Network Guide to Networks 8th edition West Solutions Manual

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Chapter 1

Introduction to Networking

Review Questions

1. In the client-server model, what is the primary protocol used for communication between a browser and web server?

    a. FTP

    b. TCP

    c. HTTP

    d. SSL

Answer: c. HTTP

2. Which two encryption protocols might be used to provide secure transmissions for browser and web server communications?

    a. HTTP and HTTPS

    b. SSL and TLS

    c. SSL and HTTP

    d. TCP and UDP

Answer: b. SSL and TLS

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3. Which email protocol allows an email client to download email messages to the local computer?

    a. IMAP4

    b. SMTP

    c. TCP

    d. POP3

Answer: d. POP3

4. Which email protocol allows an email client to read mail stored on the mail server?

    a. IMAP4

    b. SMTP

    c. TCP

    d. POP3

Answer: a. IMAP4

5. Which application embedded in Windows operating systems allows remote control of a computer and uses the RDP secure protocol for transmissions?

    a. Telnet

    b. Remote Desktop

    c. SFTP

    d. SSH

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Answer: b. Remote Desktop

6. A network consists of five computers, all running Windows 10 Professional. All the computers are connected to a switch, which is connected to a router, which is connected to the Internet. Which networking model does the network use?

    a. Star-bus

    b. Ring

    c. Hybrid

    d. Peer-to-peer

Answer: d. Peer-to-peer

7. In Question 6, suppose one computer is upgraded from Windows 10 Professional to Windows Server 2016. Which networking model can the network now support that it could not support without the upgrade?

    a. Hybrid

    b. Client-server

    c. Star-bus

    d. Ring

Answer: b. Client-server

8. A network consists of seven computers and a network printer, all connected directly to one switch. Which network topology does this network use?

    a. Hybrid

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b. Mesh

c. Star-bus

d. Star

Answer: d. Star

9. In Question 8, suppose a new switch is connected to the first switch by way of a network cable, and three computers are connected to the new switch. Which network topology is now used?

a. Hybrid

b. Mesh

c. Star-bus

d. Star

Answer: c. Star-bus

10. Which type of address is used at the Transport layer to identify the receiving application?

a. IP address

b. Port

c. MAC address

d. Protocol

Answer: b. Port

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11. What is the name of the domain controller database that Windows Server 2016 uses to store data about user access and resources on the network?

Answer: Active Directory

12. What is the fundamental distinction between a Layer 2 switch and a router?

Answer: A Layer 2 switch belongs only to its local network, and a router belongs to two or more networks.

13. What is the fundamental distinction between a node and a host?

Answer: A host is a computer that hosts a resource on the network, and a node is any computer or device that can be addressed on the network.

14. What is the fundamental distinction between a MAN and a WAN?

Answer: A MAN covers a small geographical area, and a WAN covers a large geographical area.

15. What is a message called that is delivered by TCP? What is a message called that is delivered by UDP? At which layer do the two protocols work?

Answer: Segment

Answer: Datagram

Answer: Transport layer

16. At the Network layer, what type of address is used to identify the receiving host?

Answer: IP address

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17. At the Data Link layer, which type of network address is used to identify the receiving node?

Answer: Physical address, MAC address, hardware address, or Data Link layer address

18. A computer is unable to access the network. When you check the LED lights near the computer's network port, you discover the lights are not lit. Which layer of the OSI model are you using to troubleshoot this problem? At which two layers does the network adapter work?

Answer: Physical layer

Answer: Data Link layer and Physical layer

19. A user complains that he cannot access a particular website, although he is able to access other websites. At which layer of the OSI model should you begin troubleshooting this problem?

Answer: Application layer

20. A user complains that Skype drops her videoconference calls and she must reconnect. At which layer of the OSI model should you begin troubleshooting? Which OSI layer is responsible for not dropping the Skype connection?

Answer: Application layer

Answer: Session layer

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Chapter 1

Introduction to Networking

Applying Concepts: Explore Network Operating Systems

It's easier to understand what a network operating system is if you've seen one or two in action. For each of the NOSes listed previously (Windows Server 2016, Ubuntu Server, and Red Hat Enterprise Linux), use your favorite search engine to complete the following steps:

1. Search for information about the NOS and write down a short description based on your findings.

Answer: Answers will vary.

2. Search for images of screenshots for the NOS. What are some major elements that you notice on these screens?

Answer: Answers will vary.

