

Hands-On Microsoft® Windows® Server 2016

Second Edition

Michael Palmer

Hands-On Microsoft® Windows® Server 2016

Michael Palmer



Australia • Brazil • Mexico • Singapore • United Kingdom • United States

**Hands-On Microsoft® Windows®
Server 2016**

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Dedication

I dedicate this book to Maria.

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Introduction

Hands-On Microsoft® Windows® Server 2016 is the perfect resource for learning Windows Server 2016 from the ground up. Designed to build a foundation in basic server administration, this book requires no previous server experience. It covers all of the critical Windows Server 2016 features, including the features unique to this new server operating system. You learn how to choose the right server edition for your needs, and you learn to install, configure, customize, manage, and troubleshoot your server. If you are new to server administration, this book gives you the knowledge you need to manage servers on small to large networks. If you are an experienced server administrator, the book provides a fast way to get up to speed on Windows Server 2016 administration.

The book offers you administrator skills to install and configure Windows Server 2016, use Active Directory, set up server resources for clients, configure and manage printing services, manage data storage, manage network services, configure remote access for clients, create a virtual server, establish strong security, monitor a server, and create a reliable server environment.

Each chapter is written for easy understanding and the book contains over 135 hands-on activities to make what you learn come alive. These activities give you the experience you need to truly learn Windows Server 2016 and retain what you have learned.

In addition to the hands-on activities, the book is filled with many learning aids to help you maximize what you learn. The objectives at the start of each chapter give you an overview of what you will be able to accomplish and can be used for a fast review of the chapter contents. At the end of each chapter, there are chapter summaries for more in-depth point-by-point review. There also are review questions and realistic case studies to enable you to stretch your learning. The case studies put you in the shoes of a Windows Server 2016 consultant who works in all kinds of situations fulfilling the needs of clients. Other learning tools include a list of key terms that you have encountered in the chapter and application examples provided throughout to help you understand different ways to use Windows Server 2016.

The goal when you complete this book is to give you the knowledge and confidence to be a capable server administrator. The book also provides a foundation for pursuing a Microsoft certification in Windows Server 2016 server administration.

Intended Audience

Hands-On Microsoft Windows Server 2016 is intended for anyone who wants to learn and practice using Windows Server 2016. It also can be used as a starting block in preparing for the Microsoft Server administrator certification exam track. No prior server operating system experience is required, but some basic experience with client systems, such as Windows 7, 8/8.1, or 10, is helpful.

New to this Edition

- Step-by-step hands-on activities for learning nearly every phase of Windows Server 2016, with all activities tested by a technical editor, reviewers, and validation experts
- Broad training in planning, installation, configuration, security, networking, monitoring, and troubleshooting of Windows Server 2016
- Coverage of features critical or new to Windows Server 2016, including using the graphical user interface, Windows Server Core, Nano Server, Windows PowerShell, Hyper-V, Server Manager, security features, network services, role services, monitoring tools, and much more
- An appendix to cover using Windows Server 2016 with Hyper-V virtualization
- An appendix showing Windows PowerShell command examples for managing and troubleshooting a server

Chapter Descriptions

The chapters are balanced to provide a similar amount of coverage. There are twelve chapters and two appendices. The beginning chapters introduce the Windows Server 2016 operating system, and show how to plan for, install, and configure Windows Server 2016. Because it can be vital to a server installation, you also learn about Active Directory in the early portion of the book. The middle chapters address how to configure key services, such as file and folder services, printing, data storage, network services, and remote access. The chapters at the end of the book focus on configuring security, server and network monitoring, and ensuring server reliability. The appendices provide supplementary information about using virtualization through Hyper-V and a full range of Windows PowerShell command examples you can use in your work.

- **Chapter 1, Introduction to Windows Server 2016**, explains and compares each of the Windows Server 2016 editions. The chapter discusses client systems that can be used with Windows Server 2016, identifies important features, reviews introductory networking concepts, and shows how to plan a network model to use.
- **Chapter 2, Installing Windows Server 2016**, discusses how to prepare for an installation, describes different installation methods (including using virtualization), and steps through an actual installation. The chapter additionally discusses how to implement Windows Server Core, how to implement Windows Deployment Services, how to install service packs, how to troubleshoot installation problems, and how to uninstall the operating system.
- **Chapter 3, Configuring the Windows Server 2016 Environment**, starts by familiarizing you with the Server Manager management tool. You also learn how to install and uninstall server roles, how to use the Best Practices Analyzer, configure hardware, and configure and tune the operating system. Other topics include using the System File Checker, understanding the Registry, and using Windows PowerShell.
- **Chapter 4, Introduction to Active Directory and Account Management**, presents an extensive introduction to Active Directory, including how to install and configure it. You additionally learn how to create Active Directory containers, and how to create and manage user accounts and security groups. The chapter additionally provides an introduction to Azure Active Directory for cloud services.
- **Chapter 5, Configuring, Managing, and Troubleshooting Resource Access**, teaches you how to manage folders and files, particularly in relation to setting up security. You learn how to create shared objects, such as folders, and how to publish them in Active Directory.

