

ISHub AAU Summer Bootcamp

Networking Track

Section 1: Communication Channels (Cables, Connectors, and Crimping)

1. List and explain the main differences between STP and UTP cables.

Answer: UTP:- used for connections within a short range. Most people choose it for home networking. There is an insulating material that enrobes each of the eight copper wires contained within the cable. UTP has been highly favored by most people all the time for its fast transmission speed and lower costs compared to optical fiber and coaxial cable. The categories of UTP have been developed from Category 1 to Category 7. They are different in the number of pairs of wires, transmission rate, and implementation. In recent years, Category 5, 6, and 7 have become increasingly popular for some new emerging applications. Among them, Category 5 is popular due to its widely supported operations and reasonable price.

STP:- mainly used for most business locations. In most occasions, the twisted pair is enclosed in a shield that functions as a ground. In an STP cable, cable pairs are shielded by a metallic substance, and then all four pairs are wrapped in yet another metallic protector. Three techniques — shielding, cancellation and wire twisting have been applied to prevent interference. The protective layer could protect this kind of cable from crosstalk and increase the cable's fidelity. But there is one shortcoming that great attention should be paid to when installing the cable, or installation faults may frequently occur. Most applications for this cable are between equipment, racks, and buildings.

2. What are the advantages and disadvantages of STP cables?

Answer: 1. Affordability: UTP Ethernet cable is widely recognized for its cost-effectiveness. Compared to other types of networking cables, such as fiber optic or STP. This type of cable is relatively inexpensive, making it an attractive option for budget-conscious projects.

2. Flexibility: The flexibility makes it easy to install in various environments. Whether it is for home networking, office setups, or telephone applications, the flexible nature allows for straightforward installation and maneuvering, even in tight spaces.

3. Ease of Use: The simplicity contributes to its widespread adoption. With its familiar RJ-45 connectors and straightforward termination process, this cable is user-friendly, making it accessible to individuals with varying technical expertise.

4. Versatility: This cable type supports a broad range of networking applications, including Ethernet, telephone, and multimedia transmission. Its versatility makes it a go-to solution for diverse connectivity requirements.

3. Define Coaxial cable and mention two main uses in networking.

Answer: Coaxial cable is a type of electrical cable commonly used for transmitting high-frequency signals. It consists of a central conductor, an insulating layer, a metal shield, and an outer insulating layer.

One advantage of using coaxial cable is its ability to transmit signals over long distances without loss of quality. It also provides better shielding against interference compared to other types of cables. Coaxial cable is widely used in applications such as cable television (TV), internet connections, and telecommunications due to its reliability and performance.

4. What is the function of a BNC connector, and where is it typically used?

Ans: It's used for quick connect/ disconnect of radio frequency signals. It's commonly found in applications like video and audio equipment, test and measurement instruments, and networking hardware.

5. Differentiate between RJ45 and RJ11 connectors in terms of: Number of Pins used in networking or telephony

Answer: RJ45 connectors have eight pins, while RJ11 connectors have either four or six pins. RJ45 connectors are primarily used in Ethernet networking for connecting computers, routers, and switches, whereas RJ11 connectors are commonly used for telephone connections.

6. What is the maximum data transmission capacity and range of UTP Category 5e and 6 cables?

Answer: Cat 5e supports a maximum data transfer rate of 1 Gigabit per second (Gbps), while Cat 6 can support both 1 Gbps and, at shorter distances, 10 Gbps.

7. Name and describe the two main types of Fiber Optic cables.

Answer: A. Single-mode fibers have a small core, allowing light to travel in a single path, making them suitable for long-distance, high-bandwidth transmissions.

B. Multimode fibers have a larger core, allowing multiple light paths, making them better for shorter distances and lower bandwidth applications.

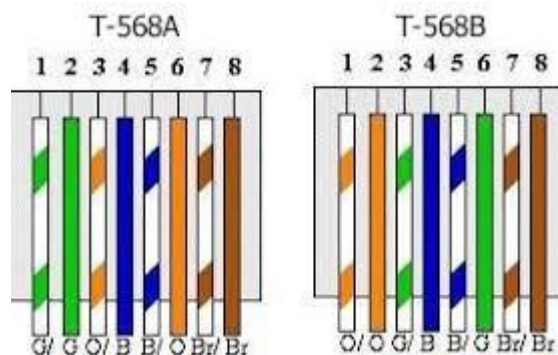
8. What is the difference between Single-mode and Multi-mode fiber?