3. Find one or two introductory videos for each NOS and watch the videos. What are some similarities between the NOSes? What are some of the differences?Answer: Answers will vary.

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Answer: c. Star-bus

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Answer: Application layer

19. A user complains that Skype drops her videoconference calls and she must reconnect. At which layer of the OSI model should you begin troubleshooting? Which OSI layer is responsible for not dropping the Skype connection?

Answer: Application layer

Answer: Session layer

Hands-On Projects

Project 1-1: Set Up a Small Network

For this project, you'll need two Windows 10 computers, a small consumer-grade switch (one that does not require its firmware to be configured), and two regular network cables (a regular network cable is also called a straight-through cable or patch cable). Do the following to set up a small network:

1. Use the network cables to connect each computer to the switch. Make sure the switch has power. Verify the LED lights on the network ports of the computers and switch are lit and/or blinking to verify network connectivity and activity.
2. Open the Network and Sharing Center of each computer to verify that Windows sees the computer is connected to the network. (Right-click the network icon in the system tray on the taskbar and click **Open Network and Sharing Center.)**
3. If you don't see connectivity, reset the connection by restarting the computer. In Chapter 3, you'll learn about easier methods to verify and reset a network connection.

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4. Open File Explorer. In the navigation pane, look in the Network group. You should see the other computer listed. You won't be able to access resources on the other computer unless you share these resources in a homegroup or share a specific folder or file.

Note

You might have to turn on Network Discovery in order to see the other computer. To do this, in the left pane of the Network and Sharing Center, click **Change advanced sharing settings**. For the current profile (probably the *Guest or Public* profile), select **Turn on network discovery**. Click **Save changes**. After completing this project, be sure to revert this setting to *Turn off network discovery* if you use this computer on public networks.

5. Answer the following questions:

   a. Does your network use a client-server or peer-to-peer model?

Answer: Peer-to-peer model

   b. What is the topology of your network?

Answer: Star topology

   c. If the lights on the switch ports were not lit or blinking, what is the best theory of probable cause? At what layer of the OSI model would this theory be?

Answer: The switch does not have power or the cables are not connected at both ends.

Answer: Physical layer

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Project 1-2: Use Quick Assist

In this chapter, you learned about Remote Desktop and RDP (Remote Desktop Protocol), which IT technicians use to manage remote computers. A similar app, Quick Assist, is also built into Windows, beginning with Windows 10's Anniversary Update. Quick Assist is a client-server application that uses the HTTPS protocol to provide a convenient way for an IT technician, family member, or computer enthusiast to remotely connect to someone else's computer while providing assistance with a computer problem.

Using Quick Assist, the person receiving assistance works at the host computer, which is acting as the server in this client-server application and is serving up its desktop to the other computer. The technician providing assistance works from the client computer, which receives the host computer's desktop. For Quick Assist to work, both computers must be running Windows 10, the technician providing assistance must have a Microsoft account, and the person receiving the connection must agree to it by entering a code generated by the technician's client computer.

Note

Throughout this book, steps are written for Windows 10 Professional with the Creators Update (Version 1703). Many of the projects work equally well on earlier versions of Windows 10 Pro, on Windows 10 Home, and even on Windows 8.1. However, if you're using an edition other than Windows 10 Pro, Version 1703, watch for places where you might need to adapt the steps to fit your OS.

To complete this project, work with a partner where one person acts as a technician giving assistance, and the other acts as a person getting assistance. Quick Assist is

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designed to help people who are not in the same location work together. So if you and your partner are working on two computers in the same room, pretend you are actually working in remote locations. Perform both sets of steps twice, so you each have the chance to give and get assistance.

To give assistance:

1. Click **Start** and type **Quick Assist**, or open the Windows Accessories folder in the Start menu. Click **Quick Assist** and you see the Quick Assist app, as shown in Figure 1-22.

[[Insert Figure 1-22 here]]

2. Click **Give assistance**, and sign in with your Microsoft account if necessary. You see a 6-digit security code that is valid for 10 minutes, as shown in Figure 1-23.

[[Insert Figure 1-23 here]]

3. Do one of the following to share this information with the person you're assisting:
   a. *Copy to clipboard*: Paste the security code and instructions into an email or chat app.
   b. *Send email*: Use Quick Assist to send the security code and instructions directly by email.
   c. *Provide instructions*: Prepare to read the instructions and security code on your screen as you talk the other person through the connection process over the phone

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After the connection is established, your computer displays the screen of the person getting assistance (the host computer), along with a toolbar (see Figure 1-24) that will help you interact with the other computer.

