Solution and Answer Guide

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Applying Concepts

Applying Concepts 2-1: Create A Network Diagram

Drawing network diagrams will help you more easily visualize all the various devices and connections on a network. You can choose from several very good, free diagram apps. Here, you'll use one of these apps, Diagrams.net, to create your own network diagram. Complete the following steps:

1. In your browser, go to **app.diagrams.net** and select a location to save your diagrams, as shown in Figure 2-26. You might already have an account with Google Drive, Dropbox, or one of the other online storage options, which will simplify this process for you. If you don't want to use one of these online options, click **Device** to download the file to your hard drive when you're finished with it.

2. Click **Create New Diagram**. Give the diagram an informative name, such as **Mod02_net1**, and click **Create**. What name did you give your diagram? You can save the file to a specific folder on the next screen if you want. You then see the screen shown in Figure 2-27.

   Answer: Answers may vary and should indicate useful information about the diagram, such as the name of the project or the module number.

3. Click a shape in the left pane to insert it onto the canvas, or drag and drop a shape from the left pane to the canvas. When you do, the format panel on the right changes and gives you many formatting options appropriate to that shape. Experiment with some of the settings, including color, fill, outline, opacity, text options, and arrangement.

4. Add a few more shapes and experiment with layers, labels, connections, and waypoints.

   a. To add a label, select a shape and start typing. Select the shape again, and then click the **Text** tab to change the location of that label and other attributes.

   b. To create a connection, move the mouse pointer over a shape, click a blue **X**, and drag the new connection to another location on the canvas. Attach the connection to another shape by dropping it on a blue X on the second shape.

   c. A waypoint is an intermediate point along a connection. To adjust waypoints, select a connection and drag any point on the connection to a different place on the canvas. You can change the waypoint style and endpoint styles on the Style tab.

5. Delete the objects currently on your canvas. You can delete items one at a time or press **Ctrl**+**A** to select all of them and press **Delete**.

6. At the bottom of the left pane, click **More Shapes**. The Shapes dialog box opens. What are three shape sets listed here that would be helpful drawing a network diagram?

   Answer: Answers may vary and should include examples relevant to network diagrams, such as AWS, Cloud & Enterprise, Cisco, Network, VMware, Electrical, and Floorplans.

7. In the Networking group, select **Cisco**, and then click **Apply**.

8. In the left pane, scroll down to the Cisco groups. Explore the many icons available here so you have a general understanding of what is included in each group.

9. Recreate the small network shown in Figure 2-28. The solid lines show logical device connections, and the cloud represents the Internet. The shaded boxes show the groupings of different subnets.

10. **Export your final diagram as a .png file** and save it to your local hard drive. Submit this visual with your answers to this activity's questions.

    Answer: Diagram should contain a cloud for the Internet, connected to one router, connected to two switches. Each switch should have multiple endpoint devices, such as PCs, a printer, and a file server. A box around each switch's network segment should indicate the name of the segment, such as "Sales Dept." or "Accounting Dept."

Note 2-3

Not every device on a network is shown in every diagram of that network. For example, in Figure 2-28, there's no firewall pictured. And yet, there would certainly be at least one firewall in place. The items that are shown in the diagram are selected specifically to illustrate one or a few aspects of the network.

Applying Concepts 2-2: Examine a Naming Convention

This is a step-by-step activity. It does not require any solutions.

A good naming convention will save you a lot of time that would otherwise be lost looking up device names. Consider the following device names:

002-09-03-01-03

phx-09-nw-01-rtr3

The first name is simply a string of numbers, which many people would have a hard time recognizing as meaningful information. A numeric system like this would force new employees to spend too much time decoding device names.

The second name is easier to interpret on the fly. Some of the numbers have been replaced with abbreviated names, locations, and other identifying information. The first field tells you that the

device is located in Phoenix, which is abbreviated as phx. The second field (09) refers to the floor number, so using a number is unavoidable. The third field (nw) refers to the data room's location within the building (the northwest corner) rather than the data room's number, which would also be onerous to memorize. The fourth field contains the rack number (01), and the final field (rtr3) identifies the type of device (a router) and the number of the router (3).

Note 2-5

When designing a naming convention, be sure to include enough digits in each field to allow for future expansion. A two-digit field is much more limited than a three- or four-digit field. One digit will work fine for numbering the racks in a small data closet, which can't possibly hold 10 racks. But if you're numbering employees or workstations, your company may quickly outgrow a two-digit workstation field.

Not every company needs long device names; and small devices, such as the ports on a switch, aren't big enough to accommodate long names. For example, when labeling ports on a patch panel or switch in a data room, a connection type (vertical versus horizontal, storage versus workstation, etc.) and possibly a room number may suffice. For jacks on a wall, consider names such as the employee's job title, desk location, or something similar. Avoid using employee names because many of those will change over the lifetime of the device. Ultimately, the name of the game is *consistency*.

Not every company needs long device names; and small devices, such as the ports on a switch, aren't big enough to accommodate long names. For example, when labeling ports on a patch panel or switch in a data room, a connection type (vertical versus horizontal, storage versus workstation, etc.) and possibly a room number may suffice. For jacks on a wall, consider names such as the employee's job title, desk location, or something similar. Avoid using employee names because many of those will change over the lifetime of the device. Ultimately, the name of the game is *consistency*.

Applying Concepts 2-3: Summarize Steps for Changing Software or Hardware

This is a step-by-step activity. It does not require any solutions.

Although the specifics vary for each type of software or hardware change, the general steps can be summarized as follows:

1. Generally, don't allow patches to be automatically installed in the OS, application, or device. When you're responsible for a computer or network, you need to fully understand the impact of any change before you allow that change.

2. Determine whether the patch or upgrade is necessary. Patches to plug security holes are almost always necessary and should be completed as soon as reasonably possible; however,

adding new features or functionality to software might cause more work than it's worth in time and money.

