing the virtual and physical environment. VMM is a comparable product to VMware VirtualCenter.

The Virtual Machine Manager 2008 Configuration Analyzer (VMMCA) is a partner diagnostic tool that verifies configuration settings for your server that are important to running VMM. For more information, see the VMMCA Web site at the following address:

http://www.microsoft.com/downloads/details.aspx?FamilyID=02d83950-c03d-454e-803b-96d1c1d5be24&displaylang=en

3.2.1 Features of Virtual Machine Manager

VMM has the following features:

- ► Allows for the conversion of physical servers to VMs (P2V)
- ► Allows for the conversion of VMs (V2V)
- ► Fast provisioning of new VMs
- ► Automates the guest deployment if running multiple hosts
- ► Enables central resource management of the resources that you use to create VMs within the VMM library
- ► Allows the creation of new VMs by using templates
- ► Provides management through Windows PowerShell, the VMM command shell
- ► Provides reporting by integrating with System Center Operations Manager 2007

For more information, see the Virtual Machine Manager FAQ available from the following address:

http://technet.microsoft.com/en-us/library/bb740760.aspx

Figure 3-2 on page 66 shows the test environment scenario for setting up an SCVMM. Microsoft SQL Server 2005 Express edition is installed locally. When setting up SCVMM, use a dedicated IBM System x server to guarantee the best performance. The SCVMM SQL Server database can be deployed locally or to a dedicated system running SQL Server. At the time at which this paper was written, Microsoft did not support SQL Server 2008 in this configuration.
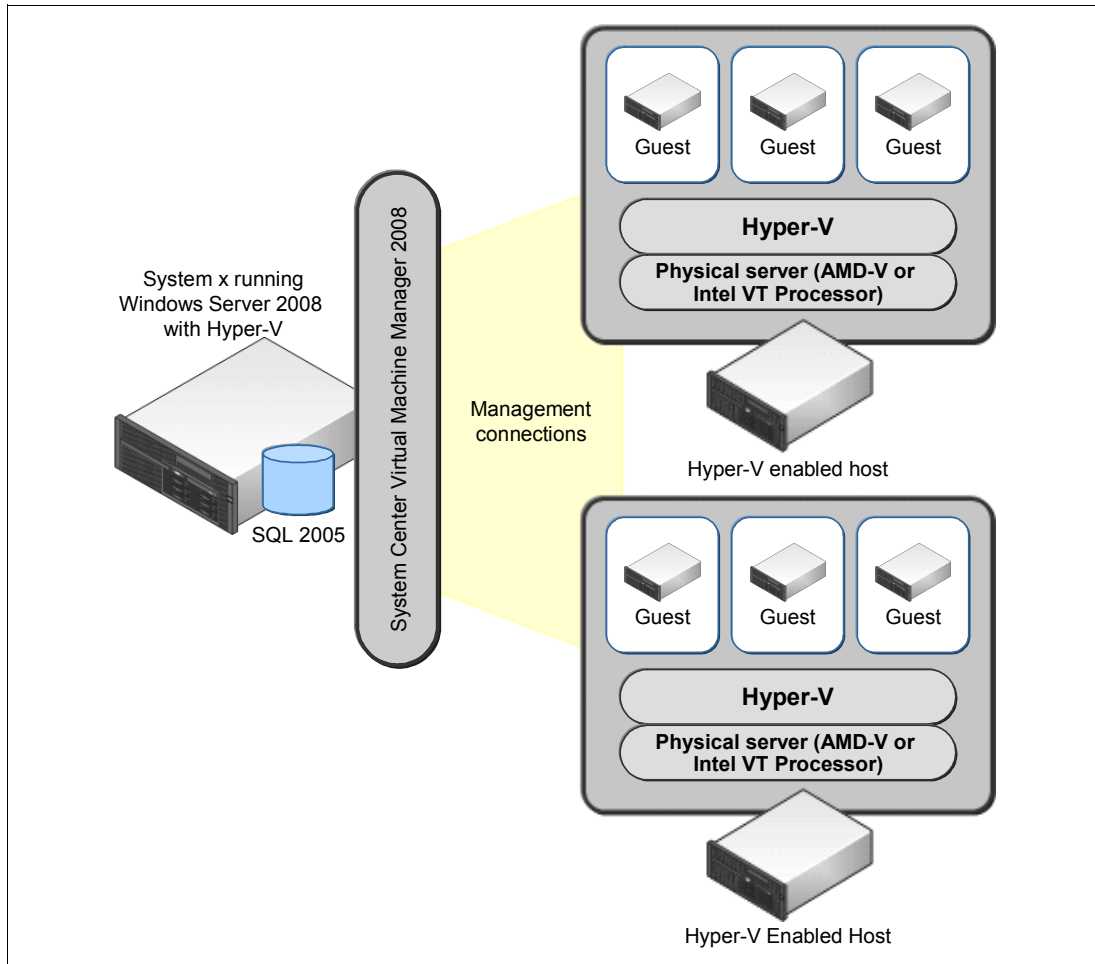
Figure 3-2   System Center Virtual Machine Manager configuration

> **Tip:** The SQL Server 2005 Express Edition SP2 database size is limited to 4 GB.
> Therefore, use a full version of SQL Server when the VMM server is managing more than
> 150 hosts. You can find the system requirements at the following address:
>
> http://www.microsoft.com/systemcenter/virtualmachinemanager/en/us/system-requir
> ements.aspx

Although the VMM server cannot be clustered, the SQL database can be deployed to a
clustered environment and the VMM server can be installed on a highly available VM. For
more information, see *Planning for the VMM Server* at the following address:

http://technet.microsoft.com/en-us/library/cc764331.aspx

While this installation does not provide high availability, SCVMM can be rapidly redeployed if
SCVMM backups are scheduled by either using a Windows system state backup, using
Backup-VMMserver `cmdlet`, or doing backups through the VMM Administrative GUI. To back
up the VMM database, you can use the following PowerShell command:

```
Backup-VMMServer -path \\server\share -VMMServer yourscvmmserver
```

If using SQL 2005 Express edition, schedule maintenance for your database. For more information, see *Managing SQL Server Express with SQL Server 2005 Management Studio Express Edition* at the following address:

http://www.microsoft.com/technet/prodtechnol/sql/2005/mgsqlexpwssmse.mspx

You can download SQL Server 2005 Management Studio Express Edition from the following address:

http://www.microsoft.com/downloads/details.aspx?familyid=C243A5AE-4BD1-4E3D-94B8-5A0F62BF7796&displaylang=en

SQL Server 2005 Management Studio Express is not supported on Windows Server 2008. If you are installing management studio in an administration workstation, see Microsoft article KB914277, "How to configure SQL Server 2005 to allow remote connections" at the following address:

http://support.microsoft.com/kb/914277

3.2.2 Virtual Machine Manager hardware requirements

The minimum and recommended hardware requirements to install and operate all VMM components on a single computer are listed in the following tables based on the number of hosts that you manage. For more information about system requirements, see the following Web page:

http://www.microsoft.com/systemcenter/virtualmachinemanager/en/us/system-requirements.aspx

When sizing the VMM system, concentrate on hard disk and network capacity. Microsoft recommends having 80 GB-150 GB of available disk space. The size of the required disk space depends on the following criteria:

► The number of virtual hard disks (VHDs) or VM templates that you are going to build into the library

► Whether you save many different type VMs in the VMM library

► The number of CD images that you are going to store in your library

Table 3-1 shows the server requirements for managing up to 10 hosts.

Table 3-1   Server requirements when managing up to 10 hosts

Hardware component	Minimum	Recommended
Processor	Pentium® 4 2 GHz	Dual-Core Pentium 4™ 3.2 GHz or greater
RAM	2 GB	2 GB
Hard disk	80 GB	150 GB

Table 3-2 shows the server requirements for managing up to 20 hosts.

Table 3-2   Server requirements when managing up to 20 hosts

Hardware component	Minimum	Recommended
Processor	Pentium 4 2.8 GHz	Dual-Core Pentium 4 3.2 GHz or greater
RAM	2 GB	4 GB
Hard disk	150 GB	200 GB

If you plan to host the VMM server on a dedicated system, the hardware listed in Table 3-3 is required, depending on the number of hosts that you plan to manage.

