# **Chapter 1**

# **Introducing Windows Server 2012/R2**

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| At a Glance |

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## Overview

This chapter serves as an introduction to the Windows Server 2012/R2 server operating system. Students will learn about basic management tools that are available in this release of Windows Server. Different roles and services that can be installed are also briefly explored, followed by a summary of features in Windows Server 2012.

## Chapter Objectives

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

* Explain the function of a server operating system in a network
* Describe the editions of Windows Server 2012/R2
* Define private cloud terms and technologies
* Explain the core technologies of Windows Server 2012/R2
* Describe Windows Server 2012/R2 roles
* Summarize the new and enhanced features of Windows Server 2012

## Teaching Tips

## The Role of a Server Operating System

1. Explain to students the role of a server in a business environment, and describe how it assists with business operations.

#### Server: Hardware or Software?

1. Explain the difference between hardware and software, and detail how the software installed on top of hardware determines its function as a server.
2. Provide students with an understanding of the differences and similarities between desktop operating systems (Such as Windows 8) and server operating systems (Windows Server 2012).

#### Server Operating Systems Versus Desktop Operating Systems

1. Emphasize how Windows Server 2012/R2 prioritizes server functions over GUI tasks, and list some of the network services available on Server 2012:
   1. File and Printer Sharing
   2. Web Server
   3. Routing and Remote Access Services (RRAS)
   4. Domain Name System (DNS)
   5. Dynamic Host Configuration Protocol (DHCP)
   6. File Transfer Protocol (FTP) Server
   7. Active Directory
   8. Distributed File System (DFS)
   9. Hyper-V
   10. Fax Server
2. Compare the services supported by Windows Server 2012 to the services supported by Windows 8.1. Note some of the increased reliability features available in the Server version of Windows in comparison to the desktop version.

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| *Teaching* *Tip* | The difference between what is considered a client vs. a server ultimately comes down to software installed on an operating system. Windows 8.1 can act as a server for some types of services, and Windows Server 2012/R2 may function as a client in some circumstances. |

## Windows Server 2012/R2 Editions

1. List the different editions of Windows Server 2012/R2:
   1. Datacenter
   2. Standard
   3. Essentials
   4. Foundation
2. Explain to students how the different editions of Windows Server are used for organizations with different requirements.

#### Datacenter and Standard Editions

1. Describe how the Datacenter Edition of Windows Server can be used to fit the needs of a large scale organization. Note the need to purchase a license for every two physical processors in a machine.
2. Students should be aware that the Datacenter edition allows for unlimited virtual instances of the OS.
3. Compare the Standard Edition of Windows Server to the Datacenter Edition, and point out that that Standard only allows two virtual instances of the OS.
4. Outline the similarities in hardware support between Datacenter and Standard editions:
   1. Up to 4 TB of RAM
   2. Up to 64 physical processors
   3. Up to 64 nodes in a server cluster
5. Server Core should be explained to students as an installation option that does not utilize a GUI.
6. Describe the need for a client access license (CAL) for each user who logs on to a server.

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| Teaching  Tip | CAL licensing can be confusing at first glance. More information on CAL licensing can be found here:  <http://download.microsoft.com/download/6/A/1/6A1647EE-3FC7-47F2-9AFE-470AD5E5D856/ClientAccessLicenses101.pdf> |

#### Essentials Edition

1. Students should be made aware of the Essentials Edition, which is intended for small businesses with 25 or less users.
2. Note that the Essentials Edition can be installed on a physical server or in a virtual machine, but not both at the same time.
3. Point out that Essentials Edition is automatically set up as a root domain controller, which is the first domain controller in an Active Directory forest. Make students aware of the other services that are automatically configured during install.
4. Explain that the Essentials Edition only supports two physical processors and up to 64 GB of RAM, and can’t be installed in Server Core mode. Students should understand that no CALs are required to support the maximum of 25 users.

#### Foundation Edition

1. Compare the Foundation Edition of Windows Server 2012/R2 to the Essentials edition, and note that only 15 users are supported.
2. Note that this edition only supports up to 32 GB of RAM and a single physical processor. Students should be aware that it can’t be installed in a virtual machine, nor can it use Server Core mode.

