Module -7: Network fundamental –

1. Which of the following messages in the DHCP process are broadcasted? (Choose Two)
   1. Request
   2. Offer
   3. Discover
   4. Acknowledge

Ans. B. Offer & C. Discover

1. Which command would you use to ensure that an ACL does not block web-based TCP traffic?
   1. Permit any
   2. Permit tcp any any eq 80
   3. Permit tcp any eq 80
   4. Permit any any eq tcp

3-Explain Network Topologies

Ans. Network Topologies are the different ways to connect devices in any Network . It shows how devices are connected eg. all in a single line , in a ring , in tree type branches or may be in combinations of all. It is generally a concept seen in guided (wired) network as in unguided network they are connected accordingly their bandwith or ranges.

Examples of Topologies :

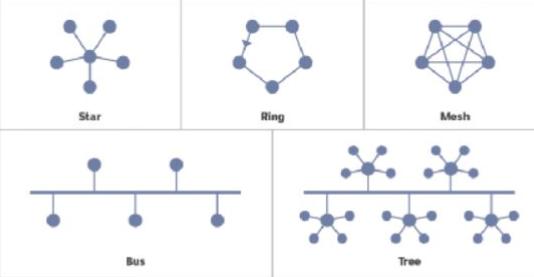
Bus Topology

Star Topology

Ring Topology

Mesh Topology

Tree Topology



4-Explain TCP/IP Networking Model

Ans. TCP : Transmission Control Protocol IP : Internet Protocol

It contains Application Layer , Transport Layer , Network Layer and Network Access layer . It is the simplified form of OSI Model in Networking. It is also the Model which is used to theoretically understand how the network works from one device to another. It contains only 4 layers in which Application layer is combination of 3 layers ( Application, Presentation and session layer) of OSI Model & Network Access layer is combination of 2 layers (Physical and Data-Link layer ) of OSI Model.

The First layer is Network Access layer ; Which deals with Physical and Data link layer where data moves in form of signals and frames . Data from a device transfer in form of signal from a physical transmission media ( wire or cables ) to Data-Link devices such as switches in form of data frames.

The Second Layer is Network Layer ; which deals with network and data here moves in form of packets in network .

The Third layer is of Transport Layer ; which deals with connections of two networks where data is in form of segments and it is the heart of both the models TCP/IP & OSI Model.

The fourth layer is Application Layer ; Which deals with the layers such as presentation , Application and session layer where data is in form of data itself and this is the main things which are visible on screen of devices.

This is how four layers of TCP/IP model works

5-Explain LAN and WAN Network

Ans. LAN means Local Area Network & WAN means Wide Area Network :

When there is Network in a particular building or Group of rooms in a small area it is the Network known as LAN . When two or more LAN network are connected it is called as the Metropolitan Area Network (MAN) and when multiple MAN Networks are connected with each other it is WAN. Accessing the Nearby PC is the example of LAN and Accessing the Server of Amazon or Google it is the WAN.

6-Explain Operation of Switch

Ans. Switch is the device which works on data link layer where data in any LAN network is transferred in form of the data frames. Switch is device which helps us to connect multiple devices in a LAN network . Its main operation to connect multiple devices in a network (specially LAN or CAN networks ).

7-Describe the purpose and functions of various network devices.

### Ans. **Purpose and Functions of Various Network Devices**

#### **1. Router**

* **Purpose**: Connects multiple networks and directs data packets between them.
* **Functions**:
  + Performs routing by selecting the best path for data transfer.
  + Provides inter-network communication (e.g., between LANs and WANs).
  + Uses routing protocols like OSPF, EIGRP, or BGP for dynamic path determination.
  + Supports NAT (Network Address Translation) for private-to-public IP conversion.

#### **2. Switch**

* **Purpose**: Facilitates communication within the same network segment (LAN).
* **Functions**:
  + Operates at Layer 2 (Data Link) of the OSI model.
  + Uses MAC addresses to forward frames.
  + Reduces collisions by creating separate collision domains for each port.
  + Can be configured for VLANs to segment traffic logically.