Table 3-3   Managing up to 150 hosts - Dedicated server

Hardware component	Minimum	Recommended
Processor	Pentium 4, 2 GHz (x64)	Dual Processor, Dual Core, 2 GHz (x64) or greater
RAM	2 GB	4 GB
Hard disk space with remote database	2 GB	50 GB
Hard disk space (with the default local SQL Server 2005 Express Edition SP2 database installed)	10 GB	Note: For the default local SQL Server 2005 Express Edition SP2, the database size is limited to 4 GB.

The SQL Server 2005 Express Edition SP2 database size is limited to 4 GB. Therefore, use a full version of SQL Server when the VMM server is managing more than 150 hosts.

Table 3-4   Managing more than 150 hosts

Hardware component	Minimum	Recommended
Processor	Pentium 4, 2.8 GHz (x64)	Dual Processor, Dual Core, 3.6 GHz or greater (x64)
RAM	4 GB	8 GB
Hard disk space	10 GB	50 GB

3.2.3 Installing the Virtual Machine Manager server

In this section, we explain how to install VMM on a single computer. We install the VMM server and the standalone SQL 2005 Express Edition product.

To install the server:

1. Purchase the software or download a trial version from the following address:

   http://www.microsoft.com/systemcenter/virtualmachinemanager

2. Run the installer. Click through the opening windows, including the license. It checks the hardware and software that are installed on your system against the system requirements as shown in Figure 3-3. Click **Next** to continue.
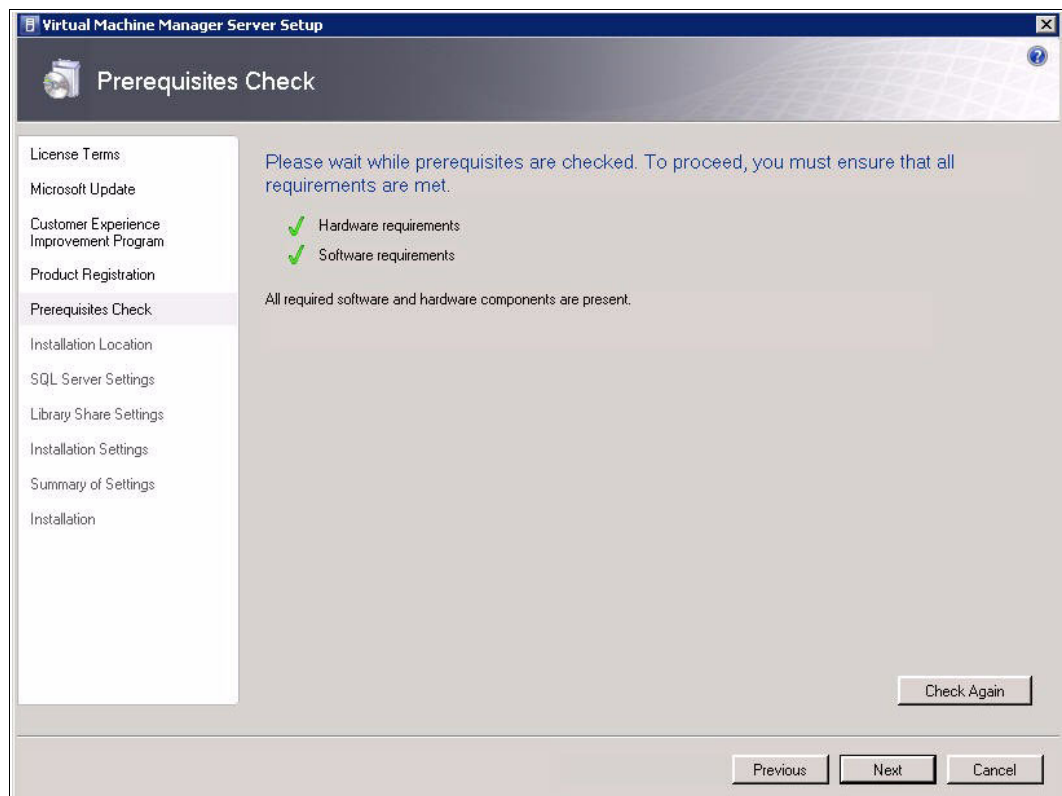

Figure 3-3   Virtual Machine Manager installation - Checking the prerequisites

3. In the Installation Location panel (Figure 3-4), select the path where you want to install the application files and click **Next**.
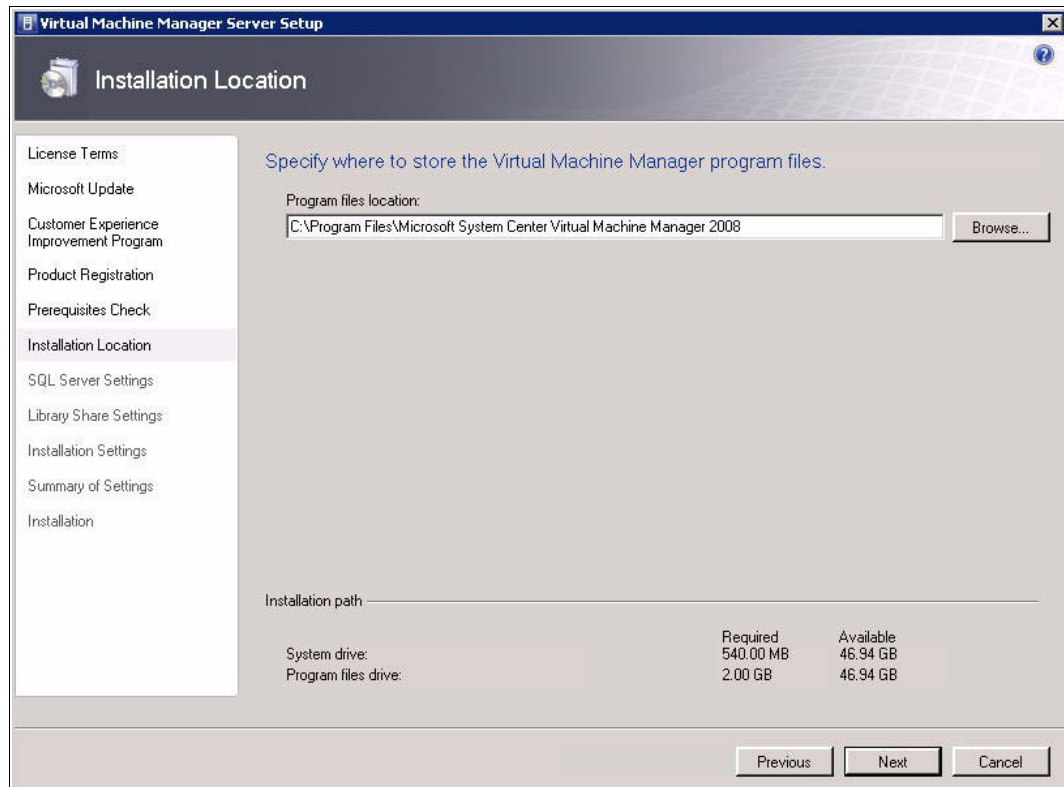