#### Comparing Editions

1. Provide an overview of the differences between the different Windows Server 2012/R2 editions.

## Windows Server 2012/R2 and the Private Cloud

1. Describe the concept of cloud computing to students, and explain some of the benefits of cloud computing.
2. Explain how virtualization is used to facilitate cloud computing, and define some of the terms associated with virtualization:
   1. Virtual machine, which is the virtual environment that emulates a physical computer’s hardware and BIOS.
   2. Guest OS, which is the OS running in a VM.
   3. Host computer, which indicates the physical computer the VM software is installed on.
   4. Virtualization software, which creates and manages VMs, and provides the virtual environment for a guest OS.
   5. Hypervisor, which serves as the virtualization software component that creates and monitors the virtual hardware environment.

#### Public Cloud Versus Private Cloud

1. Explain the differences between a public cloud, which is a cloud computing service provided by a third party, and a private cloud, which is provided by an internal IT department.
2. Describe how Virtual Desktop Infrastructure (VDI) allows an end user to connect to a private cloud to access their desktop and applications.
3. Note that Hyper-V is the essential feature in Windows Server 2012/R2 for constructing private clouds.

## Windows Server 2012/R2 Core Technologies

1. List some of the technologies upon which the Windows Server 2012/R2 is built:
   1. Server Manager
   2. New Technology File System (NTFS)
   3. Active Directory
   4. Microsoft Management Console
   5. Disk Management
   6. File and printer sharing
   7. Windows networking

#### Server Manager

1. Explain how the Server Manager is used to provide a single interface for installing, configuring, and removing server roles and features, as well as ascertain server status and configuration.
2. Demonstrate to students how to navigate inside of the Server Manager. Students should be familiar with how to open administrative tools from within the Server Manager, as well as how to add additional servers to the Server Manager window.

#### NTFS

1. Introduce students to the New Technology File System (NTFS), and discuss how it has evolved on different versions of Windows.
2. Compare the NTFS file system to FAT/FAT32, and note some of the limitations of NTFS’s predecessor.
3. Stress the importance of the capability within NTFS to utilize file / folder permissions for different users and groups.

#### Active Directory

1. Describe the Active Directory service as a service that centralizes the management of users and groups, as well as the creation of network-wide user / computer policies.
2. Discuss with students how Active Directory provides authentication and authorization of users to network resources.
3. Students should understand how Active Directory compliments DNS services in a Windows domain environment.

#### Microsoft Management Console

1. Teach students about the Microsoft Management Console, which serves as a common framework that consolidates administrative tools into a single GUI window through the use of snap-ins.
2. Show students some of the prebuilt MMCs and snap-ins available for use within the MMC.

#### Disk Management

1. Demonstrate to students how the Disk Management snap-in or the File and Storage Services role can be utilized to monitor and set up disks on a server.
2. Note that these tools can be used to create redundant disk configurations, such as RAID1 / RAID5 volumes.
3. The File and Storage Services provides the ability to create storage pools in Windows Server 2012/R2.

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| ***Teaching***  ***Tip*** | RAID configurations that are created inside of an operating system make use of software RAID, which typically has reduced performance when compared to hardware RAID. |

#### File and Printer Sharing

1. Point out that the most common reason for building and installing a server is to enable file, printer, and resource sharing.
2. Make students aware of the advanced features provided by Windows Server 2012/R2 for the explicit purpose of file, printer, and resource sharing, such as the Distributed File System, shadow copies, and disk quotas.

#### Windows Networking Concepts

1. Define the Windows workgroup model as consisting of a small collection of computers that share resources amongst each other. Note that this is also known as a peer-to-peer network.
2. Point out that the workgroup model is intended for use in networks with fewer than 10 users. Students should understand that a Windows Server 2012/R2 server that participates in a workgroup is known as a stand-alone server.
3. The Windows domain model should be introduced as a group of computers that share common management, and is preferred for networks consisting of more than 10 users.
4. Define a domain controller as a Windows server that has Active Directory installed and controls user access to domain resources. Note that a member server is a server in the management scope of a domain but does not have Active Directory installed.

