IP Address

Basic Overview of IP Address

Four levels of addresses are used in an internet employing the TCP/IP protocols: **Physical Addresses , Logical Addresses , Port addresses and specific addresses.**

Each Layer is associated with the specific layer in TCP/IP architecture.

Application Layer —> Specific Addresses

Transport Layer —> Port Addresses

Network Layer —> Logical Addresses

Physical Layer —> Physical Addresses.

Logical Layers are necessary for universal communication which are independent of underlying physical networks. Physical addresses are not adequate in an inter-network environment where different networks can have different address formats.

A universal addressing system is needed in which each host can be identified uniquely regardless of the underlying physical network.

Here the logical addresses come into play. A Logical address in the internet is currently a 32-bit address that can uniquely define a host connected to the internet.

We use the term **IP Address** to mean a logical address in the network layer of the TCP/IP protocol suit.

An IP address represents a unique address that distinguishes any device on the internet or any network from another.

IP or Internet Protocol defines the set of commands directing the setup of data transferred through the internet or any other local network.

The need for more addresses motivated a new design of IP address called the new generation of IP or **IPV6.**

In this version internet uses internet uses **128-bit** addresses that give much better flexibility in address allocation.

An IP address is represented by a series of numbers segregated by periods(.). They are expressed in the form of four pairs - an example address might be `255.255.255.255` wherein each set can range from **0 to 255.**

IP addresses are not produced randomly. They are generated mathematically and are further assigned by the **IANA (Internet Assigned Numbers Authority)**, a department of the ICANN.

ICANN stands for Internet Corporation for Assigned Names and Numbers.It is a non-profit corporation founded in the US back in 1998 with an aim to manage Internet security and enable it to be available by all.

Let’s Understand more about IP Address and It’s working:

In layman’s terms we can say that we use IP address to identify each node on the internet.

A node can be a router or a server or a printer which may have multiple network interfaces with each interface connected to a different network.

Let’s understand this situation with an analogy, A house having multiple doors with one door facing a street called Main Street and another door facing a different street called Broadway. In this situation the IP address is usually

associated with the network interface or the network connection rather than with the node.

If we can relate this with our analogy then we can say that an address is assigned to each door of a house rather than to the house itself.

As mentioned earlier currently we are using IP address which is of 32 bit or 4 Bytes. It means as of now total numbers of IP address which we can have is 2^32 means **4294967296** distinct IP addresses.These addresses are referred to as **IPV4 (IP version 4)** addresses.

The address structure of IP address was originally defined to have a two level hierarchy i.e **Network ID and Host ID**.

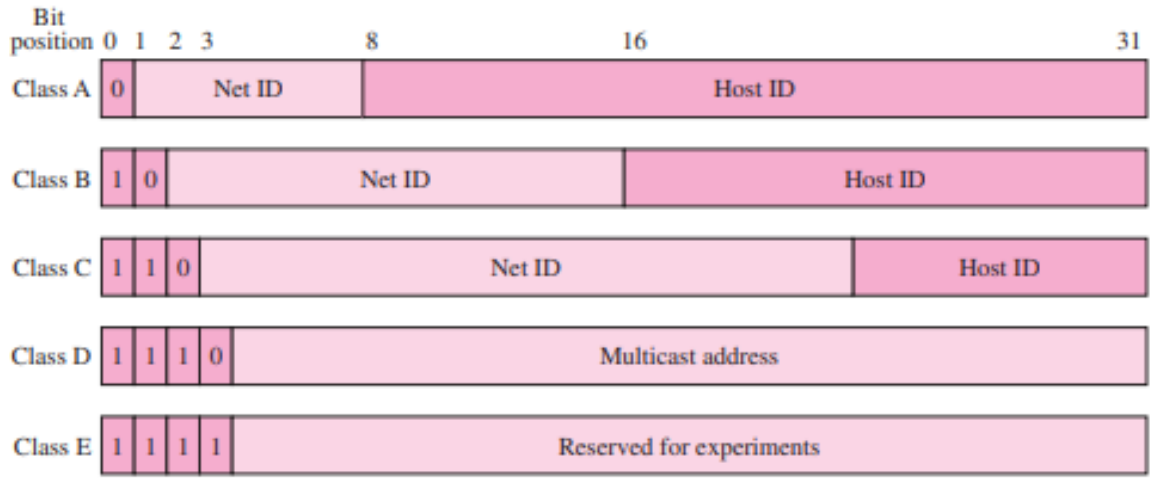
The **Network ID** identifies the network the host is connected to that means all the hosts connected to same network have same network ID.

The **Host ID** uniquely specifies the host on the network. We can find the host id by simply ANDing the IP address in binary form with its respective default subnet mask (in binary form).