[[Insert Figure 1-24 here]]

To get assistance:

1. Click **Start** and type **Quick Assist**, or open the Windows Accessories folder in the Start menu, and click **Quick Assist**.
2. Click **Get assistance**.
3. Enter the code provided by the technician giving assistance, and click **Submit**.
4. Click **Allow** to give permission for the technician to have access to your computer. After the connection is established, a toolbar appears at the top of your computer screen, as shown in Figure 1-25. During a Quick Assist session, the technician providing assistance has the same rights and privileges as the user account that is signed in on your computer (the host computer). Click **Pause** to temporarily prevent the technician from accessing your computer. Close the toolbar to end the connection.

[[Insert Figure 1-25 here]]

Project 1-3: Apply Troubleshooting Methodology

Most likely at this point in your IT career, you've already encountered some challenging troubleshooting scenarios with computers, mobile devices, and perhaps even with networks. Think back to one of the more interesting scenarios you've faced, one where

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you were able to solve the problem. Take a few moments to write down the symptoms you encountered, the information you gathered, and the questions you asked. Try to remember the sense of confusion or concern that this unknowing created. Then think through what theories you developed on the possible causes of the problem as well as what attempts you made to solve the problem. Write down as many details as you can remember about how you finally discovered the solution, and how you arrived at that conclusion.

Now look back at the troubleshooting flowchart in Figure 1-21. Map your problem-solving experience to the steps shown in the flowchart and include additional details as they come to you. Then answer the following questions:

1. What do you notice about your progression through the OSI model layers? Even without necessarily knowing what the OSI model is, did you naturally take a top-to-bottom or a bottom-to-top approach to the problem?

Answer: Answers will vary.

2. What theories did you test that turned out to be wrong? What information did you learn from those dead ends?

Answer: Answers will vary.

3. Did you involve anyone else in the problem-solving process? If so, who was that person and how did they help?

Answer: Answers will vary.

4. What did you do to test your solution? What measures did you take to ensure the problem didn't happen again?

Answer: Answers will vary.

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5. Considering what you've now learned about troubleshooting methodology, what could you have reasonably done differently to discover the solution more quickly?

Answer: Answers will vary.

Project 1-4: IT and Networking Certifications

This book prepares you to take the CompTIA Network+ N10-007 exam, which is considered a fundamental benchmark toward a career in IT. Many other IT certifications also apply to IT and networking. Use the web to research and answer the following questions:

1. Which certification does CompTIA recommend a candidate for the CompTIA Network+ exam to already have?

Answer: CompTIA A+ certification

2. How long does CompTIA recommend you work in networking before you take the CompTIA Network+ exam?

Answer: Nine to 12 months of work experience

3. Cisco offers a full range of certifications focused on all aspects of networking. How long does Cisco recommend you work in networking before you take the CCNA Routing and Switching exam for certification? Include the web address of your source along with your answer.

Answer: One to three years of networking experience;
<URL>http://ciscocert.force.com/english/articles/Article/Cisco-CCNA-R-S-Certification-What-are-the-prerequisites-

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EN?retURL=%2Fenglish%2Fapex%2FInstantAnswers%3FproductCategory%3DCCNA Routing_Switching_Certification&popup=false</URL>

4. How long does Cisco recommend you work in networking before you take the CCIE Routing and Switching exam? Include the web address of your source along with your answer.

Answer: Three to five years of networking experience; <URL>http://www.cisco.com/c/en/us/training-events/training-certifications/certifications/expert/ccie-routing-switching.html</URL>

5. Microsoft offers a group of certifications collectively called the MCSE (Microsoft Certified Solutions Expert). What are the current MCSE certifications? Include the web address of your source along with your answer.

Answer: Business Applications, Cloud Platform and Infrastructure, Data Management and Analytics, Mobility, and Productivity; <URL>https://www.microsoft.com/en-us/learning/browse-all-certifications.aspx</URL>

6. Search online for a job opening in IT networking in your geographical area and save or print the job description and requirements. (Excellent sites that post IT jobs are <URL>Indeed.com</URL> and <URL>Monster.com</URL>.) Answer the following questions about the job:

    a. Which degrees are required or recommended?

    Answer: Answers will vary.

    b. What types of skills are required or recommended?

    Answer: Answers will vary.

c. Which IT certifications are required or recommended?

