Module Practice and Quiz

4.7.1

Packet Tracer – Physical Layer Exploration 🔖

In this Packet Tracer Physical Mode (PTPM) activity, you will trace the physical path of IP packets from a home in Monterey, California to a web server at the University of Hawaii on the island of Oahu, Hawaii. You will do this in Packet Tracer and on your computer.

In the Packet Tracer simulation, a student lives in Monterey, California (USA) and regularly uses a web browser to access the University of Hawaii's web site at www.hawaii.edu. As she views the information downloaded from the web server to her home computer, she becomes curious about how the IP packets traveled between Monterey and Hawaii. What is the path those packets actually take and how did they travel over the Pacific Ocean?

You are also interested in these questions and will investigate the path from your unique location to the server in Hawaii.

This activity follows the packets between two devices in two specific locations using their specific internet connections. Two other devices in both these same two locations, but using different internet connections (different ISPs), would most likely result in the IP packets taking a much different path.

> 📄 Physical Layer Exploration – Physical Mode

⤓ Physical Layer Exploration – Physical Mode

4.7.2

Packet Tracer – Connect the Physical Layer 🔖

In this activity, you will explore the different options available on internetworking devices. You will also be required to determine which options provide the necessary connectivity when connecting multiple devices.

Finally, you will add the correct modules and connect the devices.

📄 Connect the Physical Layer

4.7.3

What did I learn in this module?

Purpose of the Physical Layer

Before any network communications can occur, a physical connection to a local network must be established. A physical connection can be a wired connection using a cable or a wireless connection using radio waves. Network Interface Cards (NICs) connect a device to the network. Ethernet NICs are used for a wired connection, whereas WLAN (Wireless Local Area Network) NICs are used for wireless. The OSI physical layer provides the means to transport the bits that make up a data link layer frame across the network media. This layer accepts a complete frame from the data link layer and encodes it as a series of signals that are transmitted onto the local media. The encoded bits that comprise a frame are received by either an end device or an intermediary device.

Physical Layer Characteristics

The physical layer consists of electronic circuitry, media, and connectors developed by engineers. The physical layer standards address three functional areas: physical components, encoding, and signaling. Bandwidth is the capacity at which a medium can carry data. Digital bandwidth measures the amount of data that can flow from one place to another in a given amount of time. Throughput is the measure of the transfer of bits across the media over a given period of time and is usually lower than bandwidth. Latency refers to the amount of time, including delays, for data to travel from one given point to another. Goodput is the measure of usable data transferred over a given period of time. The physical layer produces the representation and groupings of bits for each type of media as follows:

- **Copper cable** – The signals are patterns of electrical pulses.
- **Fiber-optic cable** – The signals are patterns of light.
- **Wireless** – The signals are patterns of microwave transmissions.

Copper Cabling

Networks use copper media because it is inexpensive, easy to install, and has low resistance to electrical current. However, copper media is limited by distance and signal interference. The timing and voltage values of the electrical pulses are also susceptible to interference from two sources: EMI and crosstalk. Three types of copper cabling are: UTP, STP, and coaxial cable (coax). UTP has an outer jacket to protect the copper wires from physical damage, twisted pairs to protect the signal from interference, and color-

coded plastic insulation that electrically isolates wires from each other and identifies each pair. The STP cable uses four pairs of wires, each wrapped in a foil shield, which are then wrapped in an overall metallic braid or foil. Coaxial cable, or coax for short, gets its name from the fact that there are two conductors that share the same axis. Coax is used to attach antennas to wireless devices. Cable internet providers use coax inside their customers' premises.

UTP Cabling

UTP cabling consists of four pairs of color-coded copper wires that have been twisted together and then encased in a flexible plastic sheath. UTP cable does not use shielding to counter the effects of EMI and RFI. Instead, cable designers have discovered other ways that they can limit the negative effect of crosstalk: cancellation and varying the number of twists per wire pair. UTP cabling conforms to the standards established jointly by the TIA/EIA. The electrical characteristics of copper cabling are defined by the Institute of Electrical and Electronics Engineers (IEEE). UTP cable is usually terminated with an RJ-45 connector. The main cable types that are obtained by using specific wiring conventions are Ethernet Straight-through and Ethernet Crossover. Cisco has a proprietary UTP cable called a rollover that connects a workstation to a router console port.

