

Module : 7 CCNA - Routing And Switching

1. Which of the following messages in the DHCP process are broadcasted? (Choose two)

A. Request

B. Offer

C. Discover

D. Acknowledge

2. Which command would you use to ensure that an ACL does not block web-based TCP traffic?

A. permit any

B. permit tcp any any eq 80

C. permit tcp any eq 80

D. permit any any eq tcp

3. Explain Network Topologies

ANS:

I. Star Topology

- Structure: All devices connect to a central hub/switch.
- Pros:
 - Easy to manage and troubleshoot.
 - Failure of one device doesn't affect others.
- Cons:
 - Central hub is a single point of failure.
 - Requires more cabling.

Example: Ethernet LANs with a switch.

II. Bus Topology

- Structure: All devices share a single backbone cable (trunk).
- Pros:
 - Simple and inexpensive.
 - Requires less cabling.
- Cons:
 - A break in the main cable shuts down the entire network.
 - Performance degrades with heavy traffic.

Example: Ethernet (10Base2, 10Base5).

III. Ring Topology

- Structure: Devices form a closed loop where data travels in one direction (unidirectional) or both (bidirectional).
- Pros:
 - No data collisions (Token Ring).
 - Equal access for all devices.
- Cons:
 - A single node failure can break the ring.
 - Adding/removing devices disrupts the network.

Example: Token Ring

IV. Mesh Topology

- Structure: Every device connects to every other device.
 - Full Mesh: All nodes interconnected (expensive, high redundancy).
 - Partial Mesh: Only critical nodes have multiple connections.
- Pros:
 - Highly fault-tolerant (no single point of failure).
 - Fast data routing (multiple paths).
- Cons:
 - Expensive (high cabling and maintenance).
 - Complex to configure.

Example: Internet backbone, military networks.

V. Hybrid Topology

- Structure: Combines two or more topologies (e.g., Star-Ring, Star-Bus).
- Pros:
 - Flexible and scalable.
 - Balances reliability and cost.
- Cons:
 - More complex to design and manage.

Example: Enterprise networks with multiple branches.

VI. Tree (Hierarchical) Topology

- Structure: Star networks connected in a hierarchy (like branches of a tree).
- Pros:
 - Scalable for large networks.
 - Easy to isolate issues.
- Cons:
 - Dependent on the root node (if it fails, the network fails).

Example: Large corporate networks with multiple departments.

4. Explain TCP/IP Networking Model

ANS: The **TCP/IP model** (also called the **Internet Protocol Suite**) is a foundational framework that defines how data is transmitted across networks, including the internet.

It consists of **four layers**, each with specific functions and protocols. That are described following:

i. Layer 4: Application Layer

Provides user interfaces and network services (HTTP, email, file transfer).

Key Protocols:

- **HTTP/HTTPS** (Web browsing)
- **FTP** (File transfer)
- **SMTP** (Email sending)
- **DNS** (Domain name → IP translation)
- **SSH** (Secure remote access)

ii. Layer 3: Transport Layer

Ensures end-to-end communication between two devices.

Key Protocols:

TCP (Transmission Control Protocol)

Reliable, connection-oriented (ensures delivery).

Used for web browsing (HTTP), email (SMTP).

UDP (User Datagram Protocol)

Fast, connectionless (no delivery guarantee).

Used for video streaming (YouTube)

5. Explain LAN and WAN Network

ANS:Local Area Network (LAN) is a network that connects computers and devices within a limited geographical area such as:

- A single home
- An office building
- A school campus
- A hospital complex

Key Characteristics of LANs

- **Limited Geographic Scope**
 - Typically covers an area from a single room to a few kilometers
 - All connected devices are usually within the same physical location
- **High-Speed Connectivity**
 - Offers blazing-fast data transfer rates (typically 100 Mbps to 10 Gbps)
 - Modern LANs using fiber optics can reach speeds up to 100 Gbps
- **Ownership and Control**
 - Entirely owned and managed by a single organization or individual
 - No reliance on third-party service providers for internal connectivity
- **Common Technologies**
 - Wired: Ethernet (Cat5e, Cat6, Cat6a cables)
 - Wireless: Wi-Fi (802.11ac, 802.11ax standards)
 - Networking devices: Switches, routers, access points

Wide Area Network (WAN) connects multiple LANs across large distances, enabling communication between:

- Different office locations of a company
- Branch offices in different cities or countries
- Remote workers and central offices
- Cloud services and on-premises infrastructure

