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Internet Protocol Version 6 (Ipv6)

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Abstract

Internet Protocol version 6 (**IPv6**) is the latest revision of the Internet Protocol (IP), the communications protocol that provides an identification and location system for computers on networks and routes traffic across the Internet. IPv6 was developed by the Internet Engineering Task Force (IETF) to deal with the long-anticipated problem of IPv4 address exhaustion.IPv6 is intended to replace IPv4, which still carries the vast majority of Internet traffic as of 2013. As of late November 2012, IPv6 traffic share was reported to be approaching 1%. Every device on the Internet must be assigned an IP address in order to communicate with other devices. With the ever-increasing number of new devices being connected to the Internet, the need arose for more addresses than IPv4 is able to accommodate. IPv6 uses a 128-bit address, allowing 2^{128}, or approximately3.4×10^{38} addresses, or more than 7.9×10^{28} times as many as IPv4, which uses 32-bit addresses. IPv4 allows only approximately 4.3 billion addresses. The two protocols are not designed to be interoperable, complicating the transition to IPv6.IPv6 addresses are represented as eight groups of four hexadecimal digits separated by colons, for example2001:0db8:85a3:0042:1000:8a2e:0370:7334, but methods of abbreviation of this full notation exist.

1. Introduction

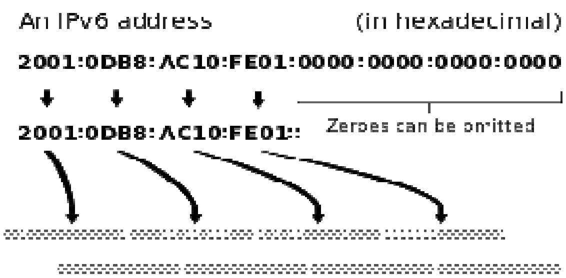
IPv6 is an Internet Layer protocol for packet-switched internetworking and provides end-to-end datagram transmission across multiple IP networks, closely adhering to the design principles developed in the previous version of the protocol, Internet Protocol Version 4 (IPv4). IPv6 was first formally described in Internet document RFC 2460, published in December 1998. In addition to offering more addresses, IPv6 also implements features not present in IPv4.

It simplifies aspects of address assignment (stateless address auto configuration), network renumbering and router announcements when changing network connectivity providers. It simplifies processing of packets by routers by placing the need for packet fragmentation into the end points. The IPv6 subnet size is standardized by fixing the size of the host identifier portion of an address to 64 bits to facilitate an automatic mechanism for forming the host identifier from link layer addressing information (MAC address). Network security was a design requirement of the IPv6 architecture, and included the original specification of IPsec.IPv6 does not specify interoperability features with IPv4, but essentially creates a parallel, independent network. Exchanging traffic between the two network requires

2. Comparison with Ipv4

On the Internet, data is transmitted in the form of network packets. IPv6 specifies a new packet format, designed to minimize packet header processing by routers. Because the headers of IPv4 packets and IPv6 packets are significantly different, the two protocols are not interoperable.

However, in most respects, IPv6 is a conservative extension of IPv4. Most transport and application-layer protocols need little or no change to operate over IPv6; exceptions are application protocols that embed internet-layer addresses, such as FTP and NTPv3, where the new address format may cause conflicts with existing protocol syntax.



The main advantage of IPv6 over IPv4 is its larger address space. The length of an IPv6 address is 128 bits, compared with 32 bits in IPv4. The address space therefore has 2^{128} or approximately 3.4×10^{38} addresses. By comparison, this amounts to approximately 4.8×10^{28} addresses for each of the seven billion people alive in 2011. In addition, the IPv4 address space is poorly allocated, with approximately 14% of all available addresses utilized. While these numbers are large, it wasn't the intent of the designers of the IPv6 address space to assure geographical saturation with usable addresses. Rather, the longer addresses simplify allocation of addresses, enable efficient route aggregation, and allow implementation of special addressing features. Internet Protocol Security (IPsec) was originally developed for IPv6, but found widespread deployment first in IPv4, for which it was re-engineered. IPsec was a mandatory specification of the base IPv6 protocol suite, but has since been made optional.

