Chapter

1

Hyper-V Overview

One of the revolutionary developments that is sweeping through our rapidly changing field is the emergence of virtualization.

If you have been in this industry long enough, you realize one thing: technology is always changing. There are many advantages and disadvantages to this trend. The biggest disadvantage of changing technology is that we all need to stay on top of it. Doing so can feel like a full-time job in itself.

The greatest advantage of changing technology is that the industry has moved forward in leaps and bounds over the past 10 years. Less than 15 years ago, most people did not know what an email address was. The industry changes every day and we are the IT professionals who make it happen.

Virtualization is one of those changes that has started taking over the computer world. Many networks now use virtualization instead of paying thousands of dollars for server equipment.

Let's begin by looking at the basics of Microsoft's Windows Server 2008 and Hyper-V.

Introducing Hyper-V

One of the fastest-growing and hottest technologies to hit the market in the past few years is server virtualization. Server virtualization is making an impact due to the many economic advantages it brings. It allows an organization to run multiple operating systems, called virtual machines, on a single machine or group of machines called a *cluster*. The ability to run multiple operating systems on a single machine or cluster helps an organization reduce many of its hardware and software costs and allows it to reduce its IT department staffing overhead.

A *virtual machine (VM)* is an implementation of an operating system that runs in its own virtualization window. The advantage to using virtual machines is that you can have multiple VMs on the same Windows Server 2008 machine. Each VM can have its own unique resources running on its operating system. An administrator can run multiple operating systems (including non-Windows-based systems) or run multiple server roles in their own virtual machines, thus allowing an organization more flexibility without the need for more servers. One of the greatest advantages of Hyper-V technology is that you have the ability to run both 32-bit and 64-bit applications within the virtual environment.

Virtualization is not new, nor is this Microsoft's first attempt at providing virtualization services. Microsoft has been doing virtualization for years and has already released products currently in use today. The two Microsoft virtualization products that you may have used before are Microsoft Virtual PC and Microsoft Virtual Server 2005.

Microsoft Hyper-V, the company's latest version of server virtualization services, was officially released with Windows Server 2008. Formerly known under codename Viridian and as Windows Server Virtualization, Hyper-V is a hypervisor-based virtualization system for x64 systems that allows for the virtualization of guest operating systems. A hypervisor, also called virtual machine monitor, is a virtualization platform that allows multiple operating systems to run on a host computer at the same time.

Let's imagine an IT department for any size organization. You come in one morning before everyone else (a common practice in our field) and see that one of your servers has crashed. The first thing that's going to happen is your heart will drop into your stomach. After that, you will start trying to fix the error; you may find that you need to rebuild the machine. Now your heart is racing and your blood pressure is going through the roof because you have to get this server up and running before anyone else comes into work. We have all been there.

Now let's imagine the same situation but all of your servers are running Hyper-V. When you come in and see your crash, you know you can relax. All you need to do is move the Hyper-V virtual machine to another machine running Hyper-V and you are back up and running. This is what Hyper-V can do for you. Hyper-V is a role-based feature that enables an organization to have multiple virtual machines (using multiple operating systems) on a single Windows Server 2008 machine. Let's take a look at some of the key benefits of using Hyper-V technology.

Hyper-V Benefits

Hyper-V is a virtualization platform that gives you the ability to manage all of your physical and virtual resources from a single set of integrated management utilities. Here are some of the benefits of using Hyper-V:

Server Consolidation   This is one of the major benefits that Hyper-V offers. Server consolidation allows you to run many versions of server-based software and operating systems (even non-Microsoft versions) on a single box. Each one of these versions is isolated from the other versions running on the same machine through the virtual architecture. This arrangement allows an organization to have a lower total cost of ownership (TCO) while maintaining all the services and servers that are required to make the network operate properly.

Downtime and Recoverability   Two major concerns that all organizations face are downtime and recoverability. Downtime includes not only unscheduled events (such as machine errors or hardware failure) but also scheduled events like backups and maintenance. Hyper-V has many features, such as live backup, that help reduce the server downtime for an organization.

Recoverability is also something that all IT staff members should be concerned about. Most organizations could not afford to lose their data and still stay in business. Disaster recoverability is supported by Hyper-V through clustering and backups, thus reducing downtime and saving the organization money.

Testing and Development   One of the nice benefits of using Hyper-V is the ability to test or develop software in a safe virtual machine operating system. If you have been in this industry long enough, you have run into the situation of loading a service pack or utility and watching your system crash because of that install. By testing your service packs or software updates in Hyper-V, an administrator can reduce the chances of network downtime on a live server.

Dynamic Datacenter   Hyper-V virtualization lets you design and create a dynamic network environment that will not only address network problems, but also anticipate higher demands for network resources.

Now that you have seen some of the benefits of Hyper-V, let's take a look at some of its new features.

Hyper-V Features

Microsoft has built many new features into Hyper-V compared to its previous virtualization environments (Virtual Server and Virtual PC). Taking into account the progression of hardware over the past several years, Microsoft has included these features to allow an organization to take full advantage of the improved hardware environments:

Symmetric Multiprocessor (SMP) Support   Hyper-V allows a virtual machine environment to use up to four processors, allowing for SMP support.

New Architecture Design   Hyper-V was designed to run on a 64-bit processor only, which lets you use several types of devices. This 64-bit architecture also results in better system performance. Keep in mind that 32-bit guest systems can run as VMs on the host, but the host must be a 64-bit system.

Operating System Support   Hyper-V enables you to run both Microsoft and non-Microsoft operating systems (Windows, Linux, Unix, etc.). The operating systems can be both 32-bit and 64-bit versions.

Virtual Machine Migration   A very nice feature of Hyper-V is the ability to migrate virtual machines from one server to another without long periods of downtime. Let's say you have a server that is having hardware problems; you can switch the virtual machine to another server running Hyper-V without having to rebuild the bad machine immediately.

