

EXPERIMENT - 6Theoretical Understanding

1) Define Network Topology.

→ Network topology refers to the physical or logical arrangement of network devices and connections. It defines how computers, cables, switches, and other devices are interconnected to facilitate communication and data exchange.

2) Advantages & disadvantages of -

• Bus Topology

Advantages -

- Cost-effective as it requires less cabling.
- Easy to set up and extend.
- Works well for small networks.

Disadvantages -

- A single point of failure (main cable) can bring down the entire network.
- Performance degrades as more devices are added.
- Data collisions can occur, reducing efficiency.

• Ring topology

Advantages -

- No data collisions due to the unidirectional or bidirectional data flow.
- Predictable data transmission due to sequential passing of data.

Disadvantages -

- Failure of a single node or cable can disrupt the entire network.
- Troubleshooting is difficult due to the dependency on all devices in the ring.
- Adding or removing devices requires temporarily shutting down the network.

Star topologyAdvantages -

- High fault tolerance; failure of one device does not affect the entire network.
- Easy to manage, scale, and troubleshoot.
- Centralized control provides better performance.

Disadvantages -

- Expensive due to the requirement of a central switch or hub.
- If the central hub/switch fails, the entire network is affected.

Mesh topologyAdvantages -

- High redundancy; failure of one connection does not disrupt communication.

- Offers excellent reliability & security.
- Data transmission is faster due to multiple paths.

Disadvantages-

- Expensive due to expensive cabling and hardware requirements.
- Complex installation and maintenance.

3) Which topology is most fault-tolerant and why?

→ Mesh topology is the most fault-tolerant because it has multiple redundant paths for data transmission. Even if one link or device fails, alternative paths ensure uninterrupted communication.

4) Which topology is cost-effective & why?

→ Bus topology is the most cost-effective because it requires minimal cabling and no expensive central devices, making it suitable for small networks.

5) Compare Mesh and Star Topology in terms of Scalability & Reliability.

→ Scalability -

Mesh topology is difficult to scale due to high wiring and configuration complexity.

Star topology is easier to scale by adding more devices to the central switch.

Reliability -

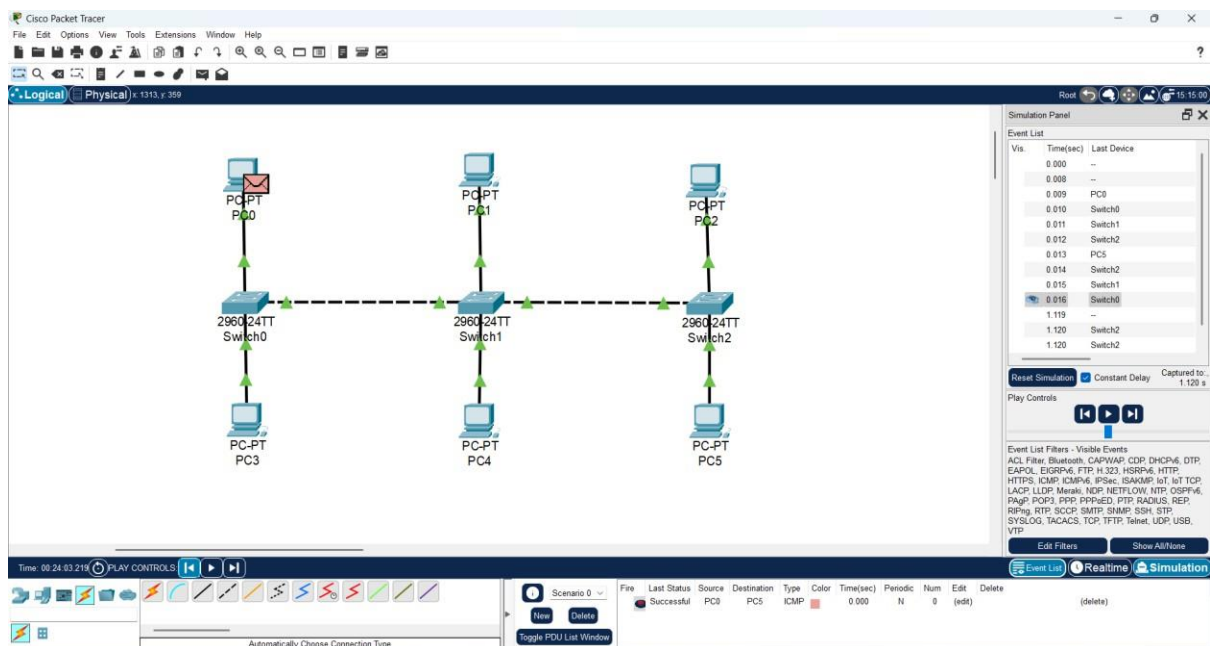
Mesh topology is highly reliable due to multiple redundant paths.