Answer: Answers will vary.

Capstone Projects

In Capstone Project 1-1, you will set up a VM (virtual machine) using Client Hyper-V, and in Capstone Project 1-2, you set up a VM using Oracle VirtualBox. We will continue to build your virtual network of VMs in later chapters. Client Hyper-V and VirtualBox are client hypervisors, which is software used to manage VMs installed on a workstation. If you don't want to use Client Hyper-V or VirtualBox as your hypervisor of choice, you can substitute another client hypervisor, such as VMware Player, which can be downloaded free from *<URL>vmware.com</URL>*. Most of the future VM projects in this book can be completed using any of these three hypervisors.

Note that Windows Hyper-V and Oracle VirtualBox don't play well on the same computer and can cause problems, such as failed network connectivity. For that reason, don't install Hyper-V and VirtualBox on the same computer. If you must choose only one hypervisor because you only have one computer available, you'll find that future projects will usually work best using VirtualBox.

Capstone Project 1-1: Set Up a Virtual Machine Using Hyper-V

In this project, you use Hyper-V, which is software embedded in Windows 10 Professional, 64-bit version, to create and manage VMs (virtual machines) and virtual networks on a single workstation. You'll first enable the workstation UEFI to support virtualization and enable Hyper-V, and then create a VM in Hyper-V. Then you will

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install an OS in the VM. Your instructor will provide access to the Windows operating system installation files used in the VM.

Using a Windows 10 Pro, 64-bit version, computer, follow these steps to enable virtualization in UEFI, enable Hyper-V, and configure a virtual switch for the virtual network:

1. For Hyper-V to work, HAV (hardware-assisted virtualization) must be enabled in UEFI setup. If you are not sure it is enabled, power down your computer, turn it on, press a key during start-up to access UEFI setup, and make sure hardware-assisted virtualization is enabled. For the system shown in Figure 1-26, that is done on the CPU Configuration screen. Also make sure that any subcategory items under HAV are enabled. Save your changes, exit UEFI setup, and allow the system to restart to Windows.

[[Insert Figure 1-26 here]]

2. Hyper-V is disabled in Windows 10 Pro by default. To enable it, right-click **Start** and click **Apps and Features**. Scroll down and click **Programs and Features** under *Related settings*. Then click **Turn Windows features on or off.** Check **Hyper-V** and click **OK**. When Windows finishes applying changes, click **Restart now** for the changes to take effect.
3. Launch the **Hyper-V Manager** application from the *Windows Administrative Tools* folder on the Start menu. In the Hyper-V Manager left pane, select the name of the host computer, which will be listed underneath *Hyper-V Manager*.

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4. To make sure your VMs have access to the network or the Internet, you need to first install a virtual switch in Hyper-V. To create a new virtual network switch, click **Virtual Switch Manager** in the Actions pane.
5. In the Virtual Switch Manager dialog box, verify **New virtual network switch** is selected in the left pane. To bind the virtual switch to the physical network adapter so the VMs can access the physical network, select **External** in the right pane. Then click **Create Virtual Switch.** In the next dialog box, make sure **Allow management operating system to share this network adapter** is checked and click **Apply.** In the Apply Networking Changes dialog box, click **Yes.** Your virtual LAN now has a virtual switch. Close the Virtual Switch Manager dialog box.

Note

Your instructor might have special instructions for the following steps. Check with your instructor before proceeding.

To create a VM, follow these steps:

6. In the Actions pane, **Quick Create**. Use these parameters for the new VM:
   - Enter a name for your VM, such as VM1 or VM_Lab_A.
   - Click **Change installation source** and select either a .iso or .vhdx file, depending on what installation media your instructor gave you.

Note

A .iso file is a Disc Image File, which is a virtual DVD or CD. A .vhdx file is a virtual hard disk.

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- Make sure Windows Secure Boot is enabled.
- Specify the VM can use the new virtual switch you created earlier.
- Click **Create Virtual Machine**.</EOCCSBL>

7. After the VM is created, you can edit its settings if required by your instructor, or click **Connect** and then click **Start**. If you used an ISO file as the installation source, when you see *Press any key to boot from CD or DVD*, press the spacebar so the VM will boot from the ISO file. Figure 1-27 shows where a Windows 10 installation has begun. Follow the prompts on-screen and make any adjustments to default settings as directed by your instructor.