3. Read the vendor's documentation regarding the patch or upgrade to learn its purpose, and make sure you understand how it will affect the system, whether or not it is compatible with current hardware and software, and how to apply or undo the change.

4. Before deploying the patch or upgrade, test it in a testing lab to make sure it acts as expected. A testing lab is a small network that is segmented from the rest of the network, and contains computers, called test beds, that represent the typical hardware and OS configurations in your network, as well as any specialized equipment your company uses (for example, printers, bar-code readers, and biometric devices, such as fingerprint readers or retina scanners) that might interact with the proposed new software or hardware. Also determine whether and how the change can be reversed in case troubles arise. Document your findings.

5. Determine whether the change should apply to some or all users, network segments, or devices. Also decide whether it will be distributed centrally or machine by machine.

6. Schedule the change for completion during off-hours (unless it is an emergency). The time period in which a change will be implemented is called the maintenance window, and many organizations maintain a regularly scheduled maintenance window during which changes can be made. Everyone responsible for those who might be affected by a disruption in service (for example, the technical staff or directors of user departments) must be informed of and agree to the maintenance window in advance.

7. Before the change is made, inform system administrators, help desk personnel, and affected users about the change and the maintenance window, and provide reminders immediately before the maintenance window opens.

Note 2-7

If problems arise as maintenance is in progress and you realize that you are about to exceed the maintenance window, be sure to inform technical staff and users of the anticipated delay and what to expect.

8. Back up the current system, software, or hardware configuration before making any modifications. You can typically copy the firmware or OS configuration of a router, switch, or server to a USB flash drive, backup media, or network share.

9. If necessary, throughout the maintenance window, prevent users from accessing the system or the part of the system being altered.

10. Keep the installation instructions and vendor documentation handy as you implement the change.

11. After the change is implemented, test the system in real time, even though you have already tested it in the testing lab. Exercise the software as a typical user would. For hardware devices, put a higher load on the device than it would incur during normal use in your organization. Note any unintended or unanticipated consequences of the modification.

12. If the change was successful, reenable access to the system. If it was unsuccessful, revert to the previous version of the software or hardware according to your rollback plan.

13. Inform system administrators, help desk personnel, and affected users when the change is complete. If you had to reverse it, make this known and explain why.

14. Record your change in the change management system, as described later in this module.

Review Questions

1. A technician from your ISP has arrived to help you troubleshoot a weak WAN connection. To what location do you take them?

    a. IDF
    b. Work area
    c. CEO's office
    d. EF

    Answer: Answers may vary and should list a valid DOCSIS version, such as 2.0, 3.0, 3.1, or 4.0.

    Explanation: The EF (entrance facility) is the location where an incoming network, such as the Internet, connects with the school or corporate network. IDFs (intermediate distribution frames) provide an intermediate connection between the MDF and end-user equipment on each floor and in each building. A work area encompasses workstations, printers, and other networked devices, and all the patch cables, wall jacks, and horizontal cabling necessary to connect these devices to a data room. The CEO's office likely does not contain networking equipment needed to troubleshoot a WAN connection.

    A transceiver was recently damaged by a lightning strike during a storm. How might you decide whether the ISP is responsible for replacing this device, or whether your company must foot the bill?

    a. Look at whether the device is located on the ISP's side of the demarc.
    b. Look at the manufacturer information on the device's label.
    c. Look at purchase records for the device to determine when it was acquired.
    d. Look at what kinds of cables are connected to this device.

    Answer: a. Look at whether the device is located on the ISP's side of the demarc.

Explanation: The device that marks where a telecommunications service provider's network ends and the organization's network begins is the **demarc (demarcation point)**. Devices on the ISP's side of the demarc are typically the responsibility of the ISP to repair or replace. Manufacturer information, purchase records, and connected cables won't indicate whether the device is the responsibility of the ISP or the customer.

Which of the following devices are you likely to find in the MDF? Choose all that apply.

a. Routers
b. Switches
c. Network printer
d. KVM switch

Answer: a. Routers, b. Switches, and d. KVM switch

Explanation: An MDF might contain the demarc (or an extension from the demarc, if the demarc itself is located outside the building), a transceiver that converts the incoming signal from the ISP into Ethernet, other connectivity devices (such as **switches** and **routers**), network servers that are accessible by a **KVM switch**, and transmission media. A network printer should be located in a room where it is easily accessible by network users and not locked away in the MDF.

Which device converts signals from a campus's analog phone equipment into IP data that can travel over the Internet?

a. Legacy PBX
b. VoIP phone
c. Voice gateway
d. Dedicated telephone switch

Answer: c. Voice gateway

Explanation: A **voice gateway** device converts signals from a campus's analog phone equipment into IP data that can travel over the Internet, or it converts VoIP data from an internal IP network to travel over a phone company's analog telephone lines. A legacy PBX is a dedicated telephone switch that connects and manages calls within a private organization, and it manages call connections that exit the network through a VoIP gateway. A VoIP phone might be a telephone sitting at each user's location or an application hosted on a user's computer or other device.

If you're shopping for a rack switch, what component on the switch tells you it can be mounted to a rack?

a. AC adapter
b. Rack ears

    c.   Padded feet

    d.   Large fans

Answer: b. Rack ears

Explanation: Devices that can be mounted in a rack often come with attached or attachable brackets, called **rack ears**, for securing the device to the posts. If a device has padded feet, it's probably designed for sitting on a desk, table, shelf, or the floor. An AC adapter provides connection to a power source such as a power strip in the rack. Some racks might have rack fans for moving air through the rack to cool devices.

