

IP Address – Detailed Notes

1. What is an IP Address?

- IP Address (Internet Protocol Address) is a unique number assigned to each device (like a computer, mobile, or printer) connected to a network or the internet.
- It acts like a home address for your device so data can reach the right destination.
- Every website or device on the internet has an IP address.

Example:

192.168.1.1 or 2400:cb00:2048:1::c629:d7a2



2. Full Form

IP – Internet Protocol

So, IP Address = Internet Protocol Address

3. Functions of IP Address

- Identifies the device on a network.
- Helps to locate the device in the network.
- Transfers data packets between devices.
- Ensures communication between networks (like from your computer to a website).

4. Types of IP Address

A. Based on Version

There are two main versions of IP:

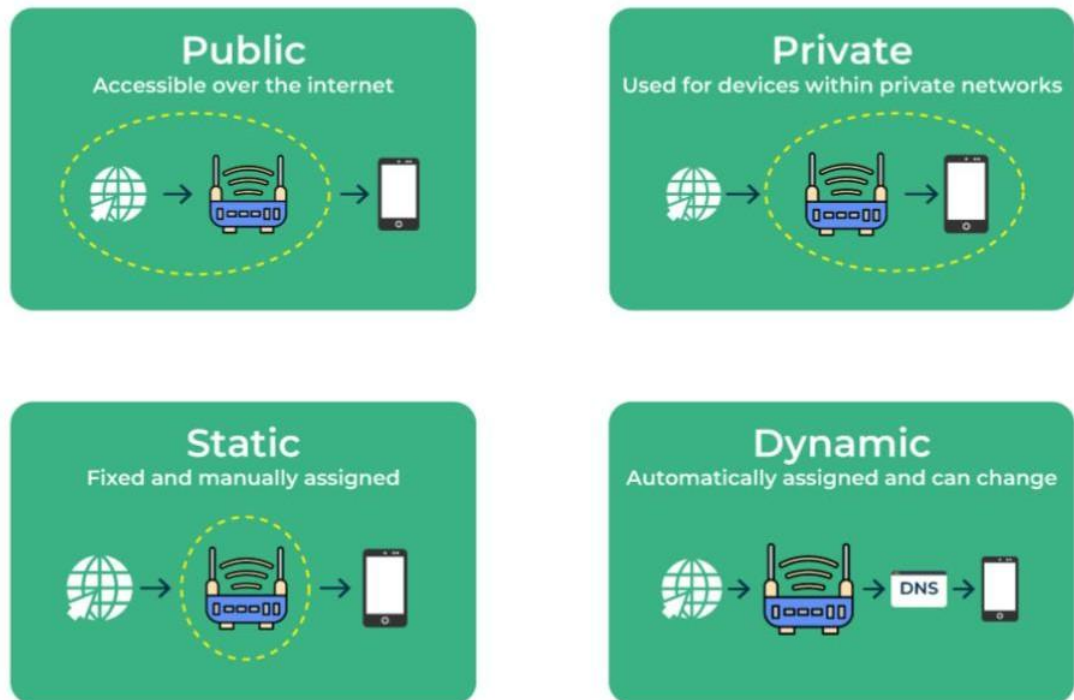
1. *IPv4 (Internet Protocol version 4)*

- Uses 32 bits address.
- Written as four numbers separated by dots.
- Each number can be from 0 to 255.
- Example: 192.168.1.1
- Total possible addresses: 4.3 billion (approx).
- Format: A.B.C.D (e.g., 192.0.2.1)

2. *IPv6 (Internet Protocol version 6)*

- Uses 128 bits address.
- Written as eight groups of hexadecimal numbers separated by colons.
- Example: 2400:cb00:2048:1::c629:d7a2
- Total possible addresses: almost unlimited.
- Developed to replace IPv4 due to shortage of addresses.

Types of IP Addresses



B. Based on Usage

1. Public IP Address

- Used to identify a device on the Internet.
- Unique for every device globally.
- Assigned by your Internet Service Provider (ISP).
- Example: When you search "What is my IP?", that's your public IP.

