

LESSON: Network Foundations

Before you Begin

This is the first module of the extended program. Instructors should spend no more than the first 45 minutes of class with introductions and a high-level review of the Canvas system as well as a 5-minute break. After this activity, keep in mind that learners have been focused for approximately one hour due to the extended time required by the orientation prior to the start of class. For this lesson and upcoming lessons, instructors are required to ensure the following activities are completed:

- Review the “Lesson Opener” and “Real World Scenario” with the learners before starting the module.
- Throughout the module, you will find “Consider the Real-World Scenario” slides. Review the questions found on these slides, tie the concepts back to the scenario discussed at the start of the lesson as well as the content you are presenting, and encourage the learners to share their thoughts.
- Ensure learners are given opportunities for breaks throughout the lesson. The pacing guide below provides recommended breaks. However, there are additional breaks added to the slide deck, please use them if needed.
- For each lesson, you will find a “Pulse Check” slide which is the opportunity for instructors to open a poll to gather feedback from the learners. For this first module, take additional time to explain the purpose of the pulse check and encourage learners to provide their anonymous feedback. Leave the poll open for about 1 minute and after you close the poll, share the results with the learners. Encourage the learners to share their thoughts. This information will help the instructors as well as the learners better understand where they are in regard to the lesson.
- Labs are to be demonstrated live for each module. The demonstration of labs is the top priority for the lead instructor. While demonstrating each lab, encourage students to participate and explore.
- At the end of each lesson, it is important to take a few minutes to review the key concepts for the lesson, provide guidance on what the learners can do to prepare for the next lesson, and wrap up with Q&A.

Summary

In this lesson, learners will gain an understanding of networking and its importance in facilitating the exchange of information between devices. They will explore various types of

networks, including LAN, MAN, and WAN, and learn about the devices that make up a network, such as end devices, media, and intermediary devices. The lesson covers the role of NICs in enabling device interaction and the functions of intermediary devices like switches, routers, and firewalls. Learners will also explore different network media, including copper ethernet cables and fiber, and understand how they transmit data. Additionally, they will learn about network topologies, such as point-to-point, star, mesh, and hybrid. The lesson also introduces the concepts of MAC addresses, IP addresses, subnet masks, and protocols, including IP, DNS, DHCP, HTTP, and HTTPS. Learners will discover essential network commands for configuration, maintenance, and troubleshooting, such as *ping*, *ipconfig*, *nslookup*, *tracert*, and *netstat*. They will also explore wireless networks, their advantages, and security risks associated with them. The lesson concludes by introducing wireless technologies like Wi-Fi, Wi-MAX, and Bluetooth, and discussing the improvements made through different IEEE standards. Finally, learners will gain insights into the speed, cost, and distance differences among copper, fiber, and Wi-Fi media.

Objectives

- Identify and describe the key characteristics of different network types, including LANs, WANs, SANs, and MANs.
- Describe the devices that comprise a network, including end devices, media, and intermediary devices.
- Explain broadcast and collision domains.
- Describe the two types of duplex models.
- Describe the different types of ethernet cables.
- Explain straight through and crossover ethernet cable configurations.
- Define network topology.
- Explain physical and logical addresses.
- Define and differentiate between various network protocols, including DNS, DHCP, HTTP, and HTTPS, and provide examples of their usage in computer networking.
- Describe network commands and how each command is used.
- Identify and describe the advantages and disadvantages of wireless networks.
- Explain the basic principles of wireless network security, including the risks and vulnerabilities associated with wireless networks, and identify common security measures used to protect wireless networks.

