Computer Networks Lab

Lab Assignment -1

Basic Network Topologies Using Switches and Hubs

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Task 1

Star Topology (2960 Switches)
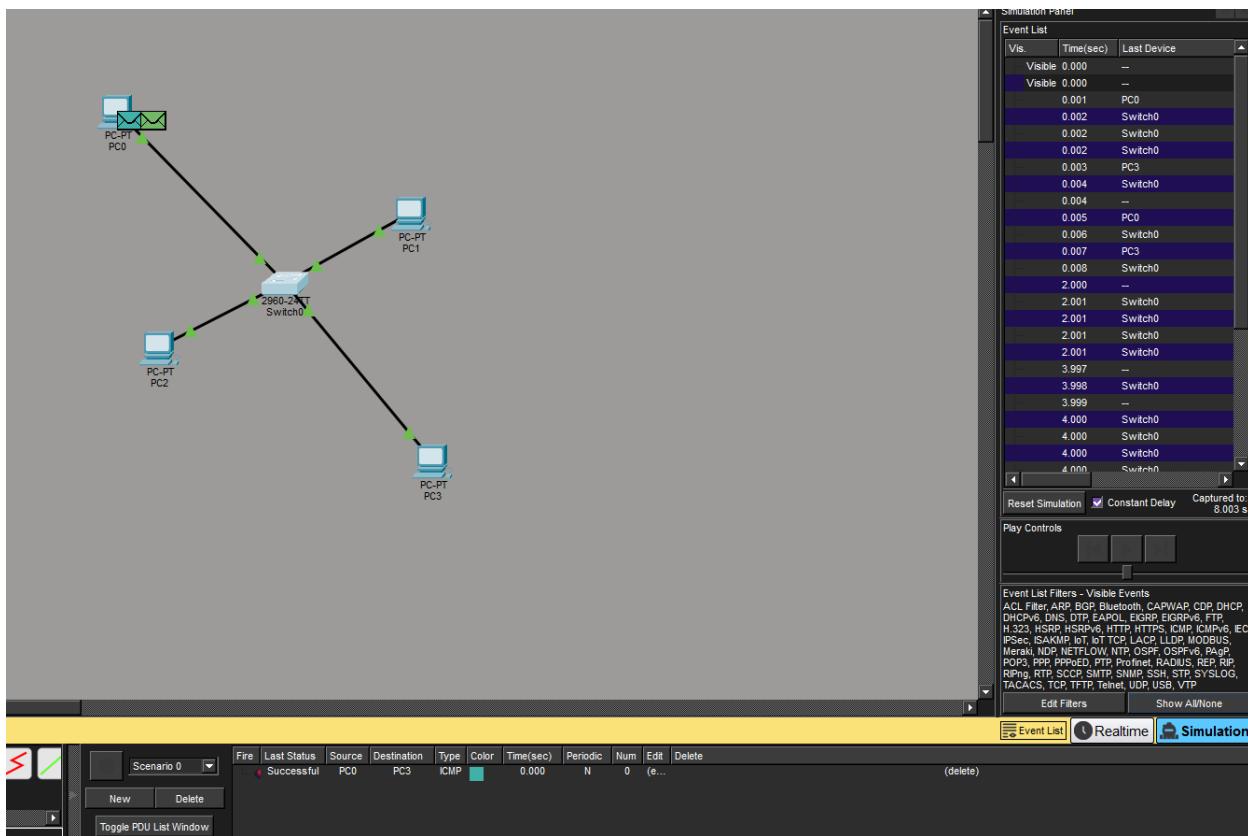
- 1 2960 Switch
- 4 PCs (with IPs configured)
- Ping PC1 -> PCx

Star Topology (Switch-based)

In a Star Topology, every end device (PCs) is connected to a single central node, which in this experiment was the 2960 Switch.

- Working: The central switch acts as a "monitor," using MAC addresses to send data only to the specific port where the destination device is connected.

- Advantages: It is highly efficient and easy to troubleshoot. If one PCs cable breaks, only that PC loses connection; the rest of the network stays online.

- Observations: This resulted in a very stable ping about 3ms with 0% packet loss in your tests.