You additionally learn how to troubleshoot security issues, how to use work folders, how to implement the Distributed File System, and how to establish disk quotas.

- **Chapter 6, Configuring Windows Server 2016 Printing**, provides information about the inner workings of Windows Server 2016 printing, including how to install local, network, and Internet printers. You implement the Print and Document Services role and learn about the XPS Print Path. You discover how to manage print jobs and how to troubleshoot printing problems. You also learn to use the Print Management tool.
- **Chapter 7, Configuring and Managing Data Storage**, shows you how to use the Disk Management tool to configure basic and dynamic disks. You learn about RAID, Storage Spaces, and other disk storage and fault tolerance options. You also learn to perform backups and restores and how to troubleshoot storage problems.
- **Chapter 8, Managing Windows Server 2016 Network Services**, focuses on how to configure the essential services needed for a smooth functioning Windows Server 2016 network, including DNS, DHCP, and Internet Information Services (Web Server). You also learn about network interface card teaming and about the IP Address Management tool.
- **Chapter 9, Configuring Remote Access Services**, enables you to learn how to set up and troubleshoot Windows Server 2016 as a virtual private network (VPN) for remote access, such as from the Internet. You additionally learn how to set up and use a DirectAccess server and how to configure and manage Remote Desktop Services for running applications directly on the server.
- **Chapter 10, Securing Windows Server 2016**, shows you a wealth of new and time-tested security features. You learn how to configure security policies, set up Active Directory rights, manage security on clients, create security templates, encrypt files and folders, use the powerful BitLocker Drive Encryption, implement Network Address Translation, configure Windows Firewall, and implement the Windows Defender virus checking software.
- **Chapter 11, Server and Network Monitoring**, teaches you how to monitor a server and a network for troubleshooting and to prevent problems. You learn how to use monitoring tools such as Resource Monitor, the Services tool, Task Manager, Performance Monitor, Data Collector Sets, and the SNMP service. Many of these tools have been enhanced in Windows Server 2016 to offer more functionality.
- **Chapter 12, Managing System Reliability and Availability**, enables you to develop problem-solving strategies for handling server difficulties. You learn how to resolve boot problems, use the Advanced Boot Options, use repair tools on the installation DVD, protect critical systems, use and configure Event Viewer, troubleshoot network problems, and how to remotely administer one or more servers.
- **Appendix A, Windows Server 2016 Virtualization and Hyper-V**, provides a foundation for understanding virtualization and virtual machines. After you learn about virtualization, you learn the ins and outs of Hyper-V, which is virtualization software included with Windows Server 2016. You also learn about using Hyper-V with Windows 8.1 Professional and above and Windows 10 and above.
- **Appendix B, Sample Windows PowerShell Cmdlets**, gives you 60 sample Windows PowerShell cmdlet examples to help you learn how to use this powerful tool. The cmdlets are presented by topical areas: file processing, system-related, network, and security.

Features

To help you better understand how Microsoft Windows Server 2016 and network management concepts and techniques are applied in real-world organizations, this book includes the following learning features:

- **Chapter Objectives**—Each chapter begins with a detailed list of the concepts to be mastered. This list provides you with a quick reference to the chapter's contents and is a useful study aid.

- **Hands-On Activities**—Over 135 hands-on activities are incorporated throughout the text, giving you practice in setting up, managing, and troubleshooting a server. The activities give you a strong foundation for carrying out server administration tasks in the real world. Many of the activities present questions for you to investigate and answer, such as by recording your answers in a Microsoft Word file. This is intended to help retention and to provide a study aid that you can go back to.

For the activities in this book, you can obtain the free Windows Server 2016 evaluation installation DVD from Microsoft or make an installation DVD (or thumb drive) from an .iso file downloaded from Microsoft's download center website. Go to www.microsoft.com and search for downloads or click a link for downloads. Also, on a home or lab computer running Windows 8.1 Professional or above or Windows 10 Professional or above, you can use Hyper-V to create a Windows Server 2016 virtual machine running Windows Server 2016. You learn how to do this in Chapter 2, Installing Windows Server 2016, and in Appendix A, Windows Server 2016 Virtualization and Hyper-V.