Lesson Activities and Teaching Strategies

Estimated Time	Lesson Portion	Directions
----------------	----------------	------------

5 min	Introductions	<ul style="list-style-type: none"> • The lead and associate instructor should introduce themselves to the learners • Encourage the learners to post something about themselves in the chat window
25 min	Canvas Overview	<ul style="list-style-type: none"> • Review the key areas of the Canvas platform so that learners could have a better understanding of where to find the resources they will need for this course. • Spend a few minutes reviewing the syllabus covering at a high level the expectations of the course
5 min	Break	<ul style="list-style-type: none"> • Share a timer on the screen so there is clarity as to when class will resume. Ensure cameras and microphones are disabled during the break.
5 min	Lesson Opener: Network Foundations	<ul style="list-style-type: none"> • Introduce learners to the importance of understanding network foundations as the basis for computer networking.
5 min	Real World Scenario: Network Foundations	<ul style="list-style-type: none"> • Review the real-world scenario challenge and inform learners that you will be constantly coming back to this scenario throughout the lesson to discover how to solve and apply concepts to this real situation. Highlight important concepts found in the scenario that the learners should pay close attention to such as network expansion, mobility, and securing data while in transit.
20 min	Cyber Uncovered: Network Types and Devices	<ul style="list-style-type: none"> • Begin by highlighting the importance of networking in facilitating communication in the modern world and how networking has greatly improved social experiences over the past few decades. • Discuss the various types of networks, including Local Area Networks (LANs), Wide Area Networks (WANs), Metropolitan Area Networks (MANs), and Storage Area Networks (SANs). • Introduce the various devices found in a network, including end devices, media, and intermediary devices, highlighting their roles and functions. • Emphasize the significance of Network Interface Cards (NICs) in enabling end devices to connect to a network • Explain the role of intermediary devices and how they facilitate communication between end devices • Be sure to cover key concepts related to network communication, including collision and broadcast domains, duplex models, and the role of routers in connecting different networks. • For the “Consider the Real-World Scenario” slides, be prepared to discuss the implication of the scenario

		presented at the beginning of class. Engage the learners by asking the questions found on these slides and encourage discussion in class.
10 min	Cyber Uncovered: Network Media and Cables	<ul style="list-style-type: none"> ● Explain that media refers to the physical cables or wireless technologies used to transmit information over a network. ● Discuss the various types of media used on a network. Briefly explain their characteristics, such as speed, distance capabilities, and susceptibility to interference and signal deterioration over distance. ● Explain ethernet cable configurations: Introduce different ethernet cable configurations (e.g., straight-through, crossover) and their purpose in connecting unlike or like devices. ● Discuss fiber-optic cables as an alternative for long-distance transmission, highlighting their use of light and immunity to interference. ● Be prepared to discuss the implication of the real-world scenario presented at the beginning of class. Engage the learners by asking the questions found on the slide and encourage discussion in class.
5 min	Break	<ul style="list-style-type: none"> ● Share a timer on the screen so there is clarity as to when class will resume. Ensure cameras and microphones are disabled during the break.
10 min	Cyber Uncovered: Network Topologies	<ul style="list-style-type: none"> ● Explain that network topology refers to the structure of a network and the connections between its components. ● Discuss types of network topologies. Highlight point-to-point, star, mesh, and hybrid topologies. ● Be prepared to discuss the implication of the real-world scenario presented at the beginning of class. Engage the learners by asking the questions found on the slide and encourage discussion in class.
15 min	Cyber Uncovered: Physical and Logical Addresses	<ul style="list-style-type: none"> ● Define MAC addresses and their importance as unique hardware identifiers. Introduce IP addresses and discuss IPv4 and IPv6 versions. ● Explain the purpose of subnet masks in defining IP address ranges. Highlight network and broadcast addresses. ● Keep the discussion at a high level. Students will cover these topics in more detail during module 4. ● Be prepared to discuss the implication of the real-world scenario presented at the beginning of class. Engage the learners by asking the questions found on the slide and encourage discussion in class.

