

DON POULTON  
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# **MCSA 70-410 Cert Guide: Installing and Configuring Windows Server 2012 R2**

Don Poulton  
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# **MCSA 70-410 Cert Guide: Installing and Configuring Windows Server 2012 R2**

**Don Poulton**  
**David Camardella**

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**Answers to Practice Exam 2**

**Appendix B Memory Tables**

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## About the Authors

**Don Poulton** (A+, Network+, Security+, MCSA, MCSE) is an independent consultant who has been involved with computers since the days of 80-column punch cards. After more than 20 years in environmental science, Don switched careers and trained as a Windows NT 4.0 MCSE. He has been involved in consulting with a couple of small training providers as a technical writer, during which time he wrote training and exam prep materials for Windows NT 4.0, Windows 2000, and Windows XP. Don has written or contributed to several titles, including *Security+ Lab Manual* (Que, 2004); *MCSA/MCSE 70-299 Exam Cram 2: Implementing and Administering Security in a Windows 2003 Network* (Exam Cram 2) (Que, 2004); *MCSE 70-294 Exam Prep: Planning, Implementing, and Maintaining a Microsoft Windows Server 2003 Active Directory Infrastructure* (Que, 2006); *MCTS 70-620 Exam Prep: Microsoft Windows Vista, Configuring* (Que, 2008); *MCTS 70-680 Cert Guide: Microsoft Windows 7, Configuring* (Que, 2011); *MCTS 70-640 Cert Guide: Windows Server 2008 Active Directory, Configuring* (Que, 2011); *MCTS 70-642 Cert Guide: Windows Server 2008 Network Infrastructure, Configuring* (Que, 2012); and *MCSA 70-687 Cert Guide: Configuring Microsoft Windows 8.1* (Que, 2014).

In addition, he has worked on programming projects, both in his days as an environmental scientist and more recently with Visual Basic to update an older statistical package used for multivariate analysis of sediment contaminants.

When not working on computers, Don is an avid amateur photographer who has had his photos displayed in international competitions and published in magazines such as *Michigan Natural Resources Magazine* and *National Geographic Traveler*. Don also enjoys traveling and keeping fit.

Don lives in Burlington, Ontario, with his wife, Terry.

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David's experience includes managing a North American datacenter, branch office server rooms, LAN/WLAN/WAN infrastructures, Active Directory/Messaging infrastructures, private clouds, and client computing systems.

Over the years, David has performed technical editing for several Microsoft and Cisco books. He holds a bachelor of science in business management as well as several levels of IT certifications, including MCSE.

In his spare time, David enjoys spending time with his family and engaging in outdoor activities and home brewing.

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## Dedication

*I would like to dedicate this book to my wife Terry, who has stood by my side and encouraged me throughout the days spent writing this book. This project would not have been possible without her love and support.*

—Don Poulton

*I would like to dedicate this book to my family. I give thanks to my parents for instilling core values in me, to my wife for her continued love and support, and to my children who inspire me to succeed.*

—Dave Camardella

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—Don Poulton

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—Dave Camardella

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## Introduction

The *MCSA Installing and Configuring Windows Server 2012 Cert Guide* (Exam 70-410) is designed for individuals responsible for designing, implementing, configuring, or administering Windows Desktop/Server infrastructures. The *Cert Guide* contains materials needed to install and configure Windows Server 2012 R2. It is structured to prepare those pursuing the Microsoft Certified Solutions Associate (MCSA) or Microsoft Certified Solutions Expert (MCSE) certification for Windows Server 2012 R2.

This book covers the “Installing and Configuring Windows Server 2012” exam (70-410), the first of three exams under the MCSA certification track. For those working toward the MCSE certification, the 70-410 exam is the first of five exams required. The exam is designed to measure your skill and ability to install and configure Windows Server 2012 R2, roles and features, Hyper-V, Active Directory, Group Policy, DNS, and other core network services. Microsoft not only tests you on your knowledge of the server operating system, but also has purposefully developed questions on the exam that force you to solve problems in the same way you would when presented with scenarios or issues supporting an organization. Passing this exam demonstrates your competency to install and configure all editions of Windows Server 2012 R2.

This book covers all the objectives that Microsoft has established for exam 70-410. It doesn’t offer end-to-end coverage of the Windows Server 2012 R2 operating system; rather, it helps you develop the specific core competencies you need to master as an administrator or engineer.

## Goals and Methods

The number-one goal of this book is a simple one: to help you pass the 70-410 Certification Exam and thereby earn the first requirement toward the MCSA or MCSE certification. Because Microsoft certification exams stress problem-solving abilities and reasoning more than memorization of terms and facts, our goal is to help you master and understand the required objectives for the 70-410 exam.

To aid you in mastering and understanding the MCTS certification objectives, this book uses the following methods:

- **Opening Topics List:** This defines the topics to be covered in the chapter.
- **Do I Know This Already? Quizzes:** At the beginning of each chapter is a quiz. The quizzes, and answers/explanations (found in Appendix A), are meant to gauge your knowledge of the subjects. If the answers to the questions don’t come readily to you, be sure to read the entire chapter.

- **Foundation Topics:** The heart of the chapter. Explains the topics from a hands-on and a theory-based standpoint. This includes in-depth descriptions, tables, and figures geared to build your knowledge so that you can pass the exam. The chapters are broken down into several topics each.
- **Key Topics:** The key topics indicate important figures, tables, and lists of information that you should know for the exam. They are interspersed throughout the chapter and are listed in table form at the end of the chapter.
- **Memory Tables:** These can be found on the CD-ROM within Appendix B, “Memory Tables.” Use them to help memorize important information.
- **Key Terms:** Key terms without definitions are listed at the end of each chapter. Write down the definition of each term and check your work against the complete key terms in the glossary.

### Study and Exam Preparation Tips

It’s a rush of adrenaline during the final day before an exam. If you’ve scheduled the exam on a workday, or following a workday, you will find yourself cursing the tasks you normally cheerfully perform because the back of your mind is telling you to read just a bit more, study another scenario, practice another skill so that you will be able to get this exam out of the way successfully.

### Learning Styles

To best understand the nature of preparation for the test, it is important to understand learning as a process. You are probably aware of how you best learn new material. You might find that outlining works best for you, or, as a visual learner, you might need to “see” things. Or, as a person who studies kinesthetically, the hands-on approach serves you best. Whether you might need models or examples, or maybe you just like exploring the interface, or whatever your learning style, solid test preparation works best when it takes place over time. Obviously, you shouldn’t start studying for a certification exam the night before you take it; it is very important to understand that learning is a developmental process. Understanding learning as a process helps you focus on what you know and what you have yet to learn.

People study in a combination of different ways: by doing, by seeing, and by hearing and writing. This book’s design fulfills all three of these study methods. For the kinesthetic, there are key topics scattered throughout each chapter. You will also discover step-by-step procedural instructions that walk you through the skills you need to master in Windows Server 2012 R2. The visual learner can find plenty of screen shots explaining the concepts described in the text. The auditory learner can

reinforce skills by reading out loud and copying down key concepts and exam tips scattered throughout the book. You can also practice writing down the meaning of the key terms defined in each chapter, and in completing the memory tables for most chapters found on the accompanying CD-ROM. While reading this book, you will realize that it stands the test of time. You will be able to turn to it over and over again.

Thinking about how you learn should help you recognize that learning takes place when you are able to match new information to old. You have some previous experience with computers and networking. Now you are preparing for this certification exam. Using this book, software, and supplementary materials will not just add incrementally to what you know; as you study, the organization of your knowledge actually restructures as you integrate new information into your existing knowledge base. This leads you to a more comprehensive understanding of the tasks and concepts outlined in the objectives and of computing in general. Again, this happens as a result of a repetitive process rather than a singular event. If you keep this model of learning in mind as you prepare for the exam, you will make better decisions concerning what to study and how much more studying you need to do.

## **Study Tips**

There are many ways to approach studying, just as there are many different types of material to study. However, the tips that follow should work well for the type of material covered on Microsoft certification exams.

## **Study Strategies**

Although individuals vary in the ways they learn information, some basic principles of learning apply to everyone. You should adopt some study strategies that take advantage of these principles. One of these principles is that learning can be broken into various depths. Recognition (of terms, for example) exemplifies a rather surface level of learning in which you rely on a prompt of some sort to elicit recall. Comprehension or understanding (of the concepts behind the terms, for example) represents a deeper level of learning than recognition. The ability to analyze a concept and apply your understanding of it in a new way represents further depth of learning.

Your learning strategy should enable you to know the material at a level or two deeper than mere recognition. This will help you perform well on the exams. You will know the material so thoroughly that you can go beyond the recognition-level types of questions commonly used in fact-based multiple-choice testing. You will be able to apply your knowledge to solve new problems.

## Macro and Micro Study Strategies

One strategy that can lead to deep learning includes preparing an outline that covers all the objectives and subobjectives for the particular exam you are planning to take. You should delve a bit further into the material and include a level or two of detail beyond the stated objectives and subobjectives for the exam. Then you should expand the outline by coming up with a statement of definition or a summary for each point in the outline.

An outline provides two approaches to studying. First, you can study the outline by focusing on the organization of the material. You can work your way through the points and subpoints of your outline, with the goal of learning how they relate to one another. For example, you should be sure you understand how each of the main objective areas for Exam 70-410 is similar to and different from one another. Then you should do the same thing with the subobjectives; you should be sure you know which subobjectives pertain to each objective area and how they relate to one another.

Next, you can work through the outline, focusing on learning the details. You should memorize and understand terms and their definitions, facts, rules and tactics, advantages and disadvantages, and so on. In this pass through the outline, you should attempt to learn detail rather than the big picture (that is, the organizational information that you worked on in the first pass through the outline).

Research has shown that attempting to assimilate both types of information at the same time interferes with the overall learning process. If you separate your studying into these two approaches, you will perform better on the exam.

## Active Study Strategies

The process of writing down and defining objectives, subobjectives, terms, facts, and definitions promotes a more active learning strategy than merely reading the material does. In human information-processing terms, writing forces you to engage in more active encoding of the information. Simply reading over the information leads to more passive processing. Using this study strategy, you should focus on writing down the items highlighted in the book: bulleted or numbered lists, key topics, notes, cautions, and review sections, for example.

You need to determine whether you can apply the information you have learned by attempting to create examples and scenarios on your own. You should think about how or where you could apply the concepts you are learning. Again, you should write down this information to process the facts and concepts in an active fashion.

## Best Practice Strategies

You should follow best practices when studying: You should study when you are alert, reduce or eliminate distractions, and take breaks when you become fatigued.

### Pretesting Yourself

Pretesting enables you to assess how well you are learning. One of the most important aspects of learning is what has been called *meta-learning*. Meta-learning has to do with realizing when you know something well or when you need to study some more. In other words, you recognize how well or how poorly you have learned the material you are studying.

For most people, this can be difficult to assess. Memory tables, practice questions, and practice tests are useful in that they reveal objectively what you have learned and what you have not learned. You should use this information to guide review and further studying. Developmental learning takes place as you cycle through studying, assessing how well you have learned, reviewing, and assessing again until you feel you are ready to take the exam.

You might have noticed the practice exam included in this book. You should use it as part of the learning process. The Pearson IT Certification Practice Exam test-simulation software included on this book's CD-ROM also provides you with an excellent opportunity to assess your knowledge.

You should set a goal for your pretesting. A reasonable goal would be to score consistently in the 90% range.

### Exam Prep Tips

After you have mastered the subject matter, the final preparatory step is to understand how the exam will be presented. Make no mistake: A Microsoft Certified Solutions Associate (MCSA) or Microsoft Certified Solutions Expert (MCSE) exam challenges both your knowledge and your test-taking skills. Preparing for the 70-410 exam is a bit different from preparing for those old Microsoft exams. The following is a list of things that you should consider doing:

- **Combine Your Skill Sets into Solutions:** In the past, exams would test whether you knew to select the right letter of a multiple-choice answer. Today, you need to know how to resolve a problem that might involve different aspects of the material covered. For example, on exam 70-410, you could be presented with a problem that requires you to understand how to install and configure the Hyper-V role, as well as identify symptoms caused by improperly configured virtual machine settings. Being able to zero in on what caused the problem and then resolve it for a specific situation is what you need to

demonstrate. In fact, you should not only be able to select one answer, but also multiple parts of a total solution.

- **Delve into Excruciating Details:** The exam questions incorporate a great deal of information in the scenarios. Some of the information is ancillary: It will help you rule out possible issues, but not necessarily resolve the answer. Some of the information simply provides you with a greater picture, as you would have in real life. Some information is key to your solution.
- **TCP/IP Troubleshooting Is Built Right In:** Because TCP/IP is a core technology to the Windows 2012 R2 operating system, you are expected to know the fundamentals of Subnetting, DHCP, how to recognize IP conflicts, and how to use the TCP/IP tools to troubleshoot the problem. Furthermore, Microsoft expects you to know how to work with the new version 6 of TCP/IP along with the traditional version 4 that has been used for many years. You should also be able to discern between an IP problem and something wrong with the OS or hardware, or even some combination that involves IP along with some other element.
- **It's a GUI Test:** You should be able to recognize each dialog box, properties sheet, options, and defaults. You will be tested on recognizing specific configurations given a dialog box or screenshot of one or more consoles or MMC snap-ins. Be prepared to be presented with scenario-based questions that you must answer given an image or dialog of an existing configuration. Microsoft may present a multi part solution where multiple answers representing each step must be selected. For example, you could be given a question asking you to configure a storage pool containing the maximum usable storage. You could be presented with an image showing the existing server disk configuration as shown in disk management.
- **Practice with a Time Limit:** The tests have always been time restricted, but it takes more time to read and understand the scenarios now and time is a whole lot tighter. To get used to the time limits, test yourself with a timer. Know how long it takes you to read scenarios and select answers.

