

What is Internet Protocol (IP)?

- The Internet Protocol is a set of rules that allows our computers to communicate via the Internet. IP addresses are basically in charge of directing the data packets to their correct destinations. IP controls all Internet traffic. Data packets containing the IP addresses of their points of origin and destinations travel on the Internet.
- When you type an URL on your browser, a data packet including your IP address is transmitted to the web server's IP address, and the website corresponding to the URL is then served back to your device over the Internet.

What is the addressing scheme of IP address?

- The Internet addressing scheme consists of Internet Protocol (IP) addresses and two special cases of IP addresses: broadcast addresses and loopback addresses. The Internet Protocol (IP) uses a 32-bit, two-part address field.

What is IPv4?

- IPv4 is a major protocol in the TCP/IP suite. IPv4 addresses provide a way to uniquely identify the hosts in a network. IPv4 uses 32-bit logical addresses. Depending on the network type, there are various ways to configure IPv4 with multiple devices, including manual and automatic configurations.
- IPv4 uses the best-effort model, which means it does not guarantee delivery of data to a host or avoid duplicate delivery.
- For Ethernet communication, IPv4 uses five classes of 32-bit addresses – A, B, C, D, and E. The bit length for addressing the network host differs between Classes A, B, and C. Multicasting is reserved for class D addresses, whereas future use is reserved for class E addresses. IPv4 has a limit of 4.20×10^9 host addresses that it can allocate to end-users.

What is IPv6?

- As the popularity of the Internet grew in the 1990s, it was soon realized that the number of IP addresses that IPv4 can create is restricted, and it will get exhausted. Hence, the Internet Engineering Task Force (IETF) had developed IPv6, which is a better and upgraded version of IPv4 that was intended to replace IPv4 eventually.
- IPv6 provides 128-bit IP addresses, which means it can generate 3.4×10^{38} addresses. In layman's terms, it can generate trillions of trillions IP addresses. IPv6 reserves blocks of numbers for particular purposes. It prohibits using specific numbers entirely, so the total number of IPv6 addresses should be slightly less. Nonetheless, the amount of IPv6 addresses is almost endless, so there would be no dearth of IP addresses in the future.
- IPv6 addresses follow the same design principles. The addresses are divided into eight groups of four hexadecimal digits separated by colons. Most IPv6 addresses do not use all of their 128 bits, resulting in fields that are either entirely zeros or are padded with zeros. The two colons (::) can represent a contiguous 16-bit field of zeros in IPv6 addressing scheme.

Features	IPv4	IPv6
Address	32 bits	128 bits
Checksum in header	Included	No checksum
Header includes options	Required	Moved to IPv6 extension headers
Quality of Services (QoS)	Differentiated Services	Use traffic classes & flow labels
Fragmentation	Done by routers & source node	Only by the source node.
IP configuration	Manually or DHCP	Auto-configuration or DHCP
IPSec support	Optional	Required
Unicast, multicast and broadcast	Use all	Uses unicast, multicast and anycast
Address Resolution Protocol (ARP)	Use to resolve an IPv4 address	replaced by Neighbor Discovery
Internet Group Management Protocol (IGMP)	Use to manage local subnet group.	Replaced with Multicast Listener Discovery (MLD)
Domain Name System (DNS)	Use host address (A) resource records	Use host address (AAAA) resource records
Mobility	Use Mobile IPv4 (MIPv4)	MIPv6 with faster handover, routing and hierarchical mobility