You need to connect a new network printer to a nearby wall jack. What kind of cable should you use?

    a.   Fiber-optic cable

    b.   Patch cable

    c.   Backbone cable

    d.   Plenum-rated cable

Answer: b. Patch cable

Explanation: A **patch cable** is a relatively short (usually between 3 and 25 feet) length of cabling that can be used to connect devices such as printers to nearby wall jacks. Especially on large, modern networks, backbones are often composed of fiber-optic cable. Cable running through the plenum above ceiling tile or below subflooring must be plenum-rated, which is coated with a flame-resistant jacket that produces less smoke than PVC (polyvinyl chloride) cable.

You've decided to run an Nmap scan on your network. Which apps could you open to perform this task? Choose all that apply.

    a.   Zenmap

    b.   Microsoft Edge

    c.   Command Prompt

    d.   PowerShell

Answer: a. Zenmap, c. Command Prompt, and d. PowerShell

Explanation: Nmap was originally designed as a command-line utility, which can be run in **Command Prompt** or **PowerShell**. It's also available in a GUI form called **Zenmap**. Nmap does not run in browsers such as Microsoft Edge.

What type of diagram shows a graphical representation of a network's wired infrastructure?

    a.   Rack diagram

    b.   Wiring diagram

    c. Network map
    d. Network topology

Answer: b. Wiring diagram

Explanation: A **wiring diagram** is a graphical representation of a network's wired infrastructure. In its most detailed form, it shows every wire necessary to interconnect network devices and the locations of those wires. A rack diagram shows the devices stacked in a rack system. A network map shows logical connections and addressing information. A network topology refers to the way a networks physical or logical resources work together.

Which of these is considered a secure place to store a list of documented network passwords?

    a. The CEO's smartphone
    b. A sticky note under the keyboard
    c. A password manager
    d. The MDF

Answer: c. A password manager

Explanation: At least a few trusted people should have access to network passwords. A **password manager** can be invaluable for this purpose. The CEO's smartphone might not be secure and is only accessible by one person. A sticky note under the keyboard is not secure and could be accessed by anyone. The MDF might be secure from most users but might also be accessible by technicians who should not have access to network passwords, and the MDF is not designed for securely storing and organizing passwords.

What is the first step of inventory management?

    a. Interview users.
    b. Identify network requirements.
    c. List an administrative account's username and password for each device on a network.
    d. List all components on the network.

Answer: d. List all components on the network.

Explanation: The first step in inventory management is to **list all components on the network**. A later step would include listing usernames and passwords. Identifying network requirements is the initial phase of the system life cycle. Interviewing users is the first step in the troubleshooting process.

Give three examples of *networked* devices that are not computers.

Answer: Answers may vary and might include security cameras, SCADA sensors that might be monitoring environmental controls (such as HVAC), electric utilities, water and sewage, traffic signals, mass transit, manufacturing equipment, refrigeration units, or lighting and entry systems. Answers should not include *networking* devices such as routers, switches, and access points, or *networked* devices that run on computers, such as servers.

Why is it important to use a structured cabling standard when installing and managing cabling systems?

Answer: Structured cabling standards describe the best ways to install various types of networking media to maximize performance and minimize upkeep.

Why is it important to use plenum-rated cabling in the area above the ceiling tile?

Answer: Plenum-rated cabling is safer than regularly coated PVC cabling. It produces less smoke when burned, and the smoke is less toxic.

What is the unit of measurement that defines the space available in a rack? How tall are standard racks?

Answer: Rack height is measured in rack units (RU or U) with the industry standard being 42U tall—about 6 feet.

Why is it important to minimize cable clutter in a rack?

Answer: Minimizing cable clutter can help prevent airflow blockages and heat buildup.

What are some elements that are typically included in network diagrams?

Answer: Answers may vary and might include physical layout, logical topology, IP address reserves, names of major network devices, and types of transmission media.

How can you go about gathering the information needed to assemble a thorough operations manual?

Answer: Answers may vary and might include visits to data rooms, an examination of servers and desktops, a review of receipts for software and hardware purchases, and the use of a protocol analyzer or network management software package.

What command invokes Nmap at a command line?

Answer: nmap, as shown in Figure 2-23

For what time period should you schedule a network change?

Answer: If possible, schedule the change for completion during off-hours. Many organizations maintain a regularly scheduled maintenance window during which changes can be made.

In a large organization, how do you typically request permission to perform a network 20. change?

Answer: Submit a change request document.

Hands-On Projects

Note 2-10

Websites and applications change often. While the instructions given in these projects were accurate at the time of writing, you might need to adjust the steps or options according to later changes.

Project 2-1: Tour MDF and IDF Data

Estimated time: 30 minutes

Objective: Compare and contrast various devices, their features, and their appropriate placement on the network. (Obj. 2.1)

Group work: This project includes enhancements when assigned as a group project.

Resources:

* Internet access

Context:

The equipment and spaces discussed in this module come alive when you can see them in real-life situations. Ideally, you would connect with IT departments at schools and businesses in your area and tour their networking facilities so you can see these things for yourself. Additionally, your instructor might be able to give you a tour of the network equipment at your school. In preparation for these real-life tours or as a suitable replacement for them if necessary, find and watch video tours online of various MDF and IDF facilities. Complete the following steps:

1. Do an online search for video tours of MDF and IDF facilities. Good search terms include "MDF IDF tour," "main distribution frame tour," "data room tour," and "MDF data room." Find two to four videos that show you around the MDF or IDF data room, identifying major components and their connections. The best tour videos include a walk to other buildings on the network's campus.

2. **For group assignments:** Each group member should find a video tour that meets the requirements from Step 1. Share each video with all group members to complete the remainder of this project.

3. Answer the following questions:

a. List the videos you watched. Include a URL for each video or an explanation of how to find it on a particular website.

Answer: List should include URLs for or instructions to find at least two videos that show a tour of a network's MDF and other data rooms.

b. What network components were shown?