#### **3. Hub** (Legacy Device)

* **Purpose**: Connects multiple devices in a network (now largely replaced by switches).
* **Functions**:
  + Operates at Layer 1 (Physical) of the OSI model.
  + Broadcasts data to all connected devices, causing increased collisions.

#### **4. Access Point (AP)**

* **Purpose**: Extends the wireless network by allowing devices to connect via Wi-Fi.
* **Functions**:
  + Acts as a bridge between wired and wireless networks.
  + Operates primarily on Layer 2.
  + Provides features like SSID broadcasting, encryption (WPA2/WPA3), and MAC filtering.

#### **5. Firewall**

* **Purpose**: Protects the network by controlling incoming and outgoing traffic.
* **Functions**:
  + Operates at Layer 3 (Network) or higher (Application).
  + Filters packets based on IP, port, or application-level rules.
  + Prevents unauthorized access using stateful inspection or proxy methods.

#### **6. Modem**

* **Purpose**: Provides internet access by converting digital signals to analog and vice versa.
* **Functions**:
  + Operates on Layer 1 (Physical) and sometimes Layer 2.
  + Enables connectivity to ISPs using DSL, cable, or fiber technologies.

#### **7. Network Interface Card (NIC)**

* **Purpose**: Enables devices to connect to a network.
* **Functions**:
  + Provides a hardware interface for wired or wireless communication.
  + Operates at Layer 2 by using MAC addresses for data transfer.

#### **8. Gateway**

* **Purpose**: Connects networks using different communication protocols.
* **Functions**:
  + Acts as a protocol converter, translating data formats.
  + Facilitates communication between different network architectures (e.g., IPv4 and IPv6).

#### **9. Bridge**

* **Purpose**: Connects two or more LAN segments.
* **Functions**:
  + Operates at Layer 2 (Data Link).
  + Reduces traffic by filtering and forwarding based on MAC addresses.

#### **10. Load Balancer**

* **Purpose**: Distributes network or application traffic across multiple servers.
* **Functions**:
  + Ensures high availability and reliability by preventing server overloads.
  + Operates at Layer 4 (Transport) or Layer 7 (Application).

#### **11. Proxy Server**

* **Purpose**: Acts as an intermediary between clients and servers.
* **Functions**:
  + Provides caching to improve performance.
  + Filters web requests for security and policy enforcement.

#### **12. Repeater**

* **Purpose**: Extends the physical range of a network by amplifying signals.
* **Functions**:
  + Operates at Layer 1 (Physical).
  + Regenerates signals to prevent attenuation.

#### **13. Wireless Controller**

* **Purpose**: Manages multiple wireless access points centrally.
* **Functions**:
  + Simplifies configuration and monitoring of APs.
  + Provides load balancing and seamless roaming for users.

#### **14. Firewall**

* **Purpose**: Monitors and protects the network from threats.
* **Functions**:
  + IDS: Detects suspicious activity and alerts administrators.
  + IPS: Proactively blocks threats in real time.

8-Make list of the appropriate media, cables, ports, and connectors to connect switches to other

### Ans. **List of Media, Cables, Ports, and Connectors to Connect Switches to Each Other**

#### **1. Media Types**

* **Copper (Twisted Pair)**: Commonly used for shorter distances in LAN environments.
* **Fiber Optic**: Preferred for long-distance connections and higher speeds.

