

IPv4 vs IPv6: What's the Difference Between IPv4 and IPv6?

What is IP?

An **IP (Internet Protocol) address** is a numerical label assigned to each device connected to a [computer network](#) that uses the IP protocol for communication. An IP address acts as an identifier for a specific device on a particular network. The IP address is also called an IP number or Internet address.

IP address specifies the technical format of the addressing and packets scheme. Most networks combine IP with a TCP (Transmission Control Protocol). It also allows developing a virtual connection between a destination and a source.

Now in this IPv4 and IPv6 difference tutorial, we will learn What is IPv4 and IPv6?

What is IPv4?

IPv4 is an IP version widely used to identify devices on a network using an addressing system. It was the first version of IP deployed for production in the ARPANET in 1983. It uses a 32-bit address scheme to store 2^{32} addresses which is more than 4 billion addresses. It is considered the primary Internet Protocol and carries 94% of Internet traffic.

What is IPv6?

IPv6 is the most recent version of the Internet Protocol. This new IP address version is being deployed to fulfill the need for more Internet addresses. It was aimed to resolve issues that are associated with IPv4. With 128-bit address space, it allows 340 undecillion unique address space. IPv6 is also called IPng (Internet Protocol next generation).

Internet Engineer Taskforce initiated it in early 1994. The design and development of that suite are now called IPv6.

KEY DIFFERENCE

- IPv4 is 32-Bit IP address whereas IPv6 is a 128-Bit IP address.
- IPv4 is a numeric addressing method whereas IPv6 is an alphanumeric addressing method.
- IPv4 binary bits are separated by a dot(.) whereas IPv6 binary bits are separated by a colon(:).
- IPv4 offers 12 header fields whereas IPv6 offers 8 header fields.
- IPv4 supports broadcast whereas IPv6 doesn't support broadcast.
- IPv4 has checksum fields while IPv6 doesn't have checksum fields
- When we compare IPv4 and IPv6, IPv4 supports VLSM (Variable Length Subnet Mask) whereas IPv6 doesn't support VLSM.
- IPv4 uses ARP (Address Resolution Protocol) to map to MAC address whereas IPv6 uses NDP (Neighbour Discovery Protocol) to map to MAC address.

Features of IPv4

Following are the features of IPv4:

- Connectionless Protocol
- Allow creating a simple virtual communication layer over diversified devices
- It requires less memory, and ease of remembering addresses
- Already supported protocol by millions of devices
- Offers video libraries and conferences

Features of IPv6

Here are the features of IPv6:

- Hierarchical addressing and routing infrastructure
- Stateful and Stateless configuration
- Support for quality of service (QoS)
- An ideal protocol for neighboring node interaction

IPv4

VS

IPv6

Example: 127.255.255.255

Example:
2001:0db8:85a3:0000:0000:8a2e:0370:7334

IPv4 vs IPv6

Difference Between IPv4 and IPv6 Addresses

IPv4 & IPv6 are both [IP addresses](#) that are binary numbers. Comparing IPv6 vs IPv4, IPv4 is 32 bit binary number while IPv6 is 128 bit binary number address. IPv4 address are separated by periods while IPv6 address are separated by colons.

Both are used to identify machines connected to a network. In principle, they are the same, but they are different in how they work. Below are the main differences between IPv4 and IPv6:

Basis for differences	IPv4	IPv6
Size of IP address	IPv4 is a 32-Bit IP Address.	IPv6 is 128 Bit IP Address.

Basis for differences	IPv4	IPv6
Addressing method	IPv4 is a numeric address, and its binary bits are separated by a dot (.)	IPv6 is an alphanumeric address whose binary bits are separated by a colon (:). It also contains hexadecimal.
Number of header fields	12	8
Length of header field	20	40
Checksum	Has checksum fields	Does not have checksum fields
Example	12.244.233.165	2001:0db8:0000:0000:0000:ff00:0042:7879
Type of Addresses	Unicast, broadcast, and multicast.	Unicast, multicast, and anycast.
Number of classes	IPv4 offers five different classes of IP Address. Class A to E.	IPv6 allows storing an unlimited number of IP Address.
Configuration	You have to configure a newly installed system before it can communicate with other systems.	In IPv6, the configuration is optional, depending upon on functions needed.
VLSM support	IPv4 support VLSM (Variable Length Subnet mask).	IPv6 does not offer support for VLSM.
Fragmentation	Fragmentation is done by sending and forwarding routes.	Fragmentation is done by the sender.
Routing Information Protocol (RIP)	RIP is a routing protocol supported by the routed daemon.	RIP does not support IPv6. It uses static routes.
Network Configuration	Networks need to be configured either manually or with DHCP. IPv4 had several overlays to handle Internet growth, which require more maintenance efforts.	IPv6 support autoconfiguration capabilities.
Best feature	Widespread use of NAT (Network address translation) devices which allows single NAT address can mask thousands of non-routable addresses, making end-to-end integrity achievable.	It allows direct addressing because of vast address Space.
Address Mask	Use for the designated network from host portion.	Not used.
SNMP	SNMP is a protocol used for system management.	SNMP does not support IPv6.
Mobility & Interoperability	Relatively constrained network topologies to which move restrict mobility and interoperability capabilities.	IPv6 provides interoperability and mobility capabilities which are embedded in network devices.
Security	Security is dependent on applications - IPv4 was not designed with security in mind.	IPSec(Internet Protocol Security) is built into the IPv6 protocol, usable with a proper key infrastructure.
Packet size	Packet size 576 bytes required, fragmentation optional	1208 bytes required without fragmentation
Packet fragmentation	Allows from routers and sending host	Sending hosts only

Basis for differences	IPv4	IPv6
Packet header	Does not identify packet flow for QoS handling which includes checksum options.	Packet head contains Flow Label field that specifies packet flow for QoS handling
DNS records	Address (A) records, maps hostnames	Address (AAAA) records, maps hostnames
Address configuration	Manual or via DHCP	Stateless address autoconfiguration using Internet Control Message Protocol version 6 (ICMPv6) or DHCPv6
IP to MAC resolution	Broadcast ARP	Multicast Neighbour Solicitation
Local subnet Group management	Internet Group Management Protocol (IGMP)	Multicast Listener Discovery (MLD)
Optional Fields	Has Optional Fields	Does not have optional fields. But Extension headers are available.
IPSec	Internet Protocol Security (IPSec) concerning network security is optional	Internet Protocol Security (IPSec) concerning network security is mandatory
Dynamic host configuration Server	Clients have to approach DHCP Server (Dynamic Host Configuration Server) whenever they want to connect to a network.	A Client does not have to approach any such server as they are given permanent addresses.
Mapping	Uses ARP(Address Resolution Protocol) to map to MAC address	Uses NDP(Neighbour Discovery Protocol) to map to MAC address
Compatibility with mobile devices	IPv4 address uses the dot-decimal notation. That's why it is not suitable for mobile networks.	IPv6 address is represented in hexadecimal, colon-separated notation. IPv6 is better suited to mobile networks.

IPv4 and IPv6 cannot communicate with each other but can exist together on the same network. This is known as **Dual Stack**.