Network Load Balancing   Hyper-V allows you to use network load balancing (NLB) across multiple virtual machines even if they are on different physical machines.

Hardware Architecture   With the new Hyper-V hardware architecture, all hardware resources in a virtual machine (disk, network card, RAM, etc.) have access to resources on the physical machine.

Scalability   Hyper-V lets you place a large number of virtual machines on the same physical machine. In this way, you can grow a network without purchasing new hardware. If you need an additional server, you can add it as a virtual machine. Eventually, however, no matter how well your network is designed and created, we all need to purchase new hardware to keep up with the ever-changing software requirements.

Before we dive any further into Hyper-V, let's examine some basic networking terms and designs. Understanding how networking works and exploring some of the networking services needed to operate your environment will allow you to see the advantages of using Hyper-V. You can use Hyper-V to set up many of these services and networking models.

Microsoft Networking Models

The first topic we'll discuss is the network model types. The choices you make in designing your network are determined by many factors, such as the number of users on your network or the amount of money you can spend. Microsoft uses two networking models: peer-to-peer and domain-based.

> **NOTE** Since this is a Microsoft Hyper-V certification book, the network models that are discussed throughout this book are Microsoft Windows–related models.

Windows Peer-to-Peer Network

When setting up a Windows peer-to-peer network (also referred to as a workgroup network), you should understand that all computers on the network are equal. All of the peer-to-peer computers, also referred to as nodes, simultaneously act as both clients and servers.

This can be an advantage for small networks that have 12 or fewer users. It allows a small network to share resources without the need for a costly server. It also enables a small company to have a network setup without hiring an internal IT department.

Peer-to-peer networks are no more than Microsoft Windows XP and Vista machines connected by a centralized connection like a router or hub (see Figure 1.1).

Windows peer-to-peer networks have been out for many years in the industry. The two operating systems today that are commonly used for this type of network are Microsoft Windows XP and Vista. Windows Vista has included some new enhancements to the Windows peer-to-peer network:

- A feature called People Near Me
- A new application programming interface (API)
- Group Policy configuration support
- A new version of the Peer Name Resolution Protocol (PNRP)
- Windows Meeting Space

To learn more about Windows Vista peer-to-peer networks, see *MCTS: Windows Server 2008 Network Infrastructure Configuration Study Guide (70-642)* by William Panek, Tylor Wentworth, and James Chellis (Wiley, 2008).

FIGURE 1.1 Peer-to-peer model
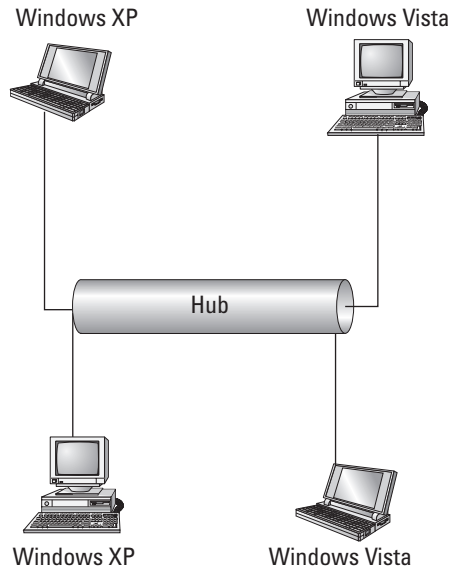
Using a Peer-to-Peer Network

One of the biggest debates among IT professionals is when to use a peer-to-peer network. These types of networks have their place in the networking world. Most of you at home use this type of network, in which all computers connect using a small internet router.

Well, it's the same for companies. You would use this network in a small environment with 12 or fewer users. This allows small organizations to share resources without using expensive equipment or server software.

But there is a downside to peer-to-peer networks related to manageability. Many new IT people like working on a small peer-to-peer network because of its size, but in fact a network with 10 users and 10 computers can be difficult to manage. Because there is no server to centralize user accounts, each Windows XP or Vista computer must have a user account and password. So, if you have 10 users with 10 computers and all 10 users must be able to access all 10 computers, you end up creating 100 accounts (10 accounts on each machine times 10 machines).

Another disadvantage of peer-to-peer networks involves backups. Most IT departments do not back up individual user machines, and since there is no centralized server for data storage, data recoverability can be an issue.

Windows Server 2008 Active Directory Network

Now that you have seen the advantages and disadvantages of a peer-to-peer network, let's discuss the domain-based network. A domain-based network is a network that uses Microsoft's Active Directory—a single distributed database that contains all the objects included within your network. Some of these objects are user accounts, group accounts, and published objects (folders and printers).

The first of many advantages to Active Directory is centralized management. As we just stated, the Active Directory database contains all the network information within a single, distributed data repository. Due to the fact that these objects are all located in the same database, an administrator can easily manage the domain from one location.

Another major advantage to using Active Directory is domain security. An administrator has the advantage of creating a single username and password for all users within the domain. This password can be used to access all resources that an individual has the proper rights to access. An administrator can determine, based on job function or position, which files or folders a user can obtain. In our earlier peer-to-peer example, you needed to create 100 accounts. Now with a domain, you would only need to create 10 accounts.

An Active Directory structure is made up of one or more *domains*. A domain is a logical grouping of objects within your organization. For example, in the Stellacon.com domain, all users in that domain should be members of the Stellacon.com organization. The objects that are contained within a domain do not need to be in the same physical location. Domains can span the entire globe even though they are part of the same organization.

A benefit to using domains is the ability to have child domains. A child domain is a subdomain of another domain. You can build child domains based on physical locations, departments, and so forth. Figure 1.2 shows the hierarchy structure of Stellacon.com with its child domains (based on geographic location).

> **NOTE** Microsoft domains are represented as triangles. It is important to remember that when taking any Microsoft exam.

By creating child domains, you achieve scalability. Active Directory lets you store millions of objects within a single domain, but child domains give you the flexibility to design a structure layout that meets your organizational needs.