## Microsoft 70-410 Exam Topics

The following list outlines the 70-410 exam objectives and weight each section carries:

### Install and configure servers (15%–20%)

- **Install servers:** Plan for a server installation, plan for server roles, plan for a server upgrade, install Server Core, optimize resource utilization by using Features on Demand, migrate roles from previous versions of Windows Server

- **Configure servers:** Configure Server Core, delegate administration, add and remove features in offline images, deploy roles on remote servers, convert Server Core to/from full GUI, configure services, configure NIC teaming, install and configure Windows PowerShell Desired State Configuration (DSC)
- **Configure local storage:** Design storage spaces, configure basic and dynamic disks, configure master boot record (MBR) and GUID partition table (GPT) disks, manage volumes, create and mount virtual hard disks (VHDs), configure storage pools and disk pools, create storage pools by using disk enclosures

### Configure server roles and features (15%–20%)

- **Configure file and share access:** Create and configure shares, configure share permissions, configure offline files, configure NTFS permissions, configure access-based enumeration (ABE), configure Volume Shadow Copy Service (VSS), configure NTFS quotas, create and configure Work Folders
- **Configure print and document services:** Configure the Easy Print print driver, configure Enterprise Print Management, configure drivers, configure printer pooling, configure print priorities, configure printer permissions
- **Configure servers for remote management:** Configure WinRM, configure down-level server management, configure servers for day-to-day management tasks, configure multiserer management, configure Server Core, configure Windows Firewall, manage non-domain joined servers

### Configure Hyper-V (15%–20%)

- **Create and configure virtual machine settings:** Configure dynamic memory, configure smart paging, configure Resource Metering, configure guest integration services, create and configure Generation 1 and 2 virtual machines, configure and use enhanced session mode, configure RemoteFX
- **Create and configure virtual machine storage:** Create VHDs and VHDX, configure differencing drives, modify VHDs, configure pass-through disks, manage checkpoints, implement a virtual Fibre Channel adapter, configure storage Quality of Service
- **Create and configure virtual networks:** Configure Hyper-V virtual switches, optimize network performance, configure MAC addresses, configure network isolation, configure synthetic and legacy virtual network adapters, configure NIC teaming in virtual machines

### Deploy and configure core network services (15%–20%)

- **Configure IPv4 and IPv6 addressing:** Configure IP address options, configure IPv4 or IPv6 subnetting, configure supernetting, configure interoperability between IPv4 and IPv6, configure Intra-site Automatic Tunnel Addressing Protocol (ISATAP), configure Teredo
- **Deploy and configure Dynamic Host Configuration Protocol (DHCP) service:** Create and configure scopes, configure a DHCP reservation, configure DHCP options, configure client and server for PXE boot, configure DHCP relay agent, authorize DHCP server
- **Deploy and configure DNS service:** Configure Active Directory integration of primary zones, configure forwarders, configure Root Hints, manage DNS cache, create A and PTR resource records

### Install and administer Active Directory (15%–20%)

- **Install domain controllers:** Add or remove a domain controller from a domain, upgrade a domain controller, install Active Directory Domain Services (AD DS) on a Server Core installation, install a domain controller from Install from Media (IFM), resolve DNS SRV record registration issues, configure a global catalog server, deploy Active Directory infrastructure as a service (IaaS) in Microsoft Azure
- **Create and manage Active Directory users and computers:** Automate the creation of Active Directory accounts; create, copy, configure, and delete users and computers; configure templates; perform bulk Active Directory operations; configure user rights; offline domain join; manage inactive and disabled accounts
- **Create and manage Active Directory groups and organizational units (OUs):** Configure group nesting; convert groups, including security, distribution, universal, domain local, and domain global; manage group membership using Group Policy; enumerate group membership; delegate the creation and management of Active Directory objects; manage default Active Directory containers; create, copy, configure, and delete groups and OUs

### Create and manage Group Policy (15%–20%)

- **Create Group Policy objects (GPOs):** Configure a Central Store, manage starter GPOs, configure GPO links, configure multiple local Group Policies
- **Configure security policies:** Configure User Rights Assignment, configure Security Options settings, configure Security templates, configure Audit Policy, configure Local Users and Groups, configure User Account Control (UAC)

- **Configure application restriction policies:** Configure rule enforcement, configure AppLocker rules, configure Software Restriction Policies
- **Configure Windows Firewall:** Configure rules for multiple profiles using Group Policy; configure connection security rules; configure Windows Firewall to allow or deny applications, scopes, ports, and users; configure authenticated firewall exceptions; import and export settings

Table I-1 lists the book chapters in which each exam topic is covered.

**Table I-1** Microsoft 70-410 Exam Topics

Chapter	Title	70-410 Exam Topics Covered	70-410 Exam Topic Details
Chapter 1	Introducing Windows Server 2012 R2	Install servers	Plan for a server installation, plan for server roles, plan for a server upgrade, optimize resource utilization by using Features on Demand, migrate roles from previous versions of Windows Server
		Configure servers	Convert Server Core to/from full GUI
Chapter 2	Installing and Configuring Windows Server 2012 R2	Install servers	Install Server Core
		Configure servers	Configure Server Core, delegate administration, add and remove features in offline images, deploy roles on remote servers, configure services, configure NIC teaming, install and configure Windows PowerShell Desired State Configuration (DSC)
Chapter 3	Configuring Windows Server 2012 R2 Local Storage	Configure local storage	Design storage spaces, configure basic and dynamic disks, configure master boot record (MBR) and GUID partition table (GPT) disks, manage volumes, create and mount virtual hard disks (VHDs), configure storage pools and disk pools, create storage pools by using disk enclosures

Chapter 4	Configuring Access to Files and Shares	Configure file and share access	Create and configure shares, configure share permissions, configure offline files, configure NTFS permissions, configure access-based enumeration (ABE), configure Volume Shadow Copy Service (VSS), configure NTFS quotas, create and configure Work Folders
Chapter 5	Configuring and Monitoring Print and Document Services	Configure print and document services	Configure the Easy Print print driver, configure Enterprise Print Management, configure drivers, configure printer pooling, configure print priorities, configure printer permissions
Chapter 6	Configuring Remote Management of Servers	Configure servers for remote management	Configure WinRM, configure down-level server management, configure servers for day-to-day management tasks, configure multiserer management, configure Server Core, configure Windows Firewall, manage non-domain joined servers
Chapter 7	Configuring Hyper-V	Create and configure virtual machine settings	Configure dynamic memory, configure smart paging, configure Resource Metering, configure guest integration services, create and configure Generation 1 and 2 virtual machines, configure and use enhanced session mode, configure RemoteFX
Chapter 8	Creating and Configuring Virtual Machine Storage	Create and configure virtual machine storage	Create VHDs and VHDX, configure differencing drives, modify VHDs, configure pass-through disks, manage checkpoints, implement a virtual Fibre Channel adapter, configure storage Quality of Service
Chapter 9	Creating and Configuring Virtual Networks	Create and configure virtual networks	Configure Hyper-V virtual switches, optimize network performance, configure MAC addresses, configure network isolation, configure synthetic and legacy virtual network adapters, configure NIC teaming in virtual machines

Chapter 10	Configuring IPv4 and IPv6 Addressing	Configure IPv4 and IPv6 addressing	Configure IP address options, configure IPv4 or IPv6 subnetting, configure supernetting, configure interoperability between IPv4 and IPv6, configure Intra-site Automatic Tunnel Addressing Protocol (ISATAP), configure Teredo
Chapter 11	Configuring Dynamic Host Configuration Protocol (DHCP)	Deploy and configure Dynamic Host Configuration Protocol (DHCP) service	Create and configure scopes, configure a DHCP reservation, configure DHCP options, configure client and server for PXE boot, configure DHCP relay agent, authorize DHCP server
Chapter 12	Deploying and Configuring Domain Name System (DNS)	Deploy and configure DNS service	Configure Active Directory integration of primary zones, configure forwarders, configure Root Hints, manage DNS cache, create A and PTR resource records
Chapter 13	Installing Domain Controllers	Install domain controllers	Add or remove a domain controller from a domain, upgrade a domain controller, install Active Directory Domain Services (AD DS) on a Server Core installation, install a domain controller from Install from Media (IFM), resolve DNS SRV record registration issues, configure a global catalog server, deploy Active Directory infrastructure as a service (IaaS) in Microsoft Azure
Chapter 14	Active Directory User and Computer Accounts	Create and manage Active Directory users and computers	Automate the creation of Active Directory accounts; create, copy, configure, and delete users and computers; configure templates; perform bulk Active Directory operations; configure user rights; offline domain join; manage inactive and disabled accounts

Chapter 15	Active Directory Groups and Organizational Units (OUs)	Create and manage Active Directory groups and organizational units (OUs)	Configure group nesting; convert groups, including security, distribution, universal, domain local, and domain global; manage group membership using Group Policy; enumerate group membership; delegate the creation and management of Active Directory objects; manage default Active Directory containers; create, copy, configure, and delete groups and OUs
Chapter 16	Creating and Applying Group Policy Objects	Create Group Policy objects (GPOs)	Configure a Central Store, manage starter GPOs, configure GPO links, configure multiple local Group Policies
Chapter 17	Configuring Security Policies	Configure security policies	Configure User Rights Assignment, configure Security Options settings, configure Security templates, configure Audit Policy, configure Local Users and Groups, configure User Account Control (UAC)
Chapter 18	Configuring Application Restriction Policies	Configure application restriction policies	Configure rule enforcement, configure AppLocker rules, configure Software Restriction Policies
Chapter 19	Configuring Windows Firewall	Configure Windows Firewall	Configure rules for multiple profiles using Group Policy; configure connection security rules; configure Windows Firewall to allow or deny applications, scopes, ports, and users; configure authenticated firewall exceptions; import and export settings

## How This Book Is Organized

Although this book could be read cover-to-cover, it is designed to be flexible and enable you to easily move between chapters and sections of chapters to cover just the material you need more work with. If you do intend to read all the chapters, the order in the book is an excellent sequence to use.

- Chapter 1, “Introducing Windows Server 2012 R2,” is an introductory chapter that is designed to ease readers new to Server 2012 R2 into this book.

It provides a broad description of the components of the Windows Server 2012 R2 operating system, including the major items that are new or recently updated and the Windows interface. It provides an overview for those planning to install or upgrade to Windows Server 2012 R2 and introduces Server Roles and Features on Demand.

- Chapter 2, “Installing and Configuring Windows Server 2012 R2,” identifies hardware requirements for Windows Server 2012 R2 and covers the process to install Windows Server 2012 R2 using GUI or Server Core options. This chapter also provides you with an overview and the process to delegate administrative activities, configure offline images, configure remote server roles, and configure and manage services and NIC Teaming.
- Chapter 3, “Configuring Windows Server 2012 R2 Local Storage,” reviews basic disk fundamentals and advanced disk configurations. It covers the concepts and usage of virtual hard disks and provides a framework for you to identify the appropriate storage strategy for your servers.
- Chapter 4, “Configuring Access to Files and Shares,” provides information on how you can share data with computers across the network and most importantly how to control who is able to access and/or modify this data. This chapter provides you with the resources and tools to administer and protect files and folders on your Windows Server 2012 R2 network.
- Chapter 5, “Configuring and Monitoring Print and Document Services,” introduces the core components and fundamentals of printing within a Windows Server 2012 R2 environment. It covers the management and troubleshooting of printers and printer drivers as well as the installation, configuration, and sharing of printers.
- Chapter 6, “Configuring Remote Management of Servers,” focuses on the various remote access methods, how to use daily management tools, how to prepare your server installations for remote access, and how to leverage Server Manager for management of multiple servers.
- Chapter 7, “Configuring Hyper-V,” begins with an introduction to Hyper-V and the new functions available with the release of Windows Server 2012 R2. It continues to describe the processes of creating and configuring virtual machines; managing virtual machine settings; and configuring dynamic memory, smart paging, resource metering, and integration services.
- Chapter 8, “Creating and Configuring Virtual Machine Storage,” focuses on the specifics on how to create, configure, and manage virtual machine storage for different scenarios for your Hyper-V infrastructure. It covers the processes to create and configure various types of virtual hard disks and virtual fibre channel adapters and how to create and manage checkpoints.

- Chapter 9, “Creating and Configuring Virtual Networks,” provides you with a foundation for Hyper-V network virtualization. It discusses how to configure virtual network adapters, including optimizing virtual network performance, and how to configure virtual MAC addresses and implement network isolation. After reading this chapter, you will have an understanding of the key concepts for creating and configuring virtual networks.
- Chapter 10, “Configuring IPv4 and IPv6 Addressing,” discusses versions 4 and 6 of the TCP/IP protocol together with setting up network connections and name resolution. It also discusses network connectivity problems.
- Chapter 11, “Configuring Dynamic Host Configuration Protocol,” introduces the concept of DHCP and describes how the four-stage DHCP process works with IPv4. The chapter also describes the important new features of DHCPv6 and provides content on DHCP server configuration and how to leverage DHCP with the PXE boot process.
- Chapter 12, “Deploying and Configuring Domain Name System,” provides you with background knowledge by introducing you to the fundamentals under which DNS is built. It then shows you how DNS works to resolve computer names to IP addresses in various situations you might encounter. The chapter continues to describe the process to install and configure DNS servers, server properties, and zones and how to manage resource records.
- Chapter 13, “Installing Domain Controllers,” introduces you to the foundations of Active Directory. It provides guidance on how to plan for an Active Directory namespace. It concludes with material on how to create forests and domains; add and remove domain controllers, including the install from media option; and leverage Active Directory services in Windows Azure.
- Chapter 14, “Active Directory User and Computer Accounts,” turns its attention to the nuts and bolts of Active Directory that enable all these activities to take place in a controlled manner. It shows you how to create user accounts for all these various employees and manage them in terms of groups. It then takes you through all the account management tasks.
- Chapter 15, “Active Directory Groups and Organizational Units,” provides a framework for creating and managing group accounts and organizational units and how to effectively delegate Active Directory object management.
- Chapter 16, “Creating and Applying Group Policy Objects,” provides an overview of Group Policy. After reading this chapter, you will be able to create, filter, and apply group policy objects; manage links; and interoperate with local group policies.

