LAB 3: SIMULATION OF NETWORK DEVICES USING CISCO PACKET TRACER

Objective:

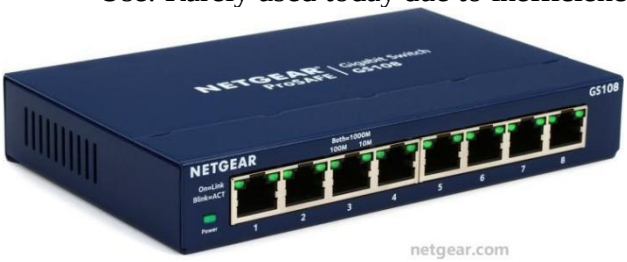
- To visualize the data transmission network in different network devices like switch, hub, bridge, repeater and router
- To understand working mechanics behind the network devices

Theory:

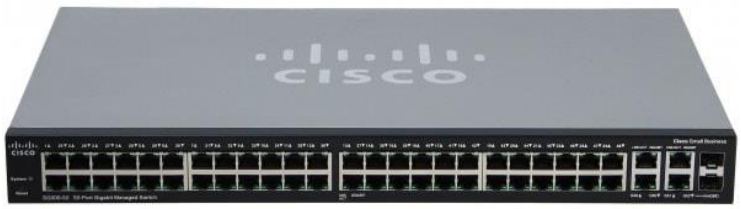
Cisco: Cisco Systems is a leading company in networking hardware and software. It manufactures devices like routers, switches, firewalls, and provides network certifications (e.g., CCNA, CCNP). Cisco is widely used in industries and educational simulations like Cisco Packet Tracer.

Hub: A hub is a basic networking device that connects multiple computers in a LAN and broadcasts data to all connected devices, regardless of the destination. It works at Layer 1 (Physical Layer) of the OSI model and has no intelligence in data handling.

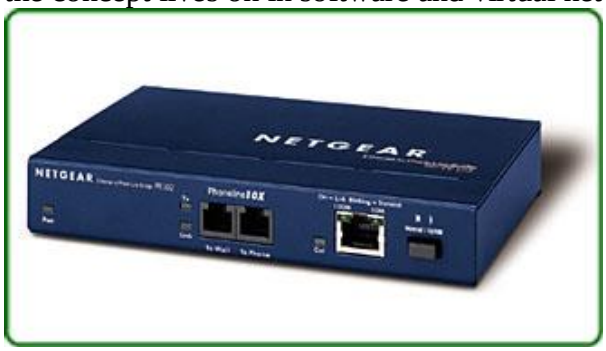
- Disadvantage: Causes network congestion and is less secure.
- Use: Rarely used today due to inefficiency.



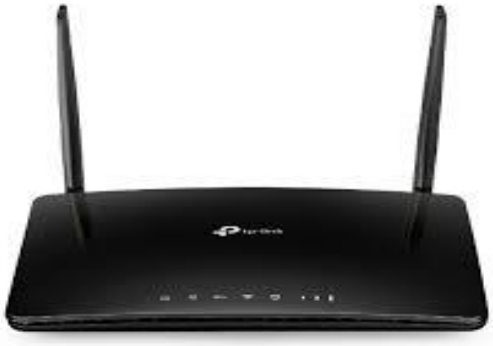
Switch: A network switch is a device that connects multiple devices within a local area network (LAN) and uses MAC addresses to forward data to the correct destination. Unlike hubs, which broadcast data to all ports, switches send data only to the specific device it's intended for, reducing traffic and collisions. Operating mainly at the data link layer (Layer 2), switches build a MAC address table by learning from incoming data. They support full-duplex communication and can be unmanaged (simple, plug-and-play) or managed (with features like VLANs and traffic control). Switches are key components in efficient, high-performance networks.



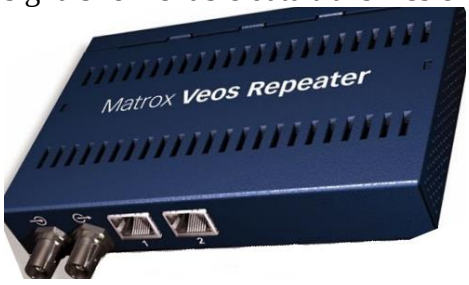
Bridge: A network bridge is a Layer 2 device that connects two or more network segments, acting as a single, unified network by intelligently forwarding data based on MAC addresses, reducing congestion and collisions by filtering unnecessary traffic, essentially segmenting a larger network into smaller, more efficient parts. While powerful for its time, modern switches have largely replaced physical bridges, though the concept lives on in software and virtual networking.