When you're setting up child domains, the parent and child domains establish a *trust* relationship. Trusts allow users to be granted access to resources in a domain even when their accounts reside in a different domain. To make administration of trust relationships easy, Microsoft has made transitive two-way trusts the default relationship between domains. This means that, by default, all domains within the same forest automatically trust one another. As shown in Figure 1.2, Stellacon.com automatically trusts Boston.Stellacon.com, NY.Stellacon.com, and Dallas.Stellacon.com. This means that all child domains implicitly trust one another.

FIGURE 1.2   Domain structure
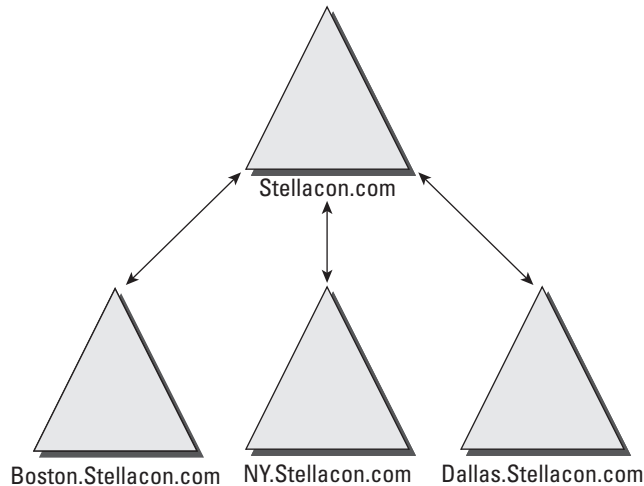
The final Active Directory advantage that we will discuss is an extensible schema. The Active Directory schema consists of the attributes of the database. For example, when you create a new user using the Active Directory Users and Computers snap-in, the system asks you to fill in the user's first name, last name, username, password, and so forth. These fields are the attributes of Active Directory, and that is the schema. An Administrator has the ability to change or expand these fields based on organizational needs.

⊕ Real World Scenario

An Example of Why You Might Change the Schema

You may be asking yourself why an organization may need to change the schema. Many years ago when I got out of the military and before I got into the computer industry, I used to cast toilets for American Standard. I made 50 toilets a day. When working for American Standard, I had an employee number of 343. All my toilets were stamped 343 (so they knew who made the product) on the bottom base. My time card did not even have my name—just my number.

This is an example of a field that you would need to add to your schema. I would have an account in Active Directory with my name, but there would need to be a field that showed my employee number. You may have to adjust your Active Directory schema based on your organization's requirements.

The major disadvantage to an Active Directory model is cost. When setting up an Active Directory domain, an organization needs a machine that is powerful enough to handle the Windows Server 2008 operating system. Also, most companies that decide to use a domain-based organization will require the IT personnel to manage and maintain the network infrastructure. To learn more about Microsoft Active Directory networks, See *MCTS: Windows Server 2008 Active Directory Configuration Study Guide (70-640),* by William Panek and James Chellis (Wiley, 2008).

Microsoft Networking Terms and Roles

Now that we have seen the two networking models that Microsoft offers, let's talk about some basic networking terms and roles. Hyper-V can act as a server or domain controller (among other roles), so it makes sense to learn what these terms and roles mean.

Server   A server is a machine that users connect to so that they can access resources located on that machine. These resources can be files, printers, applications, and so forth. Usually the type of server is dependent on the resource that the user needs. For example, a print server is a server that controls printers. A file server is a server that contains files. Application servers can run applications for the users. Sometimes you will hear a server referred to by the specific application that it may be running. For example, someone may say, "That's our SQL server or Exchange server."

Domain Controller   This is a server that contains a replica of Active Directory. As I mentioned earlier in this chapter, Active Directory is your database that contains all the objects in your network. A domain controller is a server that contains this database. Years ago (when we used NT 3.51 and NT 4.0), we had a primary domain controller (PDC) and backup domain controllers (BDCs), but that's not true today. All domain controllers are equal in a Windows Server 2008 network. Some domain controllers may contain extra roles, but they all have the same copy of Active Directory.

Member Server   A member server is a member of a domain-based network, but it does not contain a copy of Active Directory. For example, Microsoft recommends that Exchange be loaded on a member server instead of a domain controller. Both domain controllers and member servers can act as file, print, or application servers. It just depends on whether you need that server to have a replica of Active Directory.

Stand-alone Server   A stand-alone server is not a member of a domain. Many organizations use this type of server for Hyper-V. For example, you load Windows Server 2008 with Hyper-V on a stand-alone server. You can then create virtual machines that act as domain controllers to run the network.

Client Machine   A client machine is a computer that normally is used for your end users in a company. The most common operating systems for a client machine are Microsoft Vista and XP.

DNS Server   The *Domain Name System (DNS)* server has the DNS service running on it. DNS is a name resolution service. DNS turns a hostname into a TCP/IP address (a

process known as forward lookup). DNS also has the ability to turn a TCP/IP address into a name (known as reverse lookup). When you install an operating system onto a computer, you assign that computer a hostname. The problem is that computers talk to each other using the TCP/IP protocol (for example, 192.168.1.100). It would be difficult for most users to remember all the different TCP/IP addresses on a network. So normally you connect to a machine by using its hostname. DNS converts the hostname to a TCP/IP address for you.

The easiest way to understand how this works is to think of your telephone number. If someone wants to call you and they don't have your telephone number, they call information. They give information your name and they get your phone number. Well, this is how a network works. DNS is information on your network. You give DNS a hostname and it returns a network telephone number (TCP/IP address). DNS is a requirement if you want to install Active Directory. You can install DNS before or during the Active Directory installation.

DHCP Server   A *Dynamic Host Configuration Protocol (DHCP)* server runs the DHCP service. DHCP is the server on the network that assigns TCP/IP information to your computers dynamically. Every computer needs three settings to operate properly (with the Internet and intranet): a TCP/IP number, a subnet mask, and a default gateway (router number). Your computers can get this minimum information in one of two ways: manually (someone assigns the TCP/IP information) or dynamically (automatically configured). DHCP can assign more than just these three settings. DHCP can assign any TCP/IP configuration information (such as the DNS server, WINS server, or time servers).