- Chapter 17, “Configuring Security Policies,” provides you with the fundamentals to configure user rights, security options, and user account control. You will also learn how to leverage the auditing functionality of Active Directory services.
- Chapter 18, “Configuring Application Restriction Policies,” discusses the tools that Microsoft provides to limit user access to software programs that can either damage computers and network access or distract users from important work objectives; it is important that you are able to configure these tools to maximize user productivity. This chapter introduces you to rule enforcement and provides you with information to configure software restriction policies and AppLocker rules.
- Chapter 19, “Configuring Windows Firewall,” teaches you how to configure the Windows Firewall and how to successfully apply it using basic or advanced configurations.

In addition to these 19 chapters, this book includes tools to help you verify that you are prepared to take the exam. The CD-ROM includes the glossary, practice tests, and memory tables you can work through to verify your knowledge of the subject matter.



**This chapter covers the following subjects:**

- **Windows Server 2012 R2 Hardware Requirements:** Computers onto which you want to install Windows Server 2012 R2 must meet minimum hardware requirements. This section presents these requirements and describes several tasks you should perform before installing the server.
- **Installing Windows Server 2012 R2:** This section shows you how to install Windows Server 2012 R2 as either Server Core or Server with a GUI. It also shows you how to interconvert your server between Server Core and Server with a GUI, as well as the Minimal Server Interface and Full Desktop Experience options of Server with a GUI.
- **Delegation of Server Administration:** This covers best practices for delegating Server Administration and outlines some of the common tools used by delegates.
- **Configuring Offline Server Images:** This section shows you how to configure and update Offline Server images.
- **Configuring Remote Server Roles:** There are several methods for configuring server roles. This section shows you how to use the GUI and command line to configure roles on remote servers.
- **Configuring Windows Server 2012 R2 Services:** This section provides an overview of Windows Services, how they are configured, and how you can use the GUI and command line to modify Service properties.
- **Configuring NIC Teaming:** This section provides an overview of NIC Teaming and how it works with Server 2012 R2. It covers the installation and configuring of NIC Teams and how to configure the teams for different scenarios.

# Installing and Configuring Windows Server 2012 R2

The Microsoft 70-410 exam assesses your ability to install, configure, and administer Windows Server 2012 R2 in business environments from small offices to large enterprises. This chapter focuses on installing Windows Server 2012 R2 in its basic configurations and introduces you to basic server configuration actions that you should be familiar with before you undertake any advanced actions.

## “Do I Know This Already?” Quiz

The “Do I Know This Already?” quiz enables you to assess whether you should read this entire chapter or simply jump to the “Exam Preparation Tasks” section for review. If you are in doubt, read the entire chapter. Table 2-1 outlines the major headings in this chapter and the corresponding “Do I Know This Already?” quiz questions. You can find the answers in Appendix A, “Answers to the ‘Do I Know This Already?’ Quizzes.”

**Table 2-1** “Do I Know This Already?” Foundation Topics Section-to-Question Mapping

<b>Foundations Topics Section</b>	<b>Questions Covered in This Section</b>
Windows Server 2012 R2 Hardware Requirements	1–2
Installing Windows Server 2012 R2	3–4
Delegation of Server Administration	5–7
Configuring Offline Server Images	8
Configuring Remote Server Roles	9
Configuring Windows Server 2012 R2 Services	10
Configuring NIC Teaming	11

1. You have an older computer on which you want to install an evaluation copy of Windows Server 2012 R2 so that you can prepare for your MCSE exams. The server has a 1 GHz processor, 1 GB RAM, 50 GB hard drive space, and a 1024x768 monitor. After inserting the Windows Server 2012 R2 DVD-ROM, the computer copies the initial files and then displays an error message informing you that it is unable to install Windows Server 2012 R2. Which of the following problems is preventing you from proceeding?
  - a. A processor that is too slow
  - b. Insufficient RAM
  - c. Insufficient hard drive space
  - d. An inadequate monitor
  
2. You are preparing to install Windows Server 2012 R2 on your Windows 8.1 computer in a dual-boot manner. You have created a separate partition on which you plan to install Windows Server 2012 R2. Which of the following should you perform before beginning the installation? (Choose all that apply.)
  - a. Disconnect uninterruptible power supply (UPS) devices
  - b. Disconnect universal serial bus (USB) devices
  - c. Disable antivirus software
  - d. Run the Windows Memory Diagnostic tool
  - e. Back up data
  - f. Provide mass storage drivers if needed
  
3. You need to confirm which server roles and features are present on a computer running the Server Core version of Windows Server 2012 R2. What command should you run?
  - a. `oclist`
  - b. `Get-WindowsFeature`
  - c. `ServerManagerCmd`
  - d. `sconfig.cmd`

4. You are using a Windows Server 2012 R2 computer that is configured with the full GUI interface. However, you find working with the Start screen distracting and would like to simplify the user interface by removing this screen. You still want to have access to Server Manager in GUI mode. Which of the following commands should you run?
  - a. `Remove-WindowsFeature Desktop-Experience`
  - b. `Remove-WindowsFeature Server-Gui-Shell`
  - c. `Uninstall-WindowsFeature Desktop-Experience`
  - d. `Uninstall-WindowsFeature Server-Gui-Shell`
  
5. The organization is expanding, and administrative overhead is increasing. What should you do to help manage the workload?
  - a. Install Server Manager on all workstations in the organization.
  - b. Add additional servers containing the AD DS role
  - c. Delegate Administrative responsibilities
  - d. Switch to Server Core
  
6. Your company has recently hired a new helpdesk technician. You would like to provide the technician with the ability to monitor performance counters on your servers. You want to grant the technician this ability but provide him with the least amount of administrative access. How should you accomplish this?
  - a. Add the technician's user account to the server's local administrator group
  - b. Add the technician's user account to the Performance Monitor Users group
  - c. Add the technician's user account to the Performance Log Users group
  - d. Add the technician's user account to the Remote Desktop Users group

- 7.** You are the system administrator for Pearson.com. You've been tasked with adding web services on 50 servers using a standard, company-approved IIS configuration. How can you accomplish this without altering any other applications on the servers (the solution must use the least amount of administrative effort)?

  - a.** Create a configuration checklist and execute it against all new web servers
  - b.** Configure one server, create a capture image, and deploy the image to all remaining servers
  - c.** Create a custom DSC configuration and deploy it against all servers in scope
  - d.** Reinstall Windows Server 2012 R2 and import an existing XML configuration for the web services
  
- 8.** What can be done through servicing of an offline image? (Choose all that apply.)

  - a.** Enable or disable Windows features
  - b.** Enable Remote Install Services
  - c.** Upgrade to a higher edition of Windows
  - d.** Add or remove drivers
  - e.** Add or remove Remote Desktop Services
  - f.** Scan and remove active virus threats
  
- 9.** What methods are available to add servers to Server Manager for remote management? (Choose all that apply.)

  - a.** Active Directory Search
  - b.** DNS Lookup
  - c.** Text file import
  - d.** Scan Subnet
  - e.** MMC
  - f.** RDP

10. Which of the following are methods used to manage services on a local or remote server? (Choose all that apply.)
- a. Services Manager for Windows
  - b. `sc config`
  - c. Remote Desktop Services
  - d. `Services.msc`
11. You decide to reconfigure a server as a Hyper-V server. You want to use NIC Teaming with all available network cards. Which command do you use to establish the NIC Team?
- a. Reinstall the Operating System
  - b. `Remove-NetLbfoTeam`
  - c. `New-NetLbfoTeam`
  - d. `New-NICTeam`

## Foundation Topics

### Windows Server 2012 R2 Hardware Requirements

As with previous Windows versions, your hardware must meet certain requirements for Windows Server 2012 R2 to function properly. First of all, Windows Server 2012 R2 requires a 64-bit processor; Microsoft has discontinued 32-bit software with this release of Windows Server. Table 2-2 outlines the minimum and recommended hardware requirements for Windows Server 2012 R2 as provided by Microsoft:



**Table 2-2** Windows Server 2012 R2 Hardware Requirements

Component	Minimum Requirement	Microsoft Recommended
Processor	1.4 GHz	2 GHz or faster
Memory	512 MB RAM	2 GB RAM or greater
Available Disk Space	32 GB	40 GB or greater
Optical Drive	DVD-ROM drive	DVD-ROM drive
Display	Super VGA (800x600) monitor	XGA (1024x768) monitor

In addition, you must have the usual I/O peripherals, including a keyboard and mouse or compatible pointing device and a wired or wireless network interface card (NIC). If you can connect to a network location on which you have copied the contents of the Windows Server 2012 R2 DVD-ROM, you are not required to have a DVD-ROM drive on your computer. As with any other operating system installation, you will receive improved performance if you have a faster processor and additional memory on your system.

Further, when you install Windows Server 2012 R2 on an Itanium-based computer, you must have an Intel Itanium 2 processor and additional hard disk space. Computers with more than 16 GB RAM require additional disk space for paging, hibernation, and dump files. With disk space at an all-time minimum cost, it is easy to acquire a high-capacity hard disk. You will certainly need plenty of disk space on a server that will be a domain controller in a large domain.

Microsoft recommends that you also perform the following actions before installing Windows Server 2012 R2:

- **Disconnect uninterruptible power supply (UPS) devices:** If you are using a UPS, disconnect its serial or USB cable before installing Windows Server 2012 R2. However, note that you do not need to disconnect other USB devices such as external hard drives, printers, and so on.
- **Back up data:** Perform a complete backup of configuration information for your servers, especially network infrastructure servers such as DHCP servers. The backup should include the boot and system partitions as well as the system state data.
- **Disable antivirus software:** Antivirus software can interfere with operating system installation.
- **Run the Windows Memory Diagnostic tool:** This tool tests your computer's RAM. For more information, refer to "Utility Spotlight: Windows Memory Diagnostic" at <http://technet.microsoft.com/en-us/magazine/2008.09.utilityspotlight.aspx?pr=blog>.
- **Provide mass storage drivers if needed:** Save the driver file to appropriate media so that you can provide it during setup.
- **Note that Windows Firewall is on by default:** Server applications that require inbound connections will fail until you create inbound firewall rules that allow these connections. For more information, refer to "Windows Firewall with Advanced Security Overview" at <http://technet.microsoft.com/en-us/library/hh831365.aspx>.
- **Prepare your Active Directory environment for Windows Server 2012 R2:** Before adding a Windows Server 2012 R2 domain controller or updating an existing domain controller to Windows Server 2012 R2, prepare the domain and forest by running Adprep.exe. We discuss this tool in Chapter 13, "Installing Domain Controllers."

## Installing Windows Server 2012 R2

As already introduced in Chapter 1, "Introducing Windows Server 2012 R2," you can install Windows Server 2012 R2 as either Server with a GUI, which presents a full graphical user interface, or Server Core, which presents only a command prompt window.

## Installing a Windows Server Core Computer

As explained in Chapter 1, Windows Server Core includes a minimal version of the server software without the GUI; you perform all configuration tasks from the command prompt. Follow this procedure to install Windows Server Core and perform initial configuration tasks:

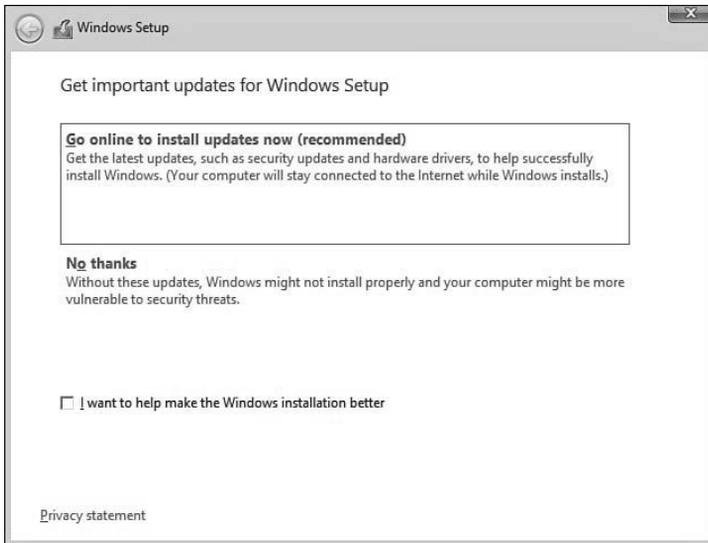
### Key Topic

1. Insert the Windows Server 2012 R2 DVD-ROM and turn on your computer. You should see a message informing you that Windows is copying temporary files; if not, you should access the BIOS setup program included with your computer and modify the boot sequence so that the computer boots from the DVD.
2. After a few minutes, you receive the Windows Server 2012 R2 screen shown in Figure 2-1. Click **Install now** to begin the installation.



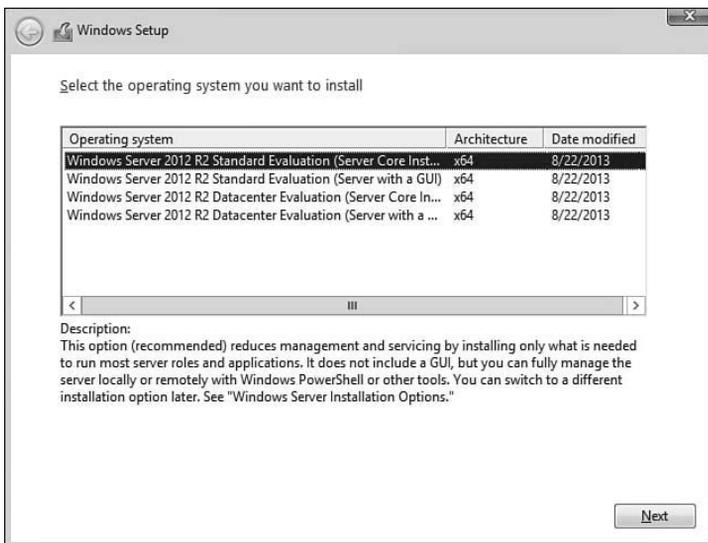
**Figure 2-1** Starting the installation of Windows Server 2012 R2.