3. Packet format

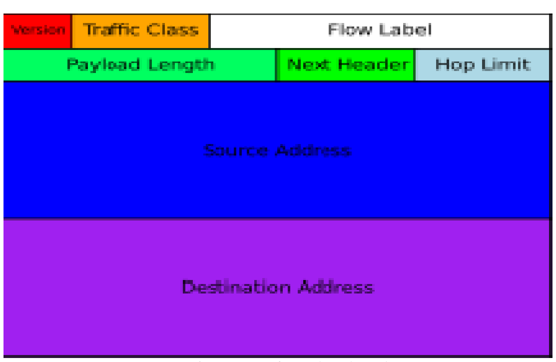


Fig 1: IPv6 packet header

An IPv6 packet has two parts: a header and payload. The header consists of a fixed portion with minimal functionality required for all packets and may be followed by optional extensions to implement special features. The fixed header occupies the first 40 octets (320 bits) of the IPv6 packet. It contains the source and destination addresses, traffic classification options, a hop counter, and the type of the optional extension or payload which follows the header. This *Next Header* field tells the receiver how to interpret the data which follows the header. If the packet contains options, this field contains the option type of the next option. The "Next Header" field of the last option, points to the upper-layer protocol that is carried in the packet's payload. Extension headers carry options that are used for special treatment of a packet in the network, e.g., for routing, fragmentation, and for security using the IPsec framework. Without special options, a payload must be less than 64kB. With a Jumbo Payload option (in a *Hop-By-Hop Options* extension header), the payload must be less than 4 GB. Unlike in IPv4, routers never fragment a packet. Hosts are expected to use Path MTU Discovery to make their packets small enough to reach the destination without needing to be fragmented. See IPv6 packet fragmentation.

4. Address representation

The 128 bits of an IPv6 address are represented in 8 groups of 16 bits each. Each group is written as 4 hexadecimal digits and the groups are separated by colons (:). The address 2001:0db8:0000:0000:0000:ff00:0042:8329 is an example of this representation.

For convenience, an IPv6 address may be abbreviated to shorter notations by application of the following rules, where possible.

1. One or more leading zeroes from any groups of hexadecimal digits are removed; this is usually done to either all or none of the leading zeroes. For example, the group *0042* is converted to *42*.
2. Consecutive sections of zeroes are replaced with a double colon (::). The double colon may only be used once in an address, as multiple use would render the address indeterminate. RFC 5952recommends that a double colon should not be used to denote an omitted single section of zeroes.[38]

An example of application of these rules:
Initial address: 2001:0db8:0000:0000:0000:ff00:0042:8329
After removing all leading zeroes: 2001:db8:0:0:0:ff00:42:8329
After omitting consecutive sections of zeroes: 2001:db8::ff00:42:8329
The loopback address, 0000:0000:0000:0000:0000:0000:0000:0001 may be abbreviated to: 1 by using both rules.

As an IPv6 address may have morthan one representation, the IETF has issued a proposed standard for representing them in text.

5. Conclusion

An IPv4 IP address is comprised of four octets (8 bits), with each of those four octets capable of going from 0 to 255. And, by the way, it's sheer coincidence that IPv4 has 4 octets; the two 4s are completely unrelated. Now, multiply 255 four times and you get a massive number – 4,228,250,625.This, dear reader, is the total number of available IPv4 addresses. Yet, we've already completely exhausted all 4.3 billion addresses. Enter IPv6 which effectively takes us from the four octets of IPv4 to a staggeringly vast pool of 128 bits.If you want to know how many addresses that is, I caution you - don't try using your calculator; it might, well, go up in smoke! Why, you ask? Well, that number is 2 to the power of 128 OR 3.4 x 10 to the power of 38 OR, get this, 340 undecillions (or sextillions). To understand its magnitude, let's just say there aren't even enough stars in the universe to total that number!

References

[1]. David Frost (20 April 2011). "Ipv6 traffic volumes going backwards".iTWire. Retrieved 19 February 2012.

[2]. Poppe, Yves (28 November 2012). "IPv6: A 2012 Report Card". Circle ID. Retrieved 9 December 2012.

[3]. a b c d e f RFC 2460, Internet Protocol, Version 6 (IPv6) Specification, S. Deering, R. Hinden (December 1998)

[4]. Google IPv6 Conference 2008: What will the IPv6 Internet look like?. Event occurs at 13:35.

[5]. a b c RFC 1752 The Recommendation for the IP Next Generation Protocol, S. Bradner, A. Mankin, January 1995.