Earlier, I told you that DNS consists of information on your network. Following this example, DHCP would be the phone company. DHCP is the component that assigns the phone number (TCP/IP number).

Global Catalog   The *Global Catalog* is a partial representation of the Active Directory objects. Think of it as an index. If you need to look something up in this book, you go to the index and find what page you need to turn to; you would not just randomly look through the book for the information. This is what the Global Catalog does on your Active Directory domain. When you need to find a resource in the domain (such as a user or published printer), you can search the Global Catalog to find its location.

Domain controllers need to use a Global Catalog to help with user authentication. Global Catalogs are a requirement on an Active Directory domain. All domain controllers can be Global Catalogs, but this is not always a good practice. Your network should have at least two Global Catalogs for redundancy, but too many can cause too much Global Catalog replication traffic.

   Now that we have covered some of the basic Microsoft terms, let's turn our focus to the Windows Server 2008 operating system. Microsoft Windows Server 2008 is the core platform for the Hyper-V environment.

Understanding Windows Server 2008

It is important to understand Microsoft Windows Server 2008 and also how to install this operating system. Hyper-V has to run on Windows Server 2008. Hyper-V is new to the server operating system, so if you are running a previous version of Microsoft Windows Server, you must install Windows Server 2008 first.

This section discusses the various versions of Microsoft Windows Server 2008 (not all versions will run Hyper-V) as well as some of the new features. We will also do an exercise to install the Windows Server 2008 operating system.

New Features of Windows Server 2008

Microsoft Windows Server 2008 is the latest release of Microsoft's server operating systems. There are many new and upgraded features, and here are just a few:

Hyper-V   As I stated earlier, Hyper-V allows an organization to create and manage virtualized server environments. This is a new feature of Windows Server 2008 64-bit edition.

AD Rights Management Services (AD RMS)   Active Directory Rights Management Service (AD RMS) is a new feature included with Windows Server 2008. AD RMS gives network users or administrators the ability to determine the access level (such as open, read, or modify) they would like to assign to other users in an organization. By using Microsoft Office 2003 Professional or Microsoft Office 2007, users have the ability to secure email messages, internal websites, and documents.

The advantage to AD RMS is that any user can secure confidential or critical company information. To use AD RMS, an AD RMS client is required. The AD RMS client is included with Windows Vista by default.

Server Manager   Windows Server 2008 has included a new single-source utility for installing, configuring, and managing roles (see Figure 1.3) on a server. *Server Manager* also will display server status and system information as well as identify problems with server roles.

Server Manager has replaced several features that had been included with Windows Server 2003. These replaced features include Manage Your Server, Configure Your Server, and Add or Remove Windows Components.

A final issue that administrators face when deploying servers is the need to run the Security Configuration Wizard. Server Manager, by default, will allow an administrator to deploy servers without running the Security Configuration Wizard because Server Manager server roles are configured with Microsoft recommended security settings.

Network Access Protection (NAP)   Windows Server 2008 has a new security feature called Network Access Protection (NAP). You can now define network access, based on client requirements, using NAP. The advantage of using NAP is that you can define this access at the granular level. NAP also gives you the ability to allow network access based

on compliancy with corporate governance policies. Here are some of the new features associated with NAP:

- Network layer protection
- DHCP enforcement
- VPN enforcement
- IPSec enforcement
- 802.1X enforcement
- Flexible host isolation

FIGURE 1.3 Server Manager
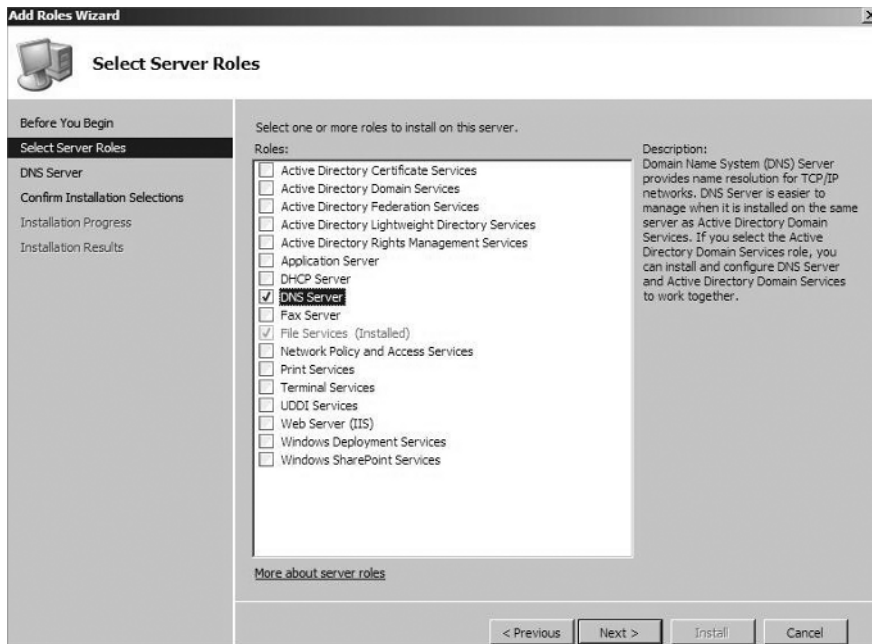
Read-Only Domain Controller (RODC)   Windows Server 2008 introduced a new type of secure domain controller called a *read-only domain controller (RODC)*. A read-only domain controller is a noneditable copy of Active Directory. Using an RODC allows an organization to place a domain controller in an area or off-site location that does not have much security.