3. Windows copies temporary files and then displays the Get important updates for Windows Setup screen shown in Figure 2-2. If you're connected to the Internet, select **Go online to install updates now (recommended)**.



**Figure 2-2** If you're connected to the Internet, you should select the option to get updates.

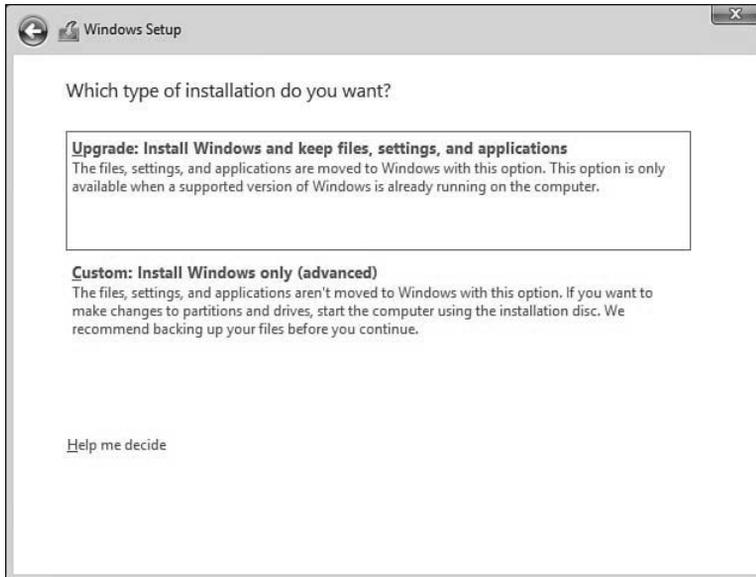
4. On the next **Install Windows** screen, click **Install now**.
5. You receive the options shown in Figure 2-3, which enable you to install the complete Standard or Datacenter version of Windows Server 2012 R2 with a GUI or Windows Server 2012 R2 Server Core. Select the **Windows Server 2012 R2 Datacenter (Server Core Installation)** option and then click **Next**.



**Key  
Topic**

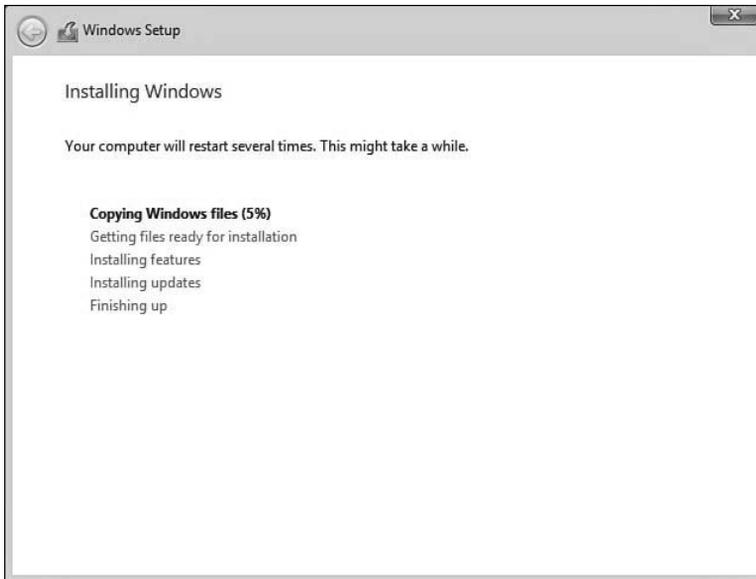
**Figure 2-3** This screen enables you to select either the complete installation of Windows Server 2012 R2 or the Server Core option.

6. You are asked to accept the license terms. Select the check box labeled **I accept the license terms** and then click **Next**.
7. You receive the options shown in Figure 2-4 to upgrade or install a clean copy of Windows Server 2012 R2. Select Custom (advanced) to install a clean copy of Windows Server 2012 R2. The upgrade option is available only if you have started the installation from within Windows Server 2008, Windows Server 2008 R2, or the original version of Windows Server 2012.



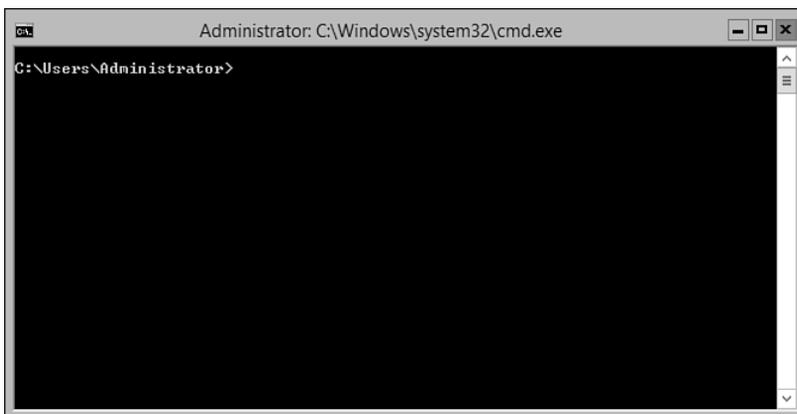
**Figure 2-4** You have the option to upgrade when run from Windows Server 2008/R2/2012.

8. Select the disk on which you want to install Windows and then click **Next**.
9. Take a coffee break while the installation proceeds. This takes some time (particularly when installing on a virtual machine), and the computer restarts several times. As shown in Figure 2-5, Setup charts the progress of installation.



**Figure 2-5** Windows Setup charts the progress of installing Windows Server 2012 R2.

10. After 15–30 minutes (depending on your hardware), Windows restarts a last time and informs you that your password must be changed before logging on for the first time. Click **OK**.
11. Type and confirm a strong password. When informed that the password is changed, click **OK**. After a minute or so, the desktop appears, containing a command window but no Start screen or desktop icons (see Figure 2-6). This is the standard Windows Server Core interface.



**Figure 2-6** At startup, Windows Server Core 2012 R2 displays only a command window.

12. To set the correct time, type `control timedate.cpl`. By default, Server Core sets the time zone to Pacific Time. If you are in a different time zone, you will need to change this. Set the appropriate time zone, change the date and time if necessary, and then click **OK**.
13. Windows installs Server Core with a randomly generated computer name. To set a name of your choice, type `netdom renamecomputer %computername% /newname:ServerC1` (where, in this instance, *ServerC1* is the name you're assigning; substitute your desired server name).
14. Windows warns you that the rename process might have an adverse impact on some services. Type **Y** to proceed.
15. You are informed that the computer needs to be restarted in order to complete the rename. Type `shutdown /r /t 0` to reboot your server.
16. After the server reboots, press **Ctrl+Alt+Delete** and log on using the password you set in step 11.

### Useful Server Core Commands

All configuration, management, and troubleshooting of Windows Server Core is done from the command line. Available utilities enable you to perform almost all regular configuration tasks in this fashion. In Windows Server 2012 and 2012 R2, many of the commands used with Server Core in Windows Server 2008 have been replaced by PowerShell cmdlets. Table 2-3 describes some of the more useful available commands.



**Table 2-3** Useful Windows Server Core Commands and Cmdlets

Command	Meaning
<code>netdom join %computername% /domain:domainname</code>	Joins an Active Directory domain. You will be prompted for the username and password of a user with domain administrator privileges.
<code>Sconfig.cmd</code>	Configures and manages a series of common Server Core installation properties. See Figure 2-7.
<code>cscript scregedit.wsf</code>	Enables automatic updates.
<code>Get-WindowsFeature</code>	Displays roles and features currently installed on the server.
<code>Install-WindowsFeature</code>	Adds roles or features.
<code>Uninstall-WindowsFeature</code>	Removes roles or features.
<code>netsh interface IPv4</code>	Includes a series of subcommands that enable you to configure IPv4 networking.

Command	Meaning
<code>netsh advfirewall</code>	Includes subcommands that enable you to configure the Windows firewall.
Help	Provides a list of all available Windows Server Core commands.

```

Administrator: Windows PowerShell
Microsoft (R) Windows Script Host Version 5.8
Copyright (C) Microsoft Corporation. All rights reserved.

Inspecting system...

=====
Server Configuration
=====

1) Domain/Workgroup:           Workgroup: WORKGROUP
2) Computer Name:             SERVER1
3) Add Local Administrator
4) Configure Remote Management Enabled
5) Windows Update Settings:   Manual
6) Download and Install Updates
7) Remote Desktop:           Disabled

8) Network Settings
9) Date and Time
10) Help improve the product with CEIP Not participating
11) Windows Activation

12) Log Off User
13) Restart Server
14) Shut Down Server
15) Exit to Command Line

Enter number to select an option:

```

**Figure 2-7** The `sconfig`.cmd utility enables you to perform many basic configuration actions on a Server Core computer.

Available commands also include most commands formerly used with MS-DOS and previous Windows versions. We discuss many Server Core commands and PowerShell cmdlets in various chapters of this book and other *Cert Guide* books in this series.

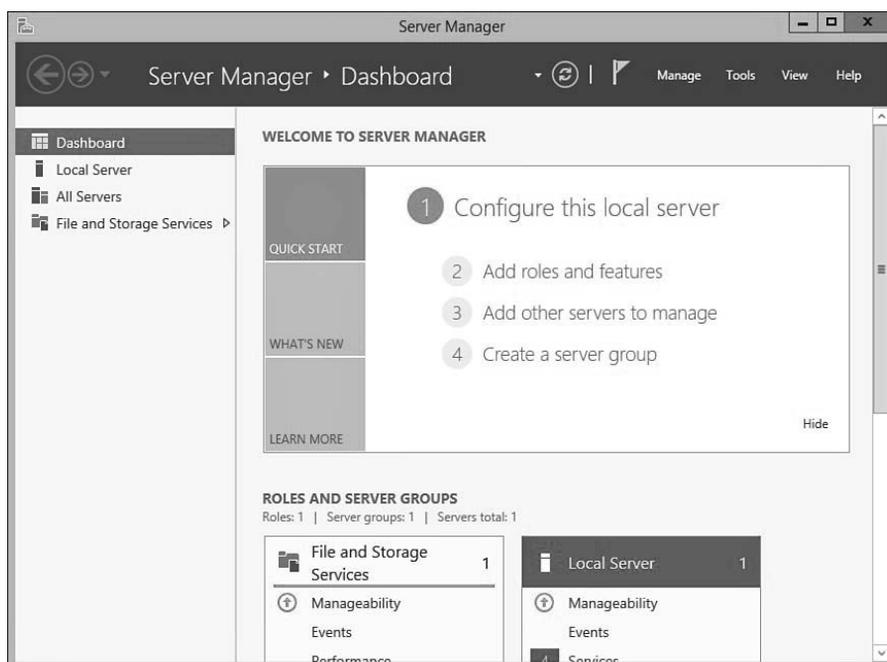
**NOTE** For additional information on installing Windows Server Core, as well as any of these commands or other commands available in Windows Server Core, type the command name followed by `/?` or consult “Configure and Manage Server Core Installations” at <http://technet.microsoft.com/en-us/library/jj574091.aspx>. For additional information on the available Windows Server 2012 R2 installation options, refer to “Windows Server Installation Options” at <http://technet.microsoft.com/library/hh831786>.

## Installing the Full GUI Server

Although Microsoft markets Server Core as being the default Windows Server 2012 R2 installation, the full GUI version still represents the most easily managed version of the server. The procedure for installing the full GUI server is the same whether you're installing directly from a DVD-ROM or a network share, except that you must have some type of network client installed on your computer to access a network share. The following procedure outlines installation from a DVD-ROM:

### Key Topic

1. Follow the procedure outlined earlier for installing Windows Server Core until you receive the screen previously shown in Figure 2-3.
2. Select either **Windows Server 2012 R2 Standard (Server with a GUI)** or **Windows Server 2012 R2 Datacenter (Server with a GUI)**, and then click **Next**.
3. Complete steps 6–10 of the earlier procedure. Installation will take 15–45 minutes, depending on your hardware.
4. Type and confirm a secure password. Windows informs you that your password has been changed. Click **OK**.
5. Windows displays a Welcome message and prepares your desktop. Then the desktop with Server Manager shown in Figure 2-8 appears.



**Figure 2-8** When you log on to Server with a GUI for the first time, Server Manager appears.

After you have performed the initial configuration steps, you will be prompted to press **Ctrl+Alt+Delete** and enter your password when you restart your server.

**TIP** When you shut down a Windows Server 2012 R2 computer, it displays the Shutdown Event Tracker dialog box, which asks you for a reason for shutting down the server. For learning purposes, it is helpful to disable this item. You can do so by typing `gpedit.msc` to open the Local Group Policy Object Editor. Navigate to Computer Configuration\Administrative Templates\System, right-click the **Display Shutdown Event Tracker** policy, and click **Properties**. On the dialog box that appears, click **Disabled** and then click **OK**.

### Upgrading a Windows Server 2008 Computer

You can upgrade a computer running Windows Server 2008 R2 with Service Pack 1 (SP1) or later to Windows Server 2012 R2, provided that the computer meets the hardware requirements for Windows Server 2012 R2. You cannot upgrade a Windows Server 2003 or older computer or a computer running any client version of Windows to Windows Server 2012 R2.