#### Windows Networking Components

1. Explain to students that a network connection consists of a collection of networking components, such as network interface, network protocol, and network client and server software.
2. Note that a network interface consists of the network interface card (NIC) hardware and the device driver software. Demonstrate how to gather information on a network interface.
3. Educate students on how a network protocol outlines the rules and format of communication between network devices. Explain that TCP/IPv4 and TCP/IPv6 are both examples of network protocols.
4. Define a network client as the software that sends requests to a server to access resources, whereas a network server is the software that responds to requests for shared network resources.

**Quick Quiz 1**

1. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is necessary for each user who logs onto a server.

Answer: Client Access License (CAL)

1. True or False: With Virtual desktop infrastructure (VDI), users must have a desktop which runs a virtual machine that gives them access to a network of resources.

Answer: False

1. What service is used to centralize authorization and authentication on a Windows network?
   1. Active Directory
   2. DNS
   3. DHCP
   4. NTFS

Answer: A

1. TCP/IPv4 and TCP/IPv6 are both examples of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ , which specify the rules and format of communication between network devices.
   1. Network applications
   2. Network servers
   3. Network clients
   4. Network protocols

Answer: D

1. Which version of Windows Server 2012/R2 is intended for a small business with 25 or fewer users?
   1. Datacenter
   2. Essentials
   3. Foundation
   4. Standard

Answer: B

## Windows Server 2012/R2 Roles

1. Explain that a server role is a function or service that a server performs, whereas role services add functions to the main role.
2. Server features can be explained as functions that can be added to enhance or support an installed role.

#### Active Directory Certificate Services

1. Educate students on the use of the Active Directory Certificate Services (AD CS) role in creating, issuing, and managing digital certificates that can be used to verify identities.

#### Active Directory Domain Services

1. Explain that the Active Directory Domain Services (AD DS) role installs Active Directory and makes a Windows Server 2012/R2 computer into a domain controller.
2. Students should understand that Active Directory’s main purpose is to handle authentication and authorization for users / computers on a network.

#### Other Active Directory-Related Roles

1. Introduce students to the other server roles related to Active Directory that can be installed on Windows Server 2012/R2:
   1. Active Directory Federation Services (AD FS) – Provides single sign-on access to web-based resources.
   2. Active Directory Lightweight Directory Services (AD LDS) – Provides AD functionality without need for forests, domains, and domain controllers.
   3. Active Directory Rights Management Services (AD RMS) – Assists with document and data control.

#### DHCP Server

1. Explain to students that the Dynamic Host Configuration Protocol (DHCP) Server role provides automatic IP address assignment and configuration for client computers.

#### DNS Server

1. Emphasize the importance of DNS in both Internet and Windows domain environments, and not that the DNS Server role in Windows Server 2012/R2 is tightly integrated with the Active Directory Domain Services role, which requires DNS for operation.

#### File and Storage Services

1. Discuss how the File and Storage Services role is used to provide highly available, reliable, and shared storage to Windows / client OSs on a network.

#### Hyper-V

1. Educate students on the Hyper-V role, which provides services for creating and managing virtual machines.
2. Familiarize students with the process for installing a guest OS into a virtual machine using the Hyper-V role.

#### Network Policy and Access Services

1. Detail how the Network Policy and Access Services role can be used to ensure client authentication, authorization, and health.
2. Note that the role services that can be installed with this role include the following:
   1. Network Policy Server (NPS)
   2. Health Registration Authority (HRA)
   3. Host Credential Authorization Protocol (HCAP)
3. The Network Access Protection tool should be discussed as a tool for ensuring all computers have necessary patches and security updates.

#### Print and Document Services

1. Explain that the Print and Document Services role enables centralization and management of access to network printers.
2. Discuss some of the role services that are available for this role, such as the Print Server, Internet Printing, Line Printer Daemon (LPD), and the Distributed Scan Server role services.

#### Remote Access

1. Introduce the Remote Access role as a role that enables a server to function as a virtual private network (VPN) server and router, as well as a DirectAccess server.
2. DirectAccess should be explained as a user friendly VPN technology that also makes management of remote computers easier.

#### Windows Deployment Services

1. The Windows Deployment Services (WDS) role can be discussed as a role that assists with the deployment of Windows in a network, as well as providing a means to configure Windows systems remotely.