As I explained earlier, all domain controllers are equal. They all have the same version of Active Directory. This is also true with a read-only domain controller. Replication between domain controllers is bidirectional (replication happens both ways) except for the use of read-only domain controllers. Replication traffic between domain controllers and RODCs is unidirectional (one way only). Other domain controllers have the ability to talk to the RODC, but the RODC does not have the ability to talk to other domain controllers.

Another advantage to using a RODC in a nonsecure location is that you can give a normal user the right to administer and maintain the RODC. This user would not require domain admin rights. They would be allowed to have the admin role for the one RODC only. This concept is known as administrator role separation.

Server Core Installation   Another new feature is the Server Core installation, which allows you to install Windows Server 2008 with minimal options. Server Core is a low-maintenance version of Windows Server 2008 and thus has limited functionality.

Windows Server 2008 Server Core has no graphical user interface (GUI) utilities. All commands have to be issued through the use of a command prompt. If you have been in the industry long enough, think of Unix or Cisco. You must know the command-line utilities to maintain the server. Server Core is a great security feature.

Think of a normal server. If you want to add or modify a user, you go to Active Directory Users and Computers (on domain-based networks) or the computer management system for workstations or nondomain servers. Once in the application, you can do what's needed. The problem with this is that it is easy to do. If a user gains access to your server room, it could be easy for them to wreak havoc on your network. In a Server Core environment, there are no GUI snap-ins. If users don't know the command-line utilities, they can't make changes.

Server Core is an installation option that allows you to set up only limited server roles: DNS, DHCP, File Server, Active Directory, Media Services, and Hyper-V. Many organizations choose this route to set up Hyper-V. Doing so provides extra security for the Hyper-V environment. By installing Server Core, you automatically create limitations:

- There is no Windows shell and very limited GUI functionality (the Server Core interface is a command prompt).
- There is no managed code support in Server Core (all code must be native Windows API code).
- **Microsoft** Installer Package (MSI) support is limited to unattend mode only.

Multiple editions of Windows Server 2008 are available. Table 1.1 shows which features are included with each version of the Windows Server 2008 operating system.

TABLE 1.1   Windows Server 2008 Editions Comparison

New Features	Enterprise Edition	Datacenter Edition	Standard Edition	Web Edition
Cryptography Next Generation (CNG)	X	X	X	X
Group Policy Preferences	X	X	X	X
Internet Information Services (IIS) 7.0	X	X	X	X
Read-only domain controllers	X	X	X	X

TABLE 1.1   Windows Server 2008 Editions Comparison *(continued)*

New Features	Enterprise Edition	Datacenter Edition	Standard Edition	Web Edition
Server Core installation	X	X	X	X
Server Manager	X	X	X	X
Network Access Protection (NAP)	X	X	X	
Hyper-V	X	X	X	
Active Directory Rights Management Services (AD RMS)	X	X	X	
Windows Deployment Services (WDS)	X	X	X	
Terminal Services Gateway and RemoteApp	X	X	X	

Enhancements	Enterprise Edition	Datacenter Edition	Standard Edition	Web Edition
Windows Server Backup enhancements	X	X	X	X
Network load balancing enhancements	X	X	X	X
Windows Reliability and Performance Monitor enhancements	X	X	X	X
TCP/IP Stack enhancements	X	X	X	X
Windows Firewall with Advanced Security enhancements	X	X	X	X
Windows Reliability and Performance Monitor enhancements	X	X	X	X
Windows Media Services enhancements	X	X	X	X
Active Directory Domain Services (AD DS)	X	X	X	
Active Directory Federation Services enhancements	X	X	X	
Terminal Services enhancements	X	X	X	

TABLE 1.1   Windows Server 2008 Editions Comparison *(continued)*

Enhancements	Enterprise Edition	Datacenter Edition	Standard Edition	Web Edition
DNS Server enhancements	X	X	X	
Public Key Infrastructure (PKI) enhancements	X	X	X	
Failover Clustering enhancements	X	X		

Requirements for Windows Server 2008 Installation

Now that you have seen what each version of Microsoft Windows Server 2008 has to offer, let's look at the requirements for installing Windows Server 2008. Even though these requirements will not be on the Microsoft Hyper-V exam, you need to know them to effectively create a Server 2008 base installation for Hyper-V. As the old saying goes, "You cannot build a good house unless you have a good foundation."

> **NOTE**   These are not the requirements for installing Hyper-V. We will cover those in Chapter 2, "Installing Hyper-V." These requirements are the basics needed to install Microsoft Windows Server 2008.

Table 1.2 shows both the minimum and recommended requirements. I have been an IT manager and consultant for many years and from personal experience, I would use only the recommended requirements or higher. The minimum requirements will allow the Windows Server 2008 operating system to install, but it will not be practical for any real-world situation. To make sure the requirements have not changed, visit Microsoft's website at `http:// msdn.microsoft.com/en-us/windowsserver/cc196364.aspx`.

TABLE 1.2   Windows Server 2008 Installation Requirements

Hardware Component	Requirements and Recommendations
Processor	Minimum: 1GHz (x86 processor) or 1.4GHz (x64 processor) Recommended: 2GHz or faster
Memory	Minimum: 512MB of RAM Recommended: 2GB of RAM or greater Maximum (32-bit systems): 4GB (Standard) or 64GB (Enterprise and Datacenter) Maximum (64-bit systems): 32GB (Standard) or 2TB (Enterprise and Datacenter)

TABLE 1.2   Windows Server 2008 Installation Requirements *(continued)*

Hardware Component	Requirements and Recommendations
Drive	DVD-ROM drive
Other hardware	Super VGA (800×600) or higher-resolution monitor Keyboard Microsoft Mouse or compatible pointing device

Activating and Installing Windows Server 2008

If you are interested in evaluating Windows Server 2008, you can do so for no cost; the installation does not require a product activation or product key. Microsoft allows you to install any Windows Server product without activating the software for 60 days.