Router: A router is a networking device that connects multiple networks (like your home Wi-Fi to the internet) and directs data traffic between them, acting as a central hub to send information (packets) to the right destination, enabling multiple devices to share a single internet connection and form a local network (LAN). Typically, a modem brings the internet connection to your home, and the router shares it via Wi-Fi or Ethernet cables to your computers, phones, and other devices, often combining functions for ease of use.



Repeater: A repeater in a computer network is a simple Layer 1 (Physical Layer) device that receives weakened signals, regenerates them by boosting strength and cleaning noise, and retransmits them to extend the network's physical reach, acting as a signal booster to overcome attenuation over long distances without making intelligent forwarding decisions like a router. Repeaters are essential for long-distance wired (Ethernet) and wireless (Wi-Fi) communication, helping maintain strong, clear signals for reliable data transmission.



Observation:

1. Hub Implementation

Device Name	Interface	IP Address	Subnet Mask
PC0	FastEthernet0	192.168.1.1	255.255.255.0
PC1	FastEthernet0	192.168.1.2	255.255.255.0
PC2	FastEthernet0	192.168.1.3	255.255.255.0
PC3	FastEthernet0	192.168.1.4	255.255.255.0
PC4	FastEthernet0	192.168.1.5	255.255.255.0
PC5	FastEthernet0	192.168.1.6	255.255.255.0

In this simulation, a Star topology was created using a Hub. PC0 is connected to the Hub-PT, likewise PC1, PC2, PC3, PC4, and PC5 are connected to the remaining ports of the Hub using Copper Straight-Through cables. When a PDU was sent from PC5 to PC0, the Hub received the packet and broadcasted it to all connected devices (PC4, PC3, PC2, PC1, and PC0). The intended recipient accepted it, while others rejected it.

2. Switch Implementation

Device Name	Interface	IP Address	Subnet Mask
PC6	FastEthernet0	192.168.1.10	255.255.255.0
PC7	FastEthernet0	192.168.1.11	255.255.255.0
PC8	FastEthernet0	192.168.1.12	255.255.255.0
Laptop0	FastEthernet0	192.168.1.13	255.255.255.0
Laptop1	FastEthernet0	192.168.1.14	255.255.255.0
Laptop2	FastEthernet0	192.168.1.15	255.255.255.0

A Switch was used to connect multiple devices. PC6, PC7, and PC8 are connected to the Switch 2960-24TT, likewise Laptop0, Laptop1, and Laptop2 are connected to the switch ports. Unlike the Hub, once the Switch learned the MAC addresses, the message flow was observed to be unicast. The packet was sent directly from the source to the destination without disturbing other ports.

3. Bridge Implementation

Device Name	IP Address	Subnet Mask
Switch0	192.168.1.2	255.255.255.0
Switch1	10.10.10.2	255.255.255.0
Bridge0	192.168.1.1	255.255.255.0

Two network segments were connected using a Bridge. The left segment switch is connected to Bridge-PT Port 0, likewise the right segment switch is connected to

Bridge-PT Port 1. The simulation demonstrated how the Bridge filters traffic. It only allows traffic to cross to the other segment if the destination address belongs to a device on that side.

4. Repeater Implementation

Device Name	Connection Type	Status
Repeater0	Port 0 to Left Segment	Active
Repeater0	Port 1 to Right Segment	Active

A Repeater was placed between two long-distance segments. The left network wire is connected to the Repeater Port 0, likewise the right network wire is connected to Repeater Port 1. The signal propagation was observed, ensuring that the packet could travel the extended distance without signal degradation.

5. Router Implementation

Device Name	Interface	IP Address	Subnet Mask	Gateway
Router0	Gig0/0 (LAN 1)	192.168.1.1	255.255.255.0	N/A
Router0	Gig0/1 (LAN 2)	10.10.10.1	255.255.255.0	N/A
PC-LAN1	FastEthernet0	192.168.1.2	255.255.255.0	192.168.1.1
PC-LAN2	FastEthernet0	10.10.10.2	255.255.255.0	10.10.10.1

A Router was configured to connect two different Local Area Networks (LAN 1: 192.168.1.x and LAN 2: 10.10.10.x). The Switch for LAN 1 is connected to Router interface GigabitEthernet0/0, likewise the Switch for LAN 2 is connected to Router interface GigabitEthernet0/1. The Router acted as a Gateway, allowing packets to travel from one network ID to another.

Discussion and Conclusion:

In this lab, we utilized the Cisco Packet Tracer program to run simulation on LANS with multiple networking devices. There were some difficulty in working with the IP address for each of the network devices but we were able to figure it out with help from our lab instructor. After which we were able simulate data flow in different networks and learn the functionality of each of the network devices.

Thus, we can conclude that we are now capable of simulating data flow within the small networks with multiple network devices using Cisco Packet Tracer.