## New and Enhanced Features in Windows Server 2012/R2

#### Server Core

1. Provide students with information on Server Core, which is a smaller disk and memory footprint install of the Windows Server OS.
2. Note that a Server Core installation must be managed via PowerShell, MMC, Server Manager, or a Windows remote shell.
3. Demonstrate to students how to utilize the text-based Server Configuration (sconfig.exe) program.
4. Point out that a Server Core installation uses only 5 GB of disk space vs. a GUI install, which uses 9 GB. Students should understand that this reduces the number of patches necessary also.
5. Stress that Windows Server 2012/R2 has the ability to switch between GUI and Server Core modes without re-installing the OS.

#### Minimal Server Interface

1. Discuss the use of the Minimal Server Interface (also known as MinShell), which provides a minimal set of GUI utilities, such as the Server Manager, several Control Panel applets, and the MMC.
2. Students should be aware of the utilities that are missing from MinShell, such as Internet Explorer, File Explorer, or the Start screen.
3. Demonstrate how to switch to MinShell by using Remove Roles and Features in Server Manager, and by removing the Server Graphical Shell feature.

#### Hyper-V 3.0

1. Describe Hyper-V 3.0 as a major component of Microsoft’s private cloud initiative, and make students aware of some of the new features present in Hyper-V 3.0 versus its predecessors.

#### PowerShell

1. Introduce the PowerShell command-line interactive scripting environment, which can be used like a command prompt.
2. Note that PowerShell uses “cmdlets” for local and remote management, and that new cmdlets can be created for use within PowerShell.
3. Discuss the different versions of PowerShell that have been released over the years, starting with version 1.0 in 2006, up to the current version 4.0 available in Windows Server 2012 R2 and Windows 8.1.
4. Provide students with an overview of some of the different features within PowerShell 3.0 and 4.0, such as additional core cmdlets, job-scheduling cmdlets, and language enhancements.

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| *Teaching* *Tip* | More information about the history and use of PowerShell in Windows can be found here:  <http://en.wikipedia.org/wiki/Powershell> |

#### Storage Spaces

1. Storage spaces should be discussed as a tool that uses virtual drives to fully utilize local storage on a server by combining storage from different types of disks into a single storage unit.
2. Describe how thin provisioning can be used to expand storage and only use physical storage when it is actually needed.

#### Resilient File System

1. Discuss the Resilient File System (ReFS), which is a new file system that provides reliability and some backwards compatibility with NTFS, while lacking features such as file-based compression, disk quotas, and encryption.
2. Note that the boot volume in a Windows environment can’t be ReFS-formatted.
3. Describe the advantages of ReFS over NTFS, such as on the fly file system repair, and support for huge volume sizes.

#### IP Address Management

1. The IP Address Management (IPAM) tool should be discussed as a means to monitor a network’s DHCP and DNS utilization.

#### Dynamic Access Control

1. Detail how Dynamic Access Control (DAC) provides the ability to have control over shared resources without the limitations of traditional file permissions.
2. Note that DAC works in conjunction with NTFS permissions by classifying data and using user attributes to assign permissions rather than use group memberships.

**Quick Quiz 2**

1. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is mostly backwards compatible with NTFS, and can perform automatic file system repair while also supporting large volume sizes.

Answer: Resilient File System (ReFS)

1. True or False: Active Directory Lightweight Directory Services (AD LDS) provides most of the functions of AD DS without the need for forests, domains, and domain controllers.

Answer: True

1. PowerShell uses \_\_\_\_\_\_\_\_\_\_ , which can perform various tasks such as display the date, or advanced tasks such as managing Active Directory.

Answer: cmdlets

1. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ interface is a reduced GUI available for Windows Server that provides access to tools such as Server Manager, but removes access to Internet Explorer.
   1. Server Core
   2. MinShell
   3. MiniGUI
   4. CoreShell

Answer: B

1. What service provides automatic assignment of IP addresses and network configuration for client computers on a network?
2. AD FS
3. Hyper-V
4. DHCP
5. DNS

Answer: C

# **Class Discussion Topics**

1. Start a class discussion on the use of virtualization to assist with scalability in enterprise and large network environments. How does virtualization help to cut costs and increase reliability?
2. Get students to discuss the use of Server Core installs. How might an administrator benefit from using Server Core installations vs. GUI installs? What disadvantages does this approach have?