Cisco pkt file:

Pings:

Task 2

Bus Topology (PT Hubs)
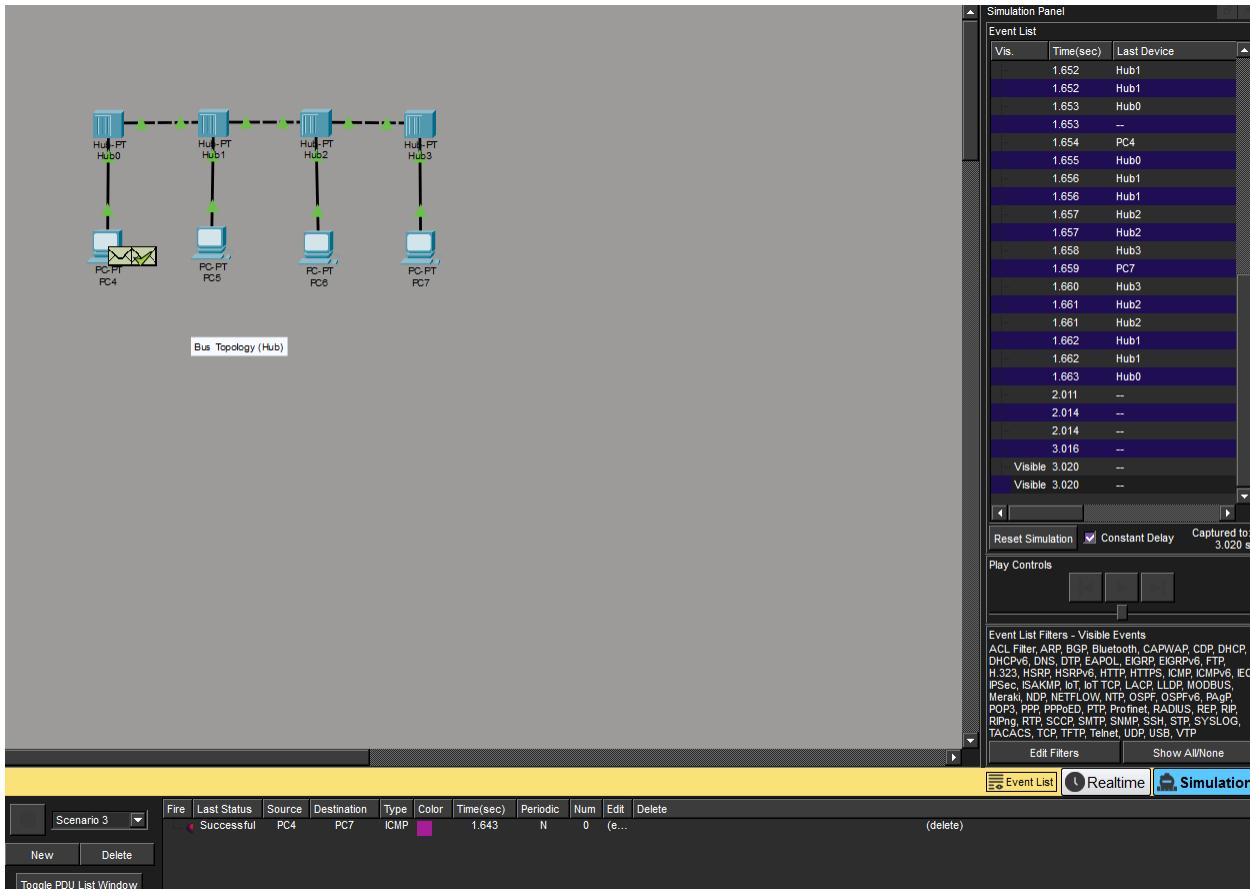
- 4 PT Hubs
- 4 PCs (with IPs configured)
- Ping PC1 -> PCx

Bus-like Topology (Hub-based)
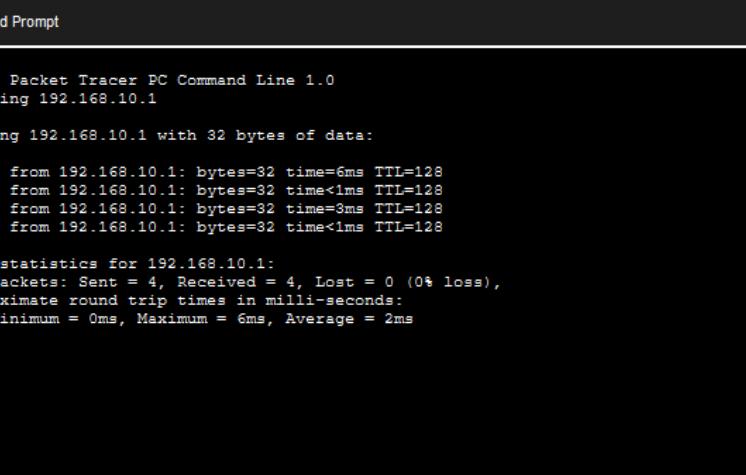
While a true physical Bus topology uses a single backbone cable, using a Hub creates a logical "Bus-like" environment.