2. Private IP Address

- Used inside a local network (like home, office, or school).
- Not visible to the outside internet.
- Used for communication within LAN.
- Example ranges:

- 10.0.0.0 to 10.255.255.255
- 172.16.0.0 to 172.31.255.255
- 192.168.0.0 to 192.168.255.255

C. Based on Assignment

1. Static IP Address

- Fixed and does not change.
- Manually assigned by network admin.
- Used by servers and websites.
- Example: Company website servers.

2. Dynamic IP Address

- Automatically assigned by DHCP (Dynamic Host Configuration Protocol).
- Changes each time device connects to the network.
- Used for home and personal devices.
- Easy to manage and more secure.

5. IP Address Classes (IPv4)

Class	Range	Use	Default Network Mask
Class A	1.0.0.0 – 126.255.255.255	Very large networks	255.0.0.0
Class B	128.0.0.0 – 191.255.255.255	Medium-sized networks	255.255.0.0
Class C	192.0.0.0 – 223.255.255.255	Small networks	255.255.255.0
Class D	224.0.0.0 – 239.255.255.255	Multicasting	Not applicable
Class E	240.0.0.0 – 255.255.255.255	Experimental	Not applicable

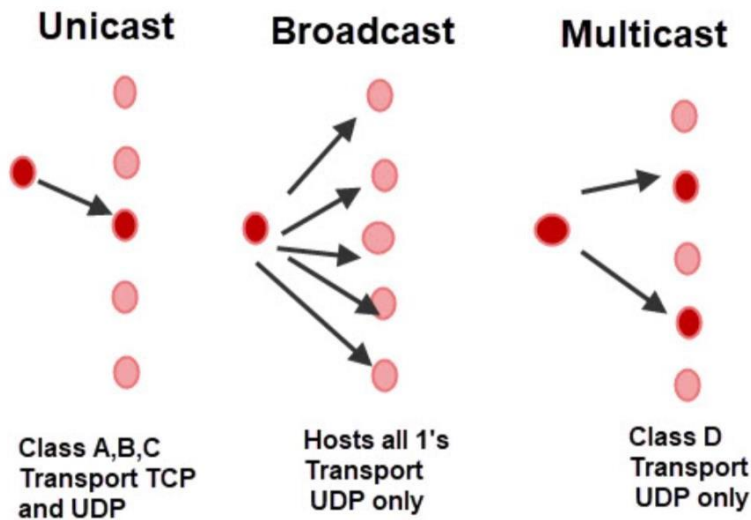
6. Subnet Mask

- Used to divide an IP address into network and host parts.
- Helps identify which part represents the network and which part represents the device.
- Example: 255.255.255.0

7. Difference Between IPv4 and IPv6

Feature	IPv4	IPv6
Address Length	32 bits	128 bits
Format	Decimal (dots)	Hexadecimal (colons)
Example	192.168.1.1	2400:cb00:2048:1::c629:d7a2
Total Addresses	~4.3 billion	Almost unlimited
Security	Optional (via IPSec)	Built-in IPSec
Speed	Slower	Faster & more efficient
Address Space	Limited	Vast and scalable

8. Types of IP Communication (Addressing Methods)



Unicast, Broadcast and Multicast IP Addressing

1. Unicast Address

- Data is sent from one device to one specific device.
- One-to-One communication.
- Commonly used for normal internet browsing or file transfer.
- Example: You visit a website — data goes directly between your device and the web server.

Example:

PC1 (192.168.1.5) → PC2 (192.168.1.10)

2. Broadcast Address

- Data is sent from one device to all devices in the same network.
- One-to-All communication.
- Used for sending announcements or discovering devices.
- Example: When a computer sends ARP request to find another device in LAN.
- IPv4 Broadcast Example: 192.168.1.255
- Note: IPv6 does not use broadcast; it uses multicast instead.

Example:

PC1 → (to all PCs in 192.168.1.0 network)

3. Multicast Address

- Data is sent from one device to a group of specific devices.
- One-to-Many communication.
- Used for video streaming, conferencing, or online gaming where data must reach multiple users efficiently.
- IPv4 Range: 224.0.0.0 to 239.255.255.255 (Class D)
- IPv6 uses FF00::/8 prefix for multicast addresses.

Example:

A teacher shares a live video lecture to multiple students' computers at once.