Figure 3-4   Virtual Machine Manager installation - Location of files

4. In the SQL Server Settings panel (Figure 3-5), select whether you want to use SQL 2005 Express edition or an existing SQL installation. Click **Next**.
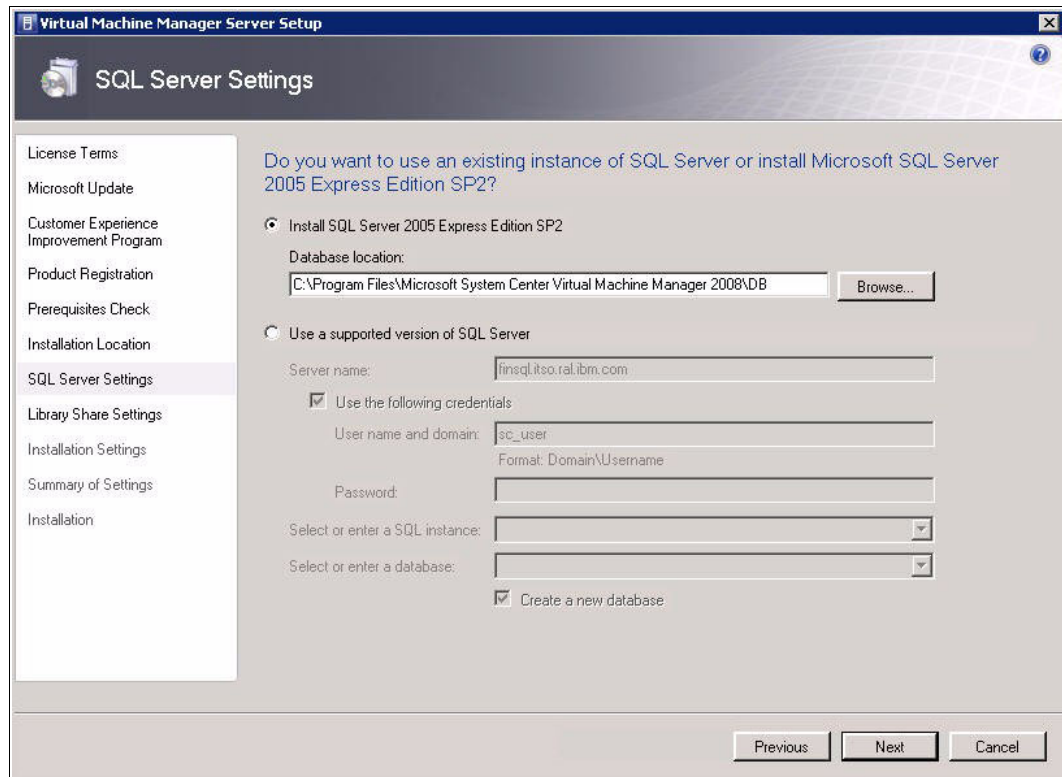

Figure 3-5   Virtual Machine Manager installation - SQL Server settings

5. In the Library Share Settings panel (Figure 3-6), specify the library share name to keep all library items (VHDs, ISO files, and so on), or use an existing network share as a library. Click **Next**.
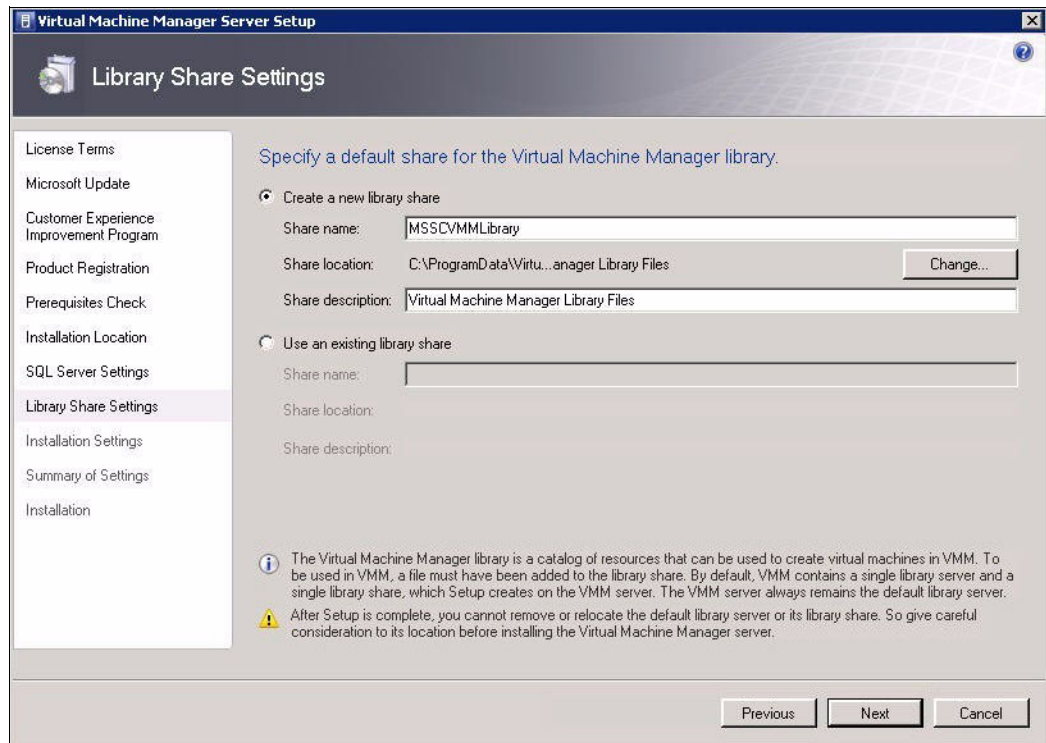

Figure 3-6   Virtual Machine Manager installation - Library share settings

6. In the Administrators Properties window (Figure 3-7), add a Virtual Machine Manager service user account to the local administrators group. Then click **OK**.
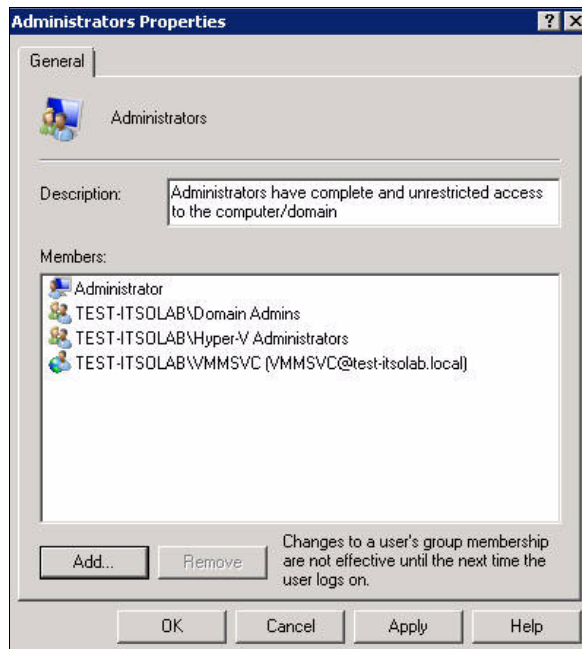

Figure 3-7   Virtual Machine Manager installation - Adding the VMM service user account to the local administrators group

7. In the Installation Settings panel (Figure 3-8), specify the ports that are used for communication. Do *not* use the default values. Specify the VMM service account to be used. If Windows Firewall is in use, the wizard adds rules for each port.
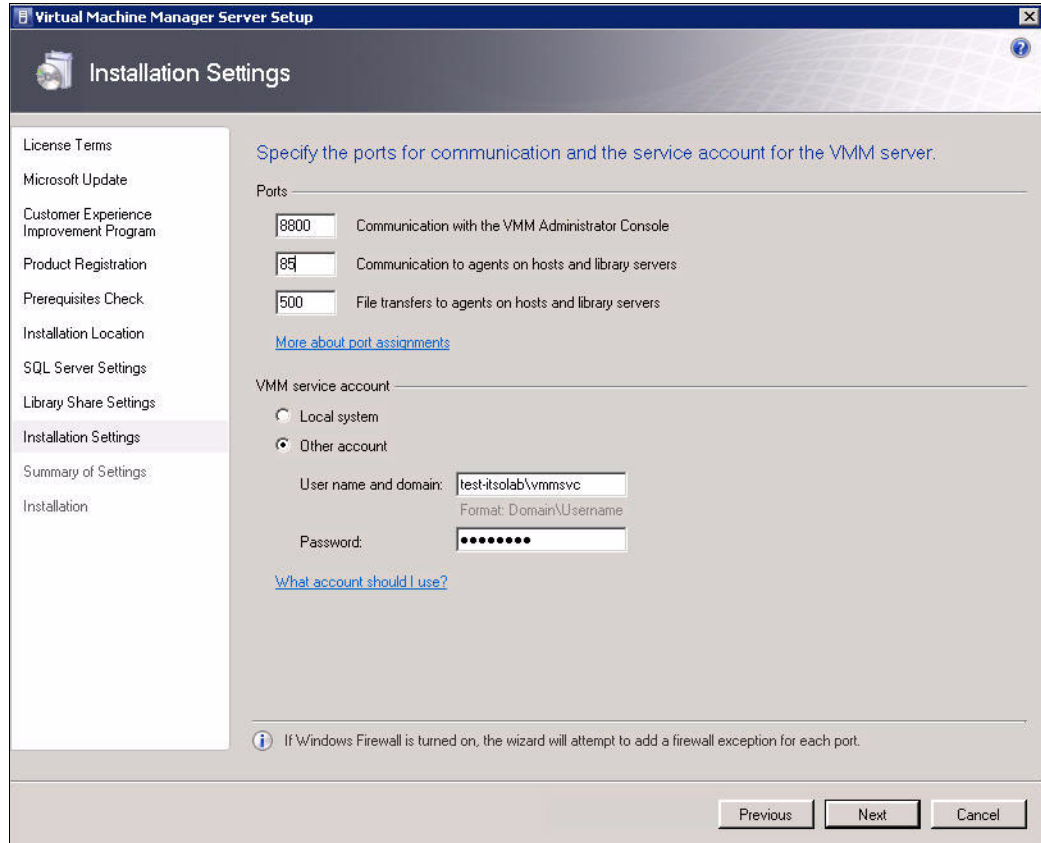
Click **Next**.

