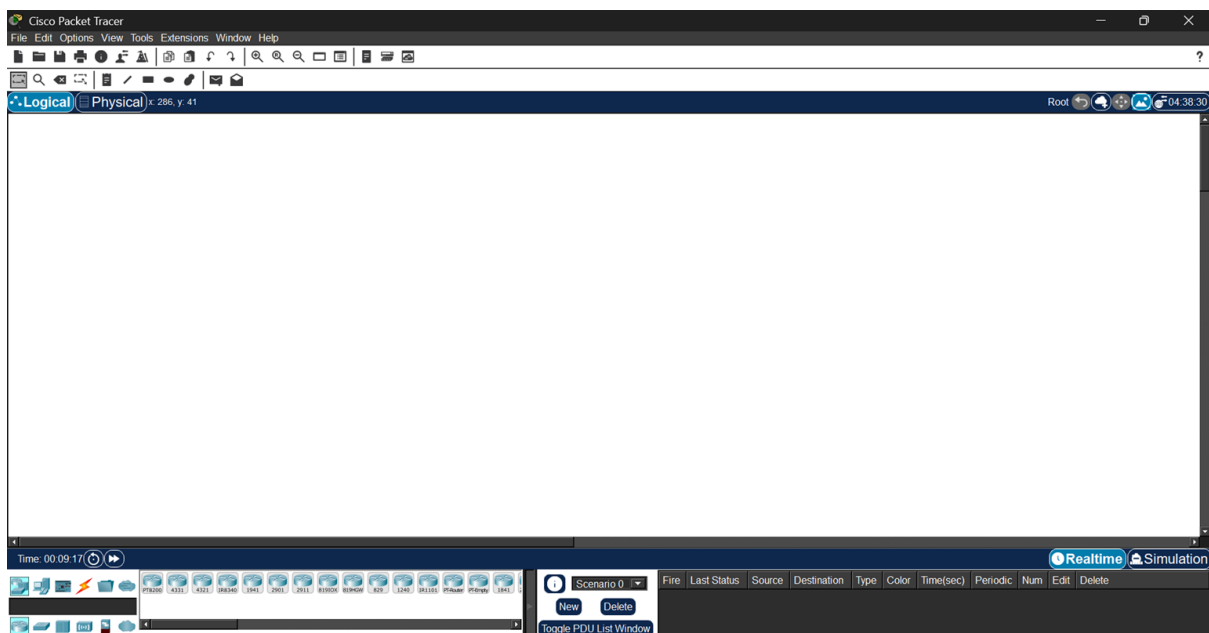# LAB 3: Simulation of network devices using cisco packet tracer

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 **network simulation tool** developed by Cisco that allows users to create, configure, and test virtual networks without using physical devices. It lets you simulate routers, switches, PCs, and other network devices, visualize how data travels through a network, and practice configuring network protocols like TCP/IP. Packet Tracer is widely used for learning networking concepts, troubleshooting, and preparing for Cisco certifications like CCNA.

Hub

A hub is a basic networking device used to connect multiple computers or devices in a local area network (LAN). It works at the physical layer of the OSI model and simply broadcasts incoming data to all connected devices, regardless of the destination. Because it does not filter or manage traffic, hubs are less efficient and more prone to data collisions, so they are mostly replaced by switches in modern networks.

Switch

A switch is a networking device used to connect multiple devices in a local area network (LAN) and operates at the data link layer of the OSI model. It forwards data only to the specific device it is intended for by using MAC addresses, which reduces network traffic and collisions. Switches are faster, more efficient, and more secure than hubs, so they are commonly used in modern networks.
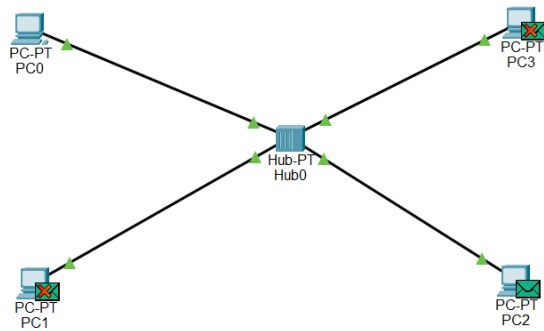

Router

A router is a networking device that connects two or more different networks and operates at the network layer of the OSI model. It uses IP addresses to determine the best path for data packets and forwards them between networks, such as connecting a local network to the internet. Routers help manage traffic, improve network efficiency, and provide security features like firewalls and network address translation (NAT).
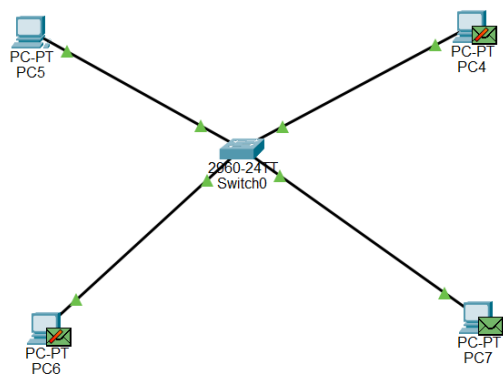
Observations

1. Hub

This diagram shows a hub-based network in Cisco Packet Tracer where four PCs (PC0, PC1, PC2, and PC3) are connected to a single hub. In a hub, data sent by one PC is broadcast to all other PCs, not just the intended destination. The green lines indicate active connections, while the red X on some PCs shows communication failure or packet collision, which happens because hubs do not manage traffic intelligently.