**2. Cables**

1. **Straight-Through Ethernet Cable**
   * Used to connect a switch to other devices like routers or computers.
   * Applicable for auto-MDIX capable switches.
2. **Crossover Ethernet Cable**
   * Used for direct switch-to-switch connections (manual configuration in older switches).
   * Modern switches typically auto-negotiate, making crossover cables less necessary.
3. **Fiber Optic Cables**
   * Types:
     + **Single-mode Fiber (SMF)**: Long-distance, higher bandwidth (e.g., WAN connections).
     + **Multi-mode Fiber (MMF)**: Shorter distances within a building or campus.
   * Fiber cables are ideal for reducing electromagnetic interference.
4. **Twinaxial Cable**
   * Used for short-distance high-speed connections, commonly in data centers (e.g., with SFP+ ports).

#### **3. Ports**

1. **RJ-45 Ports** (Copper)
   * Found on most switches for twisted-pair connections.
   * Supports speeds like 10/100/1000 Mbps and 10 Gbps Ethernet.
2. **SFP (Small Form-Factor Pluggable) Ports**
   * Used for both copper and fiber connections.
   * Supports hot-swappable transceivers for versatility.
3. **SFP+ Ports**
   * Similar to SFP but supports higher speeds (10 Gbps and beyond).
4. **QSFP (Quad Small Form-Factor Pluggable) Ports**
   * Supports higher data rates (40 Gbps, 100 Gbps).
   * Used in high-performance network environments.

#### **4. Connectors**

1. **RJ-45 Connector**
   * Standard for twisted-pair Ethernet cables.
   * Fits into RJ-45 ports on switches.
2. **LC Connector** (Fiber)
   * Common for single-mode and multi-mode fiber connections.
   * Small size for high-density port setups.
3. **SC Connector** (Fiber)
   * Larger than LC; often used in older fiber systems.
4. **ST Connector** (Fiber)
   * Common in industrial settings; uses a twist-lock mechanism.
5. **MTP/MPO Connectors** (Fiber)
   * Used in high-density fiber connections, such as in data centers.
6. **DAC (Direct Attach Cable) Connector**
   * Used with Twinaxial cables for high-speed connections over short distances.

#### **Recommendations for Connecting Switches**

1. **Short-Distance Connections (e.g., within a rack)**:
   * Use **Cat 5e/6/6a Ethernet cables** with **RJ-45 connectors** for copper connections.
   * Alternatively, use **DAC cables** for high-speed connections (e.g., 10 Gbps).
2. **Medium-Distance Connections (e.g., across a room or building)**:
   * Use **multi-mode fiber cables** with **LC connectors**.
   * Utilize **SFP transceivers** for compatibility with the fiber medium.
3. **Long-Distance Connections (e.g., between buildings or campuses)**:
   * Use **single-mode fiber cables** with **LC connectors**.
   * Use appropriate **SFP or SFP+ transceivers** for required speeds and distances

9-Define Network devices and hosts

### Ans. **Network Devices**

Network devices are hardware components used to connect, manage, and control data traffic between various nodes in a network. They ensure efficient communication and data transfer within and across networks.

#### **Examples of Network Devices:**

1. **Router**: Connects multiple networks and directs data packets between them.
2. **Switch**: Operates at the data link layer to connect devices within a network and forward data based on MAC addresses.
3. **Hub**: A basic device that broadcasts data to all connected devices in the network.
4. **Access Point (AP)**: Extends the wireless network and allows wireless devices to connect.
5. **Firewall**: Monitors and controls network traffic based on security rules.
6. **Gateway**: Connects two dissimilar networks (e.g., LAN to WAN).
7. **Modem**: Converts digital signals to analog for transmission over telephone lines and vice versa.

### **Hosts**

A host is any device connected to a network that can send or receive data, participate in communications, and perform specific functions. Hosts typically use an IP address to identify themselves on the network.

#### **Examples of Hosts:**

1. **Personal Computers (PCs)**: Desktops and laptops used by end-users.
2. **Servers**: Store, process, and distribute data or services to other devices.
3. **Smartphones and Tablets**: Mobile devices connected to the network.
4. **IoT Devices**: Smart appliances like thermostats, cameras, and sensors.
5. **Printers and Scanners**: Network-enabled devices for document handling.