DCN- Assignment

Program: MCA Online
Course : DCN

Semester: 2

Part 1: Theory Questions

1. Briefly explain the OSI reference model.

The OSI (Open Systems Interconnection) reference model is a conceptual framework that standardizes the functions of a telecommunication or computing system into seven distinct layers. Developed by the International Organization for Standardization (ISO), it helps in understanding and designing a network architecture that is robust, interoperable, and scalable.

The seven layers of the OSI model are:

1. **Physical Layer:** Handles the physical connection between devices, including cables, switches, and transmission of raw bits over a medium.
2. **Data Link Layer:** Ensures reliable node-to-node data transfer by detecting and correcting errors that occur in the physical layer. It includes MAC (Media Access Control) and LLC (Logical Link Control).
3. **Network Layer:** Responsible for logical addressing and routing. It determines the best path for data to travel between networks. IP (Internet Protocol) operates at this layer.
4. **Transport Layer:** Provides end-to-end communication services for applications. It ensures complete data transfer using protocols like TCP (Transmission Control Protocol) and UDP (User Datagram Protocol).
5. **Session Layer:** Manages sessions and controls dialogues between computers. It establishes, manages, and terminates sessions.
6. **Presentation Layer:** Translates data between the application layer and the network. It handles data encryption, compression, and translation.
7. **Application Layer:** The topmost layer that interacts directly with the end-user. It provides services like email, file transfer, and web browsing (HTTP, FTP, SMTP).

Each layer serves the layer above it and is served by the layer below it. The OSI model aids in troubleshooting, designing networks, and standardizing protocols.

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2. List out and define different transmission media used for data flow in a computer network.

Transmission media refers to the physical pathways through which data is transmitted from one device to another in a network. It is broadly classified into two categories: Guided (Wired) Media and Unguided (Wireless) Media.

1. Twisted Pair Cable:

- Composed of two insulated copper wires twisted together.
- Types: UTP (Unshielded Twisted Pair) and STP (Shielded Twisted Pair).
- Commonly used in LANs.

2. Coaxial Cable:

- Has a central core conductor surrounded by an insulating layer, metallic shield, and outer cover.
- Used for cable TV, early Ethernet networks.

3. Fiber Optic Cable:

- Uses light to transmit data.
- Consists of core, cladding, and protective coating.
- Offers high bandwidth and is immune to electromagnetic interference.

4. Radio Waves:

- Used for wireless communications like AM/FM radios, mobile phones.
- Can travel long distances and penetrate buildings.

5. Microwaves:

- Used for point-to-point communication.
- Requires line of sight.
- Used in satellite and cellular communications.

6. Infrared:

- Short-range communication.
- Used in remote controls, and short-range wireless devices.

Each medium has its advantages in terms of cost, bandwidth, range, and security.

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3. Explain different types of transmission modes used for data transmission.

Transmission mode refers to the way data flows between two connected devices in a network. It defines the direction of signal flow and is mainly of three types:

1. **Simplex Mode:**

- Data flows in only one direction.
- No feedback from receiver to sender.
- Example: Keyboard to monitor, TV broadcast.

2. **Half-Duplex Mode:**

- Data flows in both directions but one at a time.
- Sender and receiver can communicate but not simultaneously.
- Example: Walkie-talkie communication.

3. **Full-Duplex Mode:**

- Data flows in both directions simultaneously.
- Offers fast and efficient communication.
- Example: Telephone conversations, modern Ethernet.

These modes are crucial in determining the efficiency and application of network communications.

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4. List out and explain any five networking devices.

Networking devices are hardware used to connect computers and other electronic devices together so that they can communicate.

1. **Router:**

- Connects multiple networks together.
- Routes data from one network to another based on IP addresses.
- Can provide Wi-Fi access.

2. **Switch:**

- Connects multiple devices in a LAN.
- Uses MAC addresses to forward data to the correct device.
- More efficient than hubs.

3. **Hub:**

- A basic device that broadcasts data to all connected devices.
- Operates at the physical layer.
- Less secure and efficient than switches.

4. **Modem:**

- Converts digital signals into analog and vice versa.
- Used to connect to the internet via ISP.
- Essential for DSL and cable internet connections.

5. **Access Point:**

- Extends wireless coverage of a network.
- Connects to a wired router/switch via Ethernet.
- Common in Wi-Fi networks.

Each device plays a specific role in the communication process and improves network performance and connectivity.

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5. Design a network having four computers connected through a switch using CISCO PACKET TRACER.

To design this network in Cisco Packet Tracer:

Components Required:

- 1 Switch (e.g., 2960)
- 4 Computers (PC0, PC1, PC2, PC3)
- 4 Copper Straight-through Cables

Steps:

1. Open Cisco Packet Tracer.
2. Drag and drop a switch onto the workspace.
3. Add four PCs.
4. Connect each PC to the switch using a straight-through cable.
5. Assign static IP addresses to each PC:
    - PC0: 192.168.1.2
    - PC1: 192.168.1.3
    - PC2: 192.168.1.4
    - PC3: 192.168.1.5
    - Subnet Mask: 255.255.255.0

6. Test connectivity using the ping command.

This simple LAN setup allows all computers to communicate within a single network segment.

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6. Design a network using hybrid topology.

A hybrid topology is a combination of two or more different types of topologies. It leverages the strengths and minimizes the weaknesses of its component topologies.

Example Design: Combination of Star and Bus Topology

Components Required:

- 1 Switch
- 4 Computers in star configuration
- 1 Bus (represented by linear cable)
- 2 more computers connected in bus layout
- 1 Router (for internet access)

Steps in Cisco Packet Tracer:

1. Create a star topology by connecting 4 computers to a switch.
2. Create a bus topology by connecting 2 computers in series using a hub.
3. Connect the switch and the hub to a router.
4. Assign appropriate IP addresses to each node.
5. Enable routing protocols on the router if connecting multiple networks.
6. Test network connectivity with ping and traceroute.