- **Screen Captures, Illustrations, and Tables**—Numerous reproductions of screens and illustrations of concepts aid you in the visualization of theories, concepts, and how to use tools and desktop features. In addition, many tables provide details and comparisons of both practical and theoretical information and can be used for a quick review of topics. Some screen captures are cropped to emphasize the concept you are learning.
- **Chapter Summary**—Each chapter's text is followed by a summary of the concepts introduced in the chapter. These summaries provide a helpful way to recap and revisit the ideas covered in each chapter.
- **Key Terms**—All of the terms within the chapter that were introduced with boldfaced text are gathered together in the Key Terms list at the end of the chapter. This provides you with a method of checking your understanding of the terms introduced.
- **Review Questions**—The end-of-chapter assessment begins with a set of review questions that reinforce the ideas introduced in each chapter. Answering these questions will ensure that you have mastered the important concepts.
- **Case Projects**—Each chapter closes with a multipart case project. In this realistic case example, as a consultant at Aspen Consulting, you implement the skills and knowledge gained in the chapter through real-world setup and administration scenarios.

Text and Graphic Conventions

Additional information and exercises have been added to this book to help you better understand what's being discussed in the chapter. Icons throughout the text alert you to these additional materials. The icons used in this book are described below:



Tips offer extra information on resources, how to attack problems, and time-saving shortcuts.



Notes present additional helpful material related to the subject being discussed.



The Caution icon identifies important information about potential mistakes or hazards.



Each Hands-On Activity in this book is preceded by the Activity icon.



Case project icons mark the end-of-chapter case projects, which are scenario-based assignments that ask you to independently apply what you have learned in the chapter.

Instructor Resources

Everything you need for your course in one place! This collection of book-specific lecture and class tools is available online via www.cengage.com/login. Access and download PowerPoint presentations, the Instructor's Manual, and more.

- *Electronic Instructor's Manual*—The Instructor's Manual that accompanies this book includes additional instructional material to assist in class preparation, including suggestions for classroom activities, discussion topics, and additional quiz questions.
- *Solutions*—The instructor's resources include solutions to all end-of-chapter material, including review questions and case projects.
- *Cengage Testing Powered by Cognero*—This flexible, online system allows you to do the following:
 - Author, edit, and manage test bank content from multiple Cengage solutions.
 - Create multiple test versions in an instant.
 - Deliver tests from your LMS, your classroom, or wherever you want.
- *PowerPoint presentations*—This book comes with Microsoft PowerPoint slides for each chapter. They're included as a teaching aid for classroom presentation, to make available to students on the network for chapter review, or to be printed for classroom distribution. Instructors, please feel free to add your own slides for additional topics you introduce to the class.

System Requirements

Hardware Listed in the Windows Server Catalog or has the Windows Server 2016 Certified sticker on the hardware, including:

- 1.4 GHz CPU or faster 64-bit processor
- 512 MB RAM or more (more is better)
- 36 GB or more disk space (more is better)
- Optical drive or USB drive or both
- Super VGA or higher resolution monitor
- Mouse or pointing device
- Keyboard
- Network interface card connected to the classroom, lab, or school network for on-ground students—or Internet access (plus a network interface card installed) for online students
- Printer (optional, but helps to practice setting up a network printer)

Software Windows Server 2016 Standard or Datacenter Edition

Virtualization Windows Server 2016 can be loaded into a virtual server environment, such as Microsoft Hyper-V or VMware. You can download from Microsoft's download center a free copy of Hyper-V for your Windows 8.1 Professional or above personal computer. Hyper-V is included with Windows 10 Professional or above. Using Hyper-V, you can create a virtual machine in which to run Windows Server 2016. See Chapter 2 and Appendix B for details.

About the Author

Michael Palmer is an industry consultant and teacher who has written numerous networking and operating systems books, including best-selling books about Windows Server systems and UNIX/Linux. He holds a Ph.D. degree from the University of Colorado at Boulder and has worked over 30 years in higher education and in the industry as a teacher/professor, systems and networking specialist, technical manager, and consultant. He is president of CertQuick, which provides computer and network consulting services, technical authoring services, and computer science curriculum development for schools. Dr. Palmer is the author of many other books in the industry.

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Introduction to Windows Server 2016

After reading this chapter and completing the exercises, you will be able to:

- Identify the key features of each Windows Server 2016 edition
- Understand the hardware requirements for Windows Server 2016
- Identify client systems that can be used with Windows Server 2016
- Understand important general features of Windows Server 2016
- Plan a Windows Server 2016 networking model
- Explore introductory concepts for the networking protocols, IPv4 and IPv6, used by Windows Server 2016
- Configure and enable TCP/IP in Windows Server 2016

Microsoft Windows Server systems are at the core of information access, productivity, and entertainment all over the world. Chances are that you access a Windows server when you store and access data in the cloud, purchase music on the Internet, stream a movie, open a spreadsheet at work, watch a movie on a plane, or send an email. Windows Server 2016 is Microsoft's newest server platform that offers even more roles for servers, better security, easier server management, new desktop features, and more reliable computing than its predecessors.

