LAB 3: Simulation of Network Devices Using Cisco Packet Tracer

OBJECTIVES:

- To understand the basic concepts of computer networks through simulation.

- To study the working principles of network devices such as hub, switch, bridge, router, and repeater.

- To observe data transmission and packet flow between different network devices.

THEORY:

Cisco Packet Tracer is a simulation tool developed by Cisco that allows users to build, configure, and analyze computer networks in a virtual environment. It removes the need for physical networking equipment by offering simulated routers, switches, and end devices. The software helps learners visualize data flow, understand device behavior, and practice network configuration and troubleshooting, making it widely used for learning computer networking fundamentals.

Network devices are hardware components that manage, connect, and facilitate data communication between computers, servers, and peripheral devices on a network. They act as the infrastructure—or "plumbing"—of IT ecosystems, ensuring efficient data packet transmission via wired or wireless connections. Common examples include routers, switches, modems, access points, and hubs.

Hub

A hub is a simple networking component that connects several computers within the same network. It operates by receiving data from one system and forwarding it to all other connected systems without identifying the target device. This method leads to excessive traffic and frequent data collisions. As a result, hubs are inefficient and are rarely used in modern network setups.

Figure 1: Hub

Switch

A switch is a more advanced networking device that links multiple devices within a network. It identifies the destination of data using MAC addresses and forwards information only to the appropriate device. This selective transmission minimizes congestion and collisions. Because of these advantages, switches are commonly implemented in local area networks.

Figure 2: Switch

Bridge

A bridge is used to split a large network into smaller segments to enhance performance. It examines destination addresses before forwarding data, allowing only necessary traffic to pass between segments. This process reduces unnecessary data flow and improves overall network efficiency.

Figure 3: Bridge

Router

A router is a crucial networking device that interconnects different networks. It forwards data packets based on IP addresses and determines the most suitable path for transmission. Routers enable communication between separate networks and play a key role in providing internet connectivity.

Figure 4: Router

Repeater

A repeater is a device designed to increase the range of a network. It works by receiving weak signals, amplifying them, and retransmitting them to the next network segment. Repeaters do not inspect or control data; their only function is to restore signal strength.


Figure 5: Repeater

OBSERVATION:

1. Hub

Device Used: Hub-PT (Hub0)

PC Name	IP Address
PC-PT PC0	192.168.1.1
PC-PT PC1	192.168.1.2
PC-PT PC2	192.168.1.3
PC-PT PC3	192.168.1.4
PC-PT PC4	192.168.1.5
PC-PT PC5	192.168.1.6