To upgrade to Windows Server 2012 R2, proceed as follows:

1. While logged on to Windows Server 2008 R2 as an administrator, insert the Windows Server 2012 R2 DVD-ROM.
2. When the **Install Windows** screen appears, click **Install now**.
3. Select your operating system, either the standard or Windows Core version of Windows Server 2012 R2; then click **Next**.
4. Accept the licensing terms and then click **Next**.
5. On the **Which Type of Installation Do You Want?** page, select **Upgrade**.
6. Windows checks compatibility of your hardware and software and displays a compatibility report that informs you of any potential upgrade problems. Review this report and make any changes you feel are required. When you are ready to proceed, click **Next**.
7. Take a lunch break while the upgrade proceeds. This will take 60 minutes or longer, depending on your hardware configuration or use of virtual computing software. The server will reboot three or four times.
8. After the final reboot, log on using the password previously used in Windows Server 2008 R2. Windows prepares your desktop and displays the Server Manager tool as previously shown in Figure 2-8.

**NOTE** For additional information on upgrading to Windows Server 2012 R2 including a detailed list of supported upgrade paths, refer to “Upgrade Options for Windows Server 2012 R2” at <http://technet.microsoft.com/en-us/library/dn303416.aspx>.

## Converting Between Core and GUI

You can convert the full GUI version of Windows Server 2012 R2 to Server Core or vice versa at any time; further, you can interconvert the GUI version between any of the three options described in Chapter 1.

Use the following procedure to convert the full GUI server to Server Core:

### Key Topic

1. From the Search charm, type `powershell` and select **Windows PowerShell**.
2. Type the following cmdlet:  

```
Uninstall-WindowsFeature Server-Gui-Mgmt-Infra -Restart
```
3. A display on the PowerShell window tracks the removal process, which takes several minutes. A Configuring Windows features message then appears as the GUI is removed. After a few more minutes, the server restarts. When the logon screen appears, press **Ctrl+Alt+Delete** and log back on as an administrator.

Use the following procedure to convert a Server Core computer to run the full GUI:

### Key Topic

1. From the administrative command prompt, type `powershell`.
2. Type the following command:  

```
Get-WindowsImage -ImagePath <path to wim>\install.wim
```
3. This command returns the index number for the server with a GUI image. Then type the following command:  

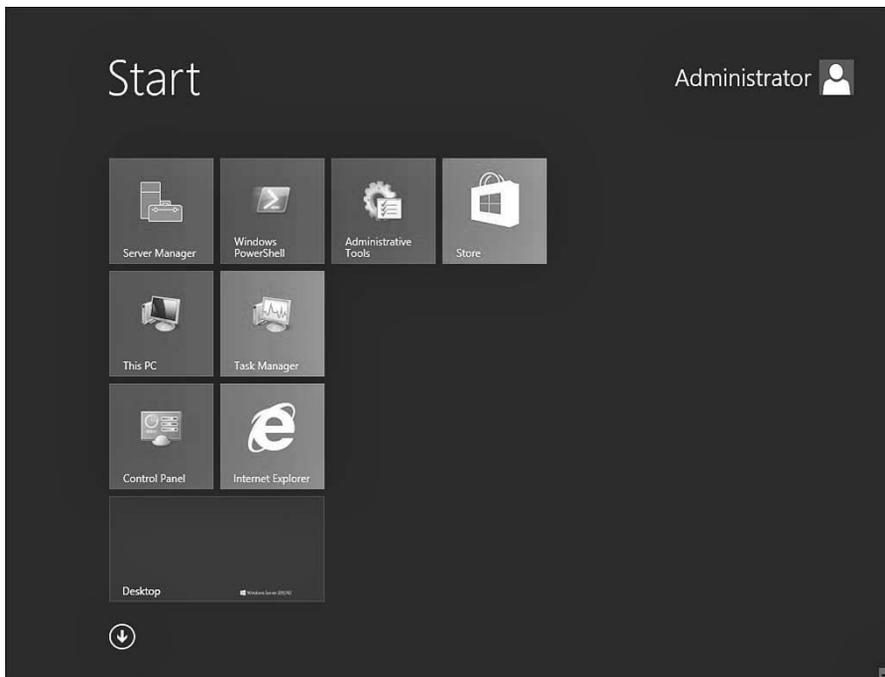
```
Install-WindowsFeature Server-Gui-Mgmt-Infra, Server-Gui-Shell -Restart -Source wim:<path to wim>\install.wim:<Index #>
```
4. Wait as Windows configures features and restarts; then press **Ctrl+Alt+Delete** and log back on as an administrator.

If you are converting a server that was originally installed in GUI mode back to GUI from Server Core, the procedure is slightly simpler. Use the following PowerShell command in place of those given in steps 2 and 3:

```
Install-WindowsFeature Server-Gui-Mgmt-Infra, Server-Gui-Shell -Restart
```

To install the complete desktop experience on your server (including access to Windows Store apps as in Windows 8 or Windows 8.1), use the following PowerShell command and then restart your computer. This mode adds a link to Windows Store on the Start screen, as shown in Figure 2-9:

```
Install-WindowsFeature Desktop-Experience
```



**Figure 2-9** The complete desktop experience in Windows Server 2012 R2 enables you to add Windows Store apps.

Installing the minimal server interface on your server requires you to remove the Start screen shell. Use the following PowerShell command and then restart your computer. You receive a command prompt window and the Server Manager console as previously shown in Figure 2-8.

```
Uninstall-WindowsFeature Server-Gui-Shell
```

## Delegation of Server Administration

As an organization grows, administration of servers can become quite overwhelming to manage. To help balance the workload and create a smooth support process, a delegation model should be implemented. Implementing a delegation model involves the following:

- Preparing for a delegation model
- Establishing delegate access
- Leveraging Active Directory
- Identifying administration tools

### Preparing for a Delegation Model

Preparing for a delegation model requires some planning up front. Deciding how to manage your systems administration can be a frustrating task. The key to success is to define a model that best works for your situation, agree upon the long-term strategy, and discipline those involved to stick with the model. There are three basic strategies to select from when deciding how to manage your environment:

- **Decentralized:** This is typically designed for small mom-and-pop shops or even home offices. In this model, administrators are present at each site and all share the same responsibilities and access to the servers. This model typically introduces challenges with scalability and standardizations.
- **Centralized:** Typically found in medium to large organizations, the centralized model focuses on driving standards and consistent management from a central site or from a central group of administrators. Branch sites might employ desktop engineers who have been granted local admin rights to workstations but limited access to servers. In many cases, the centralized approach is what the decentralized model evolves into overtime.
- **Shared/Delegated:** While a shared/delegated model can be used for an organization of any size, it is typically adopted by large/enterprise class organizations with a larger IT workforce. Containing characteristics of both decentralized and centralized models, the shared or delegated approach focuses on centralized policies and procedures governed by the enterprise admins. Enterprise admins “deputize” junior admins at each site to manage local servers and drive a consistent process among all sites. This approach is hierarchical in nature in that many layers of administration can be defined.

For example, the main office might contain the majority of the systems. These systems are managed by senior administrators or an enterprise admin group. Branch sites might contain locally significant servers such as file servers that are managed by site admins and/or the enterprise admin group. Desktop engineers might be delegated administrative access to all desktops but might escalate issues to site admins or even enterprise admins if necessary.

## Establishing Delegate Access

Once a delegation model has been selected, the next step is to decide how to delegate access. Depending on the server, installed roles, and applications installed, there are different ways to delegate access. In some cases, applications or roles include an interface where elevated access is granted. In most other situations, local built-in groups can be used to grant different access to different delegates depending on their function.

For example, suppose you have delegated backup duties to a small team of junior administrators. To grant or delegate the necessary permissions, you might decide to nest, rather than add, the junior admins' domain accounts to the built-in local backup operators group on one or more servers. To help streamline this in larger organizations, you might consider additional layers of group nesting along with group policy to push down the elevated access to a group of servers. This method provides a more scalable solution as expanding delegate access is as simple as adding more junior admin accounts to a domain group. The domain group is then automatically added to the backup operators local group on the servers. Active Directory will be discussed in more detail later. Refer to Table 2-4 for a listing of built-in local groups and their functions.

**Table 2-4** Built-in Local Groups



Group	Function
Access Control Assistance Operators	Remotely query permissions or authentication attributes for resources on the computer.
Administrators	Grants full access and control to the computer. Allows members to change and manage permissions and access to the computer.
Backup Operators	Ability to back up and restore files regardless of the permissions assigned to the folder or files. These users are unable to modify and manage permissions.
Certificate Services DCOM Access	Members are allowed to connect to Certificate Authorities.
Cryptographic Operators	Perform Cryptographic operations.
Distributed COM Users	Start, activate, and use DCOM objects.
Event Log Readers	Ability to read event logs on the computer.
Guests	Users are granted virtually no access to the system other than to use the Internet and basic applications. They are granted temporary profiles upon logon.
Hyper-V Administrators	Grants full control over Hyper-V.

Group	Function
IIS Users	Used by IIS Web Services.
Network Configuration Operators	Ability to make changes to TCP/IP Settings and release and renew IP addresses.
Performance Log Users	Manage and schedule performance counters logs and alerts on the computer.
Performance Monitor Users	Ability to monitor performance counters and read performance counter data.
Power Users	Typically used to provide elevated privileges for legacy applications.
Print Operators	Administer printers and print jobs on the server.
Remote Desktop Users	Members of this group are granted permission to log onto the computer remotely.
Replicator	Manages domain replication functions.
Users	Limited access to log on to the computer. Allows users to run applications, use local devices and peripherals but not make administrative changes.
WinRMRemoteWMIUsers	Ability to access WMI resources.

**TIP** When delegating administrative tasks, it is a good practice to create separate delegate accounts for users. The idea is to operate on the principle of least privilege, meaning for normal operations you would use a standard user account with enough access to perform your job. When elevated privileges are required, invoke the run as function or log in with your delegate account. This reduces the risk of unintentional changes that could make for an unpleasant day for the admin.

### Leveraging Active Directory

One of the major benefits of Active Directory is that you can split up administrative tasks among various individuals using the AD DS Delegation of Control Wizard. You can assign different sets of administrative responsibility to different users, and these can include segments of the directory structure such as OUs or sites. The following are several benefits of delegating administrative control:

- You can assign subsets of administrative tasks to users and groups.
- You can assign responsibility of a limited portion of the domain, such as OUs or sites, to users or groups.

- You can use a nested hierarchy of OUs for even more granular control over which users can perform certain administrative tasks.
- You can enhance network security by placing more restrictive limits on the membership of powerful groups such as Domain Admins, Enterprise Admins, and Schema Admins.

When designing your AD DS forest structure, you should keep in mind the administrative requirements of each domain. Each domain has the capability to contain a different OU hierarchy. The forest administrators, who are members of the Enterprise Admins group, are automatically granted the ability to create an OU hierarchy in any domain within the entire forest. Domain administrators, who are members of the Domain Admins group in each separate domain, by default are granted the right to create an OU hierarchy within their own domain.

When you initially create your OU design, you should do so to enable administration. After that, you should create any additional OUs required for the application of Group Policy and management of computers. Delegation of Control and management of AD DS are discussed in more detail later.

### Identifying Administration Tools

The final step in delegating administrative duties is identifying the toolsets available to your delegates. Microsoft has provided us with the following tools to help with administrative tasks:

- **Server Manager:** Server Manager provides the ability to manage local or remote servers from a central location.
- **Windows PowerShell Web Access:** As we have seen previously, PowerShell is a powerful command-line tool that has been available since Windows Server 2008. As an improvement to Server 2012 R2, PowerShell now has the ability to be executed over the Web through the use of a Windows PowerShell Web Access Gateway. This is available as an installable feature through Server Manager.

**NOTE** For additional information on installing and configuring PowerShell Web Access, refer to “Deploy Windows PowerShell Web Access” at <http://technet.microsoft.com/en-us/library/hh831611>.

- **Windows PowerShell Desired State Configuration (DSC):** PowerShell Desired State Configuration (DSC) is a PowerShell extension released with Windows Server 2012 R2 and Windows 8.1. We discuss DSC in more detail in the next section.

- **Microsoft Management Console (MMC):** As with previous versions of Windows, the MMC is still a powerful tool used by administrators to manage local and remote servers. You can create custom read-only MMC consoles with specific snap-ins containing only those tools required for the specific delegate function.
- **Remote Server Administration Tools:** Provides a set of tools to be used with client computers running Windows 8/8.1. It includes Server Manager, MMC snap-ins, PowerShell cmdlets, and additional command-line tools used to manage Windows Server 2012 R2 Core and Full installations. You can download Remote Server Administration tools from the Microsoft Download Center as a standalone installer.

**NOTE** Before using administrative tools, you must first ensure that the necessary access rights have been granted and that you have addressed any prerequisites, such as .Net Framework 4.5, Windows Management Framework 4.0, or Firewall configurations.

## Windows PowerShell Desired State Configuration

As mentioned previously, Windows PowerShell Desired State Configuration (DSC) was designed to enhance the levels of automation through the use of PowerShell 4.0. It helps administrators cut down on repetitive tasks by defining prebuilt configurations that accompany PowerShell 4.0 cmdlets. Configuration parameters are saved in a Managed Object File (MOF) and can be used as a baseline for comparison or as a template for new deployments. DSC is often used in the following situations:

- You need to verify or test applied system configurations against a configuration baseline defined in the DSC configuration.
- When using PowerShell to install or remove Server Roles/Features or installation packages based on specific configurations.
- You need to review or make changes to registry settings, environment variables, processes, or services.
- You need to manage local users/groups to ensure that they are configured according to DSC.