Classful IP Addressing:

The IP address structure is divided into five address classes i.e **Class A,Class B,Class C,Class D and Class E.**

They are identified by the most significant bits of the address.



Class A addresses have seven bits for network IDs and 24 bits for host IDs, allowing up to 126 networks and about 16 million hosts per network.
Class B addresses have 14 bits for network IDs and 16 bits for host IDs, allowing about 16,000 networks and about 64,000 hosts for each network. Class C addresses have 21 bits for network IDs and 8 bits for host IDs, allowing about 2 million networks and 254 hosts per network. Class D addresses are used for multicast services that allow a host to send information to a group of hosts simultaneously. Class E addresses are reserved for experiments

Address Range of all classes:

Class A: `1.0.0.0` to `127.255.255.255`
Class B: `128.0.0.0` to `191.255.255.255`
Class C: `192.0.0.0` to `223.255.255.255`
Class D: `224.0.0.0` to `239.255.255.255`
Class E: `240.0.0.0` to `255.255.255.255`

Types of IP Address

There are various classifications of IP addresses, and each category further contains some types.

Consumer IP addresses

Every individual or firm with an active internet service system pursues two types of IP addresses, i.e., Private IP (Internet Protocol) addresses and public IP (Internet Protocol) addresses. The public and private correlate to the network area. Therefore, a private IP address is practiced inside a network, whereas the other (public IP address) is practiced outside a network.

1. Private IP addresses

All the devices that are linked with your internet network are allocated a private IP address. It holds computers, desktops, laptops, smartphones, tablets, or even Wi-Fi-enabled gadgets such as speakers, printers, or smart Televisions. With the expansion of IoT (internet of things), the demand for private IP addresses at individual homes is also seemingly growing. However, the router requires a method to identify these things distinctly. Therefore, your router produces unique private IP addresses that act as an identifier for every device using your internet network. Thus, differentiating them from one another on the network.

2. Public IP addresses

A public IP address or primary address represents the whole network of devices associated with it. Every device included within with your primary address contains their own private IP address. ISP is responsible to provide your public IP address to your router. Typically, ISPs contains the bulk stock of IP addresses that they dispense to their clients. Your public IP address is practiced by every device to identify your network that is residing outside your internet network.

Public IP addresses are further classified into two categories- dynamic and static.

- **Dynamic IP addresses** As the name suggests, Dynamic IP addresses change automatically and frequently. With this types of IP address, ISPs already purchase a bulk stock of IP addresses and allocate them in some order to their customers. Periodically, they re-allocate the IP addresses

and place the used ones back into the IP addresses pool so they can be used later for another client. The foundation for this method is to make cost savings profits for the ISP.

- **Static IP addresses** In comparison to dynamic IP addresses, static addresses are constant in nature. The network assigns the IP address to the device only once and, it remains consistent. Though most firms or individuals do not prefer to have a static IP address, it is essential to have a static IP address for an organization that wants to host its network server. It protects websites and email addresses linked with it with a constant IP address.

Types of website IP addresses

The following classification is segregated into the two types of website IP addresses i.e., shared and dedicated.

1. Shared IP addresses

Many startups or individual website makers or various SME websites who don't want to invest initially in dedicated IP addresses can opt for shared hosting plans. Various web hosting providers are there in the market providing shared hosting services where two or more websites are hosted on the same server. Shared hosting is only feasible for websites that receive average traffic, the volumes are manageable, and the websites themselves are confined in terms of the webpages, etc.

2. Dedicated IP addresses

Web hosting providers also provide the option to acquire a dedicated IP address. Undoubtedly dedicated IP addresses are more secure, and they permit the users to run their File Transfer Protocol (FTP) server. Therefore, it is easier to share and transfer data with many people within a business, and it also provides the option of anonymous FTP sharing. Another advantage of a dedicated IP addresses it the user can easily access the website using the IP address rather than typing the full domain name.

Note:

LoopBack Addresses

`127.0.0.1` to `127.255.255.255` are known as loopback adresses. When a host send a packet with this address, the packet is returned to the host by the IP protocol software without transmitting it to the physical network. The loopback address can be used for inter-process communication on the local host via TCP/IP protocols and for debugging process.

A new version of IP Address(IPV6 Address)

IPV6 is the latest Internet Protocol. An IPV6 address looks like `1050:0000:0000:0000:0005:0600:300c:326`. It contains eight octets with sixteen bits each. The total number of IPV6 addresses is 340 trillion trillion trillion addresses.

Need of IPV6 Addressing

During the 1980s, the Internet Engineering Task Force (IETF) realized that 4.3 billion IPV4 addresses wouldn’t be enough due to the growing number of connected internet devices, as each device would need a unique IP address. So in 1998, IPV6 was created to accommodate **340 trillion trillion trillion** IP addresses.