[[Insert Figure 1-27 here]]

Note

If you have trouble booting to the ISO file, consider increasing the VM's available memory in the Settings menu. For example, 64-bit Windows installs more easily with 4 GB of RAM rather than the minimum 2 GB.

8. After you have installed Windows in the VM, open the Edge browser to confirm the VM has a good Internet connection.

In future chapters, you'll continue to build your virtual network and install resources in the VMs on your network.

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Capstone Project 1-2: Set Up a Virtual Machine Using Oracle VirtualBox

Using any edition of Windows 10, you can download and install Oracle VirtualBox and use this free hypervisor to create virtual machines and a virtual network. Have available an ISO file to install the Windows operating system in the VM. Follow these steps:

1. If you are using a 64-bit host computer and want to install a 64-bit OS in the VM, HAV (hardware-assisted virtualization) must be enabled in UEFI setup. If you are not sure it is enabled, power down your computer, turn it on again, press a key during start-up to access UEFI setup, and make sure hardware-assisted virtualization is enabled. For the system shown earlier in Figure 1-26, that's done on the CPU Configuration screen. Also make sure that any subcategory items under HAV are enabled. Save your changes, exit UEFI setup, and allow the system to restart to Windows.
2. Go to **<URL>virtualbox.org/wiki/Downloads</URL>** and download the **VirtualBox platform package** for Windows hosts to your desktop or other folder on your hard drive. Install the software, accepting default settings during the installation. The Oracle VM VirtualBox Manager window opens (see Figure 1-28).

[[Insert Figure 1-28 here]]

3. To create a virtual machine using VirtualBox, click **New** in the toolbar and follow the wizard to create a VM. Select a name for your VM, for example VM1 or VM_Lab_A, and select the Windows OS you will install in it. You can accept all default settings for the VM unless directed otherwise by your instructor.

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4. With the VM selected, click **Settings** in the VirtualBox Manager window. In the VM's Settings box, click **Storage** in the left pane.
5. In the Storage Tree area, to the right of *Controller: SATA*, click the **Adds optical drive** icon, which looks like a CD with a plus (+) symbol, as shown in Figure 1-29.

[[Insert Figure 1-29 here]]

6. A dialog box appears. Click **Choose disk.** Browse to the location of the ISO file that contains the Windows operating system setup files made available by your instructor. Select the ISO file, click **Open,** and then click **OK.** You will now return to the VirtualBox Manager window.
7. Click **Start** on the toolbar. Your VM starts up and begins the process of installing the operating system. Follow the prompts on-screen and make any adjustments to default settings as directed by your instructor.
8. After you have installed Windows in the VM, open the Edge browser to confirm the VM has a good Internet connection.

Note

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Chapter 1

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At a Glance

Instructor's Manual Table of Contents

- Overview
- Objectives
- Teaching Tips
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- Additional Projects
- Additional Resources
- Key Terms

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Lecture Notes

Overview

Loosely defined, a network is a group of computers and other devices connected by some type of transmission media. Variations on the elements of a network and its design, however, are nearly infinite. A network can be as small as two computers connected by a cable in a home office or the largest network all, the Internet, made up of billions of computers and other devices connected across the world via a combination of cable, phone lines, and wireless links. Networks might link cell phones, personal computers, mainframe computers, printers, corporate phone systems, security cameras, vehicles, and wearable technology devices. They might communicate through copper wires, fiber-optic cable, or radio waves. This chapter introduces students to the fundamentals of networks and how technicians support them.

Chapter Objectives

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

- Distinguish between client-server and peer-to-peer models used to control access to a network
- Identify types of applications and protocols used on a network
- Describe various networking hardware devices and the most common physical topologies
- Describe the seven layers of the OSI model
- Explore best practices for safety when working with networks and computers
- Describe the seven-step troubleshooting model for solving a networking problem

Teaching Tips

Network Models

1. Define and describe the term topology. Discuss the two types of topology students will need to understand:
    - physical topology
    - logical topology

2. Explain that controlling how users and programs get access to the resources on a network is a function of the OS used on the network.

3. Introduce students to the peer-to-peer and the client-server network models. Point out that the client-server model requires one or more network operating systems (NOS).

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Peer-to-Peer Model

1. Discuss the characteristics of a P2P (peer-to-peer) network model.
2. Describe the characteristics of a traditional peer-to-peer network.
3. Use Figure 1-1 to illustrate resource sharing on a peer-to-peer network.
4. Discuss the three ways resources can be shared if all computers in a P2P network are running a Windows OS.
5. Describe the advantages of peer-to-peer networks.
6. Describe the disadvantages of peer-to-peer networks.

