A **hub** is a hardware device used at the physical layer to connect multiple devices in the **network**. It is an unintelligent device that simply broadcasts the message.

switch is a device that connects multiple devices in a network, allowing them to communicate by exchanging data packets directly. A switch sends message directly to the intended device. They operate over data link layer.

Router works over network layer and is used to connect two different networks.

A network is composed of different devices like computer, laptops connected together. While connecting these devices you have choice over how many devices should be connected with one device.

Network topology refers to the arrangement of different elements like nodes, links, or devices in a computer **network**. It determines how data flow between different devices. We have different types of topologies.

- **Ring:**

  - Devices are connected in a circular pathway.

  - **Advantages:** Easy to troubleshoot; equal access to devices.

  - **Disadvantages:** Failure of a single node can break the network.

- **Star:**

  - All devices connect to a central device (hub/switch/router).

  - **Advantages:** Easy to add/remove devices; failure of one device doesn't affect others.

  - **Disadvantages:** Failure of the central device leads to network failure.

- **Mesh:**

  - Devices are interconnected directly.

  - **Advantages:** High redundancy; reliable.

  - **Disadvantages:** Expensive due to multiple connections

- **Bus:**

  - Devices are connected along a single central cable.

  - **Advantages:** Cost-effective; simple to install.

  - **Disadvantages:** A fault in the cable can disrupt the entire network.

- **Hybrid:**

  - Combination of two or more topologies.

  - **Advantages:** Flexible and scalable.

  - **Disadvantages:** Complex to design and maintain.

some cli commands in cisco packet tracer.

Cli commands

- **ipconfig:** Displays the IP address, subnet mask, and default gateway.

- **ping:** Tests connectivity to another device.

- **tracert:** Traces the path to a destination IP address.

- **arp:** Displays and modifies the Address Resolution Protocol cache.

- **netstat:** Shows active network connections.

- **nslookup:** Queries the DNS to resolve domain names to IP addresses.

Routing is the process of path selection in any network.

In static routing, a network administrator uses static tables to manually configure and select network routes.

In dynamic routing, routers create and update routing tables at runtime based on actual network conditions. They attempt to find the fastest path from the source to the destination by using a dynamic routing protocol, which is a set of rules that create, maintain, and update the dynamic routing table.

The biggest advantage of dynamic routing is that it adapts to changing network conditions, including traffic volume, bandwidth, and network failure.

Taking in terms of cisco packet tracer you can get questions on writing the commands to do static or dynamic routing.For the list of commands you can refer the previous videos.

Apart from that the specific command for

static routing is: *ip route <network id> <subnet mask><next hop>*

dynamic routing: *router rip*

network <network id>

An IP address is a unique address that is used to identify computers or nodes on the internet. We have two different types of ip addresses, ipv4 and ipv6.

An ipv4 address is a 32bit address. It is written as four numbers separated by periods, like : 192.168.1.1. Each number can range from 0 to 255. Supports ~4.3 billion addresses.

On the contrary ipv6 address is a 128 bit address and it uses hexadecimal format.

Addressing methods in networking define how IP addresses are allocated and used. We have classfulland classless addressing techniques. In classful addressing as the name suggests a network is divided into different classes.

1. **Class A:**

- Range: 0.0.0.0 to 127.255.255.255

- Default Subnet Mask: 255.0.0.0 (/8)

- Suitable for networks with a **large number of hosts**.

- Supports ~16 million hosts per network.

2. **Class B:**

- Range: 128.0.0.0 to 191.255.255.255

- Default Subnet Mask: 255.255.0.0 (/16)

- Suitable for **medium-sized networks**.

- Supports ~65,000 hosts per network.

3. **Class C:**

- Range: 192.0.0.0 to 223.255.255.255

- Default Subnet Mask: 255.255.255.0 (/24)

- Suitable for **small networks**.

- Supports 256 hosts per network.

4. **Class D:**

- Range: 224.0.0.0 to 239.255.255.255

- Reserved for **multicasting**.

5. **Class E:**

- Range: 240.0.0.0 to 255.255.255.255

- Reserved for **experimental use**.

Advantages of Classful Addressing:

- Simple to understand and implement.

- Predefined classes make address assignment straightforward.

Disadvantages of Classful Addressing:

- **Inefficient Address Usage:** Many IP addresses go unused in large networks due to fixed block sizes.

- Lack of scalability for rapidly growing networks.

- Not suitable for modern, dynamic environments.

Classless Addressing was introduced with **CIDR (Classless Inter-Domain Routing)** to address the inefficiencies of classful addressing. It allows more flexible and efficient IP address allocation. P addresses are represented with a prefix length. Eg. 192.168.1.0/24

/24 indicates the first 24 bits are the network part, and the remaining 8 bits are for hosts.

Advantages of Classless Addressing:

- Efficient Address Utilization: Subnets of different sizes can be created based on actual requirements (e.g., small subnets for branch offices and larger ones for data centers).

- Scalability: Networks can grow or shrink without wasting addresses.

- Supports Supernetting: Combines multiple smaller networks into a larger one for route aggregation, reducing routing table size.

   Disadvantages of Classless Addressing:

- More complex to configure and understand compared to classful addressing.

- Requires support for CIDR by all routing devices.

Now there are two concepts of subnetting and super netting. super netting is to combine two small networks into another network and Subnetting is to divide a network into smaller networks.

in classful addressing you can use one of the two techniques for division, flsm and vlsm. In Flsm all subnetworks have equal size while in vlsm they can have variable size.

 a **server** is a key component in networking. It is a powerful computer or system that provides resources, services, or data to other devices (clients) in the network. Servers handle requests and ensure proper communication in a network setup. We have different types of server like,

1. **Web Server**: Hosts websites and serves web pages to users.

2. **File Server**: Manages and stores files for network users.

3. **DNS Server**: Resolves domain names to IP addresses.

4. **Mail Server**: Handles email sending and receiving.

A **DHCP Server** (Dynamic Host Configuration Protocol Server) is a network service that automatically assigns IP addresses and other network configuration settings (such as subnet mask, default gateway, and DNS servers) to devices in a network. This eliminates the need for manual IP configuration and ensures efficient and conflict-free IP management.

In cse307 these were the important topics for your viva.