Figure 3-8   Virtual Machine Manager installation - Ports and VMM service account

3.2.4 Installing the Virtual Machine Manager Administrator Console

The Virtual Machine Manager Administrator Console can be installed on an administrator's workstations or it can be on same server as VMM. However, if you plan to use the monitoring or reporting functions of VMM, you *must* install the Virtual Machine Manager Administrator Console on the same machine as the VMM to enable Operations Manager administrators to perform tasks on hosts and VMs.

For the hardware requirements, see the following address:

http://technet.microsoft.com/en-us/library/cc764321.aspx

To install the Virtual Machine Manager Administrator Console from the SCVMM 2008 installation media:

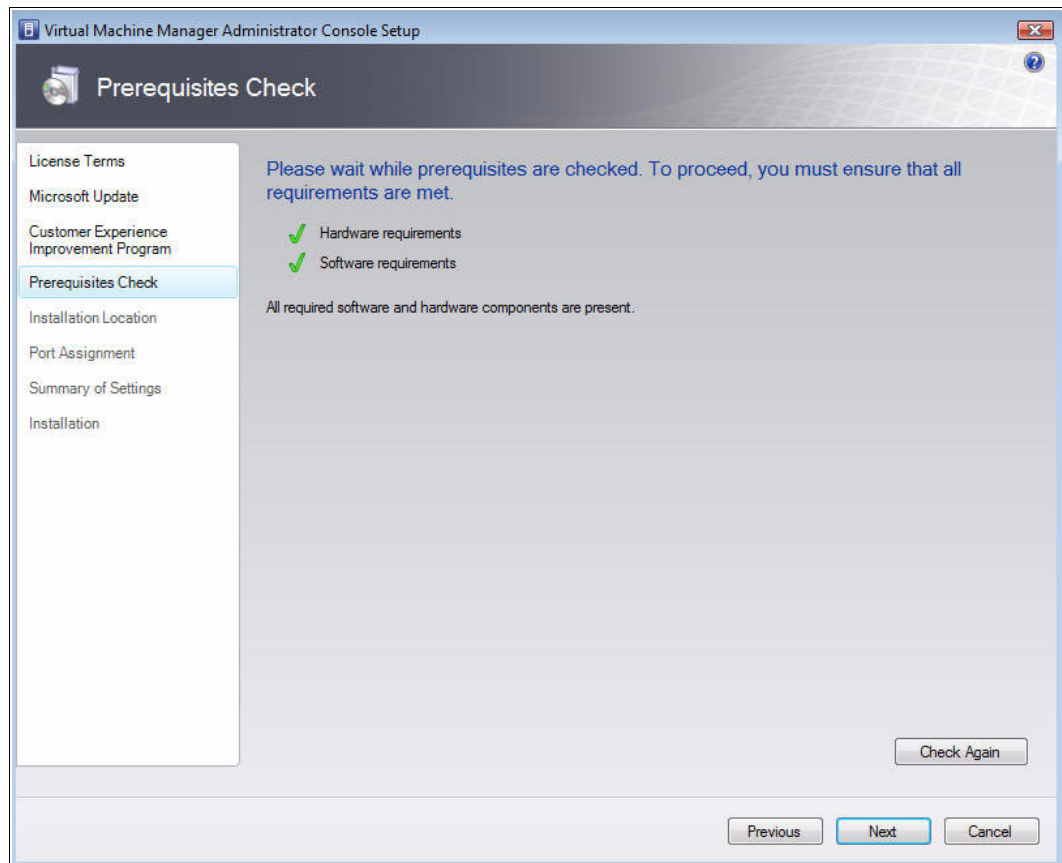1. Start the setup, which checks all prerequisites as shown in Figure 3-9. Click **Next**.

Figure 3-9   Virtual Machine Manager Administrator Console installation - Prerequisites check

2. Specify the installation location of the program files.

3. In the Port Assignment panel (Figure 3-10), enter the same port that was defined earlier when you installed the server. Click **Next**.
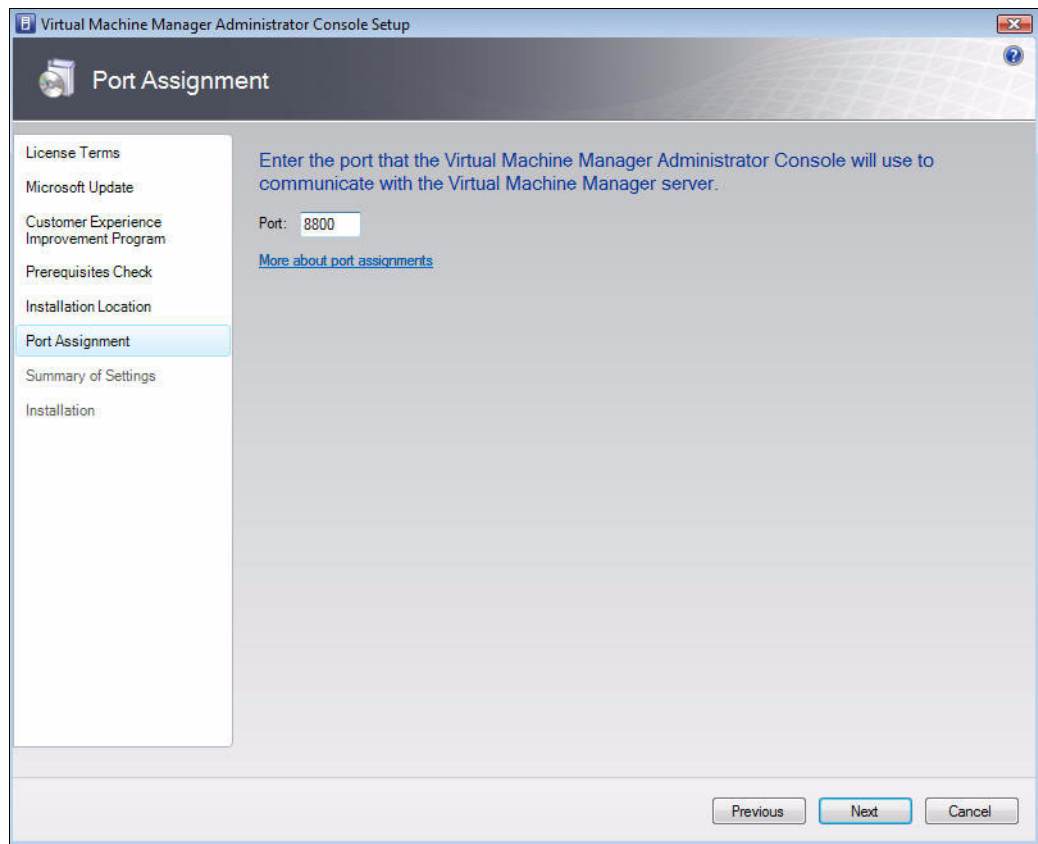

Figure 3-10   Virtual Machine Manager Administrator Console installation - Port assignment