At the end of the 60 days if you still need more time to finish your evaluation, you can reset your evaluation three more times (60 days each). This will allow an administrator or user to evaluate the product for up to 240 days. At the end of the 240 days, the Windows Server 2008 product will need to be uninstalled or a valid product key and activation will be required.

⊕ Real World Scenario

Microsoft Product Keys and Licensing

As a consultant, I have been in many IT departments throughout the United States and I have seen my fair share of organizations using illegal versions of operating systems. I cannot stress this enough: do not use illegal (copied) versions of any products. Your company should be using legal, valid copies and also have enough licenses to support the number of installations.

Remember, it is your job as an IT person to make sure your company stays legal, and it is also your job to make sure your organization understands the consequences that may be taken against them otherwise. Do not put your Microsoft certification on the line for any organization.

At this point, let's go ahead and install the product. Exercise 1.1 walks you through the steps for installing Windows Server 2008 Enterprise Edition.

> **NOTE** If you have already installed Windows Server 2008, you can skip the follow-ing exercise. Just make sure that Windows Server 2008 64-bit version was the version installed. Hyper-V must be run on a 64-bit version of Windows Server 2008. If you have a 32-bit version, please complete the exercise with a 64-bit version.

EXERCISE 1.1

Installing Windows Server 2008

1. Insert the Windows Server 2008 64-bit edition CD into the CD-ROM drive and reboot the machine. Make sure the computer can boot off the CD-ROM drive.

2. A window shows that files are loading onto the machine. Next, a screen will appear asking you to enter your language, time and currency, and keyboard settings. Choose the desired settings (just leave the defaults for US residents). Click Next.

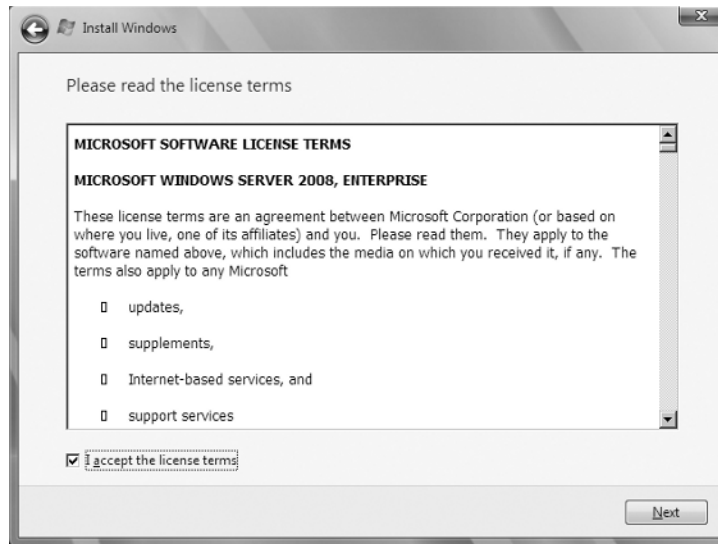**3.** At the Install Windows screen, click the Install Now arrow.

4. The next screen asks which version of Windows Server 2008 you would like to install. The choices you see may not be the same as shown here (depending on the CD you have). Choose Windows Server 2008 Enterprise (Full Installation) and click Next. If you do not have Enterprise Edition, choose Standard (Full Installation).
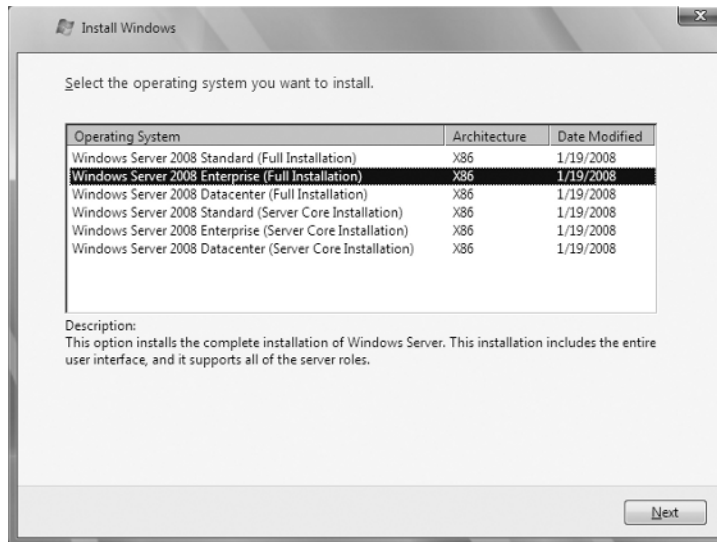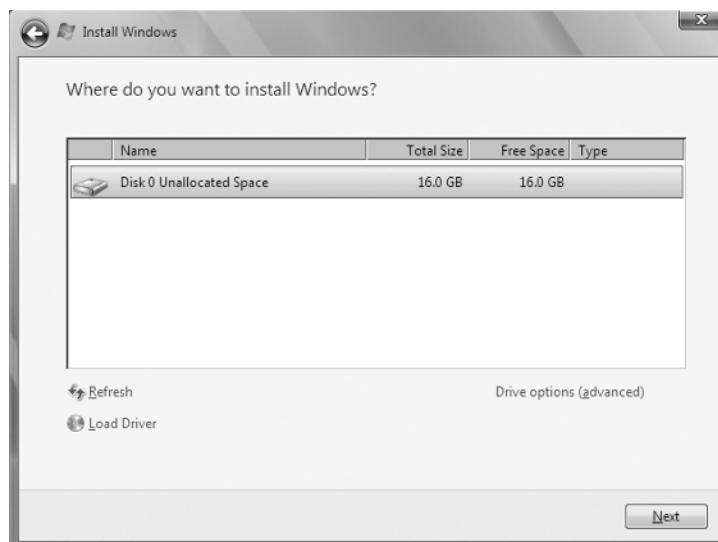
5. At the license terms screen, after reading the license, check the "I accept the license terms" check box and click Next.

