



## A comparative study of IP Versions 4, 5, and 6

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### Abstract

This research examines the Internet Protocol (IP) versions 4, 5, and 6, as well as the differences between them and which protocol is more suitable for the future of the internet, among other things. Through this research, we have established the most advantageous characteristics of these protocols, as well as the specific elements that each protocol uses to allow the internet network to operate at maximum capacity. The main aim of this study is to discover which of the internet protocols, IPv4, IPv5, or IPv6, is the most widely used. IPv4 is the most widely used protocol, followed by IPv5. The most essential elements of getting a more relevant job on the internet network are highlighted in this article. It all comes down to how IP protocols operate and what they accomplish.

## Introduction

There are two different versions of Internet protocols; IPv4 and IPv6, the primary objective of this study to establish which of the three protocols is the most widely utilized on the world, IPv4 (Internet Protocol), IPv5, and IPv6 will be compared. Additionally, this research breaks down the benefits of each and every individual that uses the internet network. It is concerned with how an IP address works, what IP protocols are available, and what they perform.

When the Internet Protocol (IP) was first created in September 1981, every computer connecting an IP-based Internet required a unique 32-bit internet address number. Previously, IP4 was the most often used protocol. Each network interface is assigned a 32-bit address in this version of the Internet Protocol. In the dotted quad decimal format, where each field's value is stated as a decimal integer, and the fields are separated by dots between each field (Dhamale et al., 2018).

There was never an IPv5. The IPv5 address was assigned to identify packets containing the nominal name of the Internet stream protocol, which was first proposed in late 1970 for experimental transmission of video, audio, and simulation distribution (NuraYusuf & Ya'u, (2016; Clark, 2018).

IPv6 is planned to replace the IPv4 protocol, which has limited internet expansion and usage, particularly in China, India, and other densely populated Asian nations. IPv6 is an abbreviation for the internet protocol, and it is one of the key technologies that help the global network run smoothly (Kumar & Shinde, 2016).

The purpose of this article is to examine the most important characteristics of the two procedures and to make a comparison between them.

Babatunde & Al-Debagy. (2014) have discussed the development of version 4 of the Internet Protocol (IPv4), its features, problems and limits, and how Internet Protocol version 6 (IPv6) tends to address some of these difficulties, including the differences and transition between these two protocols. NuraYusuf & Ya'u (2016) It provides actual work and network management advice for correct configuration choices under pre-defined and rigorous networking conditions. The IPSec protocols suite has to be provided to fit a particular network environment while considering the cost/penalty of overhead performance participation. While the main objectives of this study are to examine the effect of IPSec overheads on the IPv6 network compared to the IPv4 network, and to assess processing and space overheads imposed on IPv4 and IPv6 networks presently supported by IPSec by various cryptographic algorithms.

Dhamale et al (2018) have explained how the migration from IPv4 to IPv6 takes place. This study attempts to discover a way to minimize IPv6 deployment barriers and suggests a suitable transition method for moving from IPv4 to IPv6. Different transition methods are examined for throughput, round-trip time, and jitter. Due to the minimal header processing, the Dual Stack Transition method performs better than other tunneling strategies.

Paul & Bakon, (2016) Evaluated, compared and reported results based on the performance of two protocol stacks (IPv4 and IPv6) on different parameters analyzed when data is transmitted from one client to another or to a server over a wired network on IPv4 compared to IPv6, thus proposing a system that supports the coexistence of IPv4 and IPv6. The topic of the Internet Protocol version 6 (IPv6) new-generation numbering system is addressed as the depletion of Internet Protocol version 4 (IPv4) numbering system address space becomes a concern. Explanatory research on the IPv6 addressing architecture has been conducted, but the all-powerful objectives have yet to be met.

### **The background of internet protocols**

Known as the internet protocol (IP), it is a network layer protocol that is utilized by TCP/IP for addressing and routing data packets between nodes on the internet. The internet protocol is the component of the internet that is responsible for the operation of the whole network; it is also the portion that is responsible for the delivery of data. A network protocol is required for computers to communicate with one another. The IP protocol for the network layer is designated by the OSI model. The fact that the number of computers connected to the internet is expanding suggests that the IPv4 address pool on the internet is being depleted. IPv6 has become a standard as a result of the efforts of researchers who have adopted it (Alhassoun& Alghunaim, 2016).