4. In the Summary of Settings panel (Figure 3-11), review the summary of the settings and click **Install** to perform the installation.
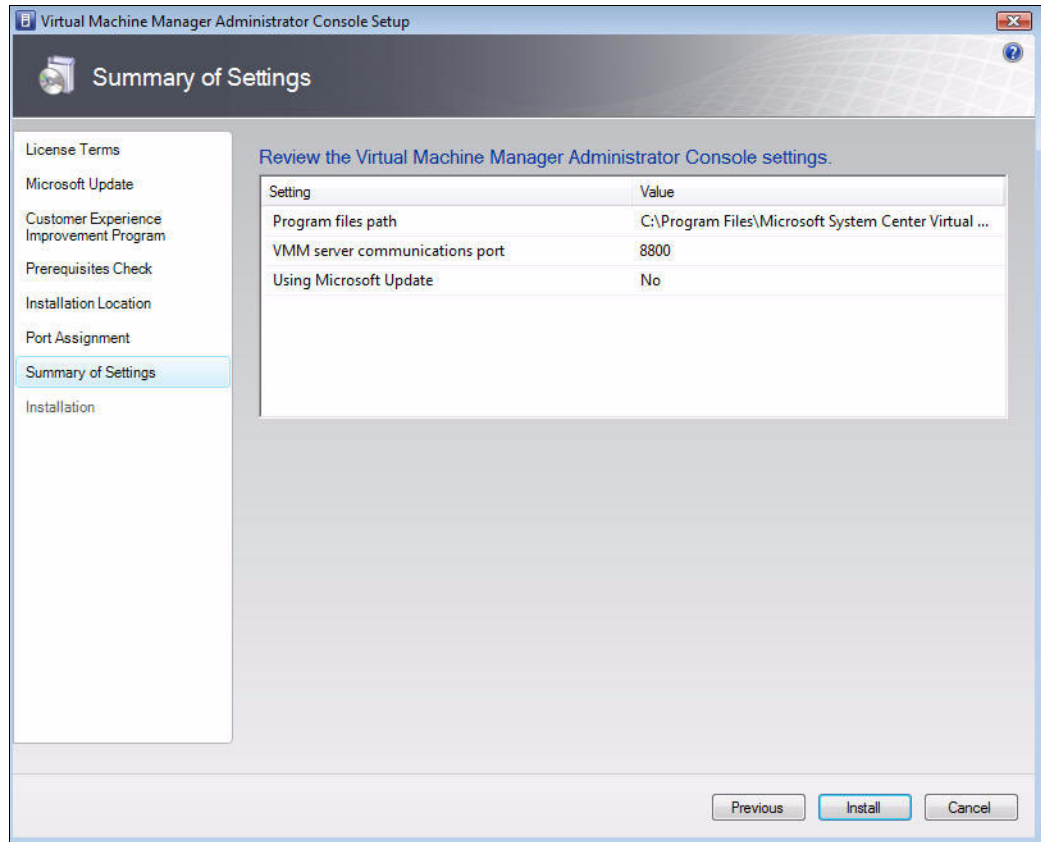

Figure 3-11   Virtual Machine Manager Administrator Console installation - Summary

5. Optional: After the installation is complete, check online for the latest updates to VMM. The installer then exits.

6. When you launch the Virtual Machine Manager Administrator Console, when prompted, enter the address and port number for the VMM server (Figure 3-12). Click **Connect**.
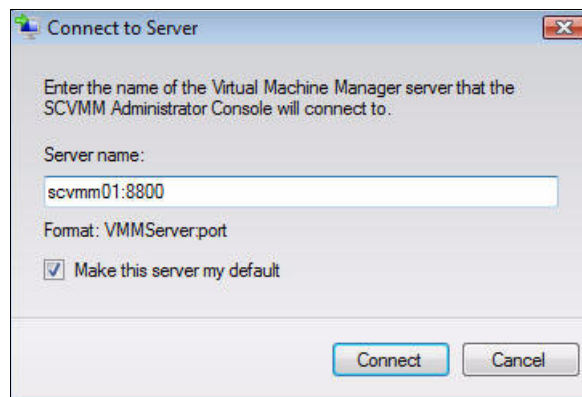

Figure 3-12   Connecting to the VMM server

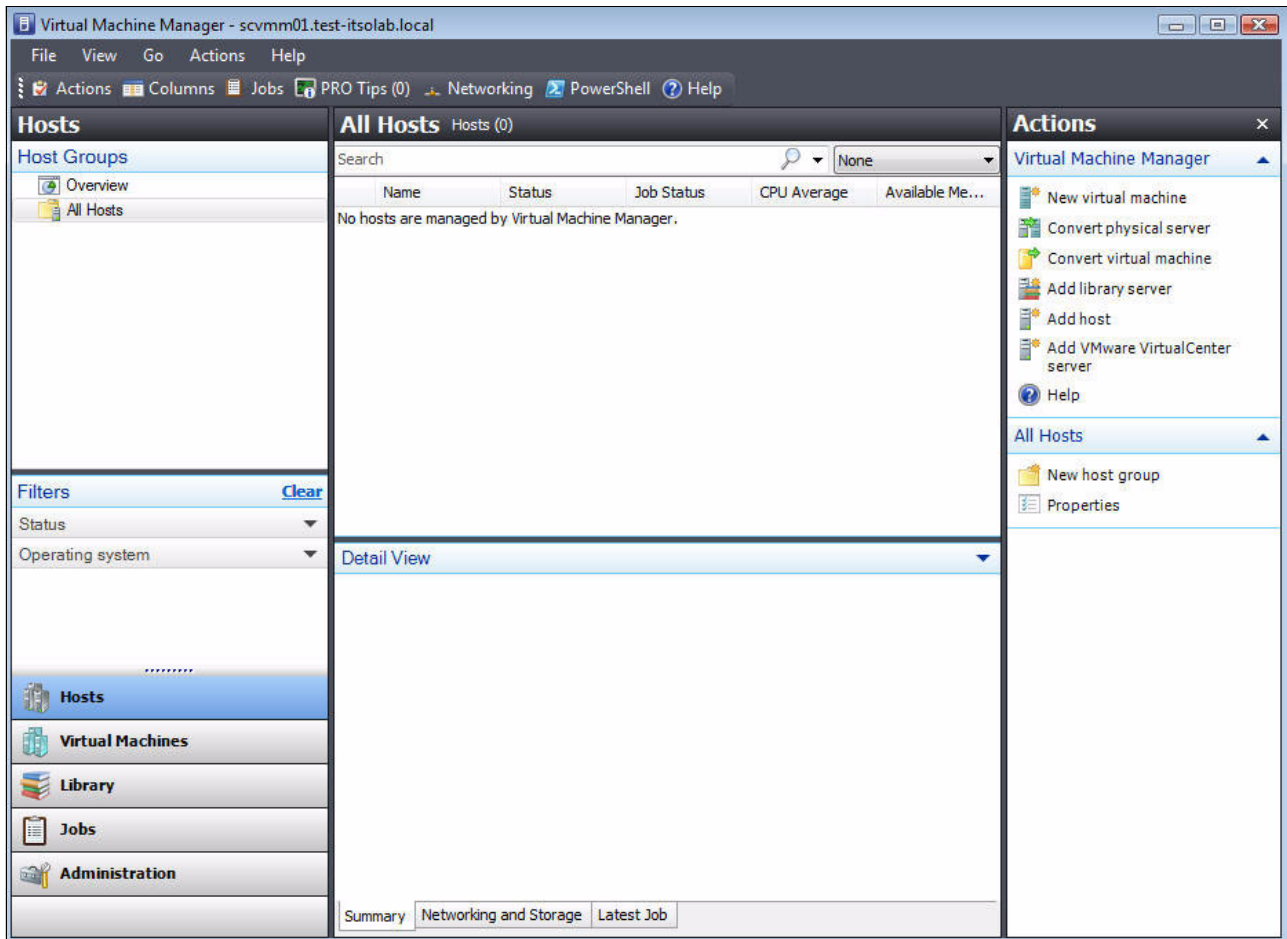When successful, you see the main window (Figure 3-13).

Figure 3-13   Virtual Machine Manager Administrator Console

To manage hosts and VMs, you must add a host to the VMM environment. If you completed all the steps correctly, the VMM server automatically installs the SCVMM agent to the host server.