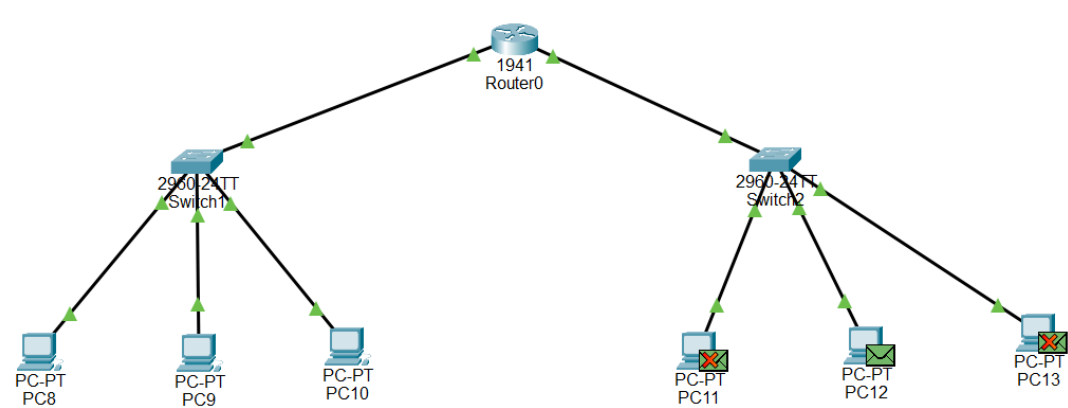| Device Name	IPv4 Address	Subnet Mask
PC0	192.166.1.1	255.255.255.0
PC1	192.166.1.2	255.255.255.0
PC2	192.166.1.3	255.255.255.0
PC3	192.166.1.4	255.255.255.0

2. Switch

This diagram shows a switch-based network in Cisco Packet Tracer where four PCs (PC4, PC5, PC6, and PC7) are connected to a switch. Unlike a hub, the switch sends data only to the intended destination device using MAC addresses, which reduces unnecessary traffic and

avoids collisions. The green envelope icons indicate successful data transmission, showing that communication is efficient and reliable.

Device Name	IPv4 Address	Subnet Mask
PC4	192.166.1.1	255.255.255.0
PC5	192.166.1.2	255.255.255.0
PC6	192.166.1.3	255.255.255.0
PC7	192.166.1.4	255.255.255.0

3. **Router**

This diagram shows a router-based network in Cisco Packet Tracer where a router connects two separate LANs through switches. PCs on the left side (PC8, PC9, PC10) and PCs on the right side (PC11, PC12, PC13) are connected to their respective switches, and the router routes data between these networks using IP addresses. The green envelopes indicate successful communication, while the red X marks show failed packet delivery, usually due to incorrect IP configuration or missing routing.

Device Name	IPv4 Address	Subnet Mask	Default Gateway
Router (Gigabit Ethernet 0/0)	192.168.1.4	255.255.255.0	-
PC8	192.168.1.1	255.255.255.0	192.168.1.4
PC9	192.168.1.2	255.255.255.0	192.168.1.4
PC10	192.168.1.3	255.255.255.0	192.168.1.4

Device Name	IPv4 Address	Subnet Mask	Default Gateway
Router (Gigabit Ethernet 0/1)	10.10.10.4	255.0.0.0	-
PC11	10.10.10.1	255.0.0.0	10.10.10.4
PC12	10.10.10.2	255.0.0.0	10.10.10.4
PC13	10.10.10.3	255.0.0.0	10.10.10.4

Discussion

The given network topology demonstrates the use of a router to connect two different local area networks (LANs) through switches. Each switch connects multiple PCs within its own network, allowing efficient internal communication using MAC addresses. The router plays a key role by routing data packets between the two LANs using IP addresses. Successful communication is shown by green envelope icons, while red X symbols indicate communication failure, which may occur due to incorrect IP addressing, subnet mismatch, or missing default gateway configuration. This setup clearly shows how routers manage inter-network communication, unlike hubs or switches that work within a single network.

Conclusion

In conclusion, the network illustrates the importance of a router in connecting multiple networks and enabling communication between them. While switches efficiently handle data transfer within a LAN, the router ensures proper packet delivery across different networks. Correct configuration of IP addresses and routing is essential for successful communication.