IPv1, IPv2, and IPv3 preceded IPv4. TCP, the previous incarnation of IP (which, as previously stated, included the functionality of IP until it was split into v4), had already been completed.

When the internet was invented, the network was far smaller. Its addressing method, which employs 32-bit binary addresses in "dotted decimal" notation with four octets for human convenience, appears to be more than adequate (Huang et al., 2018).

### **Internet Protocol Version 4 (IPv4)**

IPv4 (Internet Protocol version 4) is a network addressing type used in the TCP/IP network protocol that can only handle 4 billion users. IPv4 addresses have a netmask address. 1-255 may be the 32-bit length address (Paul & Bakon, 2016). NetID and numbers are provided A network ID is a network ID. IPv4 addresses are based on base-10 numbers. A net ID is a unique network identification. It's unlike any other computer. NetID, knot to modify the netmask, update the net ID and node. To verify the local address, a netmask is needed. For local-only PCs, no specific netmask is needed. Routing data is needed before it is forwarded to a non-local computer. 1 RL. 4bn IP addresses. The amount allocated is around 4 percent of

the total. This broad range of addresses may be introduced more than 7.991028 times. (Nagaraj et al., 2010) IPv4 is an acronym for Internet Protocol Version 4. C++ implements ISST, a new experimental stream protocol using IPv5. In the future, the overwhelming majority of networks will need IPv6. IPv5 was a huge failure. Dissonance is the number one thing listed (approximately 20 years). The ST-Internet stream protocol (RFC-1819) was created in the 1970s for Internet transmission of music and video content (Paul & Bakon, 2016; Chandra et al., 2013; Nagaraj et al., 2010) IPv5 is inexistent. Version 5 experimentally detailed ST, the non-IP real-time stream protocol. The IP 6th edition is assigned to ST 5 (Alhassoun & Alghunaim, 2016; Ali, 2012) Known as RFC 1819 Due to its enormous size and number, moving from IPv4 to IPv6 instantly is not possible (Majeed et al., 2021).

### **Internet Protocol Version 6 (IPv6)**

IPv6 was created to replace IPv4, the primary Internet address protocol. IPv6 is the most recent Internet Protocol (IP) developed by the Internet Engineering Task Force (IETF). anticipating the depletion of IPv4 in 1991. An IPv6 address is 128 bits long, which is  $3.4 \times 10^{38}$  or  $7.9 \times 10^{28}$  or 2128. The world has 4.3 billion IPv4 addresses. IPv6 is the future of IPv4. Multicasts are also possible. Many websites make use of scalability and IPsec. Addresses are more accessible when they have unique IPv6 addresses. One billion unique IPv4 addresses will be utilized by 2020 (Feldner & Herber, 2018; Hamid et al., 2021). The new IPv6 protocol includes 128-bit encryption. It is not feasible to move to a bigger site than IPv4 (Nithya & alias Jeyanthi, 2017; Kalwar et al., 2015; Wahyudi, 2021). IPv6 adoption started slowly but quickly accelerated for a variety of reasons. IPv6 is still in use. The protocol suite of the IETF (IPv6). IPv6 is expected to last as long as IPv4. IPv6 has many advantages. IPv6's potential growth. The number of accessible addresses is four times the number of unique addresses. PvP6 has a number of connections. It is tough to use and construct. The addresses of devices are fixed. Device IDs guarantee that there are enough IPv4 addresses accessible. There are  $340 \times 10^{12}$  IPv6 addresses available. This test shows an increase in IPv6 performance. It is feasible to improve routing. IPv6 is used in the creation of IoT devices and network sensors. IPv6 now supports 128-bit transfers (Nithya & alias Jeyanthi, 2017; Ashraf et al., 2020; Hamid et al., 2021; Kalwar et al., 2015; Wahyudi, 2021).