3.2.5 Installing the System Center Virtual Machine Manager Self-Service Portal

The System Center Virtual Machine Manager 2008 Self-Service Portal is an optional, Web-based component with which users can create and manage their own VMs within a controlled environment. With the SCVMM Self-Service Portal, you can perform the following tasks:

► Create and delete VMs (SCVMM library also available)
► Start and stop VMs
► Pause VMs
► Shut down VMs
► Connect to the console or start remote desktop management
► Configure the VM properties

To learn about the hardware and software requirements for the VMM Self-Service Portal, see the following address:

`http://technet.microsoft.com/en-us/library/cc764309.aspx`

Install the System Center Virtual Machine Manager Self-Service Portal by using the SCVMM 2008 installation media:

1. Begin the installation and agree to the license terms.
2. In the Microsoft Update panel (Figure 3-14), specify whether you want to check for online updates. Click **Next**.
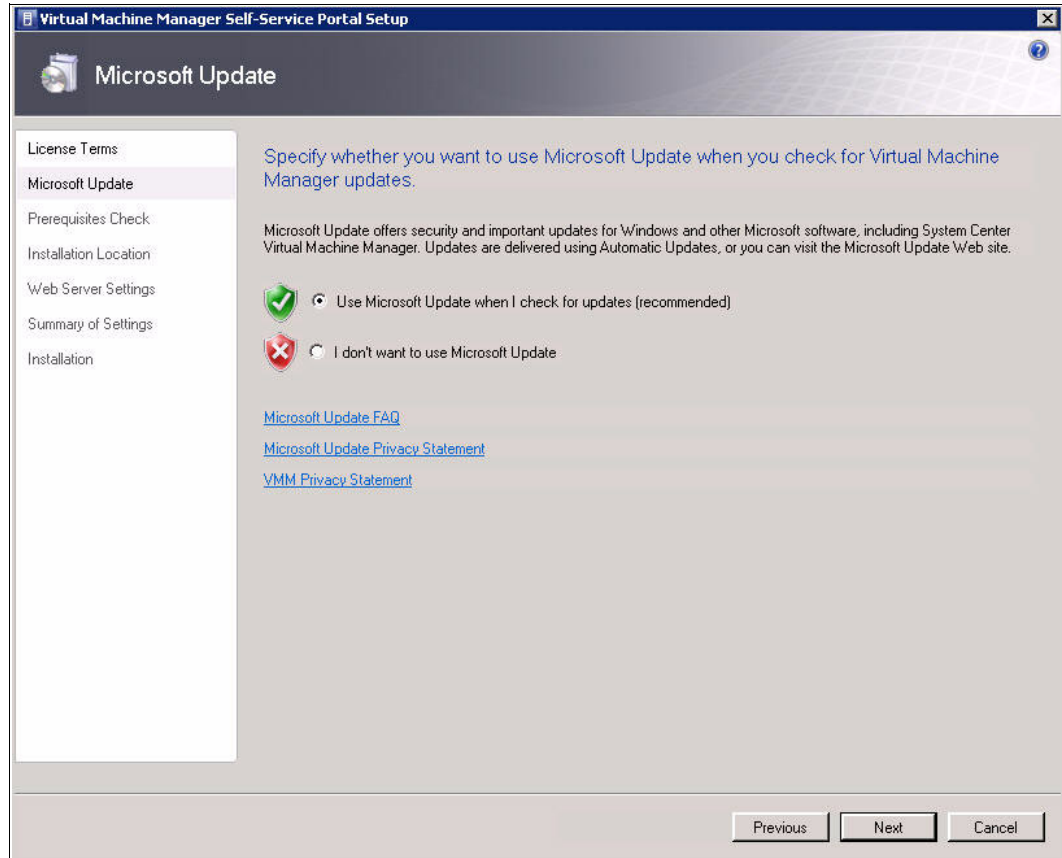

Figure 3-14   SCVMM Self-Service Portal - Installation

3. In the next panel, in which the installer checks the hardware and software prerequisites, click **Next**.
4. When prompted, specify a folder for installing the code or accept the default. Click **Next**.

5. In the Web Server Settings panel (Figure 3-15):

   a. Specify the address of the VMM server and the listening TCP port (defined during the setup of VMM).

   b. Set up the TCP port where the Self-Service Portal answers to http requests. Do *not* use default http port (80) for security purposes. The Windows Firewall, if enabled, is automatically configured with an exception.
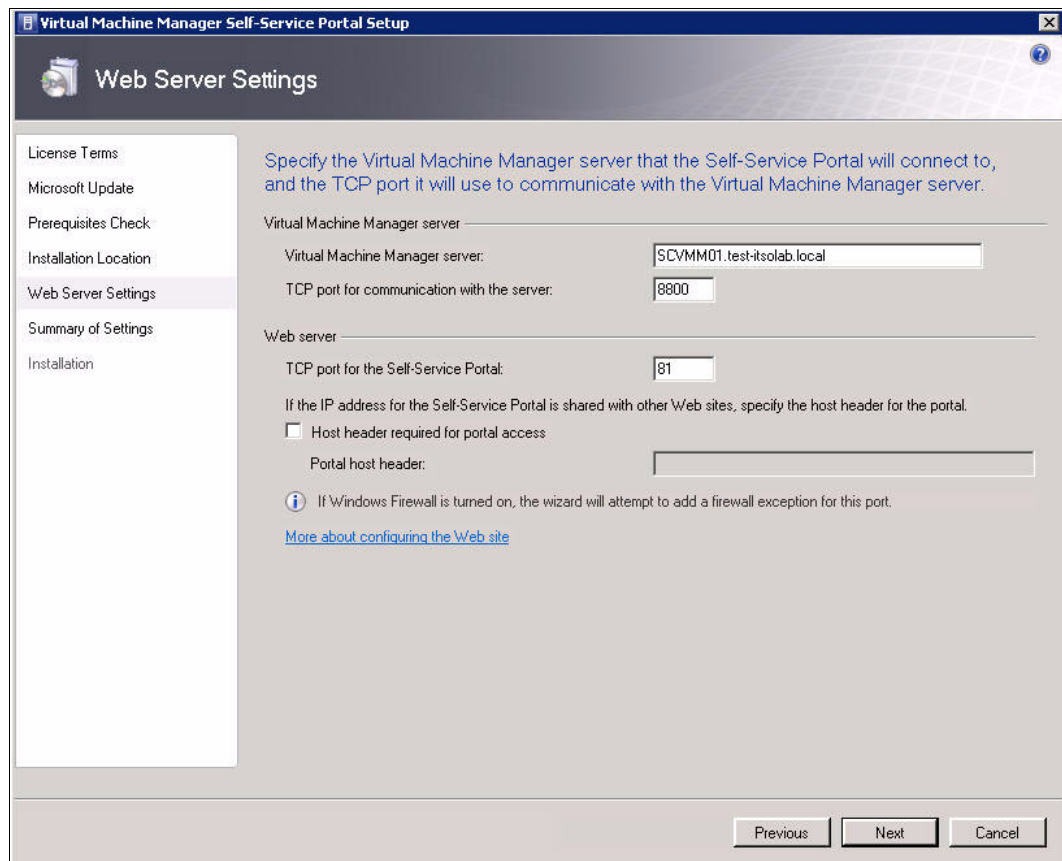
   c. Click **Next**.

Figure 3-15   SCVMM Self-Service Portal - Web settings

6. In the summary panel of the installation options, click **Install** to begin the installation.

Managing the SCVMM Self-Service Portal user permissions

Before SCVMM users can log into the Self-Service Portal, the SCVMM administrator must give permission to manage the VMs:

1. Open the SCVMM Administrator Console.

2. Click **Administration** → **User Roles**.

3. Double-click **Self-service-portal-User**.

4. In the properties window (not shown), click the **Members** tab and add the users that you want to have access to the tool. Click **OK** to save the changes.

In the Self-Service Portal, you can perform a limited number of actions to VMs. However, it is still a useful tool for doing quick operations or delegating VM access to a third-party administrator without needing to give them a full view of the Hyper-V server.