Answer: Single-mode fiber has a smaller core, allowing only one mode of light to travel, enabling longer distances and higher bandwidth, but at a higher cost. Multi-mode fiber has a larger core, allowing multiple light modes, suitable for shorter distances and lower bandwidth applications at a lower cost.

9. Give two advantages of using fiber optic cables over copper cables.

Answer: higher bandwidth and faster data transmission speeds.

10. Draw and label the color coding for the T568A and T568B standards used in Ethernet cable crimping.



Answer:

In T568A, the green pair (green/white and green) occupies pins 1 and 2, while the orange pair (orange/white and orange) occupies pins 3 and 6. In T568B, the orange pair occupies pins 1 and 2, and the green pair occupies pins 3 and 6. All other wires maintain the same pin assignments in both standards

11. What is a Straight-through cable used for? List at least two examples.

Ans: It's used to connect different types of devices. The key feature is that the wiring on both ends of the cable matches exactly.

E.g. Connecting a computer to a router or switch, Linking a switch to a modem or access point

12. What is a Crossover cable used for? Give at least one real-world use case.

Answer: A crossover cable has its send and receive wires crossed, which allows two similar devices to communicate directly, bypassing network switches or routers.

E.g., connecting two computers directly

13. Identify at least two tools used for creating or testing Ethernet cables.

Answer: Two essential tools for creating and testing Ethernet cables are a crimping tool and a cable tester. A crimping tool is used to attach RJ45 connectors to the ends of the cable, while a cable tester verifies the integrity and connectivity of the cable after it's been created.

14. Fill in the blanks: A straight-through cable connects _____ to _____.
A crossover cable connects _____ to _____.

Answer: switch/router. similar devices like a computer / another computer.

15. Compare coaxial, twisted pair, and fiber optic cables in terms of: Cost, Speed, Susceptibility to interference

Answer: Fiber optic cables offer the highest speeds and immunity to interference, but come at the highest cost. Twisted pair cables are the most affordable and easiest to install, but offer the lowest speeds and are susceptible to interference. Coaxial cables fall in between, providing a balance of cost, speed, and interference resistance.

Section 2: Communication Models

16. Define a communication model in computer networks.

Answer: A communication model defines how different components, like devices and applications, exchange information. It helps us understand the various components and protocols used in network communications. These models help us see the function of each protocol and their relationship to other protocols.

17. What are the three basic types of data flow in communication? Give Examples.

Answer:- A.Simplex: The communication is unidirectional. Only one of the two devices on a link can transmit; the other can only receive.

e.g, keyboard sending data to a computer

B. Half-duplex: Only one of the two devices on a link can transmit; the other can only receive.

e.g, Walkie-talkie

C. Full-duplex: In full-duplex mode, both devices can transmit and receive.

e.g, telephone

18. Explain the difference between: Simplex, Half-Duplex, Full-Duplex communication with examples.

Answer: Simplex is one-way, half-duplex is two-way but not simultaneously, and full-duplex is two-way with simultaneous transmission.

e.g, radio broadcast. The radio station transmits information, and your radio receives it. The radio cannot transmit back to the station. This is Simplex.

Walkie-talkies. When one person is speaking, the other person can only listen. They must "release" the transmit button to allow the other person to talk. This is Half-duplex.

A telephone conversation. Both parties can speak and listen at the same time. This is full-duplex.

19. What is the importance of a protocol in a communication model?

Answer: Communication protocols provide mechanisms for error detection, correction, and recovery, ensuring that data is transmitted reliably even in the presence of network issues or failures.

20. Briefly describe the basic elements of a communication system.

Ans: 1. Sender: The origin of the message or information to be communicated. This could be a person speaking, a computer generating data, or any entity producing information.

2. Receiver: This component receives the signal from the channel and decodes it to recover the original message. It reverses the process done by the transmitter.