- Working: A Hub is a "non-intelligent" device. When it receives a packet, it broadcasts (floods) that packet to every single port, regardless of the destination.

- Disadvantages: This creates high "traffic noise" and security risks, as all PCs receive everyone else's data.

- Advantages: Lowest average latency around 2ms. As Hub is a physical-layer device.

- Observations: In Simulation Mode, you saw the "envelope" go to all PCs simultaneously, which is less efficient than the "Star" layout.

Cisco pkt file:

Pings:

Task 3

Ring Topology (2960 Switches)

- 3 2960 Switches
- 6 PCs (with IPs configured)
- Ping PC1 -> PCx

Ring-like Topology (Redundant Loop)
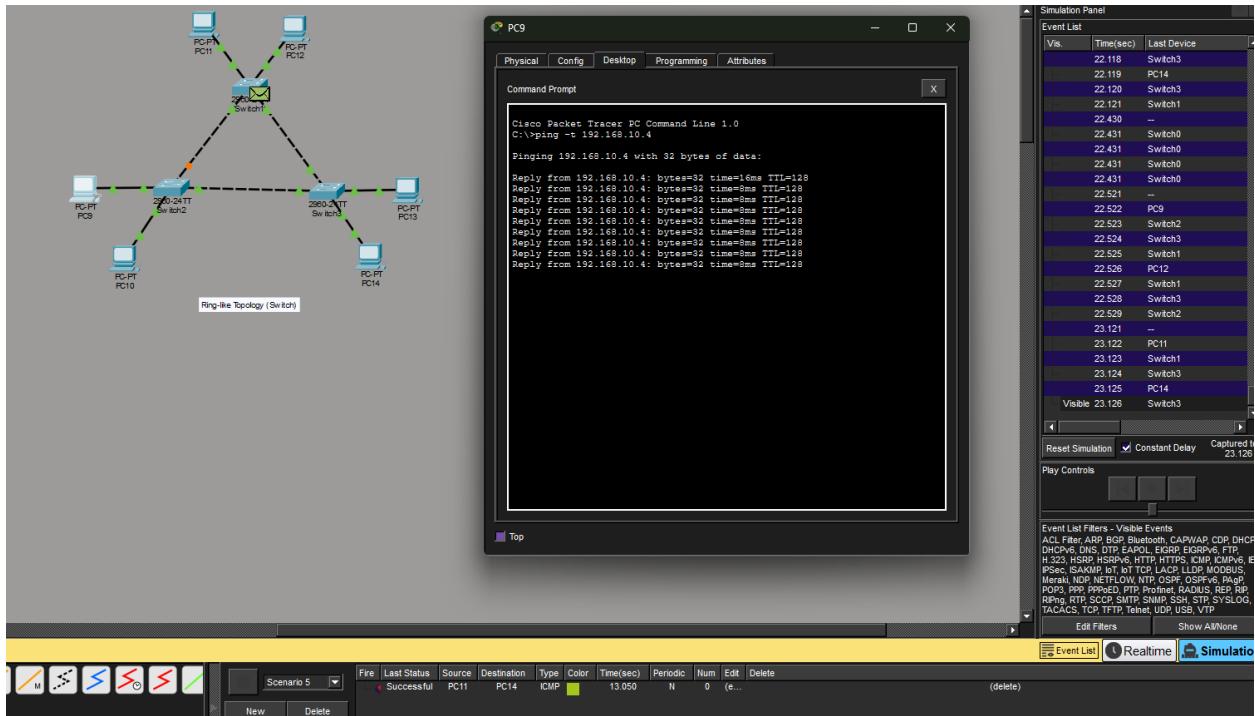
In this layout, switches are connected in a circular loop to provide multiple paths for data.

- Working: To prevent data from looping forever, the Spanning Tree Protocol (STP) automatically blocks one path.

- Advantages: If a primary link fails, the blocked path automatically opens to restore connectivity (Fault Tolerance).

- Disadvantages: Highest average ping of 8ms, due to so packet having to pass through so many switches.