Answer: Answers may vary and should include some common network devices such as racks, servers, and cables.

c. Find a point in one video that shows a good view of the layout of the room. **Take a screenshot**; submit this visual with your answers to this project's questions.

Answer: Screenshot should show a view of the layout of a data room.

d. What are three things you learned about the layout of the room, what equipment is there, or how the equipment is installed?

Answer: Answers may vary widely and should include a general description of the room layout and some insights learned about the networking equipment shown in the videos

Project 2-2: Create A Wiki

Estimated time: 30 minutes

Objective: Explain the purpose of organization documents and policies. **(Obj. 3.2)**

Group work: This project includes enhancements when assigned as a group project.

Resources:

- Internet access

Context:

One way to collect information from members of your team is to use a wiki creator to build your own wiki. There are many good wiki tools that require a purchase or subscription, such as Google Sites and SharePoint. These paid apps provide impressive features that really shine when you're collaborating with several people or making your wiki public as part of your business front. A free app such as Wikidot (*wikidot.com*), though, can give you all the features you need for tracking your own project information in this course. And it will help you better understand which features of a wiki are most important to you.

Note 2-11

Websites change. These steps were accurate at the time this text was written. However, you might need to adjust these steps to account for future changes.

Complete the following steps to create your own wiki:

1. Go to **wikidot.com** and create an account. Store your account information in your LastPass vault. Check your email to activate your Wikidot account.

2. Sign into your Wikidot account and click the **Sites** tab. In the left pane, scroll down and click **+ Create site**.

3. Give your wiki a title and web address and make sure the **Standard Template** is selected.

Note 2-12

You can choose any template for a later wiki, or you can later change the template for this wiki after completing this project.

4. Select an access policy. Unless directed otherwise by your instructor, choose the **Private** option.

5. Confirm that you have read and agreed to the Terms of Service and then click **Get my Wikidot site**. Your Wikidot site is created with generic information that will help you get started, as shown in Figure 2-34. What title and web address did you give your wiki?

    Answer: Answers may vary significantly. This information is requested for record-keeping purposes.

6. To see the admin link in the top navigation bar, click **Create Admin CSS Page** under the *First* section on the welcome page. Without making any edits to the page, click **Save** at the bottom of the page. There should now be a gear icon in the top navigation bar, as shown in Figure 2-35. Click it to see the admin navigation menu. You'll come back to that soon.

7. In the side navigation bar, click **First Time User** and read the information on this page. What feature in the Standard Template makes page creation simple?

    Answer: The Create a Page module on the sidebar.

8. Click **User Guide** in the side navigation bar and skim through this page to understand how the Site Manager works and how to edit pages. What does the Site Manager let you do?

    Answer: The site administrator can change global site options, such as membership permissions, access policy, site name, and more.

9. Click each tab along the top navigation bar and skim the contents: **Home**, **About**, **Layout**, **Membership**, **User Guide**, **Help Docs**, and **Contact**. This will help you become familiar with the pages included in this template. Each of these pages belongs to your personal wiki site and includes default information you can change later.

10. Click the **Home** link to go back to the Home page. At the bottom of the page, click **Edit**, as shown in Figure 2-36.

11. In the Header box, change the text *Welcome to Wikidot* (See Figure 2-37) to say **This is my Wikidot.** Save your changes. **Take a screenshot** of your new Home page; submit this visual with your answers to this project's questions.

    Answer: Screenshot should show "This is my Wikidot." as the title on the Home page.

12. Click the **About** link to go to the About page. In the side navigation bar, in the *Create a Page* module, type **Virtualization:VMclients** (see Figure 2-38). Notice that there is no space before or after the colon. This will create a new page named *VMclients* in the category *Virtualization*. Click **New page**.

13. You have 15 minutes to complete changes to this page. Type the information for the Capstone Projects you completed in Module 1, as shown in Figure 2-39—substitute the information for your own VMs, such as the names that you gave the VMs and the OSs you installed on them. (Note that you might have only created one VM in one hypervisor because you couldn't complete both Capstone Projects on the same computer.) Click **Save**.

14. To see a list of all pages in your wiki, click the gear icon in the top bar, and then click **List All Pages**. You will continue to add pages and content in later modules. For now, click your new **Virtualization:VMclients** page in the list. **Take a screenshot**; submit this visual with your answers to this project's questions.

    Answer: Screenshot should show one or both VMs created for the Capstone Projects in Module 1 along with information about the hypervisor used for each, each VM's name, and its OS.

15. Click the gear icon and click **Site Manager** to go to the Dashboard.

16. In the left pane, click **Security** and then click **Access policy**. If necessary, scroll up to see your current access policy. What access mode is selected? Scroll down and notice in the blue box that you can apply for a free educational upgrade. This is optional and is not required for this course. Ask your instructor whether you should pursue the upgrade.

    Answer: The Private access mode should be selected.

17. **For group assignments:** Invite your group members to your wiki. To do this, in the left pane, click **Members** and then click **Invitations**. On the Invite members tab, enter the username of each group member to invite them. Accept your group members' invitations. After each group member accepts your invitation, in the left pane, click the **Members List**. View your page's members, explore the levels of permissions you can manage for each member, and send each member a private message.

18. Click through the other settings and options and make changes as desired. When you're finished, click your wiki's name in the upper-left corner next to the Wikidot logo to return to your wiki.

Project 2-3: Install and Use Nmap and Zenmap

Estimated time: 45 minutes

Objective: Given a scenario, use the appropriate network software tools and commands. (Obj. 5.3)

Resources:

- Windows computer with ability to scan the local area network
- A computer or user account with application installation rights
- Internet access

Context:

In this activity, you install Zenmap, the GUI version of Nmap for Windows, and use it to scan your computer and your local network.

Note 2-13

Websites change. These steps were accurate at the time this text was written. However, you might need to adjust these steps to account for future changes.

