**CCNA - Network fundamentals**

**Module -1**

**• Explain is the OSI reference model?**

**Ans.** The OSI (Open Systems Interconnection) reference model is like a communication blueprint for computers and networks. Picture it as a building with seven floors, each representing a specific task in the communication process. The bottom floor deals with physical connections, like cables; the next floor manages data link functions, ensuring reliable connections; the middle floors handle network, transport, and session tasks; and the top two floors focus on presentation (data translation) and application (user interface). Overall, it helps different devices "speak the same language" to enable smooth communication.

**• What is a Network?**

**Ans.** A network is like a social web for device, allowing them to connect and communicate. It’s akin to people forming relationship to share information, enabling computers or devices to share data and resources with each other.

OR

* A network consists of two or more computers that are linked in order to share resources (such as printer and CDs), exchange files, or allow electronic communications.

**• What are Routers?**

**Ans.** A router is a device that connects two or more packets-switched networks or subnetworks. It serves two primary function: managing traffic between these network by forwarding data packets to their intended IP addresses, and allowing multiple devices to use the same internet connection.

**• Explain Encapsulation.**

**Ans.** Encapsulation is like packaging information in a box. It involves bunding data and the action that manipulate it together, creating a protective layer to control access and hide internal details. This helps organize and safeguard information, similar to how people might encapsulate a gift in wrapping to present it neatly and securely.

**• Peer-to-Peer Communication.**

**Ans.** Peer-to-peer communication among people involves direct interaction between individuals without intermediaries or central authorities. It's akin to friends having a conversation where each person can act as both a speaker and a listener, sharing information and ideas directly. This model is common in everyday conversations, discussions, or collaborations, where individuals communicate with each other on an equal footing without relying on a centralized structure.

OR

* One of the most influential communication models, peer-to-peer communication, refers to a decentralized approach of networking where two end devices(peer) interact directly with each other.

**• What is TCP and UDP?**

**Ans.** Transmission control protocol (TCP) and User datagram protocol (UDP) are foundation pillars of the internet, enabling different types of data transmission from a network source to the destination. TCP is more reliable, While UDP prioritizes speed and efficiency.

OR

* TCP is like a careful conversation, ensuring every message is received and in the right order. UDP is like a shouting across the room; it’s faster, but there’s no guarantee if the message gets through or in what order.

**• What is Internetwork Operating System software?**

**Ans.** Cisco IOS (Internetwork Operating System) is a collection of proprietary operating systems (OSes) that run on Cisco Systems hardware, including routers, switches and other network devices.

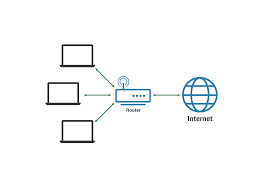
Developed in the 1980s by William Yeager, an engineer at Stanford University, the core function of Cisco IOS is to enable data communication between network nodes. Cisco IOS enables the administration, operation and management of Cisco network devices.

Cisco IOS includes the following key features:

* Interface configuration.
* Network management and monitoring.
* Quality of service (QoS).
* Routing.
* Security.
* Switching.

**• Explain LAN and draw any example.**

**Ans.**  A Local Area Network (LAN) is a collection of devices connected together in one physical location, such as a building, office, or home. A LAN can be small or large, ranging from a home network with one user to an enterprise network with thousands of users and devices in an office or school.



**Examples of Local Area Network (LAN)**

* Networking in home, office.
* Networking between two computers.
* Wi-Fi (When we consider wireless LAN)

**• Explain Network Device - Router Switch and Hub.**

**Ans. Router**: Connects different networks, makes decisions based on IP addresses, and provides internet connectivity.

**Function:** Routers operate at the network layer (Layer 3) of the OSI model and are responsible for directing data packets between different networks. They make decisions based on IP addresses to determine the most efficient path for data to reach its destination.

**Key Features:**

**Routing:** Routers analyse destination IP addresses and determine the next hop for data packets.

**Network Segmentation**: Routers can divide a network into subnets, helping manage and optimize traffic flow.

**Internet Connectivity:** Routers connect local networks to the internet.

**Switch:** Connects devices within a local network, forwards data based on MAC addresses, and enhances network efficiency.

**Function:** Switches operate at the data link layer (Layer 2) of the OSI model and are responsible for forwarding data frames within a local network. They use MAC addresses to make forwarding decisions.

**Key Features:**

**MAC Address Learning**: Switches learn the MAC addresses of connected devices to forward data only to the intended recipient.

**Broadcast Domain**: Each port on a switch creates a separate broadcast domain, reducing unnecessary traffic.

**High Performance:** Switches offer high-speed data transfer within a local network.

**Hub:** Basic device that connects devices in a local network, broadcasts data to all connected devices, and lacks intelligence compared to switches.

**Function**: Hubs operate at the physical layer (Layer 1) of the OSI model and are basic networking devices that connect multiple devices in a LAN. Unlike switches, hubs lack the intelligence to selectively forward data and instead broadcast incoming data to all connected devices.

**Key Features:**

**Broadcasting:** Hubs broadcast data to all connected devices, causing more network congestion and reduced efficiency**.**

**Simple Connectivity:** Hubs are simple and inexpensive devices used for basic network connectivity.

**Collision Domain:** All devices connected to a hub share the same collision domain, leading to potential collisions and performance issues.