3. Message: The information that the sender wants to send to the receiver..

4. Channel: The physical medium through which the signal travels from the transmitter to the receiver. This could be a wire, a radio wave, or even free space.

5. Protocol: A set of rules and standards that govern how communication occurs, ensuring clarity and proper interpretation of the message.

Section 3: OSI Model (In Detail)

21. Write down the seven layers of the OSI model in correct order (Top → Bottom).

Ans: Application layer -> Presentation layer-> Session layer-> Transport layer-> Network layer-> Data Link layer-> Physical layer

22. Match the following OSI layers with their correct protocols: a. Application –

_____ b. Transport – _____ c. Network – _____ d. Data Link –
_____ e. Physical – _____ (Options: HTTP, IP, Ethernet, TCP, Fiber Optic Cable)

Ans: A. Application - HTTP
B. Transport - TCP
C. Network - IP
D. Data Link - Ethernet
E. Physical - Fiber Optic Cable.

23. What is the main function of the Transport Layer (Layer 4)? Include two protocols used in this layer. It handles segmentation, reassembly, and flow control of data packets. Two key protocols used in this layer are TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).

Answer: The Transport Layer (Layer 4) is primarily responsible for providing reliable end-to-end communication between hosts, managing data flow, and ensuring data delivery.

24. At which layer does IP addressing occur? Explain its role.

Answer: IP addressing occurs at the Network layer, which is Layer 3 in the OSI model. Its primary role is to provide logical addressing, enabling devices to be uniquely identified and routed across networks. This allows data packets to be transmitted to the correct destination, even across multiple networks, ensuring communication within the internetwork.

25. What is the Data Unit Name used at the following layers: Layer 4 (Transport) → _____ Layer 3 (Network) → _____ - Layer 2 (Data Link) → _____ Layer 1 (Physical) → _____

Answer: Segment ->Packet->Frame->a Bit.

26. Describe the difference between a router, a switch, and a hub, and match each to its corresponding OSI layer.

Ans: Hub belongs to layer 1 of the OSI model, which means it is a physical layer device. Switch belongs to layer 2 of the OSI model, which means it is a data link layer device. A router belongs to layer 3 of the OSI model, which means it is a network layer device.

27. Explain what happens at each layer of the OSI model when you send a file from one computer to another.

Answer: When a sender sends a message, the process starts at the Application Layer (Layer 7). The sender uses SMTP (Simple Mail Transfer Protocol) to handle the message. The message is then passed to the Presentation Layer (Layer 6), where it is formatted and encrypted to ensure proper transmission. Next, the message moves to the Session Layer (Layer 5), where a session is established between the sender's server and the receiver's server. This layer manages the session, keeping the connection open long enough to send the message. The message then reaches the Transport Layer (Layer 4), where it is divided into smaller packets. TCP ensures these packets are sent reliably and in the correct order. At the Network Layer (Layer 3), each packet is assigned source and destination IP addresses, allowing it to be routed through multiple networks, including routers and switches, to reach the recipient. The Data Link Layer (Layer 2) then uses MAC addresses to handle the packets' journey across local networks and correct any errors that occur. Finally, the Physical Layer (Layer 1) converts the data into electrical signals, which are transmitted to the receiver.

28. Why is the OSI model important in understanding how networks work?

Answer: It provides a standardized, layered framework for network communication, simplifying complex processes and facilitating troubleshooting and interoperability.

29. Give a real-life analogy (e.g., post office or package delivery) to explain the OSI model's layered process.

Ans: 1. Application Layer: You write the content of the letter.
2. Presentation Layer: You format or encrypt the letter to ensure it's understandable.
3. Session Layer: You and the recipient agree on communication rules.
4. Transport Layer: You choose a reliable postal service to handle the delivery.
5. Network Layer: The postal service determines the most efficient route to deliver your letter.
6. Data Link Layer: The local post office sorts and prepares the letter for delivery.
7. Physical Layer: The postman physically delivers the letter to the recipient's address.

30. BONUS: Describe how the OSI model compares to the TCP/IP model. Mention at least one similarity and one difference.

Answer: TCP/IP is a practical model that addresses specific communication challenges and relies on standardized protocols. In contrast, OSI serves as a comprehensive, protocol-independent framework designed to encompass various network communication methods.