Complete the following steps:

1. Go to **nmap.org** and click **Download** in the grid menu at the top of the page. Scroll down to the Microsoft Windows section, which might look similar to Figure 2-40.

2. Next to the text *Latest stable release self-installer*, click the **nmap-*version*-setup.exe** link. Go to the download location on your computer and run the program to install Nmap. Respond to any system warnings. On the Choose Components window, make sure that all available components are selected, as shown in Figure 2-41. One the Installation Options screen, make sure *Install Npcap in WinPcap API-compatible Mode* is selected, as shown in Figure 2-42. Otherwise, accept all default settings during installation.

3. Once the installation is complete, close all open windows. **Take a screenshot** of the new **Nmap-Zenmap GUI** shortcut on your desktop; submit this visual with your answers to this project's questions. Double-click the shortcut to open **Nmap-Zenmap GUI**.

   Answer: Screenshot should show the Nmap-Zenmap GUI shortcut on the Windows desktop.

4. Start with a quick scan of your local computer. To do this, in the Target field, enter **localhost**, and in the Profile field, select **Quick scan.** What command does Zenmap build in the Command field?

   Answer: nmap -T4 -F localhost

5. You could accomplish the same quick scan by entering this command at a CLI (command line interface) such as Command Prompt or PowerShell. For now, click **Scan**. The scan shows a list of open ports on your computer and the services assigned to them, similar to the results shown in Figure 2-43. Take a screenshot; submit this visual with your answers to this project's questions.

    Answer: Screenshot should show the results of the quick scan.

In the following steps, you'll run a scan of your local network and see how the output changes. This time you will target all IP addresses in the same range as your computer's IP address. The easiest way to do this is to first determine your computer's IP address.

6. Open a PowerShell or Command Prompt window and enter the command **ipconfig**, as shown in Figure 2-44. What is the IPv4 address for the active connection to your local network? Be sure to look for the connection for an Ethernet adapter (but not to your hypervisor) or for a Wi-Fi adapter.

    Answer: Answers may vary. For students working on their own computers, typical answers will be 192.168.0.1 or 192.168.1.1. For students working on school computers, answers will vary widely but should show a private IPv4 address.

7. Go back to Zenmap. In the Target field, type your local computer's IPv4 address. However, so that you can scan a range of IP addresses, replace the final block of digits in your IPv4 address with **1-254**. For example, if your IPv4 address is 192.168.1.106, you would enter **192.168.1.1-254** in the Target field. What command does Zenmap build in the Command field? Click **Scan**.

    Answer: The IP address range may vary depending on the IPv4 address given earlier. The command is nmap -T4 -F *192.168.1.1-254*.

8. This time, the output shows information about other hosts on your network as well as the information you've already seen for your own computer. Scroll through the output and answer the following questions:

    a. How many IP addresses were scanned? How many hosts are up?

    Answer: Answers will vary widely. Most results will show up to a dozen IP addresses scanned and active hosts.

    b. Compared with the information you saw earlier about your own computer, what information is revealed about the other hosts?

    Answer: Answers will vary. Most results show some devices with no open ports and some devices with one or a few open ports. All devices should include an IP address and MAC address.

    c.   Find a host with open ports reported. **Take a screenshot** showing this host's open ports and their services; submit this visual with your answers to this project's questions.

Answer: Screenshot should show a network host's information listed in the scan results with open ports and identified services.

Note 2-14

You'll learn more about ports, IP addresses, and MAC addresses later.

9.   Copy the command currently listed in the Command field. In a PowerShell or Command Prompt window, paste the command and press **Enter**. How do the results from the CLI compare to the Zenmap results?

Answer: Other than a little less formatting, the results are the same.

10. The command you copied from Zenmap is intended to run a quick scan. Using the resources you've learned about in this project, determine the command to run a regular scan on one of the hosts on your network. Enter that command in the CLI. **Take a screenshot** of the command and its results; submit this visual with your answers to this project's questions.

Answer: Screenshot should show the executed command nmap *192.168.1.120*, where any local host's IPv4 address is included in the command. Results should show the IP address and MAC address of the target host and a list of its open ports and services.

In Project 2-2, you created a wiki to track information about your work in this course. You started a category called Virtualization and recorded information about the VMs you created in Module 1. App installations for projects is another kind of information you need to track in the wiki, as follows:

11. Go to your Wikidot site and click **User Guide** in the top navigation bar. In the side navigation bar, in the *Create a Page* module, type **Applications:Nmap**. This will create a new page named *Nmap* in a new category named *Applications*. Click **New page**.

12. Under "Create a new page," type some information about your Nmap and Zenmap installation. For example, you could answer the following questions:

    a.   What is Nmap? How is Zenmap different than Nmap?

    b.   On which computer did you install Nmap?

    c.   What problems did you run into, and what solutions did you come up with?

    d.   What information did you learn about your network from running scans in Zenmap and Nmap?

13. When you're finished, click **Save**.

14. **Take a screenshot** of your new page; submit this visual with your answers to this project's questions.

   Answer: Screenshot should show the *Applications:Nmap* page on wikidot with basic information about this project's activities.

15. Click the gear icon and click **List All Pages** to confirm your new page was created. In a later module, you'll streamline your navigation bars and pages.

Project 2-4: Install and Use Wireshark

Estimated time: 45 minutes

Objective: Given a scenario, use the appropriate network software tools and commands. (Obj. 5.3)

Resources:

- A computer or user account with application installation rights
- Internet access

Context:

Wireshark is a free, open-source network protocol analyzer that can help demystify network messages for you and help make the OSI model easier to understand. For some students, using Wireshark for the first time can be an epiphany experience. It allows you to study the OSI layers, all the information that is added to every message, and all the messages that have to go back and forth just to bring up a web page or simply to connect to the network. It all becomes much more real when you see how many messages Wireshark collects during even a short capture.