6. At the Which Type Of Installation Do You Want? screen, choose Custom (Advanced).

7. At the Where Do You Want To Install Windows? screen, choose the hard drive where you would like to install the operating system. Click Next.

8. The Installing Windows screen appears, showing the status of your install. Reboot after the install is complete.

9. After you reboot, the system will ask you to change the Administrator password at first login. Click OK and then enter and reenter the password **P@ssw0rd**. Click the arrow to the right of the password boxes.

10. The Password Has Been Changed screen appears. Click OK.

Summary

In this chapter, we discussed some of the features of Microsoft Hyper-V. We explored the benefits of installing Hyper-V, which include reduced hardware costs, the ability to consolidate servers, reduced downtime and enhanced recoverability, the ability to test or develop software in a safe virtual machine operating system, and the Dynamic Datacenter feature.

Hyper-V has improved many features and offers new ones, such as symmetric multiprocessors (SMP) support, a new architecture design, operating system support, virtual machine migration, network load balancing, a new hardware architecture that allows hardware resources in a virtual machine to have access to resources on the physical machine, and scalability.

Microsoft networking has two models: peer-to-peer and domain based. Microsoft peer-to-peer networks have implemented many new features like People Near Me, a new API, Group Policy configuration support, a new version of PNRP, and Windows Meeting Space.

Domain-based networks take advantage of using an Active Directory database. This gives you many advantages over a peer-to-peer, such as centralized management, domain security, expandability, and scalability. Your infrastructure needs determine which Microsoft network model you will use.

To make a proper decision as to which networking model you will design, you must understand the various server roles and terms. Understanding how servers, domain controllers, member and stand-alone servers, clients, DNS servers, DHCP servers, and Global Catalogs operate is critical to successfully designing and creating your network infrastructure.

Windows Server 2008 is the platform that Hyper-V must reside on. Windows Server 2008 has many advantages over Windows Server 2003, including AD Rights Management Services (AD RMS), Server Manager, Network Access Protection (NAP), read-only domain controllers, and Server Core installations. This chapter included an overview of the Windows Server 2008 editions and requirements.

Exam Essentials

Understand the benefits of Hyper-V.   By installing Hyper-V, you can reduce your organization's hardware costs, help consolidate servers, reduce downtime and recoverability, use Hyper-V for testing and development in a safe virtual machine operating system, and build a dynamic datacenter for your IT environment.

Be able to describe the features of Hyper-V.   Hyper-V allows for symmetric multiprocessors (SMP) support and offers a new architecture design, operating system support, virtual machine migration, network load balancing, a new hardware architecture that allows hardware resources in a virtual machine to have access to resources on the physical machine, and scalability.

Be familiar with server roles and terms.   Understand the different types of domain and network servers (domain controllers, member and stand-alone servers). Hyper-V can be used for the different types of server roles (DNS servers, DHCP servers, Global Catalogs, etc.).

Know how to install and operate Windows Server 2008.   Hyper-V runs on the 64-bit version of Microsoft Windows Server 2008. Because of this, it is important to understand how Windows Server 2008 operates and the requirements that allow Windows Server 2008 to install.

Review Questions

1. Hyper-V allows an administrator to set up what feature?

A. Monitoring Resources

B. Virtualization

C. Backups

D. Security

2. What is an implementation of an operating system that runs in its own virtualization window called?

A. Virtual window

B. Virtual process

C. Virtual machine

D. Virtual host

3. Your manager has come to you because he has heard about the new Hyper-V feature. He asks you to explain some of the benefits that the company can gain by installing Hyper-V. Which of the following are benefits to installing Hyper-V? (Choose all that apply.)

A. Server consolidation

B. The ability to test or develop software in a safe virtual machine operating system

C. Reduced hardware costs

D. Faster and more efficient Internet connection speed

4. After you have explained some of the benefits of Hyper-V to your boss, he then asks you to explain some of the features. Which of the following are features of Hyper-V? (Choose all that apply.)

A. New architecture design

B. Symmetric multiprocessors (SMP) support

C. Operating system support

D. Scalability

5. You are the administrator for a small organization with five domains within a single tree. You need to get access to a resource in another domain in another company's tree. What do you need to have set up so that users can get access to the resources in the other tree?

A. Your users would need accounts in the other company's domain.

B. The users who need to use the resource must have Administrative rights.

C. Trust must be established between companies.

D. This cannot be done.

6. Windows Server 2008 has included a new single-source utility for installing, configuring, and managing roles on a server. What is this utility called?

   A. Add/Remove Programs

   B. Computer Manager

   C. Configuration Manager

   D. Server Manager

7. You are the network administrator for your organization. You need to define access for users based on client requirements and corporate policies. What new Windows Server 2008 feature can you implement?

   A. Network Access Protection

   B. Remote Access Protection

   C. Remote Access Permissions

   D. Network Access Permissions

8. You are the network administrator for a large organization with multiple smaller nonsecure locations. These locations have to go across a WAN line to authenticate with a domain controller. You want to implement a domain controller into these nonsecure remote locations. What type of domain controller can you install?

   A. Secure domain controller (SDC)

   B. Primary domain controller (PDC)

   C. Backup domain controller (BDC)

   D. Read-only domain controller (RODC)

9. As the system administrator for your company, you have decided to implement Hyper-V. You would like to install it onto a server that has limited functionality and no GUI snap-ins for better security. What type of server installation would you use?

   A. Limited Feature Installation

   B. Server Core Installation

   C. Normal Installation and then change the registry

   D. Server Limited Installation

10. You are the network administrator for a small network of 12 users. The company has decided to expand to 30 users over the next 6 months. You want to install a domain controller with Active Directory. You also need to install some type of server that does host-name resolution. What type of server would you install?

