Data Communication and Computers Lab

Lab - 04

Familiarization of Network IP & Sub netting & super netting

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IPv4 (Internet Protocol Version 4)

- IPv4 is the fourth version of the Internet Protocol (IP) and is widely used for identifying devices on a network using an addressing system.

IPv4 Address Structure

- Size: 32 bits, divided into 4 octets, separated by dots (e.g., 192.168.1.1).
- Range: 0 to 255 for each octet.
- Regulation: IP addresses are regulated by the Internet Assigned Numbers Authority (IANA).

IPv4 Classes

IPv4 addresses are divided into five classes: A, B, C, D, and E.

Class	Range	Usage	Default Subnet Mask
A	0-126	Used for large networks.	255.0.0.0
B	128-191	Used for medium-sized networks.	255.255.0.0
C	192-223	Used for small networks.	255.255.255.0
D	224-239	Reserved for multicast groups.	Not applicable
E	240-255	Reserved for experimental purposes.	Not applicable

Note: The IP range 127.0.0.0 - 127.255.255.255 is reserved for loopback addresses.

Public and Private IP Addresses

- Private IP Addresses: Used within private networks and not routable on the internet. They are used to save public IP addresses.
- Public IP Addresses: Globally unique addresses routable on the internet.

Private IP Address Ranges

1. **Class A:** 10.0.0.0 - 10.255.255.255
2. **Class B:** 172.16.0.0 - 172.31.255.255
3. **Class C:** 192.168.0.0 - 192.168.255.255

All other addresses outside these ranges are public IP addresses.

Explanation of Classes

Class A

- Range: 0.0.0.0 - 127.255.255.255
- Private Range: 10.0.0.0 - 10.255.255.255
- Default Subnet Mask: 255.0.0.0
- Network Bits: 8
- Host Bits: 24
- Number of Networks: 2^8 = 256
- Number of Hosts per Network: 2^24 - 2 = 16,777,214 (subtract 2 for the network and broadcast addresses)

- Example:
    - Network Address: 10.0.0.0
    - Usable Host Range: 10.0.0.1 to 10.255.255.254
    - Broadcast Address: 10.255.255.255

Class B

- Range: 128.0.0.0 - 191.255.255.255
- Private Range: 172.16.0.0 - 172.31.255.255
- Default Subnet Mask: 255.255.0.0
- Network Bits: 16
- Host Bits: 16
- Number of Networks: 2^16 = 65,536
- Number of Hosts per Network: 2^16 - 2 = 65,534 (subtract 2 for the network and broadcast addresses)

- Example:
    - Network Address: 172.16.0.0
    - Usable Host Range: 172.16.0.1 to 172.31.255.254
    - Broadcast Address: 172.31.255.255

Class C

- Range: 192.0.0.0 - 223.255.255.255
- Private Range: 192.168.0.0 - 192.168.255.255
- Default Subnet Mask: 255.255.255.0
- Network Bits: 24
- Host Bits: 8
- Number of Networks: 2^24 = 16,777,216
- Number of Hosts per Network: 2^8 - 2 = 254 (subtract 2 for the network and broadcast addresses)

- Example:
    - Network Address: 192.168.0.0
    - Usable Host Range: 192.168.0.1 to 192.168.0.254
    - Broadcast Address: 192.168.0.255

Subnetting

- Subnet Mask: Defines the network and host portions of an IP address.
- Example for Class C (192.168.0.0/24):
    - Subnet Mask: 255.255.255.0 or 11111111.11111111.11111111.00000000 in binary.
    - Network Bits: 24
    - Host Bits: 8
    - Number of Subnets: 2^n where n is the number of borrowed bits for subnetting.
    - Number of Hosts per Subnet: 2^h - 2 where h is the number of host bits.

DHCP (Dynamic Host Configuration Protocol):

- DHCP is used for automatic IP address assignment in a network. When a network is not manually configured, DHCP automatically assigns IP addresses, subnet masks, default gateways, and other network settings to devices.