In this project, you will install Wireshark and take a first look at how it works. In a later module, you'll dig deeper into Wireshark's capabilities. Complete the following steps:

1. Open a browser and go to **wireshark.org**. Download and install the current stable release, using the appropriate version for your OS. If you're using the same computer you used for Project 2-3, the Wireshark installer should recognize that you already have Npcap installed and will not offer to install it. If you're using a different computer, accept the Npcap option. In the Wireshark setup window, you do *not* need USBPcap. If needed, reboot your computer to complete the Wireshark installation.

2. When installation is complete, open **Wireshark**.

3. In the Wireshark Network Analyzer window, select your network interface from the list. Then click the shark-fin icon to start the capture, as shown in Figure 2-45.

4. While the capture is running, open your browser and go to **cengage.com**. Then open a PowerShell or Command Prompt window and enter **ping 8.8.8.8**. After the ping completes, click the red box on the command ribbon to stop the capture.

Look at some of the messages you've captured. You can adjust the pane sizes by grabbing a border between them and dragging. Expand the top pane so you can see more of the captured messages at one time. Let's start to decode this blur of numbers and letters.

5. Notice the column headers along the top of the capture, as shown in Figure 2-46. Of particular interest are the Source and Destination columns, the Protocol column, and the Info column. Find a UDP (User Datagram Protocol) message that has an IPv4 Source address and click on it. **Take a screenshot** of your capture with the UDP message selected; submit this visual with your answers to this project's questions.

   Answer: Screenshot should show a Wireshark capture with a UDP message selected.

6. In the middle pane, click on each line to expand that layer's information. What pieces of information stand out to you? Which device on your network do you think sent this message, and which device(s) received it?

   Answer: Answers will vary and should discuss items of interest in the OSI layers of a UDP message, such as number of bytes or addressing information. Comments should also include speculation on sending device and receiving device.

Color highlighting can make it easier to spot different protocols. Notice in Figure 2-47 that TCP (Transmission Control Protocol) messages are a light lavender or light green color (when it includes HTTP), and UDP and DNS (Domain Name Services) messages are a light bluish color. You can see the protocol names in the Protocol column. Note that if you have trouble distinguishing colors, you can choose colors or shades that work for you. For example, you might choose a very dark shade that stands out against lighter shades. If necessary, you could also use a phone app to help, such as Be My Eyes (*bemyeyes.com*) that pairs users with a normally sighted volunteer to help identify colors, Color Blind Pal (*colorblindpal.com*) that provides descriptive information and offers a filter tool, or Pixolor that identifies colors of pixels in an image (website developers often use apps like this to define branding colors).

7. To see a list of currently assigned highlight colors and to adjust these assignments, on the main toolbar, click **View** and then click **Coloring Rules**. Here, you can change the priority for matching protocols within a message to colors in the output pane (because more than one protocol is used in each message), and you can assign colors that are easier to spot. In Figure 2-48, the background color for ICMP is changed to a bright green. When you're happy with your color selections, click **OK**.

8. To filter for a particular kind of message in your capture, type the name of the protocol in the Filter box (identified in Figure 2-48). Figure 2-49 shows a filter for ICMP messages, which are currently highlighted in bright green. These ICMP messages were generated when

pinging another host on the network. Try filtering for other protocols you've read about in this course already, such as HTTP, and see how many different types you can find in your capture. Click the **X** to clear filters between searches. Which protocols did you find?

Answer: Answers may vary and might include ICMP, TLS, UDP, ARP, DHCP, DNS, and HTTP.

9. To compare which OSI layers are represented by each of these protocols, apply a slightly more complicated filter where you can see both HTTP messages and ICMP messages in the same search. Enter the following phrase into the Filter box: **http or icmp**.

10. Click on an ICMP message and count the layers of information available in the middle pane. In Figure 2-50, there are four layers of information, which correspond to layer 2 (Frame and Ethernet II) and layer 3 (Internet Protocol Version 4 and Internet Control Message Protocol).

11. Examine an HTTP message. Figure 2-51 shows five layers of information in the middle pane. This time, layer 7 (Hypertext Transfer Protocol) and layer 4 (Transmission Control Protocol) are represented, in addition to layer 3 (Internet Protocol Version 4) and layer 2 (Ethernet II and Frame).

12. Recall that TCP is a connection-oriented protocol. You can filter a capture to follow a TCP stream so you can see how these messages go back and forth for a single session. Clear your filter box and then find a TCP message. Right-click it, point to **Follow**, and click **TCP Stream** (see Figure 2-52). If you picked the right TCP stream, you might see the Cengage URL listed in this conversation, as shown in Figure 2-53. Next, click **Close** to close the Follow TCP Stream window and notice that Wireshark has filtered the capture for this stream's messages. Click the **X** to clear the filter.

13. In your wiki, add a new page titled **Applications:Wireshark**. Indicate the module and project number for this installation, the computer you used for this project, a brief description of what you learned, and any other information you might find helpful when using Wireshark later. You'll return to Wireshark in a later module.

Capstone Projects

Capstone Project 2-1: Set Up an Ubuntu Desktop VM

Estimated time: 45 minutes

Objective: Explain the characteristics of network topologies and network types. (Obj. 1.2)

Resources:

- Access to the same computer used to complete Capstone Project 1-1 or Capstone Project 1-2
- Internet access

- If desired, instructor can provide Ubuntu Desktop image file

Context:

In the Capstone Projects of Module 1, you created a virtual machine using Windows 10 Client Hyper-V and/or Oracle VirtualBox. In this Capstone Project, you create a second VM in your virtual network and install Ubuntu Desktop in the VM. In Module 3, you'll install Ubuntu Server in your network. Ubuntu is a well-known version of Linux and offers both desktop and server editions. For these VM projects, you can use your choice of hypervisor.