To function properly, DSC requires the following components:

- A strong knowledge of PowerShell
- Installation of the Windows PowerShell Desired State Configuration Service feature

- .NET Framework 4.5
- Windows Communication Foundation (WCF) Services
- Web Server (IIS) and related role services/features
- Clients running at least Windows 7 or Windows Server 2008 R2 with Windows Management Framework 4.0

## Installing and Configuring DSC

DSC works via two basic methods: Pull and Push. The Pull method works through the use of a Pull Server. Using this method, you can configure a server as the Pull Server, which acts as central configuration repository storing the configuration data for computers. The Pull Server stores DSC resources required by the target computers, also known as *nodes*. In large environments, nodes can be configured to pull from the server as they come online. The second method is the Push method. In smaller implementations, a central server can be configured to Push DSC configurations. The down side is that this doesn't always guarantee that all nodes receive the updated configuration. As an administrator, you also have the ability to use a combination of both Pull and Push methods.

DSC works through the basis of defining configurations within scripts. Using Notepad, you can build a custom DSC configuration. Configurations contain several components, all of which are organized within a *configuration block*. The keyword **Configuration** tells PowerShell that a specific configuration is to follow. The use of braces { } identify the start and end of the configuration. Together, both of these items create the foundation of a configuration block. The basic structure of a configuration block is

```
Configuration MyConfigName
{
}
}
```

Inside the configuration block, *node blocks* are identified. A node represents a computer in the environment. Nodes are used when you need to apply a configuration block to a specific computer or computers. Like configuration blocks, node blocks start and end with a brace { }. Multiple node blocks can be created within a configuration block, although a configuration block does not have to contain any node blocks. Depending on the requirements, you might need to use node blocks.

```
Configuration MyConfigName
{
```

```

Node "MyComputer1"
{

}
}

```

Inside the node blocks, *resource blocks* can be identified. Resource blocks are used to configure specific resources. These can be configured manually, or you can use several prebuilt resources available within the PowerShell framework. Some of the built-in resources include

- **DSC Configuration Archive:** For working with compressed/archive files
- **DSC Configuration Environment:** For managing computer environmental configurations
- **DSC Configuration File:** For managing files and folders
- **DSC Configuration Group:** For managing local groups on target nodes
- **DSC Configuration Log:** For writing messages to the DSC event log
- **DSC Configuration Package:** For installing msi/exe packages
- **DSC Configuration Process:** For managing processes on target nodes
- **DSC Configuration Registry:** For managing registry keys on target nodes
- **DSC Configuration Role:** For adding or removing Windows features and roles on target nodes
- **DSC Configuration Script:** For running PowerShell script blocks on target nodes
- **DSC Configuration Service:** For managing services on target nodes
- **DSC Configuration User:** For managing local user accounts on target nodes

Resource blocks are identified by a resource name followed by an identifier. Again, use braces to establish the start/finish boundary. For example, to add configuration details to ensure that the Web-Server role is installed for **MyComputer1**, use the following syntax:

```

Configuration MyConfigName
{
    Node "MyComputer1"
    {
        WindowsFeature MyRoles
    }
}

```

```

    {
        Ensure = "Present"
        Name = "Web-Server"
    }
}

```

After you have created the appropriate configurations, save it as a PowerShell script. To invoke the configuration, execute it via an administrative PowerShell session. Invoking the configuration creates the MOF file in the working directory containing the configuration block script. To execute the configuration, run the command:

```
Start-DscConfiguration -Wait -Verbose -Path .\MyConfigName
```

**NOTE** The intent of this section was to provide a high-level overview of DSC and how to use it. There are a variety of configuration parameters and best practices that go beyond the scope of this *Cert Guide*. For more information on implementing DSC, refer to “Windows PowerShell Desired State Configuration Overview” at <http://technet.microsoft.com/en-us/library/dn249912.aspx>.

## Configuring Offline Server Images

In any large-scale deployment, imaging technology will be one of your strongest allies. Microsoft has continued to evolve its imaging process through enhancements made to the Windows Deployment Services (WDS) role. WDS is covered in the *70-411 Cert Guide*, but in this section, we will assume you already have a prebuilt image and are looking to perform offline servicing of the image.

So what is meant by servicing an image, and why offline? Historically speaking, updates to images required the administrator to deploy a new computer from the image, run through any customizations or updates, repackage the image, and upload it back to the repository. This is often a lengthy process—especially when only minor updates are required. For these instances, Microsoft has provided the ability to inject updates to a Windows image file (.wim) or virtual hard disk (.vhd or .vhdx) via the command line. Scenarios in which images require updating include

- Enable or disable Windows roles and features
- Add or remove drivers or installable packages such as hotfixes
- Perform an inventory of installed packages, drivers, features, and so on

- Modify logging abilities to help post deployment troubleshooting
- Modify the `offlineServicing` section of an `Unattend.xml` answer file
- Configure international settings
- Upgrade the installation to a higher edition of Windows

## Deployment Image Servicing and Management

Servicing an image offline requires an understanding of the Deployment Image Servicing and Management (DISM) tool. DISM is a command-line tool included in Windows Server 2012 R2. For previous installations of Windows it is also available within the Windows Automated Installation Kit (AIK), which can be downloaded from the Microsoft Download Center.

DISM takes the legwork out of the mix by enabling an administrator to mount the image file, similar to mounting a hard disk, and issue commands to update the image. When the updating is complete, changes are committed to the image and the file is unmounted, in which case the image is ready for the next deployment. Some key points and best practices to consider when using DISM:

- Must be run as administrator.
- Service an image offline whenever possible.
- If Windows image files are split or spanned across multiple types of media, you must copy them centrally to a single folder to service. Without this, mounting the image is not possible.
- Keep architecture consistent, meaning don't inject x64 drivers into x86 images.
- Remote image updates is not currently supported. To make any changes, you must first copy the Windows image to the local machine, perform the necessary updates, and then copy the image back to the repository.
- After deployment, use the system file checker `sfc.exe /verifyonly` option.

**TIP** DISM is typically used for updating offline images, but it can also be used to update servers that are online especially in cases when you need a fast method to standardize or update to a higher edition of Windows.

There are several parameters you should understand when servicing images. Table 2-5 outlines some of the key parameters:

**Table 2-5** Useful DISM Parameters

<b>Command</b>	<b>Meaning</b>
<code>/Get-ImageInfo</code>	Used to gather information from the image file such as index number, image name, description, and image size.
<code>/ImageFile</code>	Used to identify the location of the source image file.
<code>/Mount-Image</code>	Parameter used to mount the image. When mounting the image, you must also specify an in index number or the name associated with the image. This information can be extracted from the <code>/Get-ImageInfo</code> parameter.
<code>/MountDir</code>	Directory in which the image is mounted to. For optimal performance, this should be on the local computer that is updating the image. <code>Dism /Mount-Image /ImageFile:C:\TestImages\TestImage.wim /Name:"Image Name" /Mountdir:C:\MountedImage</code>
<code>/Cleanup-Mountpoints</code>	In some cases images might become locked/orphaned and are unable to be remounted. Use this switch when experiencing trouble with mounting images that might have been previously mounted.
<code>/Add-Package</code>	Adds one or more install packages or cabinet files (.cab) to a mounted image. When applying multiple packages, packages are listed in the order in which they should be installed. <code>/Add-Package /PackagePath:[package path\package.cab] /PackagePath:[second package path\package2.cab]</code>
<code>/Add-Driver</code>	Adds a driver to the offline image. For third-party drivers, you might choose the <code>/ForceUnsigned</code> switch.
<code>/Remove-Driver</code>	Removes a driver from the offline image.
<code>/Commit-Image</code>	Applies changes made to a mounted image and leaves the image mounted for additional changes.
<code>/Get-Packages</code>	Produces a list of Packages from the mounted image in the mount directory. This can also be piped > to a .txt file for easy reading.
<code>/Get-Features</code>	Produces a list of features by their case-sensitive name and their enabled/disabled status. This can also be piped > to a .txt file for easy reading. It's used in conjunction with <code>/Get-FeatureInfo /FeatureName:[FeatureName]</code> to output additional details for the feature.
<code>/Enable-Feature</code>	Enables a specific feature.
<code>/Disable-Feature</code>	Disables a specific feature.
<code>/Remove-Package</code>	Removes an installed package.

Command	Meaning
<code>/Unmount-Image</code>	Unmounts the image. Use the <code>/commit</code> or <code>/discard</code> switch to apply or cancel any changes made before the image is unmounted.
<code>/Set-Edition</code>	Used to change an offline windows image to a higher edition. This might also be done online with the <code>/AcceptEula</code> and <code>/ProductKey</code> switches.

**NOTE** This list introduces only a few of the DISM parameters. For a full list of options, refer to “Deployment Image Servicing and Management Command Line Options Reference” at <http://technet.microsoft.com/en-us/library/hh825099.aspx>.

## Using DISM to Enable Remote Desktop Services

Now that you have an understanding of DISM and some of the key options, let’s see it in action by enabling the Remote Desktop Services feature in an offline image. The first thing you need to do is obtain a copy of the source image. In this example, we will use one of the default Windows image files found on the Server installation media and extracted by a WDS server. Again, WDS is covered in more detail in the *70-411 Exam Cert Guide*. To enable a feature in an offline image, perform the following steps:

1. Gather identifying information from the image using the `/Get-ImageInfo` option as shown in Figure 2-10.

**Key  
Topic**



```

Administrator: Windows PowerShell
PS C:\TestImages> dism /Get-ImageInfo /ImageFile:c:\testimages\testimage.wim
Deployment Image Servicing and Management tool
Version: 6.2.9200.16384

Details for image : c:\testimages\testimage.wim

Index : 1
Name : Windows Server 2012 SERVERDATACENTER
Description : Windows Server 2012 SERVERDATACENTER
Size : 11,997,664,663 bytes

The operation completed successfully.
PS C:\TestImages> _

```

**Figure 2-10** Dism /Get-ImageInfo

- Using either the index number or name of the image, mount the image to a temporary mount directory. This will extract the contents of the image (Figure 2-11) to a directory structure in the temp mount directory specified. This process might take time depending on the speed of your computer.

```
PS C:\TestImages> dism /Mount-Image /ImageFile:c:\testimages\testimage.wim /Name:"Windows Server 2012 SERVERDATACENTER"
/MountDir:c:\mountedimage
Deployment Image Servicing and Management tool
Version: 6.2.9200.16384

Mounting image
[=====100.0%=====]
The operation completed successfully.
PS C:\TestImages>
```

**Figure 2-11** Dism /Mount-Image.

- Review the current state of the Remote-Desktop-Services feature. Shown in Figure 2-12, take notice that the feature is currently disabled.

```
PS C:\TestImages> dism /Image:c:\mountedimage /Get-FeatureInfo /FeatureName:Remote-Desktop-Services
Deployment Image Servicing and Management tool
Version: 6.2.9200.16384

Image Version: 6.2.9200.16384
Feature Information:
Feature Name : Remote-Desktop-Services
Display Name : Remote Desktop Services
Description : Add or remove Remote Desktop Services.
Restart Required : Possible
State : Disabled

Custom Properties:
ServerComponent\Description : <a href="TS_admin.chm::html/2584b4b6-9185-4914-9f3f-9e60a72a3bda.htm">Remote Desktop Serv
ices</a> enables users to access virtual desktops, session-based desktops, and RemoteApp programs. Use the Remote Deskt
op Services installation to configure a Virtual machine-based or a Session-based desktop deployment.
ServerComponent\DisplayName : Remote Desktop Services
ServerComponent\EventQuery : RemoteDesktop.Events.xml
ServerComponent\Id : 18
ServerComponent\Type : Role
ServerComponent\UniqueName : Remote-Desktop-Services
ServerComponent\Version\Major : 6
ServerComponent\Version\Minor : 2
ServerComponent\BestPractices\Model\Id : Microsoft/Windows/TerminalServices

The operation completed successfully.
PS C:\TestImages> _
```

**Figure 2-12** Dism /Get-FeatureInfo /FeatureName:Remote-Desktop-Services.

- Enable the Remote-Desktop-Services feature in the offline image by executing the command shown in Figure 2-13.

```
PS C:\TestImages> dism /Image:c:\mountedimage /Enable-Feature /FeatureName:Remote-Desktop-Services
Deployment Image Servicing and Management tool
Version: 6.2.9200.16384

Image Version: 6.2.9200.16384
Enabling feature(s)
[=====100.0%=====]
The operation completed successfully.
PS C:\TestImages> _
```

**Figure 2-13** Dism /Enable-Feature /FeatureName:Remote-Desktop-Services.

5. Verify that the feature has been enabled using the `Dism /Get-FeatureInfo` command as shown in Figure 2-14.

```

PS C:\TestImages> dism /Image:c:\mountedimage /Get-FeatureInfo /FeatureName:Remote-Desktop-Services
Deployment Image Servicing and Management tool
Version: 6.2.9200.16384

Image Version: 6.2.9200.16384
Feature Information:
Feature Name : Remote-Desktop-Services
Display Name : Remote Desktop Services
Description : Add or remove Remote Desktop Services.
Restart Required : Possible
State : Enabled

Custom Properties:
ServerComponent\Description : <a href="TS_admin.chm::/html/2584b4b6-9185-4914-9f3f-9e60a72a3bda.htm">Remote Desktop Services</a> enables users to access virtual desktops, session-based desktops, and RemoteApp programs. Use the Remote Desktop Services installation to configure a Virtual machine-based or a Session-based desktop deployment.
ServerComponent\DisplayName : Remote Desktop Services
ServerComponent\EventQuery : RemoteDesktop.Events.xml
ServerComponent\Id : 18
ServerComponent\Type : Role
ServerComponent\UniqueName : Remote-Desktop-Services
ServerComponent\Version\Major : 6
ServerComponent\Version\Minor : 2
ServerComponent\BestPractices\Model\Id : Microsoft/Windows/TerminalServices

The operation completed successfully.
PS C:\TestImages> _

```

**Figure 2-14** Change Verification—`Dism /Get-FeatureInfo /FeatureName:Remote-Desktop-Services`.

6. Commit changes to the image and unmount the **.wim** file, as shown in Figure 2-15. This will repack the image file with the changes made. It might take some time depending on the speed of your computer.

```

PS C:\TestImages> dism /Unmount-Image /MountDir:c:\mountedimage /commit
Deployment Image Servicing and Management tool
Version: 6.2.9200.16384

Saving image
[=====100.0%=====]
Unmounting image
[=====100.0%=====]
The operation completed successfully.
PS C:\TestImages> _

```

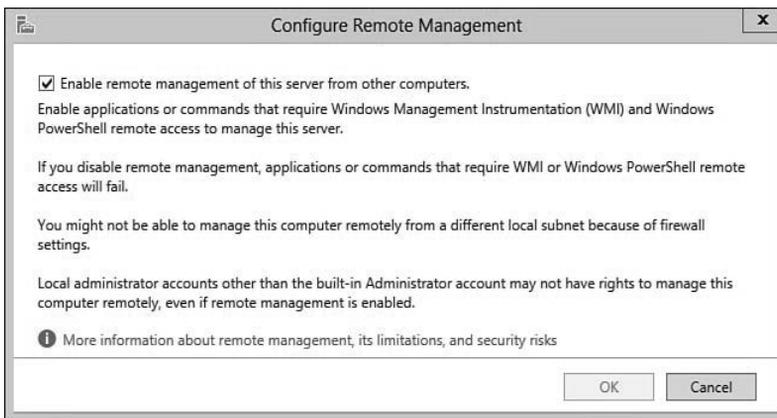
**Figure 2-15** `Dism /Unmount-Image /commit`.