   A. DHCP server

   B. RAS server

   C. DNS server

   D. WINS server

11. What Windows Server 2008 server role allows a user to secure an email while using Micro-soft Office 2007 Outlook?

   A. Active Directory Domain Services

   B. Active Directory Federation Service

   C. Active Directory Rights Management Service

   D. Active Directory Lightweight Directory Service

12. You are the administrator for a mid-sized organization. When you took the network over from the previous administrator, he had implemented all TCP/IP information manually. You have decided to switch Internet providers. You want to now implement a server to automatically assign TCP/IP information to all of your users. What type of server do you need to install?

   A. DHCP server

   B. RAS server

   C. DNS server

   D. WINS server

13. What component is a database of all Active Directory objects without all of the attributes and thus a partial representation of the Active Directory objects?

   A. Schema files

   B. Active Directory Index

   C. Schema index

   D. Global Catalog

14. Which of the following features of Active Directory allows information between domain controllers to remain synchronized?

   A. Replication

   B. Global Catalog

   C. The schema

   D. None of the above

15. You are the network administrator for a mid-sized company. You have decided to imple-ment Hyper-V onto a new server. What editions of Windows Server 2008 can you install to install Hyper-V?

   A. Enterprise Edition

   B. Standard Edition

   C. Datacenter Edition

   D. Web Edition

16. Which of the following is a requirement of Active Directory?

    A. DHCP

    B. RAS

    C. DNS

    D. WINS

17. You are a consultant and have been asked by a new company to install a Microsoft network. They want to share folders and printers. What are the two types of Microsoft networks? (Choose all that apply.)

    A. AppleTalk network

    B. Domain-based network

    C. Peer-to-peer network

    D. Shared network

18. You are a network administrator for a small company. You are thinking about installing Windows Server 2008. You would like to install Server 2008 and see the features. How long can you evaluate the product before activating the server?

    A. 60 days

    B. 120 days

    C. 180 days

    D. 240 days

19. You are the system administrator for a large organization that just installed Windows Server 2008. All client machines are Windows XP and Vista. You are thinking of installing Network Access Protection (NAP). What are the features of NAP?

    A. Network layer protection

    B. DHCP enforcement

    C. VPN enforcement

    D. IPSec enforcement

20. You are the administrator of a mid-sized organization that has decided to install Windows Server 2008 Server Core. By choosing a Server Core installation, what characteristics should you expect? (Choose all that apply.)

    A. There is no Windows shell and very limited GUI functionality (the Server Core interface is a command prompt).

    B. There is no managed code support in Server Core (all code must be native Windows API code).

    C. Managed code support in Server Core for all coding.

    D. MSI support is limited to unattend mode only.

Answers to Review Questions

1. B. Hyper-V is the next-generation hypervisor-based virtualization technology. Hyper-V is a role-based feature that allows an organization to have multiple virtual machines on a Windows Server 2008 machine.

2. C. A virtual machine (VM) is an implementation of an operating system that runs in its own virtualization window. The advantage to using virtual machines is that you can have multiple VMs on the same Windows Server 2008 machine. Each VM can have its own unique resources running on its operating system.

3. A, B, C. Options A, B, and C are correct. Option D is not a benefit of installing Hyper-V.

4. A, B, C, D. All the options are correct. In addition, Hyper-V offers virtual machine migration and network load balancing.

5. C. Trust allows users to be granted access to resources in a domain even when their accounts reside in a different domain.

6. D. Server Manager is a new single-source utility for installing, configuring, and managing roles on a Windows Server 2008 machine. Server Manager also will display server status and system information as well as identify problems with server roles.

7. A. Windows Server 2008 has a new security feature called Network Access Protection (NAP). Administrators can now define network access, based on client requirements, using NAP. The advantage of using NAP is that administrators can specify this access at the granular level.

8. D. Windows Server 2008 introduced a new type of secure domain controller called a read-only domain controller (RODC). A read-only domain controller is a noneditable copy of Active Directory. It allows an organization to place a domain controller in an area or off-site location that does not have much security.

9. B. A feature new to Microsoft servers is the Server Core installation. This allows an administrator to install Windows Server 2008 with minimal options. Server Core is a low-maintenance version of Windows Server 2008 and has limited functionality.

10. C. A DNS server is a server that handles hostname resolution. DNS can turn a hostname into a TCP/IP address (forward lookup) or turn a TCP/IP address into a hostname (reverse lookup).

11. C. Active Directory Rights Management Service (AD RMS) is included with Microsoft Windows Server 2008. This service allows administrators or users to determine what access (open, read, modify, etc.) they give to other users in an organization. This access can be used to secure email messages, internal websites, and documents. Organizations can use AD RMS for confidential or critical information.

12. A. A DHCP server is a machine that will automatically assign TCP/IP addresses to your users. Not only can DHCP assign the IP address, subnet mask, and default gateway, but it can also assign all TCP/IP users configurations.

13. D. The Global Catalog is a database of all Active Directory objects without all of the attributes and is thus a partial representation of the Active Directory objects.

14. A Replication ensures that information remains synchronized between domain controllers. Replication can be bidirectional or unidirectional (for RODCs).

15. A, B, C. Hyper-V can be installed on Enterprise, Standard, or Datacenter editions of Windows Server 2008. Web and Itanium editions cannot install Hyper-V.

16. C. DNS does hostname resolution. DNS is a requirement of Active Directory. DNS can be installed and configured in a Hyper-V environment.

17. B, C. Microsoft networking allows for peer-to-peer networks or domain-based networks.

18. D. The activation allows for 60 days initially, but you can reset your evaluation three more times (60 days each). This will allow an administrator or user to evaluate the product for up to 240 days. At the end of the 240 days, the Windows Server 2008 product will need to be uninstalled or a valid product key and activation will be required.

19. A, B, C, D. NAP gives administrators the ability to allow network access based on compliancy with corporate governance policies. Some of the new features associated with NAP are network layer protection, DHCP enforcement, VPN enforcement, IPSec enforcement, 802.1X enforcement, flexible host isolation.

20. A, B, D. By installing Server Core, you automatically create limitations: there is no Windows shell and limited GUI functionality, there is no managed code support, and MSI support is limited to unattend mode only.