Figure 3-16 shows the login panel for the Self-Service Portal.

Figure 3-16   SCVMM Self-Service Portal login panel

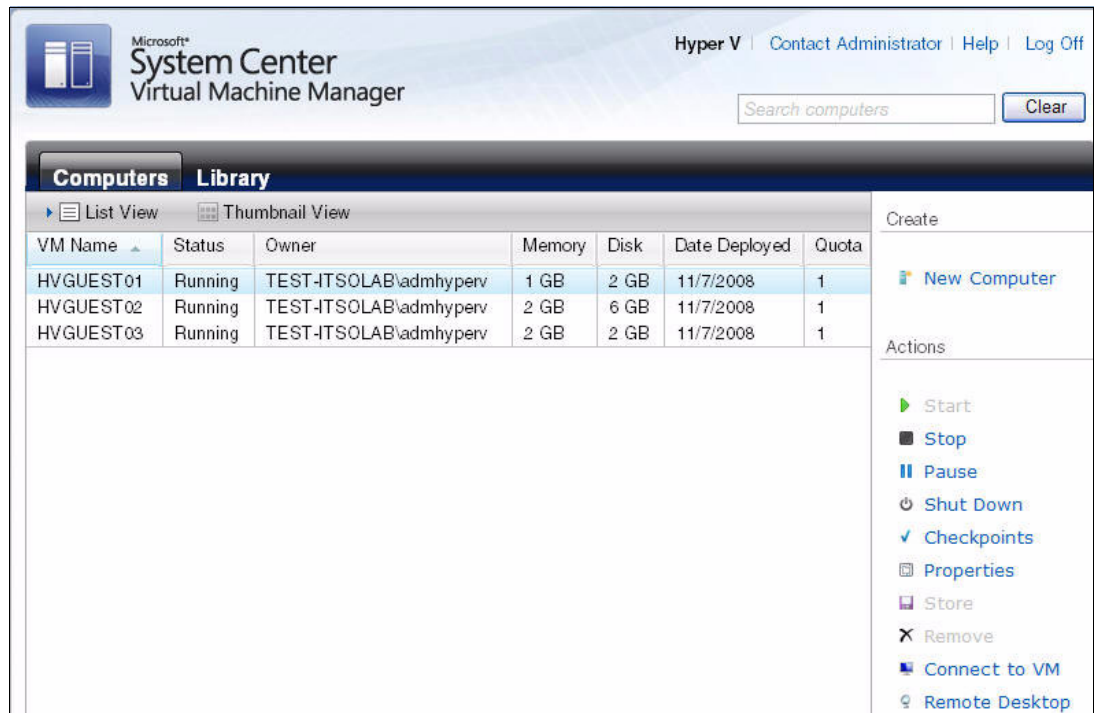Figure 3-17 shows the Self-Service Portal.

Figure 3-17   Self-service portal

4

High availability solutions with Hyper-V and System x

In this chapter, we discuss the following topics about improving the availability of a system through the use of Hyper-V:

► 4.1, "IBM Storage Solutions for Microsoft Hyper-V" on page 82
► 4.2, "Quick Migration with Hyper-V" on page 82

4.1 IBM Storage Solutions for Microsoft Hyper-V

A virtualized server environment helps to improve the efficiency of your computing resources by using your hardware resources more efficiently and fully. With Microsoft Hyper-V and Windows Server 2008, organizations are equipped to streamline their IT infrastructure and take advantage of the more efficient storage and server solutions that IBM offers. By using Microsoft Hyper-V, you can create and manage a virtualized server computing environment and help your organization improve efficiency and reduce costs. To complete the solution, IBM System Storage™ provides the high performing, scalable, reliable, available, and flexible midrange storage systems that are needed to support the Microsoft Hyper-V information infrastructure.

Hyper-V virtual servers run as cluster resources and automatically fail over if one host node is unavailable. These virtual machines (VMs) can also be quickly migrated between the cluster nodes, pausing running applications and resuming automatically once online. In a disaster recovery event, replicated logical unit numbers (LUNs) and guests are manually activated and brought online.

IBM offers industry leading storage virtualization to help provide a complete, end-to-end virtualized information infrastructure, complementing Hyper-V server virtualization. With the high-performing IBM SAN Volume controller, customers can virtualize their Microsoft storage environment. SAN Volume Controller combines the capacity of multiple disk storage controllers into a single storage resource. These disk controllers can be from many different vendor companies. From a single resource, operators can apply copy services across all the disk controllers in this resource and perform point-in-time copies (FlashCopy®) or replicate data by using Metro Mirror or Global Mirror. SAN Volume Controller also has the ability to perform many tasks within the storage infrastructure by using the data that is stored on the disk controllers, without disrupting the Microsoft platform.

When putting together both IBM Storage and Microsoft Hyper-V, Microsoft Hyper-V users benefit from a new era of affordable application virtualization to companies of all sizes. This combination offers organizations new opportunities for increased resource utilization, ease of management, and improved return of investment. IBM has worked closely with Microsoft to help ensure that our products are optimized for Hyper-V deployments. Together with the new IBM System Storage DS5000, or by adding SAN Volume Controller to virtualize a multivendor storage environment, the ability for companies of all sizes to efficiently implement a highly available and disaster-tolerant computing environment continues to improve.

4.2 Quick Migration with Hyper-V

Hyper-V provides customers the ability to reduce the cost of expected and unexpected downtime through Quick Migration, helping them to meet stringent uptime and response metrics. In this section, we describe how we implemented this feature.

In our lab, we ran a system as a guest VM on a physical server and configured the physical server as a node in a failover cluster. The virtual hard disk (VHD) of the guest VM was made available to all nodes in the cluster by using shared storage.

Quick Migration saves the state of the running guest operating system, logically moves the storage connectivity from one node to another, and restores the guest operating system onto the second server. The speed of migration depends on the amount of memory needed to be written to disk and the speed of connectivity to storage, but is usually measured in seconds.

Figure 4-1 shows the setup for our cluster. Two nodes (physical servers) are connected to domain controllers, printers, and routers by using the public network. A private network is used for cluster-related network traffic only, and it helps the cluster nodes verify the state of the others nodes.
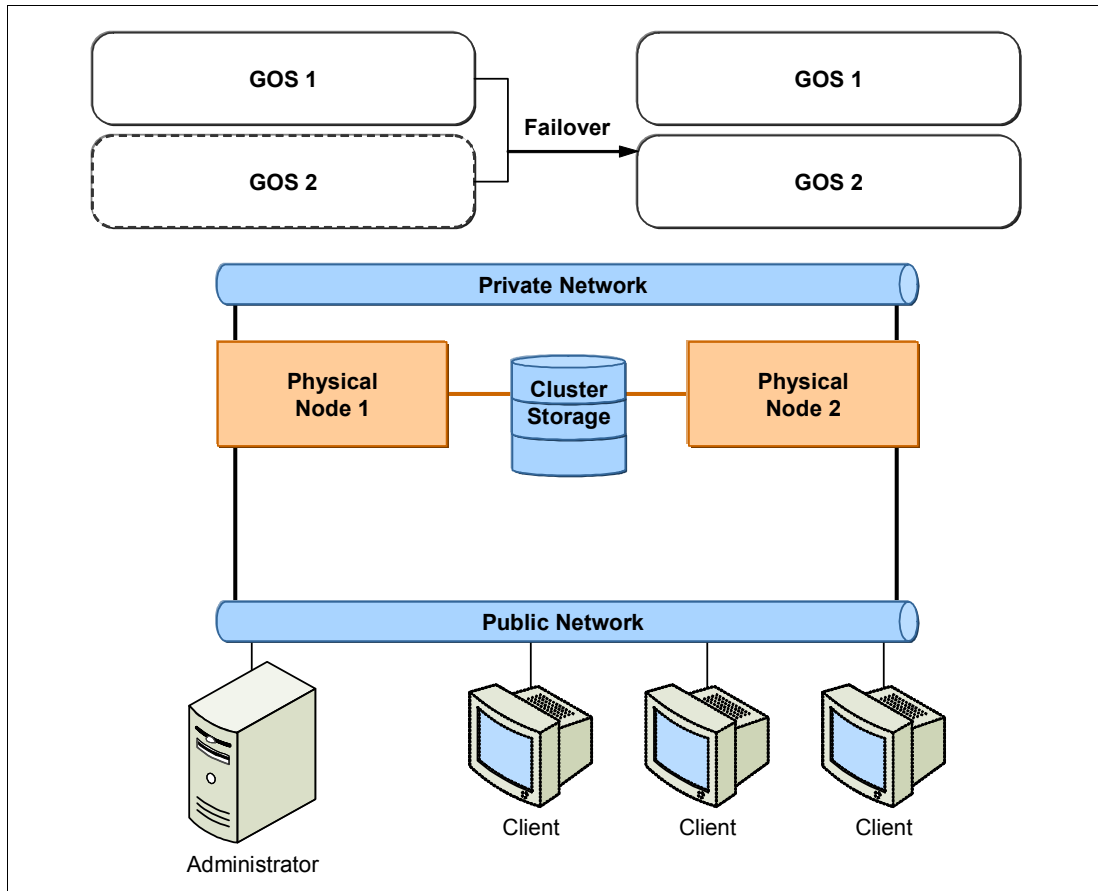