Using one of the same computers that you used in Capstone Project 1-1 or 1-2 that has Client Hyper-V or Oracle VirtualBox installed, depending on which hypervisor you prefer, follow these steps:

1. Open the Oracle VM VirtualBox Manager or Hyper-V Manager. Following the directions in the Module 1 Capstone Projects, create a new VM with an informative name. Consider the following tips:

    a. If you're using Hyper-V Manager and you use the Quick Create option, choose the most recent Ubuntu image, such as **Ubuntu 20.04.1 LTS**. After it downloads, click **Connect**.

    b. If you're using VirtualBox, first go to **ubuntu.com** and download the Ubuntu Desktop OS to your hard drive. This is a free download, so you can decline to make any donations. The file that downloads is an ISO file. Back in VirtualBox, choose the **Linux** type and the **Ubuntu (64-bit)** version. When you're ready, mount the ISO file that contains the Ubuntu Desktop image to a virtual DVD in your VM.

2. Start the VM and install Ubuntu Desktop (click **Install Ubuntu**; do *not* click Try Ubuntu). Accept all default settings except, when given the option, don't install any extra software bundled with the OS. Give permission to download updates while installing (see Figure 2-54). Record your user credentials for your Ubuntu VM in a secure note in your LastPass vault. You'll need to restart the VM when the installation is finished.

3. To verify you have an Internet connection, open the Mozilla Firefox browser and surf the web. **Take a screenshot** of your desktop showing your hypervisor, your running VM, and the VM's successful connection with the Internet; submit this visual with your answers to this project's questions

    Answer: Screenshot should show the host computer's desktop, the hypervisor window, the VM running in a hypervisor window, and the Mozilla browser open on the VM showing a web page.

4. Good network technicians must know how to use many operating systems. Poke around in the Ubuntu Desktop interface and get familiar with it. You can also search the web for

tutorials and YouTube videos on how to use Ubuntu Desktop. What are two ways to open the Settings window in Ubuntu Desktop?

Answer: There are multiple ways to open the Settings window, including the following:

Click the Power icon and click Settings

Click Show Applications and click Settings

Click Ubuntu Software, Installed, and Settings

Click Activities and search for Settings

From Terminal, enter gnome-control-center

5. When you're ready to shut down your VM, click the power icon in the upper-right corner of the Ubuntu Desktop screen, click **Power Off/Log Out**, click **Power Off...**, and then click **Power Off**.

6. Before you walk away from this project, take a moment to add the new information to your VMclients page in your wiki. Go to the **Virtualization:VMclients** page, click **Edit** at the bottom of the page, and add the new VM to your list. Include the module number, hypervisor used, VM computer name, and VM operating system. Also note any additional information that you might find helpful when you return to this VM in the future. When you're finished, click **Save**.

7. **Take a screenshot** of the edited wiki page; submit this visual with your answers to this project's questions.

    Answer: Screenshot should show information for at least two VMs, one for each module so far. Information should include hypervisor, virtual resources created, VM name, and VM OS.

Capstone Project 2-2: Install and Use Packet Tracer

Estimated time: 1 hour

Objective: Given a scenario, use the appropriate network software tools and commands. (Obj. 5.3)

Resources:

- A computer or user account with application installation rights
- Internet access

Context:

If you plan to pursue networking or security as your area of specialty in IT, you might consider earning a few Cisco networking certifications after you complete your CompTIA Network+

certification. The Cisco Networking Academy website provides many useful tools for advancing your networking education. One of those tools is a network simulator called Packet Tracer.

In this Capstone Project, you download and install Packet Tracer and take a tour of the simulator interface. This version of Packet Tracer is free to the public, and your school does not have to be a member of Cisco's Networking Academy for you to download and use it. In later projects, you'll return to Packet Tracer to build networks and even learn some basic Cisco IOS commands. Cisco IOS (Internetworking Operating Systems) is the operating system used on Cisco networking devices, such as routers and switches (with minor variations in the specific IOS for each different type of device). Many other manufacturers of networking devices use the same or similar commands, and those that use different commands typically use very similar functions, even if they call it something a little different.

To get the Packet Tracer download, you must first sign up for the free Introduction to Packet Tracer online course on the Cisco Networking Academy website. Complete the following steps to create your account:

1. Go to **netacad.com/courses/packet-tracer**. If the course is not listed on this page, do a search for *packet tracer site:netacad.com* and follow links to "Download Packet Tracer" or "Introduction to Packet Tracer" to find the current Packet Tracer introduction course. Enter your name, email, and text verification to enroll in the course.

2. Open the confirmation email and confirm your email address. Configure your account and save your account information in your LastPass vault. You will need this information again.

3. Take the brief tour of the course.

Now you're ready to download and install Packet Tracer. If you need help with the download and installation process, use the Course Index to navigate to Page 1.1.2.1 for additional guidance. Complete the following steps:

4. Inside the course, under *Introductory Chapter*, click **Student Support and Resources**. Scroll down and click **Download and install the latest version of Packet Tracer**. Choose the correct version for your computer. After the download is complete, install Packet Tracer. When the installation is complete, run **Cisco Packet Tracer**. When Packet Tracer asks if you would like to run multi-user, click **No**.

5. When Packet Tracer opens, sign in with your Networking Academy account that you just created. If you see a Windows Security Alert, allow access through your firewall. Cisco Packet Tracer opens. The interface window is shown in Figure 2-55.

The Introduction to Packet Tracer course presents an excellent introduction to Packet Tracer and provides lab activities. Packet Tracer Activities are interactive labs in which you download a start file, make the changes instructed in the lab, and then grade the activity in Packet Tracer. Complete the following steps to access your course:

6. Return to your Introduction to Packet Tracer course. You've already downloaded Packet Tracer, so you can skip Chapter 1.

7. Complete Chapters 2, 3, and 4, including their videos and labs. The other chapters provide excellent information on Packet Tracer but are not required for this project. Answer the following questions along the way:

    a. What is the first step in deploying a Packet Tracer network?

