IP Addressing

Objective:

By the end of this lesson, students should be able to comprehend the concept of IP addressing, distinguish between IPv4 and IPv6, and understand how to interpret and assign IP addresses.

# Introduction:

IP addressing is a fundamental concept in networking, serving as a way to uniquely identify devices on a network. This lesson will delve into the basics of IP addressing, covering both IPv4 and IPv6, and provide examples to reinforce the understanding.

# 1. What is an IP Address?

## - Definition:

- An IP (Internet Protocol) address is a numerical label assigned to each device participating in a computer network.

- It serves two principal functions: host or network interface identification and location addressing.

## - Format:

- In IPv4, addresses are written in the form of four sets of numbers separated by dots (e.g., 192.168.1.1).

- In IPv6, addresses are much longer and are written in hexadecimal notation (e.g., 2001:0db8:85a3:0000:0000:8a2e:0370:7334).

# 2. IPv4 Addressing:

## - Format:

- Consists of four sets of decimal numbers ranging from 0 to 255.

- Example: 192.168.0.1

## - Classes:

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

- Classes A, B, and C are commonly used for host addressing.

## - Subnetting:

- Subnetting allows the division of a large IP network into smaller, more manageable sub-networks.

- Example: 192.168.1.0/24, where "/24" denotes the subnet mask.

# 3. IPv6 Addressing:

## - Format:

- Longer and more complex than IPv4 addresses.

- Consists of eight sets of four hexadecimal digits, separated by colons.

- Example: 2001:0db8:85a3:0000:0000:8a2e:0370:7334

## - Advantages:

- Larger address space, accommodating the increasing number of devices on the internet.

- Simplifies routing and configuration with a streamlined header structure.

# 4. IP Address Classes and Ranges:

## - Class A:

- Example Range: 1.0.0.1 to 126.255.255.254

## - Class B:

- Example Range: 128.1.0.1 to 191.255.255.254

## - Class C:

- Example Range: 192.0.1.1 to 223.255.254.254

## - Class D:

- Reserved for multicast groups.

- Example Range: 224.0.0.0 to 239.255.255.255

## - Class E:

- Reserved for experimental purposes.

- Example Range: 240.0.0.0 to 254.255.255.254

# 5. Private and Public IP Addresses:

## - Private IP Addresses:

- Used within a private network and not directly accessible from the internet.

- Examples: 192.168.x.x, 10.x.x.x, 172.16.x.x to 172.31.x.x

## - Public IP Addresses:

- Routable on the internet and uniquely identifies a device on a global scale.

- Obtained from Internet Service Providers (ISPs).

# 6. IP Address Assignment:

## - Static IP Address:

- Manually assigned to a device and does not change.

- Example: 192.168.1.100

## - Dynamic IP Address:

- Automatically assigned by a DHCP (Dynamic Host Configuration Protocol) server.

- Example: Obtaining an IP address from a router when connecting to a Wi-Fi network.

# Conclusion:

Understanding IP addressing is fundamental for anyone working with computer networks. Whether you're configuring routers, troubleshooting connectivity issues, or designing network architectures, a solid grasp of IP addressing is essential. This lesson has provided a foundation for comprehending IP addresses, their formats, classes, and the distinctions between IPv4 and IPv6.