This book is intended to give you a solid grounding in how to install, administer, and use Windows Server 2016 for all types of computing situations. In this chapter, you begin your journey by learning about the different Windows Server 2016 editions, from the industrial-strength Datacenter Edition to the more basic Essentials Edition. You also learn how Windows Server 2016 works in tandem with client desktop systems such as Windows 7, Windows 8, Windows 8.1, and Windows 10.

Windows Server 2016 incorporates many new features, which you learn about in this chapter and go on to master in later chapters. After exploring the features, you review the networking models used by Windows Server 2016, from peer-to-peer to server-based networking. Finally, you learn basic networking protocol concepts and configuration techniques for effective Windows Server 2016 networking.

Windows Server 2016 Editions

Servers have a wide variety of uses designed to match the needs of users from small businesses to international corporations. They are also finding their way into homes and home offices. Because one size does not fit all needs, it is important to offer different types of server operating systems. Windows Server 2016 comes in several versions. All versions are built on the same foundation but offer unique capabilities to suit a home office or a business with branches all over the world.

The main Windows Server 2016 platforms are as follows:

- Windows Server 2016 Essentials Edition
- Windows Server 2016 Standard Edition
- Windows Server 2016 Datacenter Edition

Additional Windows Server 2016 platforms that are targeted for specific-purpose niches at this writing include:

- Windows Server 2016 Multipoint Premium Server
- Windows Storage Server 2016
- Windows Hyper-V Server 2016

These platforms are discussed in the next sections.

Windows Server 2016 Essentials Edition

For a business or organization with up to 25 users, Windows Server 2016 Essentials Edition is a good option. Another reason to consider Essentials Edition is when your business is relatively small now, but you expect it to grow up to 25 users and you want a system that can grow in the future.

At this writing, Windows Server 2016 Essentials Edition supports a maximum of:

- 25 users
- 16.8 million connections for file sharing through Server Message Block (SMB) services
- 2 central processor sockets
- 50 Remote Desktop connections
- 50 Routing and Remote Access connections



Maximum capabilities are provided at this point to help you understand the differences between editions and how to select the right edition for a specific use.

Besides the limitations of 25 users and 50 devices, Windows Server 2016 Essentials Edition cannot join a domain, other than to migrate files and data from one server to another. A domain is used to centrally manage a large number of users, server applications, and multiple servers (you learn more about domains later in this chapter as well as in Chapter 4, Introduction to Active Directory and Account Management).

Further, Windows Server 2016 Essentials Edition provides most but not all server roles. For example, it does not provide a role for hosting virtual machines, which is the Hyper-V role (you learn about virtual machines in the Windows Server 2016 Standard Edition section of this chapter). This also means that the Essentials Edition cannot provide cloud services to an organization. Even though Windows Server 2016 Essentials Edition cannot host virtual machines, it can be installed in Hyper-V as one of many virtual machines.

Microsoft has implemented features to Server 2016 Essentials Edition (also available on higher editions) to make it particularly attractive to small businesses and organizations. These features include:

- User groups can be created to manage clients and client access to Microsoft Office 365.
- Backups and restores can use file history information for each user instead of only for each device.
- Size and growth of a server folder can be managed through a space quota.
- Installation can be on a standalone physical server or as a virtual machine (guest server) on a virtual server, which means it can be a guest operating system on another server that houses multiple guest operating systems.
- Server Health Reports are automatically installed to be available at the time Essentials Edition is installed.
- Mobile devices can be managed using Dashboard, which is a tool within Server Manager for simplified management of the server.
- BranchCache is available so that data can be accessed quickly on a server running Essentials Edition at an offsite location.

See Table 1-1 to compare Essentials Edition to the other main Windows Server 2016 editions.