Teaching Tip	Be sure to emphasize that modifying file-sharing controls is operating system dependent and that this method of resource sharing may lead to access controls that are not uniform or secure.

Client-Server Network Model

1. Introduce the client/server model. Use Figure 1-2 in your discussion.
2. Define and describe a Windows domain. Point out the centralized database that contains user account information and security for the entire group of computers is called Active Directory (AD).
3. Point out that a Microsoft account links local domain resources with Microsoft cloud resources. Compare this type of account to a local account, which is specific to a domain.

Teaching Tip	Students can learn more about Microsoft Active Directory by visiting: https://docs.microsoft.com/en-us/windows-server/identity/ad-ds/get-started/virtual-dc/active-directory-domain-services-overview

4. Describe how clients and servers communicate.
5. Provide examples of current Network Operating Systems and discuss some of the tasks that a NOS is responsible.

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6. Describe the disadvantage of a client/server network relative to a peer-to-peer network.

7. Describe the advantages of a client/server network relative to a peer-to-peer network.

Client-Server Applications

1. Define network services.

2. Explain that a client-server application involves two computers:
   - client computer
   - server

3. Use Figure 1-3 to demonstrate how a client and server communicate across a network.

4. Define and discuss protocols.

Teaching Tip	Be sure to emphasize that it is possible for a computer to act as both a client and a server and explain how this might occur.

5. Discuss several popular client-server applications used on networks and the Internet:
   - web service
   - email services
   - FTP service
   - Telnet service
   - remote applications
   - Remote Desktop

Network Hardware

1. Introduce this section by using Figure 1-6 to discuss networking hardware and how that hardware is connected together.

LANs and Their Hardware

1. Define and describe a LAN. Mention that LANs are usually contained in a small space, such as an office or building.

2. Define and describe a switch.

3. Introduce the star topology. Use Figure 1-6 to illustrate a typical star topology network.

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4. Compare a star topology to a mesh topology, where each device connects to multiple other devices. Use Figure 1-1 to illustrate a mesh topology.

5. Use Figure 1-8 to discuss the concept of a network port.

6. Define and describe NICs (network interface cards). Use Figure 1-9 in your discussion. Point out that a NIC may also be called a network adapter.

7. Introduce the concept of a network backbone.

8. Note the cabling needs for a network backbone and discuss why they are important.

9. Introduce the bus topology as devices that are daisy-chained together.

10. Define and describe the star-bus topology, which is a type of hybrid topology. Use Figure 1-10 to illustrate a star-bus topology.

11. Define and describe a router as a device that manages traffic between two or more networks. Mention that a very important function of a router is to determine the best path for traffic to go through in order to reach its destination.

12. Use Figures 1-12 and 1-13 to discuss the difference between a switch and a router.

MANs and WANs

1. Define and describe a WAN as a group of LANs that spread over a wide

2. Define and describe a MAN. Point out that a MAN may also be called a CAN.

3. Use Figure 1-14 to illustrate a WAN connecting two LANs in different geographical areas.

Teaching Tip	Be sure to mention that the Internet the largest and most varied WAN in the world.

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Quick Quiz 1

1. Which of the following protocols is used by a client to send an email message?
   a. HTTP
   b. SMTP
   c. FTP
   d. RDP

   Answer: B

2. When Windows Server controls network access to a group of computers, this logical group is called which of the following?
   a. workgroup
   b. homegroup
   c. domain
   d. access group

   Answer: C

3. True or False: A client/server network is the simplest network model.
   Answer: False

4. A _____ is a central conduit that connects the segments (pieces) of a network.
   Answer: backbone

5. A network that is larger than a LAN and connects clients and servers from multiple buildings is known as which of the following?
   a. WAN
   b. MAN
   c. PAN
   d. LAN

   Answer: b

The Seven-Layer OSI Model

1. Use Figure 1-15 to compare network communications and the US Postal Service.

2. Define and describe the OSI reference model. Stress the importance of using the OSI model to help understand networking protocols and to troubleshoot network problems.

3. Introduce the seven layers of the OSI model. Use Figure 1-16 in your discussion.

4. Emphasize that the OSI model is a theoretical representation of what happens between two nodes communicating on a network.