# **Additional Projects**

Task students with testing some of the more basic PowerShell cmdlets. If possible, have students go through a basic PowerShell tutorial to get them acquainted with the utility.

Get students to experiment using the MMCs included in Windows for managing various aspects of the operating system.

# **Additional Resources**

1. Microsoft page detailing Hyper-V on Windows Server 2012:

<http://technet.microsoft.com/en-us/library/hh831410.aspx>

1. Howstuffworks article on virtualization:

<http://www.howstuffworks.com/server-virtualization.htm>

**Key Terms**

* **Active Directory** The Windows directory service that enables administrators to create and manage users and groups, set network-wide user and computer policies, manage security, and organize network resources.
* **client access licenses (CALs)** A license required by law for each user who logs on to a Windows Server 2012/R2 Standard or Datacenter Edition server.
* **cloud computing** A collection of technologies for abstracting the details of how applications, storage, network, and other computing resources are delivered to users.
* **Datacenter Edition** A Windows Server 2012/R2 edition, intended primarily for organizations using virtualization on a large scale.
* **domain controller** A Windows server that has Active Directory installed and is responsible for allowing client computers access to domain resources.
* **Essentials Edition** A Windows Server 2012/R2 edition suitable for small businesses with 25 or fewer users. This edition doesn’t support Hyper-V, and some services, such as Active Directory and DNS, are installed automatically during OS installation.
* **Foundation Edition** A Windows Server 2012/R2 edition intended as an entry-level server edition. It’s an OEM-only version that supports only 15 users and can only be purchased already installed on a server.
* **guest OS** The operating system running in a virtual machine installed on a host computer. *See* virtual machine (VM).
* **host computer** The physical computer on which virtualization software is installed and virtual machines run.
* **hypervisor** The virtualization software component that creates and monitors the virtual hardware environment, which allows multiple virtual machines to share physical hardware resources.
* **member server** A Windows server that’s in the management scope of a Windows domain but doesn’t have Active Directory installed.
* **network client** The part of the OS that sends requests to a server to access network resources.
* **network protocol** Software that specifies the rules and format of communication between devices on a network.
* **network server software** The part of the OS that receives requests for shared network resources and makes these resources available to a network client.
* **New Technology File System (NTFS)** A file system used on Windows OSs that supports compression, encryption, and fine-tuned permissions.
* **PowerShell** A command-line interactive scripting environment that provides the commands needed for most management tasks in a Windows Server 2012/R2 environment.
* **private cloud** A cloud computing service provided by a company’s internal IT Department. *See* cloud computing.
* **public cloud** A cloud computing service provided by a third party. See cloud computing.
* **role services** Services that can be installed in Server Manager to add functions to the main role. *See also* server role.
* **root domain controller** The first domain controller installed in an Active Directory forest. *See also* domain controller.
* **Server Core** A Windows Server 2012/R2 installation option that doesn’t have a traditional GUI.
* **server features** Components you can install that provide functions to enhance or support an installed role or add a stand-alone feature.
* **server operating systems** OSs designed to emphasize network access performance and run background processes rather than desktop applications.
* **server role** A major function or service that a server performs.
* **stand-alone server** A Windows server that isn’t a domain controller or a member of a domain.
* **Standard Edition** A Windows Server 2012/R2 edition suitable for most businesses that need a full-featured server and might need to use virtualization on a moderate scale.
* **virtual desktop infrastructure (VDI)** A rapidly growing sector of private cloud computing whereby users access their desktops through a private cloud; the OS and applications run on servers in a corporate data center rather than on the local computer.
* **virtual machine (VM)** The virtual environment that emulates a physical computer’s hardware and BIOS.
* **virtualization** A technology that uses software to emulate multiple hardware environments, allowing multiple operating systems to run on the same physical server simultaneously.
* **virtualization software** The software for creating and managing virtual machines and creating the virtual environment in which a guest OS is installed.
* **Windows domain** A group of Windows computers that share common management and are subject to rules and policies that an administrator defines.
* **Windows workgroup** Also called a peer-to-peer network, it’s a small collection of Windows computers whose users typically have something in common, such as the need to share files or printers with each other. No computer has authority or control over another. Logons, security, and resource sharing are decentralized.