During the simulation, the hub connected all systems within a single network. It was noticed that whenever one computer transmitted data, the information was sent to every connected device. This caused increased traffic and collisions, clearly demonstrating the limitations of hubs in network communication.
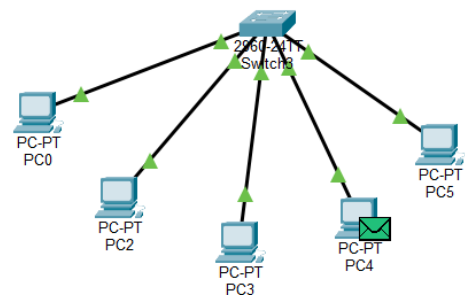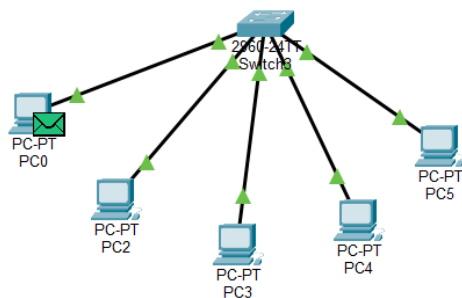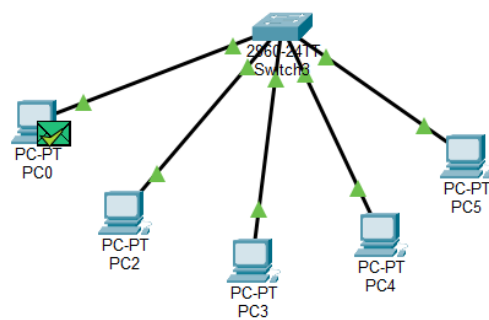
Event List
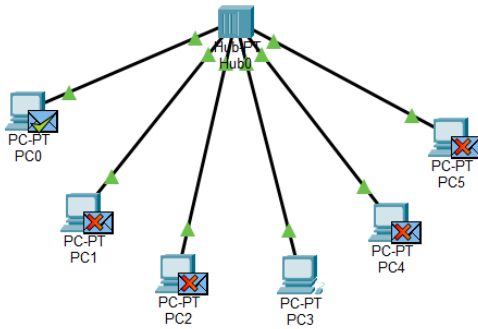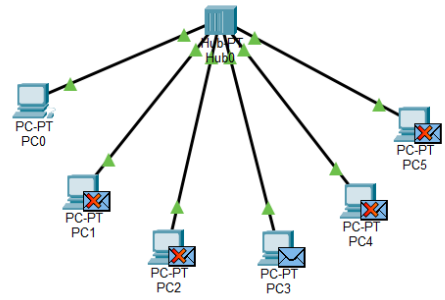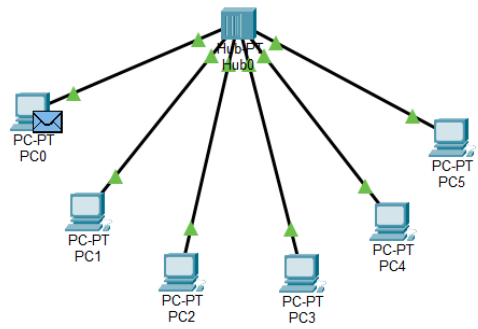
Vis.	Time(sec)	Last Device	At Device
	0.000	--	PC0
	0.001	PC0	Hub0
	0.002	Hub0	PC1
	0.002	Hub0	PC2
	0.002	Hub0	PC3
	0.002	Hub0	PC4
	0.002	Hub0	PC5
	0.003	PC3	Hub0
	0.004	Hub0	PC0
	0.004	Hub0	PC1
	0.004	Hub0	PC2
	0.004	Hub0	PC4
	0.004	Hub0	PC5

2. Switch

Device Used: 2960-24TT (Switch3)

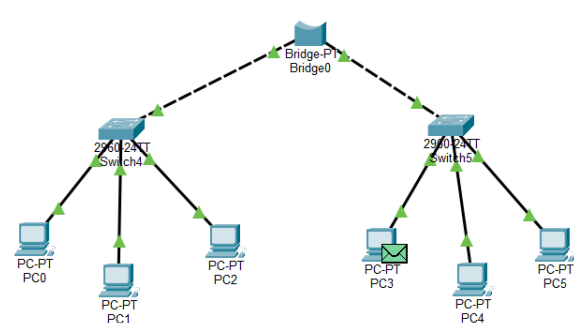| PC Name	IP Address
PC-PT PC0	192.168.1.1
PC-PT PC1	192.168.1.2
PC-PT PC2	192.168.1.3
PC-PT PC3	192.168.1.4
PC-PT PC4	192.168.1.5
PC-PT PC5	192.168.1.6

The switch provided more efficient communication than the hub. Data packets were delivered only to the intended destination, which reduced unnecessary traffic. This behavior highlighted the advantage of switches in achieving faster and more reliable network communication.

3. Bridge

Devices Used:

- Bridge-PT (Bridge0)
- 2960-24TT (Switch4 and Switch5)

PC Name	IP Address
PC-PT PC0	192.168.1.1
PC-PT PC1	192.168.1.2
PC-PT PC2	192.168.1.3
PC-PT PC3	192.168.1.4
PC-PT PC4	192.168.1.5
PC-PT PC5	192.168.1.6

The bridge successfully separated the network into smaller sections. It controlled the flow of data between these sections by filtering traffic. This resulted in reduced congestion and smoother data transmission across the network.