Table 1-1 Maximums for the main Windows Server 2016 editions

Limitations	Essentials Edition	Standard Edition	Datacenter Edition
Maximum users	25	Limited only by the number of user licenses and processor cores	Limited only by the number of user licenses and processor cores
Maximum server RAM	64 GB	4 TB	4 TB
Maximum CPU sockets	2	64	64
Can join a domain	Only to enable migration	Yes	Yes
Maximum SMB connections	16.8 million	16.8 million	16.8 million
Maximum Routing and Remote Access connections	50	No limit	No limit
Support for Hyper-V	No support	Yes	Yes
Windows Server containers	No support	No limit	No limit
Hyper-V containers	No support	Up to 2	No limit

Windows Server 2016 Standard Edition

Windows Server 2016 Standard Edition is designed to meet the everyday needs of small to large businesses and organizations. Standard Edition provides file and print services, secure Internet connectivity, centralized management of users, and centralized management of applications and network resources. This platform is built on technology from previous Windows Server systems, such as Windows Server 2003 through Windows Server 2012 R2—but includes many new features. Also, the program coding of old features is constantly enhanced for security and efficiency.

A small company or a department in a larger company might use Windows Server 2016 Standard Edition to manage its accounting and payroll software, for example. A medium-sized or large company might use it to manage email or network resources. Small to large companies might use Standard Edition to manage users' access to application software, such as Office 365.

New features in Windows Server 2016 Standard Edition include:



These new features also apply to the Essentials Edition that is derived from the Standard Edition. Some of these features were introduced with Windows Server 2012 R2 but merit listing here as well.

- The Start button and Start menu are back in the desktop interface after being removed in Windows Server 2012 (the Start button returned in Windows Server 2012 R2 and the Start menu in Server 2016).
- Active Directory, which is the cornerstone database for managing users, applications, and networking, is easier to set up and has improved file security.
- A domain controller, which houses Active Directory, can be cloned to quickly create additional domain controllers.
- **Generic Routing Encapsulation (GRE) tunneling** to enable virtual private networks to go over external networks, including wide area networks (a private communications tunnel over a cable- or public telephone-based network, for example)
- **Desired State Configuration** is used to monitor specific server states and roles so that desired states don't change as other elements are changed on one or many servers in the same server pool.
- **Windows Defender** is automatically included as an antivirus and antimalware program.
- **Storage tiering** allows selected blocks of data to be moved to different storage locations, such as moving data from hard drive storage to solid state storage.
- **Storage pinning** works with storage tiering to enable you to move (and ensure they stay) specific files to a desired type of storage, such as ensuring that customer service files that require fast access are always kept in solid state storage.
- A new network controller role that provides information about the network structure, such as about protocol services, virtual private networks, and the physical structure of a network.
- **Parallel rebuild** that enables a failed disk in RAID (a set of disks for redundant storage) to be rebuilt significantly faster.
- **Virtual desktops**—which is a capability that is also a part of Windows 10—enables you to run different desktops side-by-side, such as having one desktop working with programming tools and another desktop using server administration tools.

Included with Standard Edition is **Hyper-V**. Hyper-V enables Windows Server 2016 to offer a **virtualization** environment, which is a way to run more than one operating system on a single computer at the same time. Historically, organizations have used multiple servers for different operating systems, such as one server for Windows Server 2016 and one for Linux. The disadvantage of this approach is the cost of multiple computers. In organizations that require tens or hundreds of servers, the hardware costs rise fast. Also, additional costs are associated with housing the computers in temperature-controlled computer rooms, including the cost of security and cooling the machines. Virtualization offers a way to cut costs by using fewer computers.

As you learn about virtualization, it is useful to make a distinction between virtual server and virtual machine. A computer running virtual server software, such as Hyper-V, is typically referred to as a **virtual server**, while each instance of an operating system running within the software is a **virtual machine**. A virtual server is considered the host and each virtual machine is a guest. For example, a host computer running Hyper-V might be home to two operating systems, Windows Server 2016 Standard Edition and Linux, both running as guests in a virtual server host. Each operating system is running in its own virtual machine, for a total of two virtual machines.

In Windows Server 2016, Hyper-V is improved on many fronts including faster cloning and migration of individual virtual machines. Also, Hyper-V virtual machine information is stored in a new file format that protects virtual machine information from being directly edited (such as by an attacker or inexperienced administrator).

New to Windows Server 2016 is the option to use containers. Containers enable applications to run in an isolated fashion with the ability to execute multiple applications on one computer system. There are two types of containers: Windows Server containers and Hyper-V containers. Windows Server containers use isolation through domain namespace capabilities and by isolating running processes. In Hyper-V, isolation is achieved because each container runs within a “lightweight” virtual machine. Standard Edition supports unlimited Windows Server containers and up to two Hyper-V containers. You learn more about containers later in the chapter.

In addition to containers, Standard Edition provides basic server elements that enable file and printer sharing, essential network services, application sharing, user authentication, and many other server services. Historically, Standard Edition has paved the way for Windows Server operating systems to use **symmetric multiprocessor (SMP) computers**, which are computers that use more than one processor.