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Teaching Tip	Students may find more information on the OSI Model's seven layers at http://support.microsoft.com/kb/103884

Layer 7: Application Layer

1. Introduce and describe the Application layer.
2. Explain how the Application Layer facilitates communication between software applications and lower-layer network services.
3. Point out that data passed between applications or utility programs and the OS is called a payload.

Layer 6: Presentation Layer

1. Introduce and describe the Presentation layer as being responsible for reformatting, compressing, and/or encrypting data in a way that the application on the receiving end can read.
2. Explain how the Presentation layer services also manage data encryption (such as the scrambling of passwords) and decryption.

Layer 5: Session Layer

1. Introduce and describe the function of the Session layer.
2. Explain how the term session is used to describe an established connection between two end points.
3. Point out that most tasks are performed by the OS when an application makes an API call to the OS.

Layer 4: Transport Layer

1. Introduce and describe the function of the Transport layer.
2. Define and describe TCP and the characteristics of a connection-oriented protocol.
3. Define and describe UDP and the characteristics of a connectionless protocol.
4. Define encapsulation as the process of adding of a header to the data inherited from the layer above.
5. Discuss the Transport layer's use of ports numbers.

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6. Point out that TCP messages are divided into smaller messages called segments and UDP messages are known as a datagram.

Layer 3: Network Layer

1. Introduce and describe the function of the Network layer.

2. Note that the IP protocol is the most common Network layer protocol.

3. Explain how the data unit accepted from the Transport layer is transformed into a packet.

4. Define and discuss an IP address. Mention that because an IP address is used by the Network layer, it may also be known as a network address.

5. Point out that IP relies on several routing protocols to find the best route for a packet when traversing several networks on its way to its destination.

6. Define and discuss fragmentation, which is a process that divides a packet into smaller packets.

Layer 2: Data Link Layer

1. Introduce and describe the function of the Data Link layer.

2. Point out that switches and NICs operate at this layer.

3. Explain that the Data Link layer puts its own control information in a header and attaches control information to the end of the packet (called a trailer) that was received from the Network layer above. The entire Data Link layer message is then called a frame.

4. Describe the communication mishap referred to as partial communication.

5. Describe a MAC address as a Layer 2 address that is found on every network adapter on the globe. Mention that a MAC address may also be referred to as a physical address, hardware address, or a Data Link layer address.

Layer 1: Physical Layer

1. Introduce and describe the function of the Physical layer.

2. Explain the different signal types corresponding to the different transmission media.

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Protocol Data Unit or PDU

1. Describe a PDU (protocol data units) and explain how it flows through the model.

2. Use Table 1-1 to discuss the different names for a PDU as it moves from one layer to another.

Summary of How the Layers Work Together

1. Use Figure 1-17 and Table 1-2 to describe the steps through the OSI layers during a browser-to-Web server transmission.

Safety Procedures and Policies

Emergency Procedures

1. Discuss the importance of knowing the best escape route in the event of an emergency.

2. Describe the components of a fire suppression system:
    a. emergency alert system
    b. portable fire extinguishers
    c. emergency power-off switch
    d. suppression agent

3. Discuss the difference between a fail open and a fail close. Point out that a fail-open policy is often based on common sense so as to ensure that, in an emergency, no one is harmed when a system is not working.

4. Explain that a material safety data sheet (MSDS) explains how to properly handle substances such as chemical solvents and how to dispose of them.

Safety Precautions

1. Explain that electrical and tool safety in workplaces is generally regulated by OSHA.

2. Discuss the general OSHA guidelines that should be followed when using power tools or other hand tools in the workplace:
    a. Wear PPE (personal protective equipment)
    b. Keep all tools in good condition and properly stored
    c. Use the right tool for the job
    d. Watch out for trip hazards

3. Describe the guidelines that should be followed when lifting heavy objects.

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4. Define and describe grounding.

5. Discuss the negative effects that static electricity (ESD) can have on electronic components.

6. Describe the steps that should be followed before touching a component.

Troubleshooting Network Problems

1. Introduce basic troubleshooting methodology.

2. Use Figure 1-21 to describe each of the seven steps of the troubleshooting methodology.

3. Demonstrate using the seven steps to troubleshoot a failed network connection (see "Applying Concepts: Troubleshoot a Failed Network Connection").

