Explain the IP Address its various classifications and usage

> Tags: Internet Protocol, Transmission Control Protocol, IP address,Local IP address, Global IP address, Internet Service Provider(ISP), IP Masquerading, Static IP, Dynamic IP,

How the Internet Works

Internet Protocol (IP) - enables computers to route communications traffic from one network to another

Transmission Control Protocol(TCP) - the widely used transport layer protocol that most internet applications use with IP.

IP address - a 32-bit(4 byte) number that identifies a computer on the Internet

- IPv6 uses 128-bits to widen the available address space.

IP Address

IP address is a unique network identification number organized in the formal below, containing 4 parts:

$$A.B.C.D$$

Each part takes values between 0-255.
Theoretically, with this logic we can have 4,294,967,296 unique IP addresses(with some exceptions)

Taking into consideration the growth of the Internet and devices connected to it(now one person holds more than one device connected to the Internet), in the 2000s, it was decided to gradually migrate to a newer version of IP addressing - **IPv6**
Traditional IP addressing is called **IPV4** addressing.

IPv6 addresses

In **IPv6** the address size was increased up to 128 bits, thus providing up to $3.4 \cdot 10^{38}$ addresses

IPv6 addresses are represented as 8 groups of 4 hexadecimal digits with the groups being separated by colons.

$$A:B:C:D:E:F:G:H$$

Each part is a number between 0 - 65535 (again with some exceptions)

Example:

$$2001 : cdba : 85a3 : 0000 : 0000 : 8a2e : 3257 : 9652$$

Migration to IPv6 shall be performed in a smooth way (systems shall support both standards) and probably the **total migration will take years**.

IP addresses can either be **local** or **global**.

Local IP addresses
are temporary "visible" only inside the given organization or sub-network

- This IP address can be repeated in many local networks and used for local routing
- Organizations do not pay any fee for local IP addresses

Global IP addresses
are part of the Internet ; they are unique and can be reached from any computer connected to the Internet.

- **Global IP addresses** are purchased from Tier 2 or Tier 3 organizations.

Local vs Global IP Explained

- Inside your house, you can put any number you want on doors of your rooms
- But it doesn't mean that postman will deliver posts addressed to them - these numbers are not registered anywhere(globally)
- You can set any numbers and change them whenever you want - they're only recognized internally.
- Only **you** know that room number 35 is kitchen.

This is how ***Local IP address work***

- When you build a house, you need to have it numbered officially and registered.
- When your house or apartment gets its number, postman locates your apartment easily.

This is a ***Global IP address analogy***

IP Masquerading

*is a form of **Network Address Translation(NAT)**,which allows internal computers with no known address outside their network, to communicate to the outside.*

Static and Dynamic IP

When a device is assigned a **Static IP address**, the address does not change.

Most devices use **Dynamic IP addresses**, which are assigned by the network when they connect and change over time.

Static IP addresses normally matter more when external devices or websites need to remember your IP address.

- One example is VPN or other remote access solutions that trust (whitelist), certain IPs for security purposes.