IP Address

Introduction

An **IP (Internet Protocol) Address** is a numeric address used to identify a computer or device on a network. Every device connected to a network must have a unique IP address for communication purposes.

Structure of an IP Address

An IP address consists of two parts:

1. **Network Address**: This portion identifies the specific network to which the device belongs.
2. **Host Address**: This portion identifies the specific device (host) within the network.

Types of IP Addresses

There are two versions of IP addresses:

1. **IPv4**:
    - A 32-bit numeric address, usually written in decimal form as four 8-bit numbers separated by periods.
    - Each number can range from 0 to 255.
    - **Example**: IP Address 66.94.29.13

How Computers Read IPv4 Addresses

Computers read IP addresses in binary. Let's take the example of 66.94.29.13 and break down the first segment:

128 64 32 16 8 4 2 1 → 0 1 0 0 0 0 1 0 → 64+2 → 66
128 64 32 16 8 4 2 1 → 0 1 0 1 1 1 1 0 → 64+16+8+4+2 → 94
128 64 32 16 8 4 2 1 → 0 0 0 1 1 1 0 1 → 16+8+4+1 →29
128 64 32 16 8 4 2 1 → 0 0 0 0 1 1 0 1 → 8+4+1 → 13

01000010.01011110.00011101.00001101 == 66.94.29.13

1. **IPv6**:
    - A 128-bit alphanumeric address, written as eight groups of four hexadecimal digits, separated by colons.
    - IPv6 was developed to address the limited number of available IPv4 addresses.
    - **Example**: 2001:0db8:85a3:0000:0000:8a2e:0370:7334

Key Differences Between IPv4 and IPv6

Feature	IPv4	IPv6
Bit Length	32 bits	128 bits
Address Format	Numeric (e.g., 66.94.29.13)	Alphanumeric (e.g., 2001:0db8::7334)
Total Addresses	~4.3 billion addresses	Virtually limitless
Notation	Dotted-decimal (e.g., 192.168.0.1)	Hexadecimal, colon-separated

Why Are IP Addresses Important?

IP addresses are crucial for communication on the internet. They serve as unique identifiers for devices, enabling data to be sent to the correct destination. Without an IP address, a device would not be able to communicate over a network or the internet.