Star topology is also reliable but dependent on the central hub/switch, which is a single point of failure.

Task 2: Network Topology Design in Cisco Packet Tracer

Design and simulate the following network topologies using Cisco Packet Tracer:

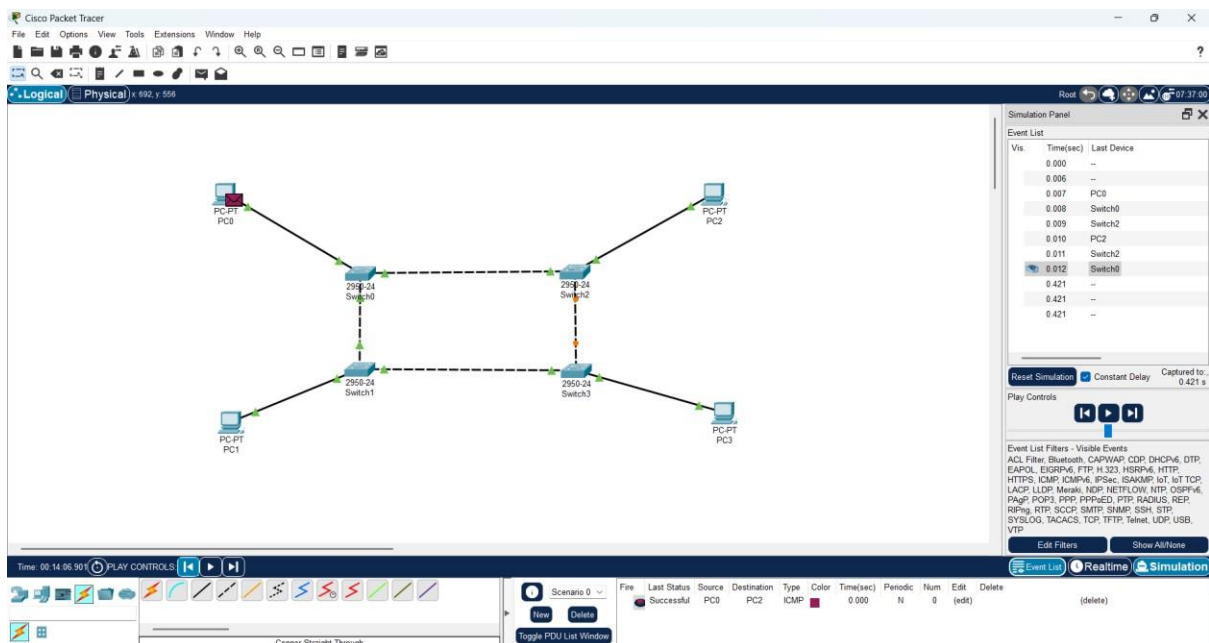
- Bus Topology (Using a single backbone cable)



Data Transmission Flow:

- Data travels along the backbone in both directions.
- Only the intended recipient processes the data.
- If two devices send data simultaneously, a collision occurs, requiring a retransmission.

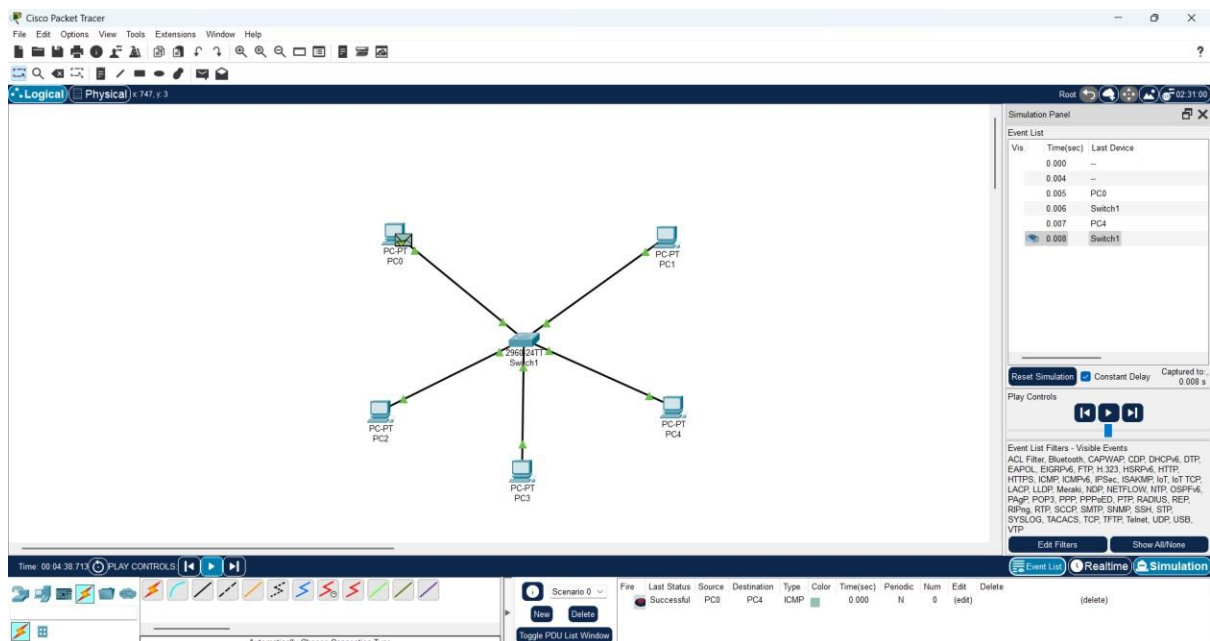
- Ring Topology (Connecting all devices in a loop)