**NOTE** When unmounting images, it is important to close all windows and applications, especially File Explorer windows. This will help prevent locks during the unmounting process.

## Configuring Remote Server Roles

As discussed previously, remote management of servers is extremely helpful for an administrator, especially in scenarios in which your organization is driving a centralized management approach or if you are managing a group of Server Core installations.

Before remote management can occur, the remote servers must be configured to enable remote management. This is on by default for new installations but can be changed by navigating to the Local Server properties of Server Manager as shown in Figure 2-16.

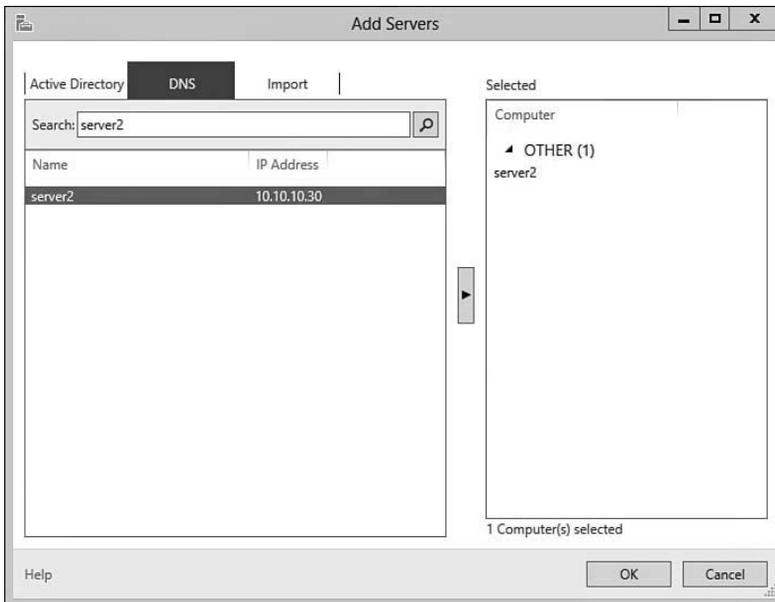


**Figure 2-16** Server Manager Remote Management.

Similarly, remote management can be also be configured using the PowerShell command `Configure-SMRemoting.exe -Enable` or the `-Disable` switch if choosing to disable the service.

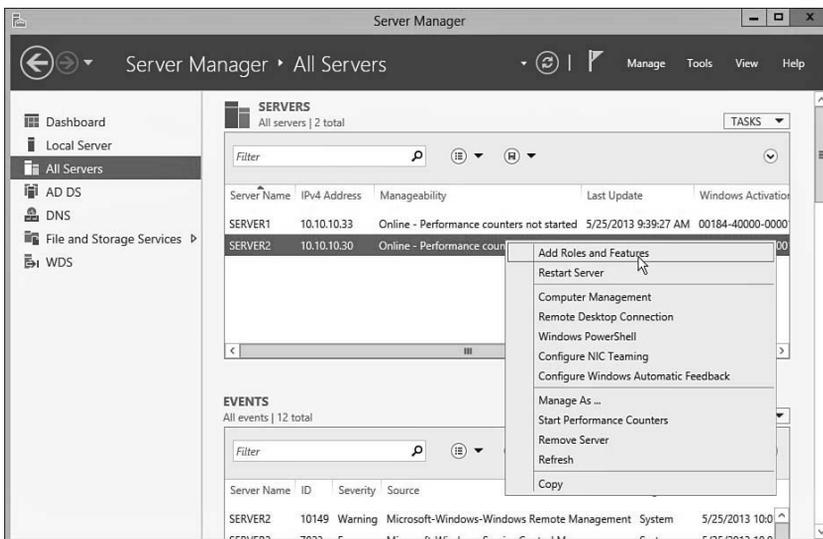
**NOTE** To enable remote management on legacy systems, you might be required to perform additional configuration steps, such as enabling WMI through the Windows Firewall service. For more information, refer to “Manage Multiple, Remote Servers with Server Manager” at <http://technet.microsoft.com/en-us/library/hh831456.aspx>.

Once enabled for remote management, use the **Add other servers to manage** feature from the Server Manager Dashboard. The Add Servers dialog enables you to search for remote servers using Active Directory by importing a list from a text file or by using DNS as shown in Figure 2-17.



**Figure 2-17** Add Servers Dialog Box.

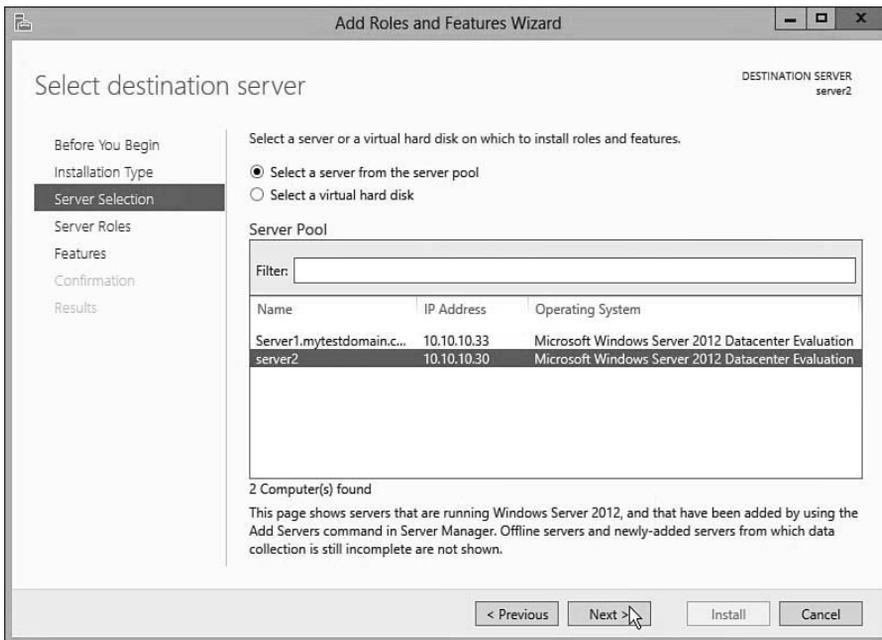
After adding a remote server, it will be listed under the *Server Manager > All Servers* group. To perform a remote administrative task, such as Adding Roles and Features, highlight the remote server and right-click to bring up the list of remote management options as shown in Figure 2-18.



**Figure 2-18** Adding Roles and Features Remotely.

**NOTE** In situations where different security boundaries—such as managing between workgroups or domains—exist, you might consider using the **Manage As** function to first supply the necessary authoritative credentials.

From this point, step through the Add Roles and Features Wizard as you have done previously. The only difference this time is to select the remote server previously added. To ensure the proper remote server is selected, take note of the destination server listed in the upper-right corner of the dialog box, as shown in Figure 2-19.



**Figure 2-19** Adding Roles and Features to Destination Server.

After you have installed the role, you now have the ability to manage and configure services associated with the role centrally from Server Manager on your managing server. In addition to Server Manager, PowerShell can be another powerful tool to simplify the installation and management of server roles remotely.

Using PowerShell, an administrator can perform a series of commands. Some common commands are outlined in Table 2-6.

**Table 2-6** PowerShell Remote Server Commands

Command	Meaning
<code>Get-Windows Feature -ComputerName [remote computer name]</code>	Retrieves a list of roles and features installed on the remote server specified
<code>Install-WindowsFeature -Name [feature name] -ComputerName [remote computer name] -Restart</code>	Installs a specific feature to the destination computer listed. Issues a restart if required
<code>Uninstall-WindowsFeature -Name [feature name] -ComputerName [remote computer name] -Restart</code>	Removes a specific feature to the destination computer listed. Issues a restart if required.

## Configuring Windows Server 2012 R2 Services

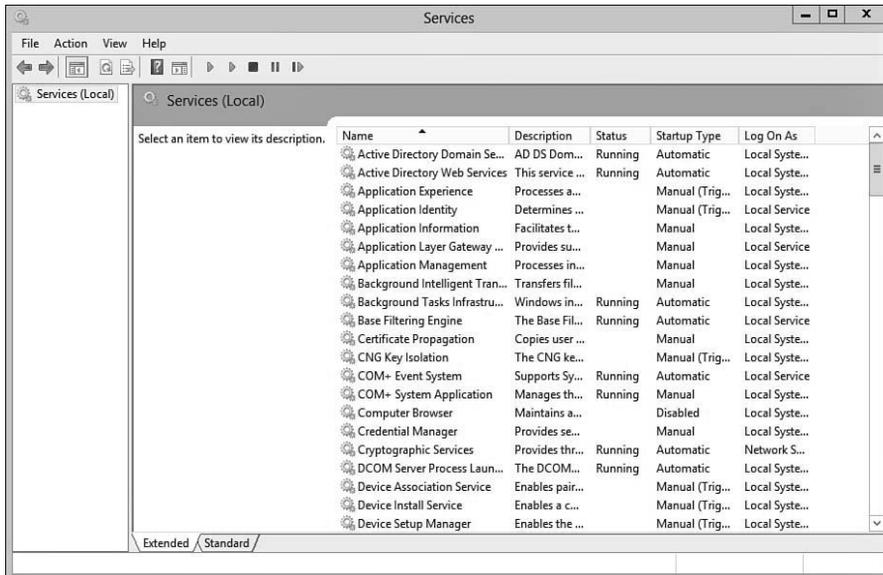
Windows services have been around for some time. If you recall, a service is an application that runs in the background without a traditional user interface or requiring user interaction to complete its core function. Services and their configurations are stored in a database known as the Service Control Database. Information is also stored under subkeys located in the Registry. Many services are installed and configured by default when the operating system or additional roles are installed. Examples of services include Windows Print Spooler, Windows Firewall, Windows Event Log, Windows Time, and so on.

Depending on the scenario, some services require additional configuration and management. As with all administrative operations, managing services also requires the proper permissions. Members of the local administrators group, account operators, domain admins, or higher all have the ability to manage services by default. Microsoft has provided two methods for managing services, the `services.msc` snap-in for the Microsoft Management Console (MMC) and the Service Controller configuration `sc config` command. An administrator will use these methods to perform the following:

- Local and remote administration of services
- Configuration of custom developed services
- Start, stop, pause, resume, or disable services
- Configure recovery actions if a service fails
- Run services as a specific user
- Enable or disable services for certain hardware profiles
- View service status and details

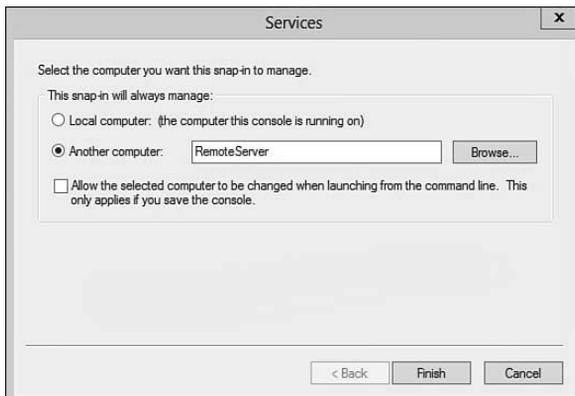
## Services.msc

To manage services via a GUI, use the Services.msc snap-in. The services snap-in, as shown in Figure 2-20, can be launched by searching for services.msc from the Charms bar or by navigating to **Start > Administrative Tools > Services**.



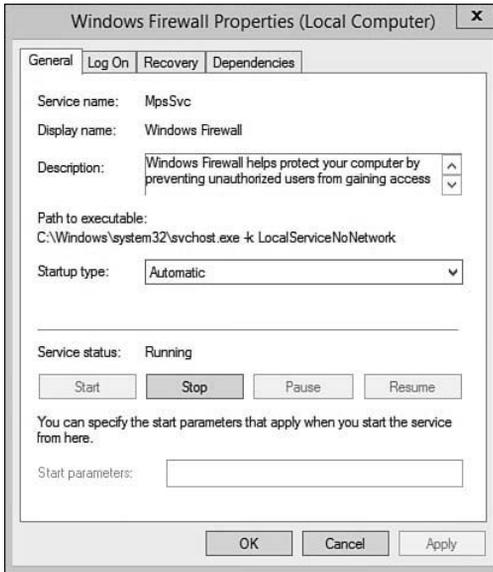
**Figure 2-20** Services Snap-in for Microsoft Management Console.