Fiber-Optic Cabling

Optical fiber cable transmits data over longer distances and at higher bandwidths than any other networking media. Fiber-optic cable can transmit signals with less attenuation than copper wire and is completely immune to EMI and RFI. Optical fiber is a flexible, but extremely thin, transparent strand of very pure glass, not much bigger than a human hair. Bits are encoded on the fiber as light impulses. Fiber-optic cabling is now being used in four types of industry: enterprise networks, FTTH, long-haul networks, and submarine cable networks. There are four types of fiber-optic connectors: ST, SC, LC, and duplex multimode LC. Fiber-optic patch cords include SC-SC multimode, LC-LC single-mode, ST-LC multimode, and SC-ST single-mode. In most enterprise environments, optical fiber is primarily used as backbone

Wireless media carry electromagnetic signals that represent the binary digits of data communications using radio or microwave frequencies. Wireless does have some limitations, including: coverage area, interference, security, and the problems that occur with any shared medium. Wireless standards include the following: Wi-Fi (IEEE 802.11), Bluetooth (IEEE 802.15), WiMAX (IEEE 802.16), and Zigbee (IEEE 802.15.4). Wireless LAN (WLAN) requires a wireless AP and wireless NIC adapters.

4.7.4

Module Quiz - Physical Layer

1. A network administrator is troubleshooting connectivity issues on a server. Using a tester, the administrator notices that the signals generated by the server NIC are distorted and not usable. In which layer of the OSI model is the error categorized?

- ○ data link layer
- ○ network layer
- ○ physical layer
- ○ presentation layer

2. What type of cable is used to connect a workstation serial port to a Cisco router console port?

- ○ crossover
- ○ rollover
- ○ coaxial
- ○ straight-through

3. Why are two strands of fiber used for a single fiber optic connection?

- ○ They prevent crosstalk from causing interference on the connection.
- ○ They increase the speed at which the data can travel.
- ○ They allow for full-duplex connectivity.
- ○ The two strands allow the data to travel for longer distances without degrading.

4. Which procedure is used to reduce the effect of crosstalk in copper cables?

- ○ avoiding sharp bends during installation
- ○ designing a cable infrastructure to avoid crosstalk interference
- ○ requiring proper grounding connections
- ○ wrapping the bundle of wires with metallic shielding
- ○ twisting opposing circuit wire pairs together

5. What is one advantage of using fiber optic cabling rather than copper cabling?

- ○ It is able to be installed around sharp bends.
- ○ It is usually cheaper than copper cabling.
- ○ It is easier to terminate and install than copper cabling.
- ○ It is able to carry signals much farther than copper cabling.

6. A network administrator is designing a new network infrastructure that includes both wired and wireless connectivity. Under which situation would a wireless connection be recommended?

   - ( ) The end-user device needs mobility when connecting to the network.
   - ( ) The end-user device requires a dedicated connection because of performance requirements.
   - ( ) The end-user device area has a high concentration of RFI.
   - ( ) The end-user device only has an Ethernet NIC.

7. Which type of UTP cable is used to connect a PC to a switch port?

   - ( ) straight-through
   - ( ) crossover
   - ( ) console
   - ( ) rollover

8. What is the definition of bandwidth?

   - ( ) the speed of bits across the media over a given period of time
   - ( ) the amount of data that can flow from one place to another in a given amount of time
   - ( ) the measure of usable data transferred over a given period of time
   - ( ) the speed at which bits travel on the network

9. Which statement correctly describes frame encoding?

   - ( ) It uses the characteristic of one wave to modify another wave.
   - ( ) It generates the electrical, optical, or wireless signals that represent the binary numbers of the frame.
   - ( ) It transmits data signals along with a clock signal which occurs at evenly spaced time durations.
   - ( ) It converts bits into a predefined code in order to provide a predictable pattern to help distinguish data bits from control bits.

10. What is a characteristic of UTP cabling?

   - ( ) cancellation
   - ( ) immunity to electrical hazards
   - ( ) cladding
   - ( ) woven copper braid or metallic foil

11. A wireless LAN is being deployed inside the new one room office that is occupied by the park ranger. The office is located at the highest part of the national park. After network testing is complete, the technicians report that the wireless LAN signal is occasionally affected by some type of interference. What is a possible cause of the signal distortion?

- the microwave oven
- the number of wireless devices that are used in the wireless LAN
- the large number of trees that surround the office
- the elevated location where the wireless LAN was installed

12. What is the purpose of the OSI physical layer?

- performing error detection on received frames
- transmitting bits across the local media
- exchanging frames between nodes over physical network media
- controlling access to media

13. Which characteristic describes crosstalk?

- the distortion of the network signal from fluorescent lighting
- the loss of wireless signal over excessive distance from the access point
- the weakening of the network signal over long cable lengths
- the distortion of the transmitted messages from signals carried in adjacent wires

14. What is indicated by the term throughput?

- the measure of the bits transferred across the media over a given period of time
- the guaranteed data transfer rate offered by an ISP
- the measure of the usable data transferred across the media
- the time it takes for a message to get from sender to receiver
- the capacity of a particular medium to carry data

15. Which standards organization oversees development of wireless LAN standards?

- TIA
- ISO
- IEEE
- IANA

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