10 min	Pulse Check	<ul style="list-style-type: none"> • This is the first of many pulse checks to come for these learners. Instructors are to spend a few minutes explaining the purpose of this poll as well as the zone. • After the poll is concluded, spend a few minutes asking why students have selected their zones. Encourage them to share with each other. • Future pulse checks should only take 3-5 min to administer.
5 min	Break	<ul style="list-style-type: none"> • Share a timer on the screen so there is clarity as to when class will resume. Ensure cameras and microphones are disabled during the break.
20 min	Cyber Uncovered: Network Protocols and Commands	<ul style="list-style-type: none"> • Explain the concept of communication protocols and their role in enabling device communication. • Emphasize the importance of protocols as predefined sets of rules for maintaining order in technology interactions. • Introduce key network protocols: IP, DNS, DHCP, HTTP, and HTTPS, highlighting their functions and purposes. • Discuss the real-world scenario of secure communication between the original clinic and the new clinic, focusing on the use of network protocols to safeguard sensitive patient information. • Highlight the significance of network commands for configuration, maintenance, troubleshooting, and error detection including <i>ping</i>, <i>ipconfig</i>, <i>nslookup</i>, <i>tracert</i>, and <i>netstat</i>, explaining their purposes and demonstrating their usage in diagnosing and resolving network issues. • Be prepared to discuss the implication of the real-world scenario presented at the beginning of class. Engage the learners by asking the questions found on the slide and encourage discussion in class.
20 min	Lab: Network Protocols and Commands	<ul style="list-style-type: none"> • Demonstrate the lab and remind learners to use this lab to practice and apply the concepts they have learned throughout the session. Encourage student engagement while you demonstrate the lab.
5 min	Break	<ul style="list-style-type: none"> • Share a timer on the screen so there is clarity as to when class will resume. Ensure cameras and microphones are disabled during the break.
15 min	Cyber Uncovered: Wireless Technology	<ul style="list-style-type: none"> • Introduce the concept of wireless networks and their advantages over wired networks, emphasizing flexibility and the absence of physical cables. • Discuss the security issues associated with wireless networks, including coverage area limitations, transmission interference, lack of physical media, and shared medium challenges.

		<ul style="list-style-type: none"> ● Apply the knowledge of wireless network security issues to the real-world scenario of the clinic, exploring security measures to protect sensitive medical information and expansion requirements for seamless connectivity between the original and new clinics. ● Explain the key components of a wireless LAN, including access points (AP) and wireless NIC adapters, and their role in enabling wireless connectivity. ● Present different wireless technologies such as Wi-Fi, Wi-MAX, and Bluetooth, highlighting their specific use cases and range of coverage. ● Discuss the significance of wireless LAN components in designing a solution for the new clinic, considering factors such as coverage, scalability, and security.
20 min	Lab: Intro to Networking	<ul style="list-style-type: none"> ● Demonstrate the lab and remind learners to use this lab to practice and apply the concepts they have learned throughout the session. Encourage student engagement while you demonstrate the lab.
10 min	Lesson Closure	<ul style="list-style-type: none"> ● For this first lesson, spend just a few minutes reminding the learners what the key "take-aways" were from the lesson and what they should do to prepare for the next module. The take-aways discussion should include key concepts such as the devices found on a network, physical and logical addressing, protocols, and tools used for troubleshooting. Students should review this information prior to moving to the next module. ● You will be able to use the data collected in the pulse check to help with the lesson closure. Remind those learners that reported being in the "red zone" to take advantage of office-hours. ● Recommend that the learners ensure they submit all of the assignments on-time to ensure the appropriate credit is provided to them. ● Recommend that the students read-ahead and come prepared for the next lesson. ● Q&A
	Additional Time Filler (if needed)	<ul style="list-style-type: none"> ● Kahoot ● Discuss interview prep and questioning ● Use breakout rooms for additional lab practice ● Continue Real World Scenario Conversation

Share Your Experience

Cybersecurity is a challenging field, and learners need to stay motivated and engaged. To learners, you are not only a subject matter expert but also a role model and an inspiration.

Consider sharing your personal experience in these areas:

- Share a time when you faced a cybersecurity challenge or encountered a network security breach. How did you handle the situation, and what did you learn from it?
- Reflect on a moment when you felt motivated and engaged in the field of computer networking or cybersecurity. What sparked your interest, and how did it impact your learning and career path?
- Describe a networking project or task that you found particularly challenging. How did you approach it, and what strategies or resources did you use to overcome the difficulties?
- Think about a time when you had to troubleshoot a complex network issue. What steps did you take to diagnose and resolve the problem, and what skills or knowledge did you gain from that experience?