Figure 4-1   Layout of our cluster for migration

The system requirements include hardware, network, and storage requirements for a quick migration scenario as follows:

► The system need a Domain Name System (DNS), DNS dynamic update protocol, or Windows Internet Naming Service (WINS).

► Nodes in the cluster are in the same Active Directory domain and in the same domain role.

► Nodes in the cluster have the same hardware resource and processor architecture.

► An Intel VT or AMD-V processor is required.

► Hardware components must be compatible with cluster technology because failover cluster is installed on a storage area network (SAN).

► CPU speed is at least 1.0 GHz for each guest operating system.

► Total hard disk space of 2 GB is required on each node.

► For each guest operating system, 512 MB RAM is required.

- ► Each of two cluster nodes must have at least two network adapters and is connected by two independent networks.
  - – These two nodes must be able to access the Active Directory domain. The domain controller is in the same local area network (LAN) as these two nodes.
  - – These two nodes must be connected to an external disk storage that is used as the cluster storage. If using iSCSI, each node needs a network adapter connected to this external storage.
- ► The file system of the shared storage must be NTFS and is configured as a shared-nothing configuration.

By using Quick Migration, users can migrate a running VM from one physical host to another by taking advantage of the high availability function of Windows Server and Microsoft System Center management tools. Windows Server 2008 sees the VHD files that make up the VMs on the LUNs. The Windows cluster administrator can also work with the LUNs and the VMs running on those LUNs. This is one of the benefits of Windows Server 2008, thereby making the migration of VMs faster and easier.

In Windows Server 2008 Enterprise and Data Center, users can run each server that provides client services as a guest VM on a physical server and configure the physical server as a node in a failover cluster. In addition, users can make the VHD of the guest VMs available to the other nodes with the cluster, so that each server that provides client services now runs as a highly available VM.

For a planned migration, Quick Migration saves the state of a running guest VM, moves the storage connectivity from one physical server to another, and then restores the guest VM onto the second server. The speed of the migration depends on how much memory must be written to disk and on the speed of the connectivity to storage. Generally migration takes a few seconds. However, in the case of unplanned migration, the images written to the disk are failed over from the shared storage automatically.

After a cluster is set up and the VM is online, users can use Quick Migration to quickly move it between physical host servers. Hyper-V Manager provides information about host servers. Users can discover which VM runs on which physical host server in this Hyper-V Manager console.

Quick Migration entails the following actions:

1. Open the Failover Cluster Management console in which users can see the VMs running on the individual nodes.
2. Highlight a VM to provide a summary of its properties.
3. Right-click the VM name. From the Actions menu, users can see the option to move the VM from one node to another node. Users can choose the destination node.
4. After the task is run, the VM enters a pending state before it is moved.
5. After a few seconds, the VM is displayed on the destination node, and the status returns to *Online*.

The Quick Migration is now completed.

Abbreviations and acronyms

AD	Active Directory		**RAID**	redundant array of independent disks
AMD	Advanced Micro Devices			
API	application programming interface		**RAM**	random access memory
BIOS	Basic Input/Output System		**RDP**	Remote Desktop Protocol
CD	compact disk		**RODC**	Read-only Domain Controller
COM	Component Object Model		**SAN**	storage area network
CPU	central processing unit		**SAS**	Serial Attached SCSI
CSV	comma separated variable		**SATA**	Serial ATA
DAS	Direct Attached Storage		**SCSI**	Small Computer System Interface
DHCP	Dynamic Host Configuration Protocol		**SCVMM**	System Center Virtual Machine Manager
DNS	Domain Name System		**SMB**	Server Message Block
FAQ	frequently asked questions		**SQL**	Structured Query Language
FTP	File Transfer Protocol		**TCB**	trusted computing base
GA	general availability		**TCP**	Transmission Control Protocol
GB	gigabyte		**UI**	user interface
GUI	graphical user interface		**USB**	universal serial bus
HPC	high performance computing		**V2V**	VM
I/O	input/output		**VHD**	virtual hard disk
IBM	International Business Machines		**VLAN**	virtual LAN
ID	identifier		**VM**	virtual machine
IIS	Internet Information Server		**VMM**	Virtual Machine Manager
IP	Internet Protocol		**VMMCA**	Virtual Machine Manager 2008 Configuration Analyzer
ISO	International Organization for Standards		**VSS**	Volume Shadow Copy Services
IT	information technology		**VT**	Virtualization Technology
ITSO	International Technical Support Organization		**WINS**	Windows Internet Naming Service
JVM	Java virtual machine		**WMS**	Windows Media Services
LAN	local area network		**WOW**	Windows on Windows
LUN	logical unit number		**XML**	Extensible Markup Language
MB	megabyte			
MMC	Microsoft Management Console			
MSDN	Microsoft Developer Network			
NAP	Network Access Protection			
NAS	network attached storage			
NAT	Network Address Translation			
NTFS	NT File System			
P2V	physical servers to VMs			
PATA	parallel ATA			
PC	personal computer			

Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this paper.

IBM Redbooks

For information about ordering these publications, see "How to get Redbooks" on page 88. Note that some of the documents referenced here may be available in softcopy only.

► *Planning, Installing, and Managing the IBM System x3950 M2*, SG24-7630

► *Running Microsoft SQL Server 2008 on the IBM System x3950 M2*, REDP-4476

Online resources

These Web sites are also relevant as further information sources:

► Hyper-V Server

http://www.microsoft.com/servers/hyper-v-server/

► Windows Server 2008

http://www.microsoft.com/windowsserver2008/

► Supported guest operating systems

http://support.microsoft.com/kb/954958

► Windows Server Catalog: Server hardware certified by Microsoft to run Hyper-V

http://go.microsoft.com/fwlink/?LinkID=111228

► Hyper-V management tools

http://support.microsoft.com/kb/952627

► Fixes to the general availability (GA) release of Windows Server 2008 including updates that were made available after GA of Hyper-V

http://support.microsoft.com/kb/950050

► Microsoft Remote Server Administrative Tool

http://support.microsoft.com/kb/941314

How to get Redbooks

You can search for, view, or download Redbooks, Redpapers, Technotes, draft publications and Additional materials, as well as order hardcopy Redbooks publications, at this Web site:

ibm.com/redbooks

Help from IBM

IBM Support and downloads

ibm.com/support

IBM Global Services

ibm.com/services

Implementing Microsoft Hyper-V on IBM System x and IBM BladeCenter

Introduces the new virtualization platform from Microsoft

Explains how to install Hyper-V on System x and BladeCenter servers

Describes the available management tools

Microsoft Hyper-V is the next-generation server virtualization technology. This technology is available either as a feature of Windows Server 2008 or as a separate free download in the form of the Hyper-V Server.

In this IBM Redpapers publication, we introduce Hyper-V and describe its features. We explain how to install and use the product to create virtual machines and introduces the tools that you can use to manage the virtual machines that run on Hyper-V. In addition, we introduce high availability features such as clustering and migration.

The paper is suitable for IT specialists who want to learn what Hyper-V offers and how to install, configure, and manage the product.

REDP-4481-00