- Observations: Your ringERRORping showed a brief period

  "Request timed out" while the network was "repairing" itself, proving its high reliability for office or lab designs.
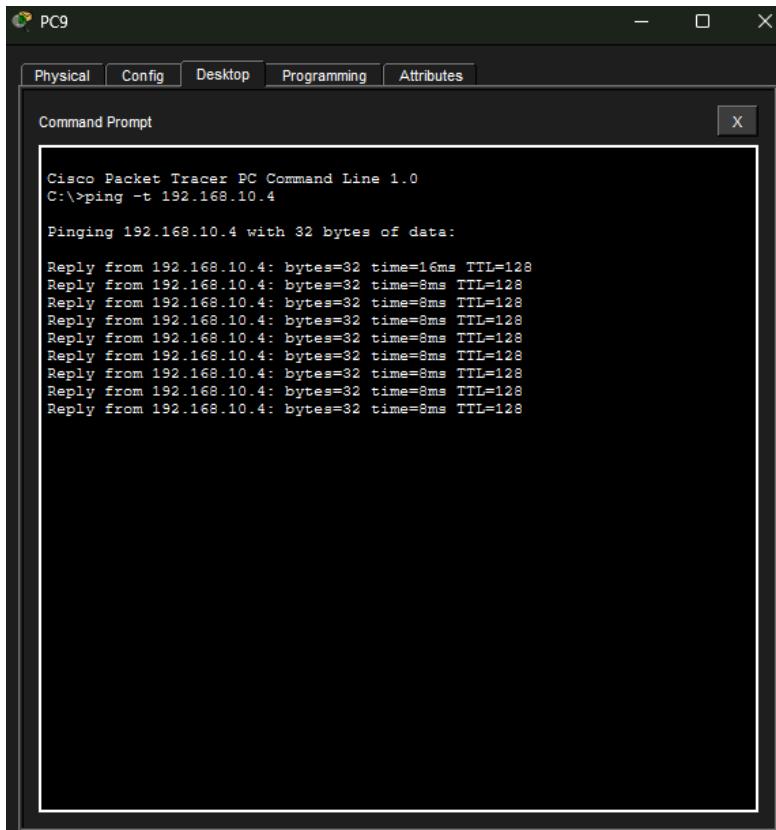
Note: Once you connect the three switches, one of the copper cross-over links b/w switches remains Orange.

While the others turn Green, why?, this happens due to [STP] which 'blocks' one path to prevent data from looping endlessly.

Cisco pkt file:

## Pings:

Task 4

Ring Topology (2960 Switches)
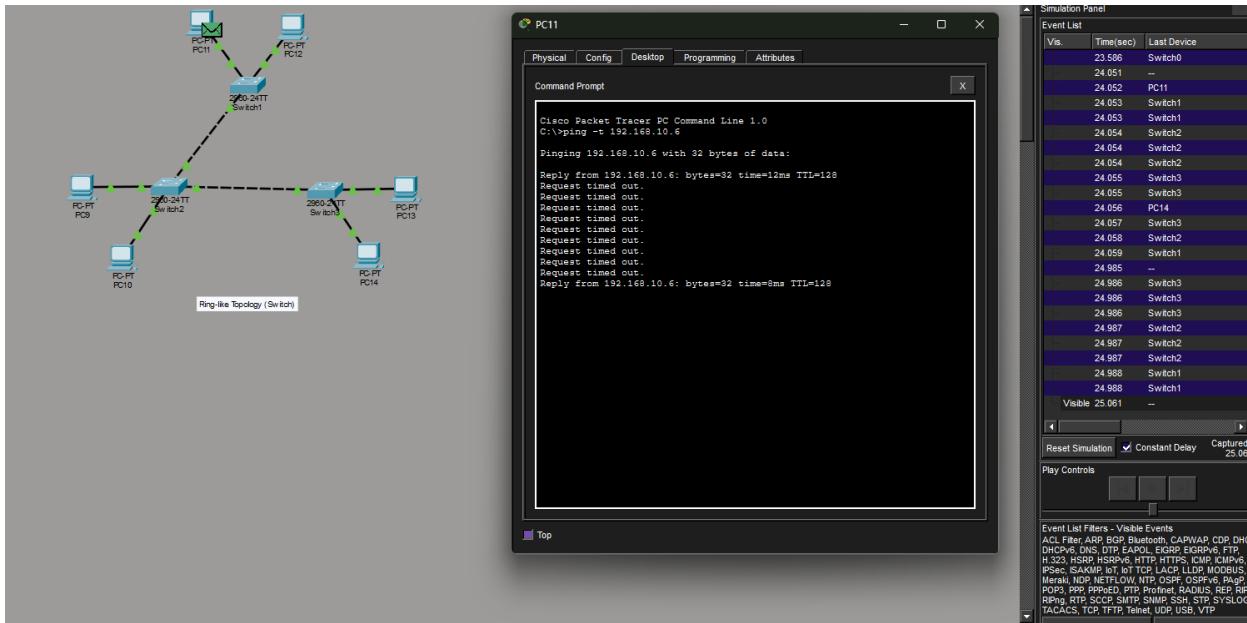
- 3 2960 Switches
- 6 PCs (with IPs configured)
- Ping PC1 -> PCx