For companies that develop their own software, all editions of Windows Server 2016 are compatible with the common language runtime used in Microsoft .NET Framework and Microsoft Visual Studio .NET, and Windows Server 2016 enables computer programmers to develop and use program code in several programming languages.

Another feature of Windows Server 2016 Standard Edition is clustering. **Clustering** is the ability to increase the access to server resources and provide fail-safe services by linking two or more discrete computer systems so they appear to function as one (see Figure 1-1). An immediate advantage of server clustering is the increase in computer speed or capacity to complete server tasks faster. Also, server clustering provides more computing power for handling resource-hungry applications. With clustering, as an organization adds more users and requires more demanding applications, one or more computers can be added to the cluster to handle the growth. This is a faster, less-expensive approach than having to purchase a larger computer and transfer users and applications to a new system because the old one is overwhelmed. Standard Edition supports clusters of up to 16 computers.



Windows Server 2016 clustering enhancements include Cloud Witness, which enables more integration with Microsoft Azure for cloud computing and the ability to migrate Windows Server 2012 R2 to Windows Server 2016 without having to take servers offline. There is also the ability to create workgroup clusters, clusters all in the same domain, or clusters in different domains. You learn about workgroups and domains later in this chapter.

Windows Server 2016 Standard Edition maximums include (see Table 1-1):

- Number of users limited only by the number of user licenses purchased and number of server cores
- Up to 16.8 million connections for file sharing through SMB services
- Up to 64 central processor sockets
- Number of Remote Desktop connections limited only by the number of user licenses purchased

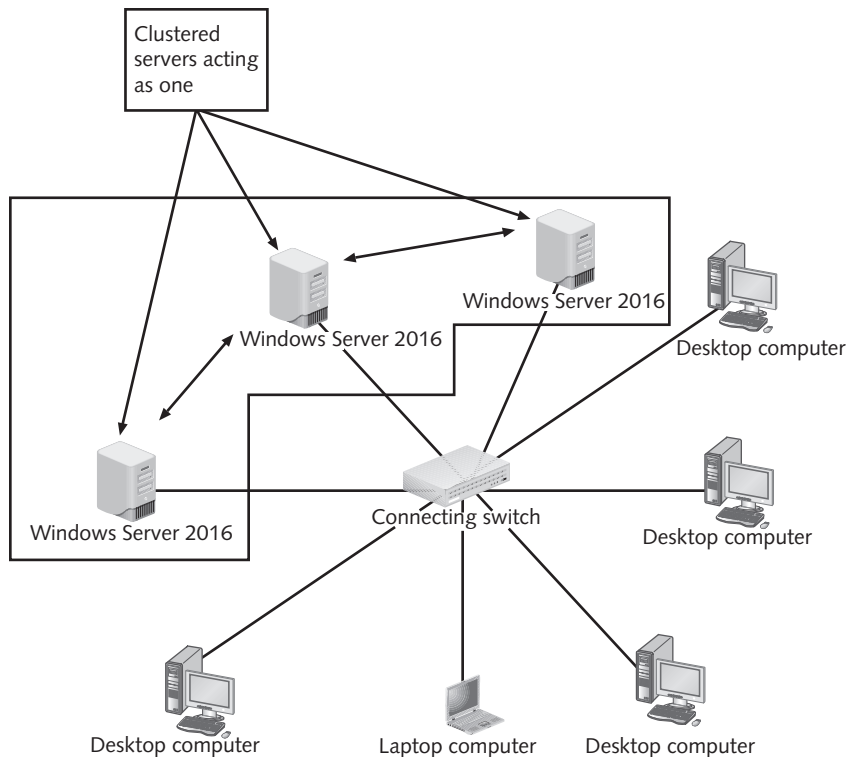


Figure 1-1 Three servers acting as one in a cluster

- Number of Routing and Remote Access connections limited only by the number of user licenses purchased
- No limit to the number of Windows Server containers and up to two Hyper-V containers

Windows Server 2016 Datacenter Edition

Windows Server 2016 Datacenter Edition is designed for environments with mission-critical applications, very large databases, very large virtualization requirements, cloud computing needs, and information access requiring high availability. This platform offers support for clustering with up to 64 computers. As with Standard Edition, Datacenter Edition uses SMP computers supporting up to 64 processor sockets.