**• Describe Router and switch connection in LAN.**

**Ans.** Local Area Network (LAN), routers and switches work together to facilitate communication among devices and enable data transfer.

**Router-Switch Connection:**

1. **Router Connection:**

* Routers are often positioned at the edge of a LAN, connecting it to external networks such as the internet.
* The router serves as the gateway for the LAN, directing traffic between the local network and external networks.
* LAN devices connect to the router either directly or through a switch.

2**. Switch Connection:**

- Switches are used within the LAN to connect multiple devices, such as computers, printers, and other networked devices.

- Devices within the LAN connect to the switch ports, creating a local network segment.

-The switch manages local traffic, forwarding data only to the specific device intended as the recipient.

**• Types of Cable - explain types of Ethernets and speed.**

**Ans.** Ethernet is a widely used networking technology that utilizes different types of cables for data transmission. The most common types of Ethernet cables and their associated speeds are:

1. **Ethernet Cable Types:**

**Twisted Pair Cables (UTP - Unshielded Twisted Pair):**

* **Cat5e (Category 5e):** Supports speeds up to 1,000 Mbps (1 Gbps) and is suitable for most home and small business networks.
* **Cat6 (Category 6):** Supports speeds up to 10,000 Mbps (10 Gbps) for short distances and is commonly used in larger and more demanding networks.
* **Cat6a (Category 6a):** Supports speeds up to 10 Gbps over longer distances compared to Cat6, often used in enterprise networks.

**Fiber Optic Cables:**

* **Single-mode Fiber:** Supports very high data transfer rates over long distances and is commonly used in large-scale networks, data centres , and telecommunications.
* **Multi-mode Fiber:** Suitable for shorter distances at high data transfer rates, commonly used in enterprise networks.

1. **Ethernet Speeds:**

* **10/100 Mbps (Fast Ethernet):** Found in older networks and some basic setups. It supports data transfer rates of 10 or 100 megabits per second.
* **1,000 Mbps (1 Gbps - Gigabit Ethernet):** Standard for most modern networks, providing data transfer rates of 1 gigabit per second.
* **10 Gbps (10 Gigabit Ethernet):** Used in high-performance networks where increased speed is necessary, especially in data centers and enterprise environments.
* **40 Gbps and 100 Gbps (40/100 Gigabit Ethernet):** Deployed in high-demand environments like data centers and for backbone connections.
* **Beyond 100 Gbps:** Evolving standards, such as 400 Gigabit Ethernet and Terabit Ethernet, are being developed for future network requirements**.**

**• Explain TCP/IP -List of Protocol and port Number.**

**Ans.** TCP/IP (Transmission Control Protocol/Internet Protocol) is a suite of protocols that provides the foundation for communication on the internet and many private networks. It consists of multiple protocols, each serving a specific purpose. Here are some key TCP/IP protocols along with commonly associated port numbers:

**Transmission Control Protocol (TCP):**

Port 20 and 21: FTP (File Transfer Protocol)

Port 22: SSH (Secure Shell)

Port 23: Telnet (used for remote login)

Port 25: SMTP (Simple Mail Transfer Protocol)

Port 80: HTTP (Hypertext Transfer Protocol)

Port 443: HTTPS (HTTP Secure)

Port 110: POP3 (Post Office Protocol version 3)

Port 143: IMAP (Internet Message Access Protocol)

Port 3389: RDP (Remote Desktop Protocol)

**User Datagram Protocol (UDP):**

Port 53: DNS (Domain Name System)

Port 67 and 68: DHCP (Dynamic Host Configuration Protocol)

Port 69: TFTP (Trivial File Transfer Protocol)

Port 123: NTP (Network Time Protocol)

**Internet Protocol (IP):**

**IPv4 (Internet Protocol version 4):** The most widely used version of IP, using 32-bit addresses.

**IPv6 (Internet Protocol version 6):** The newer version of IP, designed to overcome the limitations of IPv4, using 128-bit addresses.

**Internet Control Message Protocol (ICMP):**

Used for diagnostic and error messages.

**Address Resolution Protocol (ARP):**

Resolves IP addresses to MAC addresses on a local network.

**Dynamic Host Configuration Protocol (DHCP):**

Automates the assignment of IP addresses and other network configuration parameters to devices on a network.

Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) use ports to differentiate between multiple services running on the same device. Ports are categorized into well-known, registered, and dynamic/private ranges. Well-known ports are standardized and typically associated with specific services.

**• Explain Node (back born) and Physical layer.**

**Ans.**

**Node (Backbone):**

* Definition: In networking, a node refers to a device that is part of a network. In the context of a backbone network, a node typically represents a high-capacity networking device like a router or switch.
* Function: Nodes in a backbone network facilitate the transfer of data between different segments of the network, helping to create a seamless and interconnected infrastructure.

**Example:** In an internet backbone, nodes could be major routers connecting various regions.

**Physical Layer:**

* Definition: The lowest layer of the OSI model, the physical layer deals with the actual transmission and reception of raw data bits over a physical medium (cables, fibers, etc.).
* Function: It specifies the hardware characteristics of the network, such as cables, connectors, and signalling methods, ensuring reliable and efficient physical transmission of data.

**Example:** Ethernet cables, Fiber optics, and the electrical or optical signals used to transmit data fall under the physical layer.