Same as Task 3, but using the redundancy feature buy cutting one of the Copper Cross-over links during active connection. As the PC1 tries to ping target PCx, the network times out but fixes itself in Real-time.
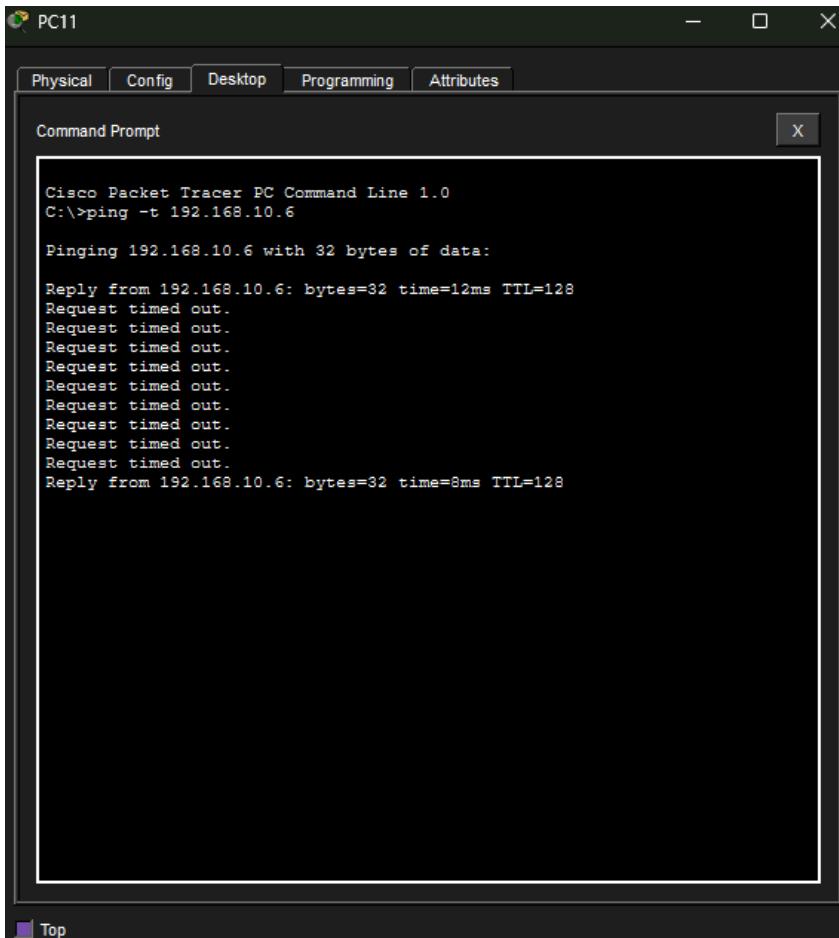
Observations:

1. As the ringERRORping shows 9 consecutive timeouts after the link was cut b/w Switch 1 & Switch 3 before the connection was restored.
2. This delay occurs due to Spanning Tree Protocol (STP) has to detect the link failure and transition the 'blocked' port to 'forward' state.
3. The Ring topology is the only one that survived a hardware failure, proving its **high fault tolerance**.

Cisco pkt file:

Pings:

Miscellaneous

Topology	Average Ping Latency	Behaviour Observation
Star (Switch)	3ms	High efficiency; packets sent only to destination.
Bus (Hub)	2ms	Low latency but high congestion; packets broadcast to everyone. +1
Ring (Loop)	8ms	Redundant pathing; higher latency due to multiple hops.

Conclusion

Based on the simulation and the **ringERRORping** data, the following conclusions were reached:

- **BEST Performance:** The **Star topology** using a switch is the most effective for modern LANs because it reduces unnecessary traffic through intelligent port forwarding.

- **BEST Scalability:** The **Bus-like (Hub)** topology is inefficient for larger networks due to its broadcasting nature, which increases the risk of collisions.

- **BEST Fault Tolerance:** The **Ring-like topology** is superior for mission-critical networks. As seen in the failure test, although it took roughly 9 pings to recover, the network successfully self-healed using Spanning Tree Protocol (STP) to reroute traffic after a link failure.