In the instances where services need to be managed remotely from a central console, you can add the Services snap-in to a custom Microsoft Management Console. To do this, launch the MMC application from the Search charm, add the Services snap-in to the console, and specify the name of another computer or browse to it using the **Browse** button as shown in Figure 2-21.



**Figure 2-21** Remote Services Management.

Regardless of local or remote, a handful of items are configurable from the Services snap-in. Each service listed has a series of configurable properties. For example, Figure 2-22 illustrates the Properties dialog box for the Windows Firewall service (MpsSvc).



**Figure 2-22** Windows Firewall (MpsSvc) Properties Dialog Box.

As you can see, several configurable items are grouped into different tabs as outlined in Table 2-7.

**Table 2-7** Configurable Properties for Services

Property Tab	Description
General	Used to view information about the service such as: <ul style="list-style-type: none"> <li>■ <b>Service name:</b> Windows short name for the service</li> <li>■ <b>Display name:</b> User-friendly display name for the service</li> <li>■ <b>Description:</b> Brief explanation of the service function</li> <li>■ <b>Path to executable:</b> Local path for the executable or binary of the service</li> <li>■ <b>Startup type:</b> Sets the startup type for the service such as automatic, automatic with a delayed start, manual, or disabled</li> <li>■ <b>Service status:</b> Displays the current status of the service whether it is running, stopped, or paused and provides the ability to change the service status</li> </ul>

Property Tab	Description
Log On	Used to configure the account used to start the service upon boot up. In most cases, this is defaulted to the Local Service or System built in accounts. If a specific account has been delegated the ability to run the service, this tab provides the ability to supply the authoritative credentials.
Recovery	Provides recovery options and the automated responses if the service fails.
Dependencies	Lists the dependant and depending services or applications for the specific service.

## SC Commands

For local or remote management through the command line, Microsoft has included the ability to interface with the Service Controller using the **C:\Windows\System32\SC.exe** application. Launch the application by opening an Admin Command Prompt by right-clicking the **Start** button and choosing **Command Prompt (Admin)**. SC.exe is particularly useful when working with Server Cores and for testing/troubleshooting issues. Commonly used SC commands are listed in Table 2-8.

**Table 2-8** Common SC Commands

Command	Meaning
SC Query	Queries a server for Service Status. Outputs information such as Service Name, Display Name, Type, and State of the service.  <b>SC [\\ServerName] Query</b>
SC [Start, Stop, Pause, Continue]	Executes command to start, pause/continue, or stop a service.  <b>SC [\\ServerName] [Start/Stop/ Pause/Continue] [ServiceName]</b>
SC Create	Creates a new service in the Service Control Managers database. The startup type, location to the binary path, display name, and so on are among the configuration options for this command.
SC Config	Configures local or remote services.  <b>SC [\\ServerName] config [ServiceName] [options]</b>  <b>Common Options:</b> <ul style="list-style-type: none"> <li>■ <i>Start</i>=[boot, auto, demand, disabled]</li> </ul>
SC delete	Deletes a service.  <b>SC [\\ServerName] delete [ServiceName]</b>

Command	Meaning
SC description	Provides or updates the user friendly name, or description of a service.  <b>SC</b> [\\ServerName] <b>description</b> [ServiceName] [Description]
SC failure	Sets the services automatic recovery options if a failure occurs.  <b>SC</b> [\\ServerName] <b>failure</b> [ServiceName] [Options]  <b>Common Options:</b> <ul style="list-style-type: none"> <li>■ <i>Reset</i>= [x, where x is the period of time measured in seconds in which the error count will be reset back to zero]</li> <li>■ <i>Reboot</i>= [message to be broadcasted upon failure]</li> <li>■ <i>Command</i>= [command to be executed upon failure]</li> <li>■ <i>Actions</i>= [Specifies the actions and time in which they will occur such as run, restart, and reboot]</li> </ul>

**NOTE** These are only a few of the options available for the SC command. For a complete list, refer to “SC” at <http://technet.microsoft.com/en-us/library/bb490995.aspx>.

## Configuring NIC Teaming

NIC Teaming, also known as Load Balancing/Fail Over (LBFO), is a strategy used to increase network availability and overall performance. Multiple network interface cards are joined together and operate as a single entity. Previously, NIC Teaming was left for the manufacturers to provide a tool. Today, NIC Teaming is included in Windows Server 2012 R2 to provide the following capabilities:

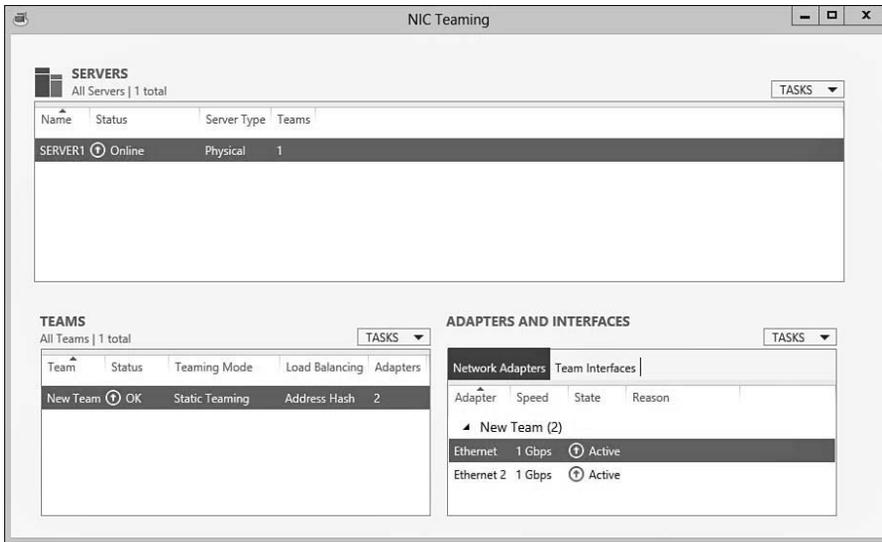
- **High Availability:** A server can contain multiple network cards, each connected to a different network switch part of the same network segment. This scenario provides high network link availability in the event of a single NIC failure, single switch failure, or single link failure.
- **Increased Throughput:** Multiple network interface cards can be teamed together to provide increased throughput or load-balancing capabilities. The aggregation of multiple links provides a “larger pipe” to connect to the network.

## Configure NIC Teaming via GUI

You can launch the NIC Teaming configuration interface, as shown in Figure 2-23, from the Server Manager Local screen. To configure NIC Teaming via GUI, perform the following steps:

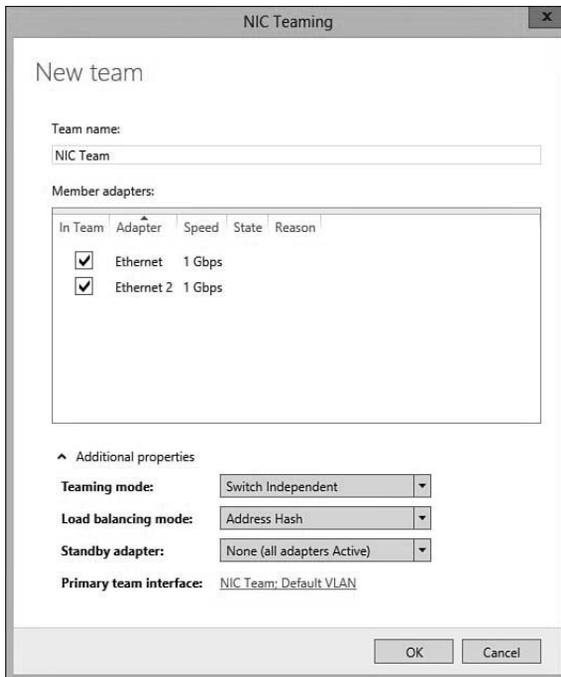
**Key  
Topic**

1. From the NIC Teaming interface, highlight the available adapters to be added to the team as shown in Figure 2-23.



**Figure 2-23** NIC Teaming Configuration Interface.

2. Once highlighted, select **Add to New Team** from the **Tasks** drop-down list. This will launch the New team dialog box.
3. Type a Team name in the NIC Teaming dialog box as shown in Figure 2-24. Confirm that all appropriate adapters are checked.



**Figure 2-24** New Team Dialog Box.

- Expand the **Additional Properties** drop-down and choose the appropriate Teaming mode. The following modes can be selected:
  - **Static Teaming:** This mode requires custom configurations on the switch and host to identify the links as being part of the team. Static Teaming is considered a Switched Dependent mode because it depends on the switch for configuration. It is used for custom scenarios with supported switches where more granular or manual control is required.
  - **Switched Independent:** Refers to the ability of the NIC Team to manage the connections to the switches and keeps track of the teams' connection state. This is the most common teaming method as it supports just about any Ethernet switch. This option enables the NIC Team to split adapters' connections between one or multiple switches.

Because the Team manages the connection states, Switched Independent mode also provides an option for Active/Active or Active/Standby teaming. In Active/Active, all links are used for load balancing and throughput. For Active/Standby teaming, one link can be designated as the active link where others are remaining passive. The passive links stand by and take over during a failover event resulting from the active link failing.

- **LACP:** Link Aggregation Control Protocol (LACP) is a Switched-Dependent mode used to dynamically identify and aggregate links between a host and switch. The use of enterprise classed managed switches is required.
5. Choose the appropriate load balancing mode from the following options:
    - **Address Hash:** Load balances outbound network traffic across all active NICs. Inbound traffic is received by only one NIC in the team. This mode is typically seen with web servers.
    - **Hyper-V Port:** Provides improved support for load balancing between virtual machines (VMs). Hyper-V with the NIC Team to load balance and deliver VM traffic over specific NICs.
  6. Select the appropriate Standby adapter by selecting a specific adapter or choosing **None** where all adapters remain active.
  7. Confirm the Primary team interface. This enables you to choose the default or specific Virtual Local Area Network (VLAN).
  8. Click **OK** when complete.

After you have successfully configured a NIC Team, a new logical adapter will be available for management under the Network and Sharing Center. From here, you can manage adapter settings much like you have done previously with a traditional adapter. In the event that you decide to remove the NIC Team, the NIC Team user interface will return the adapters to the previous state prior to teaming.

**NOTE** There are many scenarios and configurations for NIC Teaming. For a complete installation and configuration guide, refer to “Windows Server 2012 R2 NIC Teaming Deployment and Management” available from the Microsoft Download Center at <http://www.microsoft.com/en-us/download/details.aspx?id=40319>.

### Configure Basic NIC Teaming via PowerShell

You can configure NIC Teams by issuing PowerShell commands. To create a new NIC Team, execute the following command:

```
New-NetLbfoTeam [Team Name], Ethernet, Ethernet 2
```



Once issued, the NIC Team will be established and enabled in the default Switch Independent mode. To remove the NIC Team, execute the command:

```
Remove-NetLbfoTeam [Team Name]
```

**NOTE** For a complete list of PowerShell cmdlets refer to “NIC Teaming Cmdlets in PowerShell” at, [http://technet.microsoft.com/en-us/library/jj130849\(v=wps.620\).aspx](http://technet.microsoft.com/en-us/library/jj130849(v=wps.620).aspx).

## Exam Preparation Tasks

### Review All the Key Topics



Review the most important topics in the chapter, noted with the key topics icon in the outer margin of the page. Table 2-9 lists a reference of these key topics and the page numbers on which each is found.

**Table 2-9** Key Topics for Chapter 2

Key Topic Element	Description	Page Number
Table 2-2	Describes the minimum hardware requirements for installing Windows Server 2012 R2.	40
Step list	Shows you how to install the Server Core version of Windows Server 2012 R2.	42
Figure 2-3	You can select either the Server Core version or the Server with a GUI.	43
Table 2-3	Summarizes several more common commands used in configuring Server Core.	46
Step list	Shows you how to install the Server with a GUI version of Windows Server 2012 R2.	48
Step list	Shows you how to convert your server from Server with a GUI to Server Core.	50
Step list	Shows you how to convert your server from Server Core to Server with a GUI.	50
Table 2-4	Listing of local groups built into Windows Server 2012 R2.	53

<b>Key Topic Element</b>	<b>Description</b>	<b>Page Number</b>
Step list	Shows you tasks to complete when servicing offline images.	62
Step list	Shows you how to create a new NIC team using the NIC Teaming interface.	73
Paragraph	Shows you how to configure NIC Teaming via PowerShell.	75

## Complete the Tables and Lists from Memory

Print a copy of Appendix B, “Memory Tables” (found on the CD), or at least the section for this chapter, and complete the tables and lists from memory. Appendix C, “Memory Tables Answer Key,” is also on the CD and includes completed tables and lists to check your work.

## Definitions of Key Terms

Define the following key terms from this chapter, and check your answers in the glossary.

Desired State Configuration (DSC), Failover, Load Balance, Sconfig.cmd, Windows PowerShell



**This chapter covers the following subjects:**

- **Designing storage spaces:** Planning is one of the most important aspects for any deployment. This section introduces storage spaces and the many benefits they bring to the table, including the support for disk enclosures and tiered storage under Windows Server 2012 R2.
- **Configuring Basic and Dynamic Disks:** This section provides an overview of basic and dynamic disks and how to manage them within Windows.
- **Configuring MBR and GPT Disks:** This section discusses the importance of disk signatures and partition tables and when to use each type.
- **Managing Volumes:** Taking a deeper look into basic and dynamic disks, this section identifies the various types of basic volumes and advanced disk configurations with the use of dynamic disks.
- **Creating and Mounting Virtual Hard Disks (VHDs):** This section provides you with an understanding of virtual hard disks and how to manage them in your environment using tools such as Disk Management.
- **Configuring Storage Pools and Disk Pools:** This section provides step-by-step instructions on how to implement storage pools and virtual disks.

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