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CN Assignment 4

Lab 4: Demonstrating the Working of Switches and Hubs using Cisco Packet Tracer

Objective

The objective of this lab is to design and implement two network topologies using a hub and a switch, and to observe their behavior in terms of data forwarding, collision domains, and MAC address handling.

Scenario 1: Basic Communication – Hub vs. Switch

Topology Description

Two separate LANs were created in Cisco Packet Tracer:

- **Hub Network**: PC0, PC1, and PC2 were connected to a hub.
- **Switch Network**: PC3, PC4, and PC5 were connected to a switch.

All devices were assigned static IP addresses within their respective subnets:

Hub Network (192.168.1.0/24):

Device	IP Address	MAC Address
PC0	192.168.1.10	(auto-generated)
PC1	192.168.1.20	(auto-generated)
PC2	192.168.1.30	(auto-generated)

Switch Network (192.168.2.0/24):

Device	IP Address	MAC Address
PC3	192.168.2.10	(auto-generated)
PC4	192.168.2.20	(auto-generated)
PC5	192.168.2.30	(auto-generated)

Implementation Steps

1. Each PC was configured with a static IP and connected using straight-through cables to either a hub or a switch.

2. Pings were sent from:

    - PC0 to PC2 in the hub network

    - PC3 to PC5 in the switch network

3. Simulation Mode was used to observe packet flow.

Observations

- In the **hub network**, the ping request from PC0 to PC2 was **broadcast to all connected devices** (including PC1).
- In the **switch network**, the ping from PC3 to PC5 was sent **only to the destination PC** after the switch learned MAC addresses.

Conclusion for Scenario 1

The hub acted as a repeater and broadcasted frames to all devices, regardless of the destination. The switch used MAC address learning and only forwarded the frame to the appropriate port, showing better performance and efficiency.

Scenario 2: Simultaneous Communication and Collision Domains

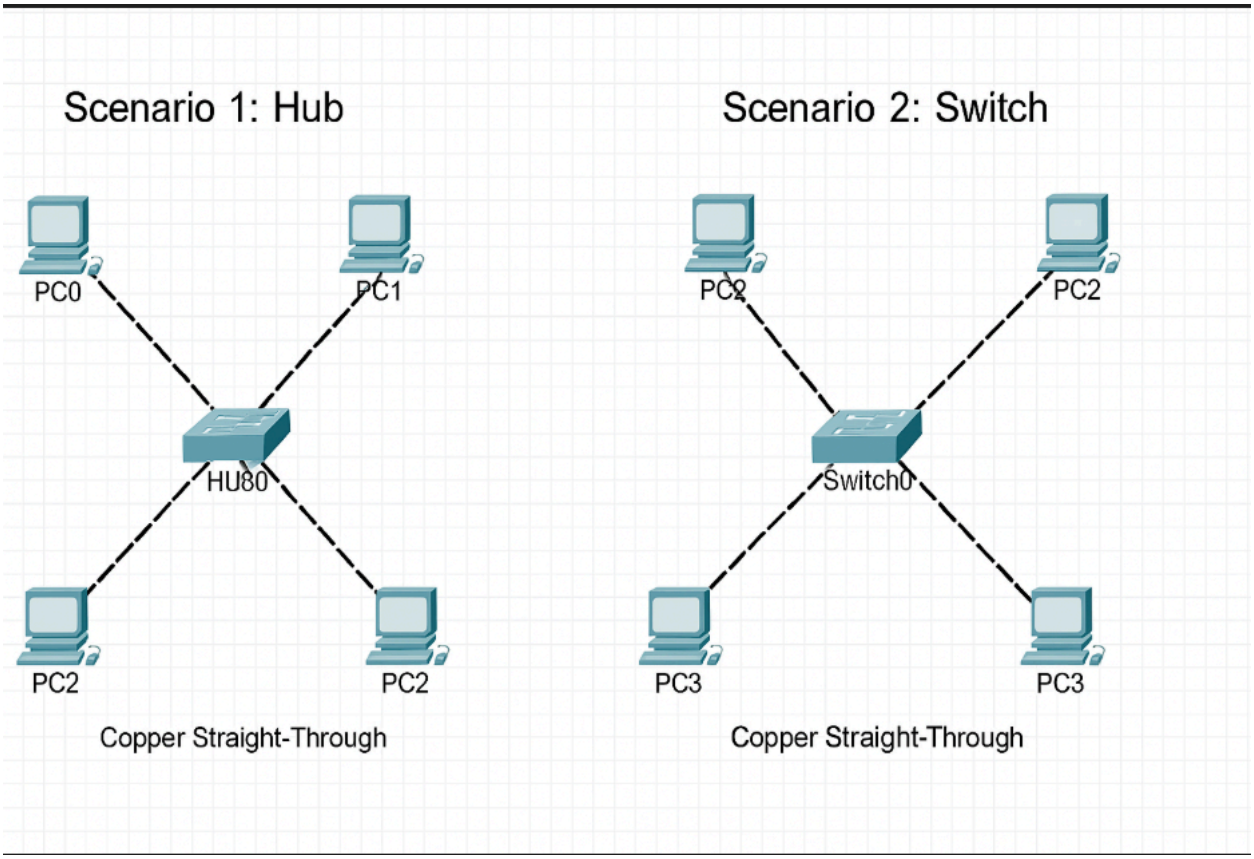
Topology Description

The same two topologies (hub and switch) were used to simulate simultaneous communication:

- In the hub network: PC0 and PC1 both sent data to PC2 at the same time.
- In the switch network: PC3 and PC4 both sent data to PC5 simultaneously.

Implementation Steps

1. In Simulation Mode, PC0 and PC1 were both used to ping PC2.
2. At the same time, PC3 and PC4 were used to ping PC5.
3. Packet flow and collision behavior were monitored in the simulation panel.



Observations

- In the **hub network**, when PC0 and PC1 sent data at the same time, **packet collisions occurred**. This was visible in the simulation as dropped or delayed packets.

- In the **switch network**, **no collisions occurred**. The switch handled both simultaneous communications efficiently using separate collision domains per port.

Conclusion for Scenario 2

Hubs operate within a single collision domain, which means that only one device can transmit at a time. When multiple devices transmit simultaneously, collisions occur, leading to degraded network performance. Switches provide a separate collision domain for each port, which prevents collisions and supports simultaneous communication efficiently.

Final Conclusion

This lab demonstrated the fundamental differences between hubs and switches. Hubs are outdated devices that broadcast data to all devices and suffer from collisions in shared networks. Switches, on the other hand, intelligently forward frames based on MAC addresses, create separate collision domains, and significantly improve network efficiency and scalability. The observations clearly support the use of switches in modern LAN environments.