### **The Results of the Comparative Analysis**

For this study, we examined IPv4 and IPv6, their history, headers, and fields. IPv4 was deployed worldwide for the first time. More internet-capable devices are making IPv4 an issue. IPv4 has issues, but IPv6 solves them. To extend these devices, gadgets need IP addresses. IPv4 addresses are 32-bit length, while IPv6 addresses are 128-bit length.

IPv4 has mobility issues. An IP address that has moved must be re-discovered. IPv6 helps mobile users. A mobile node may move without losing its IP address. End nodes are the most insecure. IPsec data is contained in the IPv6 header. This uses AH, ESP, and IKE. The system uses automation or DHCP for IP allocation. IPv6 has been anticipated to exceed IPv4 for years.

There should be an in-depth investigation of IPv4 and IPv6. Having a good understanding of IPv4/IPv6 addressing using tunneling and dual stack technologies is very important. A dual-stack/tunneling comparison. A dual stack is not supported by current network equipment. The network function is unaffected, and may greatly improve reliability. It has obvious usefulness. Using IPv6, existing tunneling methods may impact different performance metrics. More research and investigation is required to generate internet addresses.

Table 1. the difference between IPV4 and IPV6

IPV4 Addressing	Format :32 bit Representation: decimal Total no. of addresses: 4,294,967,296 unique addresses Mode: Unicast, Broadcast, Multicast
IPV6 Addressing	Format :128 bit Representation: Hexadecimal Total no. of addresses: 340,282,366,920,938,463,463,374,607,431,7 addresses 68,211,456 unique addresses Mode: Unicast, Multicast, Anycast
IPV4 Packet Format	There are 12 fields. An IP header contains the following information: version number, Internet Header length, type of service, Total Length, Identification flags, Fragment offset, Time-to-Live information, Protocol, Header checksum information, Source and Destination addresses, and Options.
IPV6 Packet Format	There are eight fields. The IP Header contains information such as the version, Traffic Classes, Flow Label, Payload Length, Next Header, Hop Limit, and so on. IPv6 Source Address (128 bits), IPv6 Destination Address (128 bits) (128 bits)
IPV4 Style of Address	dotted decimal notation E.g., 192.172.10.3.
IPV6 Style of Address	Suppressing leading zeros in the colon in the hexadecimal output. Dotted-decimal notation IPv4-compatible addresses are stated. F90:0000:0000:0000:0301:B3EE:FE1E:80
IPV4 Loopback Address	127.0.0.1
IPV6 Loopback Address	::1
IPV4 Representation of bits in a network.	Dotted-decimal subnet mask
IPV6 representation of bits in a network.	Notation only for prefix length

## Conclusion

Pv4 and IPv6 are used wherever required. IPv6 is a dynamic domain and mobility is the future. The additional address space offered by IPv6 makes it more useful. This was built to replace IPv4, but it will take many years before we fully transition. In this study, we have discovered that the future of the internet is based on Pv6. However, there will be many years before everyone migrates to IPv6. Multiple methods will enable these protocols to coexist, with no problems, as more businesses move to the new standard. Stack/tunneling is helpful for IPv4/IPv6 address decoding. Setup is easy, and network support is strong. This technique is reliable and doesn't impact network operations. Tunneling is crucial. IPv6 will affect many of the performance indicators. A significant amount of further study is required to finalize the internet addressing method. Rich environments have many components. IPv6's future on TCP/IP and on the Internet is expected. To test the Internet, IPv6 is used. IPv4 comprehension techniques No-this broadcast address technique is no longer in use. The node uses this IP address as its IPv4 address. Both ends of IPv6 networking expertise must be in place. Only 8% of IPv4 addresses are available. IPv4 will be depleted. IPv6 addresses last for an extended period of time. useless for all approaches Large IPv4-to-IPv6 migrations exist. IPv4 is faster than IPv6. IPv6 headers are larger than IPv4 headers (IPv4 header is 32 long while the source and destination addresses of IPv6 header are 128 bits long). Furthermore, 41.1% of IPv6 traffic flowed down the network. We're thankful for CLSU-enabled user devices. There are many hurdles that IPv6 faces today. Lastly, we'll examine IPv6-specific migration issues.

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