Key Characteristics of WANs

- **Extended Geographic Reach**
 - Can span cities, countries, or even continents
 - Connects locations hundreds or thousands of miles apart
- **Diverse Connection Types**
 - Uses various technologies including leased lines, MPLS, VPNs, and cellular networks
 - Often incorporates multiple connection types for redundancy
- **Service Provider Dependence**
 - Relies on telecommunications companies and ISPs
 - Involves ongoing subscription costs
- **Variable Performance**
 - Speeds typically range from 1 Mbps to 1 Gbps
 - Latency increases with distance due to physical limitations

6. Explain Operation of Switch

ANS: A switch operates at **Layer 2 (Data Link Layer)** of the OSI model, using MAC addresses to forward frames intelligently within a LAN.

Operation of Switch:

i. MAC Learning

- Records the **MAC address** of each connected device and the **port** it's on.

- Stores this in a **MAC address table** (CAM table).
- ii. **Intelligent Forwarding**
 - When a data **frame** arrives, the switch checks the **destination MAC**.
 - If the MAC is **known**, it sends the frame **only to the correct port**.
 - If **unknown**, it **floods** the frame to all ports (except the sender's).
- iii. **No Broadcasting Unnecessary Traffic**
 - Unlike **hubs**, switches avoid unnecessary traffic, reducing congestion.
- iv. **Handles Broadcasts & Multicasts**
 - **Broadcasts** (e.g., ARP requests) go to all devices in the LAN.
 - **Multicasts** (e.g., video streams) go only to interested devices.

7. Describe the purpose and functions of various network devices

ANS:

- i. **Router**: Connects different networks (e.g., LAN to WAN/internet).
 - **Functions:**
 - Routes traffic using IP addresses.
 - Provides NAT (Network Address Translation).
 - Often includes firewall capabilities.
- ii. **Switch**: Connects devices within a LAN.
 - **Functions:**
 - Forwards data using MAC addresses.
 - Reduces collisions (vs. hubs).
 - Supports VLANs, QoS, and PoE (in managed switches).
- iii. **Hub**: Basic connectivity (no longer widely used).
 - **Functions:**
 - Broadcasts data to all ports.
 - No intelligence – causes network congestion.
- iv. **Firewall**: Protects networks from unauthorized access.
 - **Functions:**
 - Filters traffic based on security rules.
 - Blocks malware, intrusions, and DDoS attacks.
 - Can be hardware or software-based.
- v. **Wireless Access Point**: Provides Wi-Fi connectivity.
 - **Functions:**
 - Converts wired signals to wireless.
 - Supports standards like Wi-Fi 6/6E.
 - Often managed via a controller (in enterprise setups).
- vi. **Modem**: Connects to ISP (e.g., cable, DSL, fiber).
 - **Functions:**
 - Modulates/demodulates analog signals to digital.
 - Typically paired with a router.

8. Make list of the appropriate media, cables, ports, and connectors to connect switches to othe

ANS:

Connection Type	Recommended Cable	Connector	Speed/Distance
Switch-to-PC/Server	Cat6/Cat6a	RJ45	1Gbps/10Gbps @ 100m
Switch-to-Switch	SFP+ DAC (for short)	SFP+	10Gbps @ 7m
Switch-to-Switch (Long)	LC-LC SMF fiber	LC Duplex	100Gbps @ 40km
Switch-to-Router	Cat6a or fiber	RJ45/SFP+	Depends on port
Management	Console cable/USB-C	RJ45-to-DB9	Serial speeds

9. Define Network devices and hosts

ANS:

- i. **Network Devices:** Hardware components that enable communication between hosts by forwarding, routing, or managing data traffic.
 - **Routers:** Connect networks (LAN to WAN) using IP addresses.
 - **Switches:** Connect devices within a LAN using MAC addresses.
 - **Firewalls:** Filter traffic to protect networks from threats.
 - **Access Points (WAPs):** Provide wireless connectivity.
 - **Modems:** Convert signals for ISP connections (e.g., cable, DSL).
- ii. **Hosts:** End devices that generate or consume data on a network.
 - **Computers (PCs, laptops):** Send/receive emails, browse the web.
 - **Servers:** Host applications, websites, or files (e.g., web servers).
 - **Smartphones/Tablets:** Access network resources via Wi-Fi/cellular.
 - **IP Cameras/Printers:** Provide services or data to other hosts.