

# Understanding IPv4 Addressing

## What is an IPv4 Address?

An IPv4 address is a 32-bit numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication. It's written in decimal format as four octets separated by periods, for example: 192.168.1.1.

## Structure of IPv4 Addresses

Each IPv4 address consists of four octets (8 bits each), making up 32 bits in total. Each octet can range from 0 to 255. The format is known as 'dotted decimal notation', e.g., 192.0.2.1.

## Classes of IPv4 Addresses

IPv4 addresses are divided into five classes:

- Class A: 0.0.0.0 to 127.255.255.255 (Large networks)
- Class B: 128.0.0.0 to 191.255.255.255 (Medium-sized networks)
- Class C: 192.0.0.0 to 223.255.255.255 (Small networks)
- Class D: 224.0.0.0 to 239.255.255.255 (Multicast)
- Class E: 240.0.0.0 to 255.255.255.255 (Experimental)

## Private IP Address Ranges

Private addresses are reserved for use within private networks and are not routable on the internet:

- Class A: 10.0.0.0 to 10.255.255.255
- Class B: 172.16.0.0 to 172.31.255.255
- Class C: 192.168.0.0 to 192.168.255.255

## Subnetting and CIDR Notation

CIDR (Classless Inter-Domain Routing) notation is used to define subnet masks, e.g., 192.168.1.0/24. The '/24' means the first 24 bits are the network part. Subnetting helps in efficient IP address allocation.

## IPv4 Limitations

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IPv4 can support about 4.3 billion addresses, many of which are reserved or unusable. This limitation is one of the reasons for the development of IPv6.