Quick Quiz 2

1. What is the seventh layer of the OSI model?
   a. Physical layer
   b. Transport layer
   c. Application layer
   d. Session layer

   Answer: C

2. The name given to a group of bits as it moves from one layer of the OSI model to the next is which of the following?
   a. frame
   b. packet
   c. segment
   d. protocol data unit (PDU)

   Answer: D

3. Protocols in the ____layer accept data from the Session layer and manage end-to-end delivery of data.
   Answer: Transport

4. True or False: The IP (Internet Protocol) operates in the Transport layer.
   Answer: False

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5. The least intelligent switches operate at which layer of the OSI model?
   a. Physical layer
   b. Transport layer
   c. Session layer
   d. Data Link layer

   Answer: D

Class Discussion Topics

1. Discuss the differences and similarities between a peer-to peer network and a client server network.

2. As a class, discuss the difference between a physical topology and a logical topology. Why are both necessary?

Additional Projects

1. The student has learned that the OSI model allows TCP to function at the Transport layer and IP to function at the Network layer. Have the students' research TCP/IP protocols in more depth in relation to the OSI model. The students should then prepare a report summarizing their research. Included in the report should be a critique of the question, "Does the OSI models conform to TCP/IP protocols, or vice versa? Require students to defend their thoughts.

Additional Resources

1. Understanding Client-Server Applications
   https://www.experts-exchange.com/articles/11271/Understanding-Client-Server-Protocols-and-Web-Applications.html

2. Client-Server vs. Peer Networks
   http://www.tomshardware.com/reviews/local-area-network-wi-fi-wireless,3020-2.html

3. The Seven Layers of the OSI Model
   http://www.webopedia.com/quick_ref/OSI_Layers.asp

4. How Stuff Works – Networking Library
   http://computer.howstuffworks.com/computer-networking-channel.htm

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Key Terms

For definitions of key terms, see the Glossary near the end of the book.

- **Active Directory (AD)**
- **Active Directory Domain Services (AD DS)**
- **API (application programming interface) call**
- **Application layer**
- **backbone**
- **bus topology**
- **CAN (campus area network)**
- **catastrophic failure**
- **client**
- **client-server applications**
- **client-server network model**
- **connectionless protocol**
- **connection-oriented protocol**
- **Data Link layer**
- **Data Link layer address**
- **datagram**
- **decapsulation**
- **domain**
- **emergency alert system**
- **encapsulation**
- **ESD (electrostatic discharge)**
- **fail close**
- **fail open**
- **fire suppression system**
- **firmware**
- **fragmentation**
- **frame**
- **FTP (File Transfer Protocol)**
- **grounding**
- **hardware address**
- **header**
- **host**
- **HTTP (Hypertext Transfer Protocol)**
- **HTTPS (HTTP Secure)**
- **hub**
- **hybrid topology**
- **IMAP4 (Internet Message Access Protocol, version 4)**
- **IP (Internet Protocol)**
- **IP address**
- **knowledge base**

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- **local area network (LAN)**
- **logical topology**
- **MAC (Media Access Control) address**
- **MAN (metropolitan area network)**
- **mesh topology**
- **material safety data sheet (MSDS)**
- **network**
- **network interface card (NIC)**
- **Network layer**
- **network operating system (NOS)**
- **network services**
- **node**
- **OSHA (Occupational Safety and Health Administration)**
- **OSI (Open Systems Interconnection) reference model**
- **peer-to-peer (P2P) network**
- **Packet**
- **PAN (personal area network)**
- **payload**
- **protocol data unit (PDU)**
- **physical address**
- **Physical layer**
- **physical topology**
- **POP3 (Post Office Protocol, version 3)**
- **port number**
- **PPE (personal protective equipment)**
- **Presentation layer**
- **protocol**
- **RDP (Remote Desktop Protocol)**
- **remote application**
- **Remote Desktop Services**
- **ring topology**
- **router**
- **scalable**
- **segment**
- **server**
- **Session layer**
- **SFTP (Secure File Transfer Protocol)**
- **SMTP (Simple Mail Transfer Protocol)**
- **SNMP (Simple Network Management Protocol)**
- **SOHO (small office-home office)**
- **SSH (Secure Shell)**
- **SSL (Secure Sockets Layer)**
- **star topology**
- **star-bus topology**
- **static electricity**
- **switch**

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- **TCP (Transmission Control Protocol)**
- **TCP/IP**
- **Telnet**
- **TLS (Transport Layer Security)**
- **topology**
- **trailer**
- **Transport layer**
- **trip hazard**
- **UDP (User Datagram Protocol)**
- **upset failure**
- **WAN (wide area network)**

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