    Answer: Find and deploy physical devices in the simulation.

    b. When looking at a physical device's tabs in Packet Tracer, which tab is considered the learning tab?

    Answer: The Config tab

    c. What three questions can be answered using the Simulation Mode?

    Answer: Simulation Mode allows for checking the following functions:

    Can all devices communicate with each other?

    Are access lists functioning as designed?

    Are applications and services such as DNS, HTTP, and FTP functioning as designed?

    d. Which Packet Tracer feature do you think will be most helpful for you in learning how to manage a network? Why do you think this?

    Answer: Answers will vary and should discuss evidence to support the student's stated objective.

8. Back in your Packet Tracer window, deploy at least three physical devices into your workspace. You don't need to configure or connect them. Take a screenshot of your deployment; submit this visual with your answers to this project's questions.

    Answer: Screenshot should show at least three physical devices deployed into the workspace. The devices do not need to be configured or connected.

9. In your wiki, add a new page titled **Applications:PacketTracer**. Remember *not* to include a space after the colon so your PacketTracer page will be collected in the Applications category. Indicate the module and project number for this installation, the computer you used for this project, a brief description of what you learned, and any other information you might find helpful when using Packet Tracer later. You'll return to Packet Tracer many times throughout this course.

MindTap

Reflection 2: Project Management

Change management often falls under the scope of a project manager's role. While project management doesn't heavily focus on the technical skills required for network management, having some understanding of the project management process will help you more efficiently manage changes on any network for which you're responsible, and it will give you insights on how to effectively manage the human side of handling changes. In fact, obtaining some formal training in project management can give you an edge over the competition when you're applying for a new job or a promotion.

Respond to the following questions:

● List three organizations that offer popular project management certifications.
● In your own words, what is a project? Give an example.
● According to one of the project management certifying organizations you listed above, what are the basic phases of project management? Be sure to provide a link to your resource.

Go to the discussion forum in your school's LMS (learning management system). Write a post of at least 100 words discussing your thoughts about these questions. Then respond to two of your classmates' threads with posts of at least 50 words discussing their comments and ideas. Use complete sentences and check your grammar and spelling. Try to ask open-ended questions that encourage discussion. Remember to respond to people who post on your thread.

> **Answer**: Rubric provided for grading

Networking for Life 2: Working in Technology

As you move into your career, you'll find that your continued success relies on your ability to keep learning. And the more you learn, you'll find that you're able to advance more quickly in your career and achieve your goals. Dice.com is a website devoted to providing information about technology careers. By understanding more about the interplay between your educational pursuits and the needs of the IT industry, you'll better position yourself for success. Go to **insights.dice.com/category/working-in-tech/** and find an article relevant to your career goals.

Respond to the following questions:

● What did you learn about your chosen career path that you didn't already know?
● How can this information benefit you in your schoolwork and later into your career?
● What alterations to your education plans might you consider after learning this information?

Go to the discussion forum in your school's LMS (learning management system). Write a post of at least 100 words discussing your thoughts about these questions. Then respond to two of your classmates' threads with posts of at least 50 words discussing their comments and ideas. Use complete sentences and check your grammar and spelling. Try to ask open-ended questions that encourage discussion. Remember to respond to people who post on your thread.

Answer: Rubric provided for grading

Rubric for Hands-on Projects and Capstone Projects

Criteria	Beginning	Developing	Proficient	Exemplary	Score
Responses to questions	All missing or incorrect **[0 points]**	Most missing or incorrect **[15 points]**	Little missing or incorrect **[20 points]**	All complete **[25 points]**	
Other deliverables	Missing **[0 points]**	Present but missing most or all the required information **[15 points]**	Present but missing some of the required information **[20 points]**	Present and contains all the required information **[25 points]**	
Critical thinking and engagement	Student shows little to no evidence of attempting to meet the performance requirements of the assignment **[0 points]**	Student retains their existing understanding while attempting to meet the performance requirements of the assignment **[15 points]**	Student challenges their existing understanding and shows evidence of new learning **[20 points]**	Student challenges their existing understanding and displays creative and original insights **[25 points]**	
Mechanics	Grammar, spelling, punctuation, and formatting make student's message	Grammar, spelling, punctuation, and formatting detract from student's message **[15 points]**	Grammar, spelling, punctuation, and formatting support student's message **[20 points]**	Grammar, spelling, punctuation, and formatting enhance student's message **[25 points]**	

	difficult to understand **[0 points]**			
			Total	

Rubric for Discussion Assignments

Task	*Developing*	*Proficient*	*Exemplary*	*Score*
Initial post	Generalized statements **[30 points]**	Some specific statements with supporting evidence **[40 points]**	Self-reflective discussion with specific and thoughtful statements and supporting evidence **[50 points]**	
Initial post: Mechanics	· Length < 100 words · Several grammar and spelling errors **[5 points]**	· Length = 100 words · Occasional grammar and spelling errors **[7 points]**	· Length > 100 words · Appropriate grammar and spelling **[10 points]**	
Response 1	Brief response showing little engagement or critical thinking **[5 points]**	Detailed response with specific contributions to the discussion **[10 points]**	Thoughtful response with specific examples or details and open-ended questions that invite deeper discussion of the topic **[15 points]**	
Response 2	Brief response showing little engagement or critical thinking **[5 points]**	Detailed response with specific contributions to the discussion **[10 points]**	Thoughtful response with specific examples or details and open-ended questions that invite deeper discussion of the topic **[15 points]**	

Both responses: Mechanics	· Length < 50 words each · Several grammar and spelling errors **[5 points]**	· Length = 50 words each · Occasional grammar and spelling errors **[7 points]**	· Length > 50 words each · Appropriate grammar and spelling **[10 points]**	
			Total	