4. Router

Devices Used:

- Router: 1941 (Router2)

- Switches: 2960-24TT (Switch4 and Switch5)

Router Interface IP Addresses:

- GigabitEthernet0/0: 192.168.1.1

- GigabitEthernet0/1: 10.10.10.1

PC Name	IP Address
PC-PT PC0	192.168.1.2
PC-PT PC1	192.168.1.3
PC-PT PC2	192.168.1.4
PC-PT PC3	10.10.10.2
PC-PT PC4	10.10.10.3
PC-PT PC5	10.10.10.4

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC0	ICMP
	0.001	PC0	Switch6	ICMP
	0.002	Switch6	Router2	ICMP
	0.003	Router2	Switch7	ICMP
	0.004	Switch7	PC4	ICMP
	0.005	PC4	Switch7	ICMP
	0.006	Switch7	Router2	ICMP
	0.007	Router2	Switch6	ICMP
	0.008	Switch6	PC0	ICMP
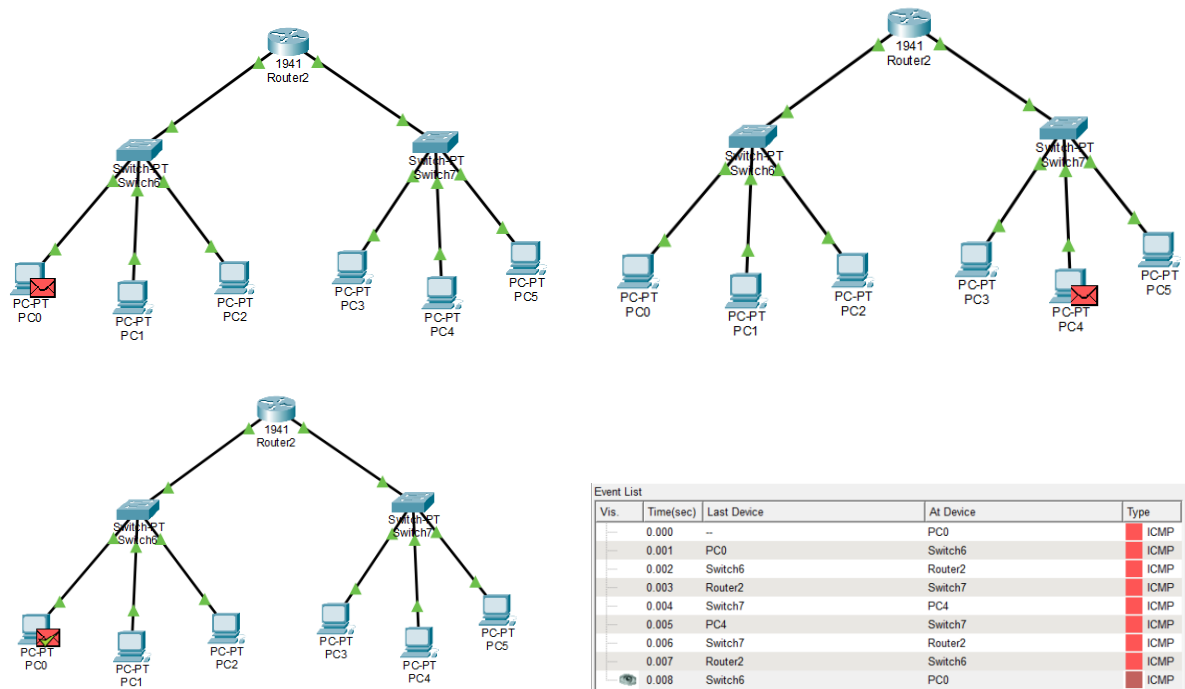
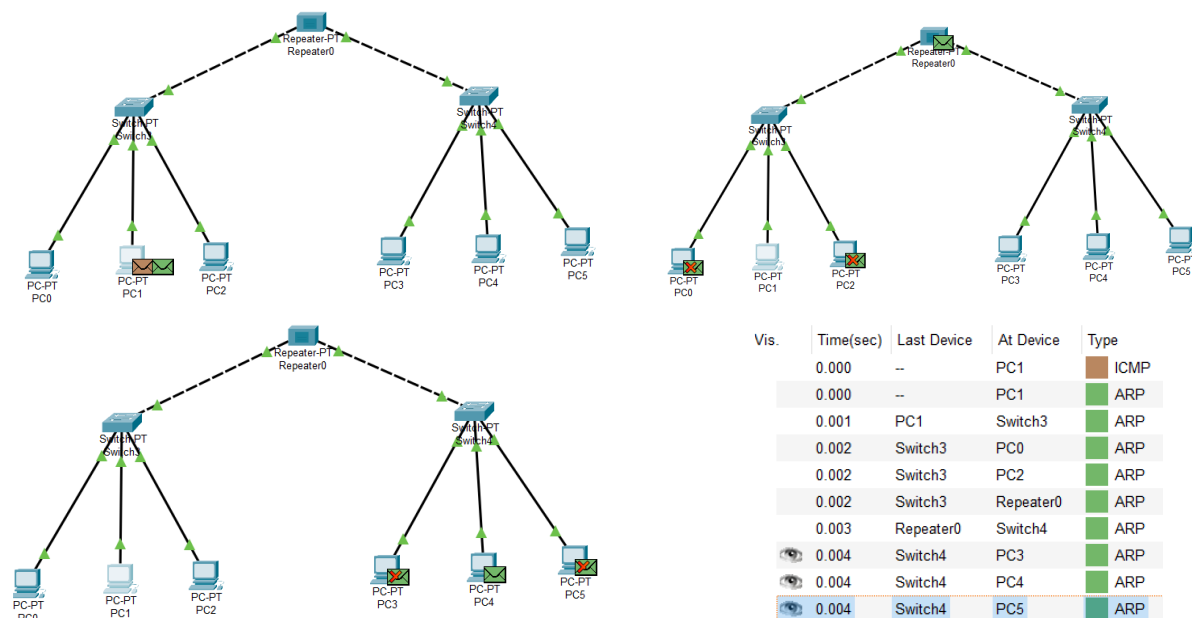The router enabled communication between two distinct networks. It routed data packets using IP-based addressing and selected appropriate transmission paths. This experiment demonstrated how routers are essential for linking multiple networks.