Data Transmission Flow:

- Data moves in one direction (unidirectional) or both directions (bidirectional in modern implementations).
- A token-passing mechanism is used to prevent collisions.

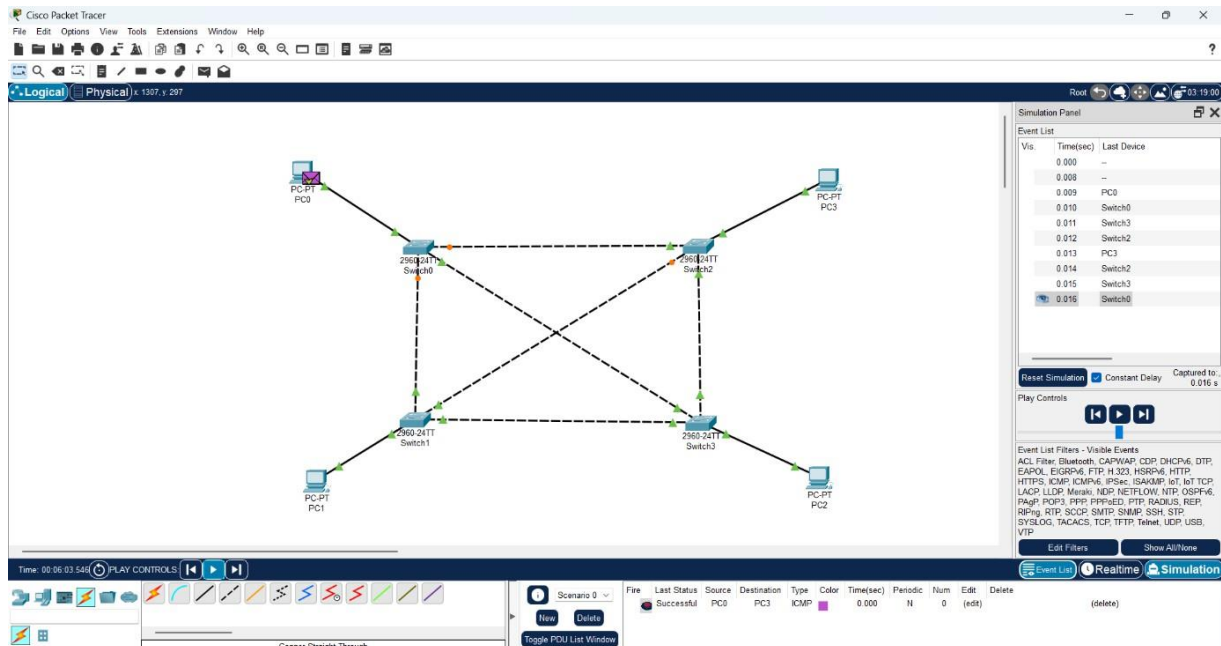
- Star Topology (Using a central switch or hub)



Data Transmission Flow:

- Data travels from the sender to the switch/hub, then forwarded to the recipient.
- Switches use MAC addresses to forward packets, while hubs broadcast data to all devices.

- Mesh Topology (Full or partial, as per requirement)



Data Transmission Flow:

- Data follows multiple paths, ensuring redundancy and fault tolerance.
- Routing protocols like OSPF or RIP can be used for dynamic path selection.