The RAM capabilities for the Datacenter Edition are identical to Standard Edition, supporting up to 4 TB. The maximums for Datacenter Edition are (see Table 1-1):

- Number of users limited only by the number of user licenses purchased and number of server cores
- Up to 16.8 million connections for file sharing through SMB services
- Up to 64 central processor sockets
- Number of Remote Desktop connections limited only by the number of user licenses purchased
- Number of Routing and Remote Access connections limited only by the number of user licenses purchased
- No limit to the number of Windows Server containers and Hyper-V containers

The new features in Windows Server 2016 Standard Edition also apply to Datacenter Edition. The differences between the two editions focus on Datacenter Edition's industrial strength capabilities in the areas of virtualization, cloud computing, and database handling—which can all be interlinked on a massive scale. For example, Standard Edition supports only two virtual machines, whereas Datacenter Edition's support for virtual machines is limited only by the hardware resources and operating system licenses that you own—thus it is practically unlimited.

Windows Server 2016 Datacenter Edition does not come with database software, such as Microsoft SQL Server, but it is designed to provide the operating system resources to accommodate large database applications in any organization. A university alumni association might use it to house a database that tracks information on thousands of alumni all over the world. A large company, such as an automobile manufacturer, might use it for an integrated accounting system that stores information in a complex database. A national investment firm might use it to track and manage the investment holdings of its customers. Furthermore, with Datacenter Edition, such large databases can be tied into massive virtualization and cloud environments.

Windows Server 2016 Multipoint Premium Server

Multipoint services enable many users to share the same physical computer through each person connecting a keyboard, monitor, and mouse to a USB hub that is connected to a server. This approach, for example, might be used to connect users in a computer lab at a school.

Windows Server 2016 Multipoint Premium Server is offered to educational customers as a way to provide volume licensing for multipoint services. The Multipoint Services role is included as a regular server role in Windows Server 2016 Standard and Datacenter Editions. However, some educational institutions require volume licensing to run multiple computer labs, for example, and Windows Server 2016 Multipoint Premium Server fulfills this need.

Windows Storage Server 2016

Original equipment manufacturers (OEMs) that focus on storage solutions for organizations can offer Windows Storage Server 2016 on the server-based products they sell. Windows Storage Server 2016 turns a server into a central storage center for data in an organization and takes advantage of the storage utilities offered in Windows Server 2016. To learn more about the storage services, see Chapter 7, Configuring and Managing Data Storage.

Microsoft Hyper-V Server 2016

At this writing, Microsoft Hyper-V Server 2016 is a free download of a basic server system that enables you to use Hyper-V. You might use this if you want to learn more about how Hyper-V works or to set up a basic Hyper-V system, such as to load Windows Server Standard Edition into a virtual machine that is dedicated as a simple file and print server or as a DNS server.

Hardware Requirements for Windows Server 2016

Before you install any Windows Server 2016 edition, carefully consider the hardware needs for your installation. Table 1-2 lists the minimum hardware requirements, which is only a starting place. Your server installation should be planned on the basis of what you need to do with the server. Here are some general questions to consider:

- What role or roles will the server have in your organization? For example, is this a small business limited to file and printer sharing? Are you implementing a web server or an email server? Will your server offer remote access or will it be a source of applications for users?
- Do you need to deploy virtual machines, and if so how many? (Hyper-V will need a CPU that supports hardware virtualization, see Appendix A, Windows Server 2016 Virtualization and Hyper-V.)
- What databases will be used and how large are they?
- Will the server offer image libraries or multimedia to users?
- How many local and remote users are to be supported?
- What kind of support is needed from the hardware vendor?
- What redundancy features are needed to ensure the server continues running in the event of a hardware failure, such as a failed disk drive, power supply, or network interface card?
- What growth in server use and resources is expected in the next 3 to 5 years?

Table 1-2 Minimum hardware requirements for Windows Server 2016

Hardware	Minimums	Additional considerations
CPU	1.4 GHz 64-bit processor (includes support for NX, DEP, CMPXCHG16b, LAHF/SAHF, EPT, or NPT)	Processor clock speed, amount of processor cache, number of processor cores (more than one is needed for virtualization), and a processor that supports hardware virtualization for Hyper-V implementations
RAM	512 MB (2 GB for a server with the GUI desktop)	Each virtual machine requires 800 MB for setup (although this can be scaled back after setup is complete)
Hard disk	32 GB	32 GB is enough for using Server Core (command line installation) with web services, 36 GB is the minimum for installing the GUI mode
Network interface card	1 gigabit Ethernet adapter (such as 10/100/1000baseT) that is compatible with PCI Express architecture and Pre-boot Execution Environment (PXE)	Additional adapters are recommended for multiple virtual machines
Optical drive	DVD drive	DVD drive is needed (for installations from DVD media) or a USB drive can be used for installation from a thumb drive
Display	Super VGA at 1024 × 768 or higher resolution	Multiple servers can share one display via the use of a switch box
Interactive devices	Keyboard and pointing device	Multiple servers can share a keyboard and pointing device via the use of a switch box

These questions only provide a starting point for your planning. In a small business, much of the planning can be done with the help of the business owner. In medium and large businesses, the planning will likely require input from management, user departments, technical people, software providers, and hardware vendors.