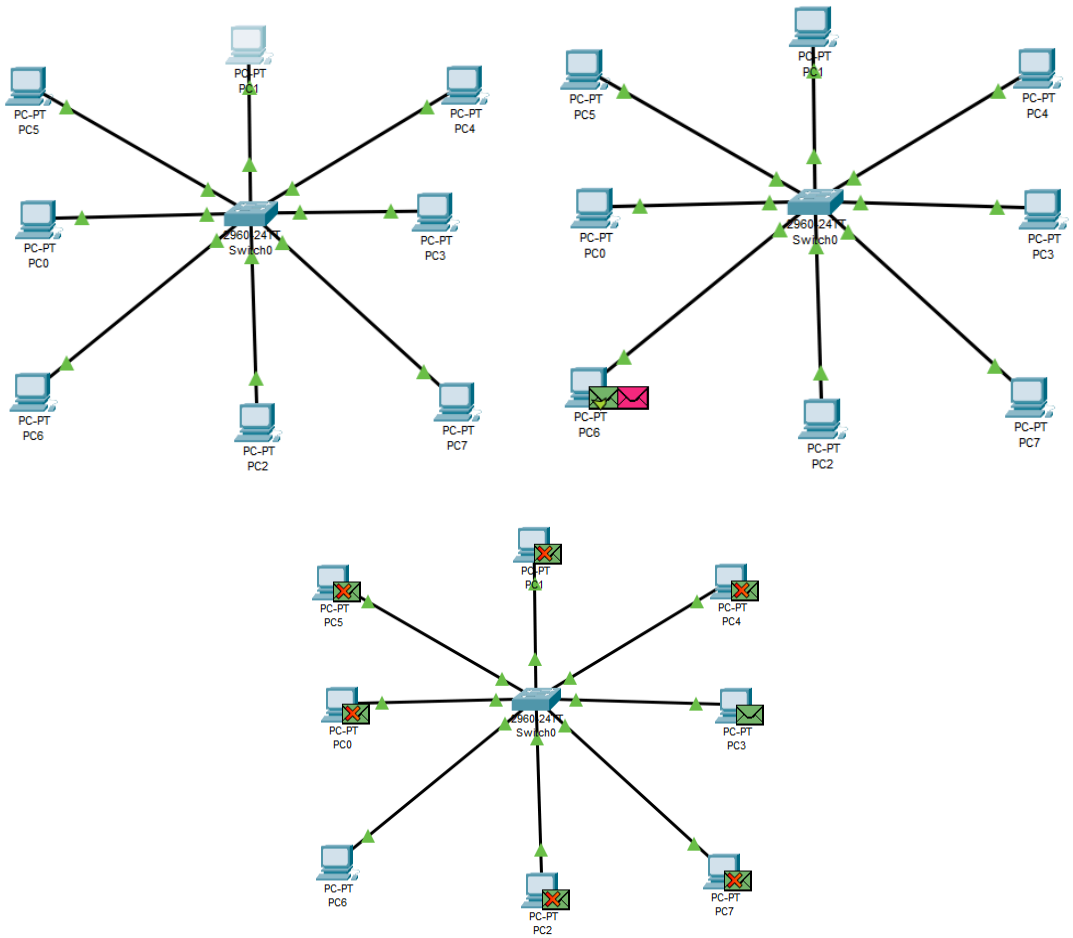
Key Points:

- IPv4 Address Size: 32 bits.
- Private IP Ranges: Defined for Classes A, B, and C.
- Subnetting: Divides an IP address range into multiple smaller networks.
- DHCP: Automatically assigns IP addresses in a network.

A star topology network:

Star Topology is a network configuration where each device (such as a PC) is connected to a central device (like a switch or hub).

A central switch is connected to multiple PCs .
Each PC has a direct point-to-point connection to the central switch, making it an example of a star topology.
This topology is commonly used in local area networks (LANs) due to its simplicity, ease of management, and ability to isolate network problems.



Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC6	PC3	ICMP		0.000	N	0	(edit)	(delete)

What's happening

When a PDU (Protocol Data Unit), such as an Ethernet frame, is sent from one device (like PC0) to another device (PC1) in a network using a switch, here is what happens:

Initial Frame Transmission

- PC0 sends the frame to the switch (Switch0). The frame contains the destination MAC address (hardware address) of PC1.

Switch Behavior:

- The switch examines the destination MAC address in the frame.
- If the switch does not know which port corresponds to PC1 (when it is learning the network), it will send the frame out to all ports except the one it came from. This is called flooding. All connected devices will receive the frame, but only PC1 will recognize its own MAC address and process the frame.

Learning Process:

- When PC1 responds, the switch learns and records which port PC1 is connected to (this is called building the MAC address table).

Subsequent Communications:

- Once the switch has learned the MAC addresses and corresponding ports, it will directly forward future frames to the correct port only, instead of flooding to all ports.
- This process makes the communication more efficient, reducing unnecessary network traffic.