LAB EXPERIMENT-1(2023000608)

Aim:

To design and implement a hybrid network topology that combines star, bus, ring, and mesh structures using interconnected switches and PCs, and to study its behavior by verifying how data packets are transferred seamlessly between different topologies.

Equipment Used:

- Switches:
  Cisco 2960-24TT switches (used for connec ng mul ple PCs and forming the hybrid topology).

- PCs:
  Standard PCs (17 in total) for tes ng data transfer and communica on between nodes.

- Cables:
  Ethernet cables for wired connec ons between switches and PCs.

- Simula on So ware:
  Cisco Packet Tracer (used to design, simulate, and test the network topology).

Network topologies:

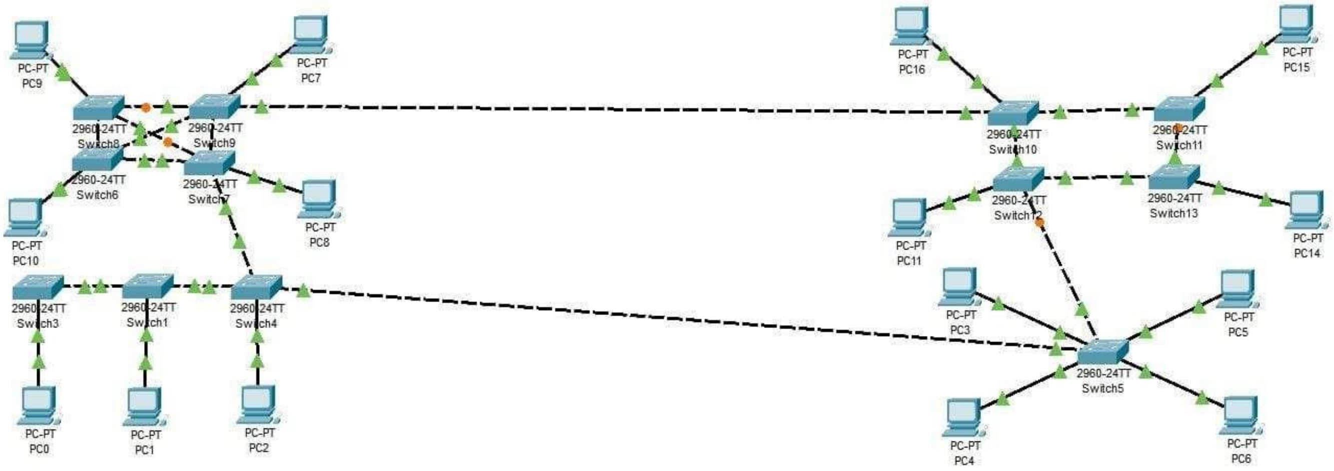
- Star Topology:
  In a star topology, all devices (e.g., computers or printers) are connected to a central device, usually a switch or hub. The central device acts as the mediator for communica on, making it easier to manage the network and troubleshoot. However, if the central device fails, the en re network is disrupted.

- Bus Topology:
  A bus topology uses a single central cable (the bus) to which all devices are connected. Data sent by any device is broadcast to all other devices on the network. It's simple and cost-effec ve, but it can suffer from performance degrada on as more devices are added, and a failure in the bus can take down the en re network.

- Ring Topology:
  In a ring topology, each device is connected to two other devices, forming a circular data path. Data travels in one direc on, passing through each device un l it reaches its des na on. This topology offers predictable performance, but if any device or connec on fails, the en re network can be affected unless addi onal measures like a dual ring are implemented.

- Mesh Topology:
  In a mesh topology, every device is connected to every other device. This creates mul ple pathways for data to travel, ensuring high fault tolerance and redundancy. While it offers excellent reliability and performance, the setup and maintenance can be complex and costly due to the large number of connec ons required.

Connection:



Procedure:

- Open Cisco Packet Tracer:

  Launch Cisco Packet Tracer so ware and create a new project.

- Add Devices to the Workspace:

  Drag and drop the Switches (e.g., 2960-24TT) and PCs (e.g., PC0, PC1) from the Network Devices and End Devices sec on into the workspace.

- Select the Connec on Tool:

  Click the "Connec ons" icon (lightning bolt) from the bo om toolbar.

- Connect PCs to Switches:

  Choose Copper Straight-Through Cable.
  Click on the PC you want to connect, select FastEthernet0 port, and then click on an available FastEthernet port on the Switch (e.g., FastEthernet0/1).
  Repeat this for all PCs, connec ng them to different ports on the switch.

- Connect Mul ple Switches (If Applicable):

  If you have more than one switch, use the Copper Straight-Through Cable to connect FastEthernet ports on the switches (e.g., FastEthernet0/1 on Switch 1 to FastEthernet0/2 on Switch 2). Ensure all switches are properly interconnected.

- Assign IP Addresses to PCs:

  Click on a PC and go to the Desktop tab, then select IP Configura on.
  Assign a unique IP address to each PC (e.g., PC0: 192.168.1.1, PC1: 192.168.1.2, etc.), with Subnet Mask as 255.255.255.0.

- Verify Connec ons:

  Check the link lights on the switches—green indicates a successful connec on.
  Make sure all PCs are connected to switches and switches are interlinked.

- Check Connec vity Using Ping:
  Open the Command Prompt on a PC (Desktop > Command Prompt) and use the ping command to test connec vity between PCs (e.g., ping 192.168.1.2 from PC0 to PC1). If the ping is successful, devices are correctly connected.

- Enable Simula on Mode:
  Click on the Simula on bu on (at the bo om-right of the screen).
  Choose a device (e.g., PC0), and ini ate a ping or traffic flow to simulate data transmission.

- Observe Simula on Results:
  In Simula on Mode, observe how data packets travel between devices.
  You can view the path, delay, and check for any issues during the transmission of packets. This helps verify the network setup and troubleshoot any errors.

Observation:

The network illustrates the integra on of mul ple topologies connected through switches to enable communica on across different segments. Each switch manages data transmission using its MAC address table, direc ng packets toward their des na on while avoiding loops, likely with the help of protocols like Spanning Tree Protocol (STP). The design ensures seamless interac on between devices in separate sec ons, providing scalability and efficient data flow throughout the network.

For Example,

Packet Transfer from PC1 to PC9:

- Packet Genera on by PC1:
  PC1 creates a data packet with the des na on address of PC9, which includes the IP and MAC addresses of PC9.

- Forwarding at Switch1:
  The packet is sent to Switch1, which examines its MAC address table. If the MAC address of PC9 is not in the table, Switch1 broadcasts the packet to all ports except the incoming one.

- Intermediate Switches:
  The packet travels through the network via intermediate switches (e.g., Switch3 and Switch8). Each switch checks its MAC table to decide the next port for forwarding. If the address is unknown, the broadcast mechanism is used to locate the des na on.

- Des na on Switch (Switch8):
  When the packet reaches Switch8, which directly connects to PC9, the switch uses its MAC table to iden fy the port associated with PC9 and forwards the packet to it.

- Delivery to PC9:
  The packet arrives at PC9, comple ng the transfer. PC9 processes the data based on the communica on protocol in use.

Conclusion:

The interconnected network topology demonstrates an efficient system for packet transmission between devices located in different segments. By u lizing switches, MAC address tables, and protocols like Spanning Tree Protocol, the network ensures reliable data delivery without loops. The design facilitates seamless communica on, scalability, and efficient handling of traffic, making it suitable for complex systems requiring high performance and reliability.