You can do the hands-on activities in this book from a Windows Server 2016 server with or without virtualization. If you are not working from a virtual machine, just follow the steps as written. If you are using a virtual machine, such as in Hyper-V, you first need to access the server from within the virtual environment or over a network. The following steps show how to start and access a Hyper-V virtual server that is already installed on the local server and how to sign in to a virtual machine within the virtual server. You learn how to install a virtual server in Microsoft Hyper-V in Chapter 2, *Installing Windows Server 2016*.

Virtual Activity

To access a virtual server in Microsoft Hyper-V, follow these general steps:

1. Click Start, click Windows Administrative Tools, and click Hyper-V Manager.
2. In the Hyper-V Manager window under Virtual Machines, click the virtual machine (server), such as Windows Server 2016.
3. If the server is not already started (State is Off), click the Action menu and click Start as shown in Figure 1-2 (otherwise skip to Step 5). Note that some figures, such as this one, are cropped at the bottom or top for emphasis.
4. Wait for the server to start up.

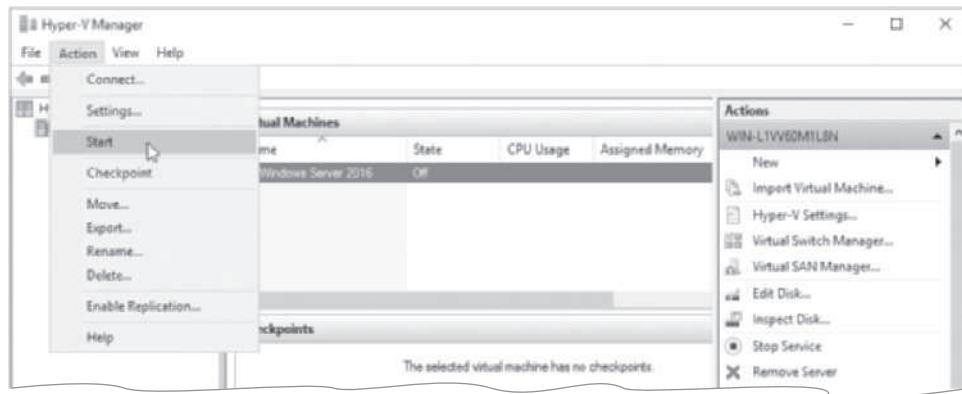


Figure 1-2 Starting a virtual machine in Hyper-V Manager

5. Right-click the name of the server and click **Connect** to open its working window, which is the Virtual Machine Connection window.
6. If you see the screen that says Press CTRL+ALT+DELETE to sign in (don't press CTRL+ALT+DELETE yet), click the Action menu under the title bar and click CTRL+ALT+DELETE.
7. Sign in using your account and password.
8. Click the Maximize square in the upper-right corner of the window to go into the full screen mode or use the View menu and select Full Screen Mode.
9. Whenever you are finished (and signed out of your account) and want to leave the full screen mode, click the Restore Down icon (two tiled squares) in the title bar at the top of the screen (as you would to go back to windowed mode in any application).
10. Close the Virtual Machine Connection window.
11. In the Hyper-V Manager window, if you want to shut down the server, select the server, click the Action menu, and click Shut Down to properly shut down the server. If you see the Shut Down Machine box asking if you are sure you want to shut down, click Shut Down.
12. Close Hyper-V Manager.



NOTE

Some steps in the activities in this book include bulleted questions for you to answer. Plan to record your answers in a Microsoft Word document, in a course journal, in your class notes, or in the book margins for later personal reference or for your instructor to see. Additionally, for all of the activities in this chapter, you'll need an account with Administrator privileges. These activities can be completed on a virtual machine or computer, such as in Hyper-V.



ACTIVITY

Activity 1-1: Determining the Windows Server 2016 Edition

Time Required: Approximately 5 minutes

Objective: Determine the Windows Server 2016 edition installed on a computer.

Description: A computer room might have only a few or hundreds of servers. Sometimes it is important for a server administrator to verify which edition of Windows Server 2016 is running on a particular server. In this activity, you learn how to make a quick determination. You will need a server account provided by your instructor or server administrator.

1. Sign in to Windows Server 2016 using your account.
2. If Server Manager is not already open, click **Start** and click the **Server Manager** tile (or click **Start** and click **Server Manager** under S in the listing of selections).
3. Click **Local Server** in the left pane of Server Manager (see Figure 1-3).