Repeater

Devices Used:

- Repeater-PT (Repeater0)

- Switches: 2960-24TT (Switch3 and Switch4)

PC Name	IP Address
PC-PT PC0	192.168.1.1
PC-PT PC1	192.168.1.2
PC-PT PC2	192.168.1.3
PC-PT PC3	192.168.1.4
PC-PT PC4	192.168.1.5
PC-PT PC5	192.168.1.6

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC1	ICMP
	0.000	--	PC1	ARP
	0.001	PC1	Switch3	ARP
	0.002	Switch3	PC0	ARP
	0.002	Switch3	PC2	ARP
	0.002	Switch3	Repeater0	ARP
	0.003	Repeater0	Switch4	ARP
👁	0.004	Switch4	PC3	ARP
👁	0.004	Switch4	PC4	ARP
👁	0.004	Switch4	PC5	ARP

The repeater was used to increase the effective length of the network. It strengthened weak signals and retransmitted them, allowing data to travel longer distances. This observation confirmed the role of repeaters in maintaining signal quality.

Discussion and Conclusion:

The experiment was carried out successfully using Cisco Packet Tracer to model different networking devices. Through this lab, the operational behavior of hubs, switches, bridges, routers, and repeaters was clearly understood without the need for actual hardware. The exercise also emphasized the importance of selecting suitable network devices based on performance and requirements. Overall, the lab enhanced practical understanding of networking concepts and improved skills related to network design and analysis.