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COMPARITIVE STUDY ON IPV4 AND IPV6 INTERNET PROTOCOL

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Abstract: As we know daily many devices are manufactured which need an IP address to get connected to internet. IPv6 is known as next generation IP which is currently being used at few places and still more research are going on in this region, this paper contains the comparison between the two IP address schemes namely IPv4 and IPv6. The header formats and performance parameters of the both scheme are discussed. Also the benefits of IPv6 over IPv4 is discussed in brief

Keyword:-IPv4; IPv6; IPsec; Interface; Protocol

I. INTRODUCTION

Every device on the Internet is assigned an IP address for identification purpose. With the hasty need of the Internet in the year 1990, it became obvious that far more addresses than the IPv4 address space will be needed for new devices to connect to internet in the future [1]. The IPv4 version uses 32-bit addresses which is around 4.3 billion devices can be connected with their identical IP. By 1998, the Internet Engineering Task Force (IETF) had formalized the protocol named IPv6. IPv6 uses a 128-bit address which allows approximately 3.4×10^{38} addresses which is more than 7.9×10^{28} times then the IPv4[2].

A significant difference in address notation of IPv6 and IPv4 is that the IPv4 uses a period (.) between each octet while in case of IPv6 it uses a colon (:).

II. IPV4.

Class	High order bits	Start	end
A	0	0.0.0.0	127.255.255.255
B	10	128.0.0.0	191.255.255.255
C	110	192.0.0.0	223.255.255.255
Multicast	1110	224.0.0.0	239.255.255.255

Table 1. Different class ranges of IPv4 [3]

The following figure shows the different parts of an IPv4 address, 172.16.50.56



Figure 1. IPv4 Address Format [3]

A. 172.16

This is registered IPv4 network number. In class-based IPv4 notation, this number also defines the IP network class. Here it is class B.

B.50.56

This shows host part of the IPv4 address. The host part uniquely identifies an interface on a system on a network. On each interface on a local network, the network part of the address is the same, but the host part should be different.

III. PV6

IPv6 is internet version 6 – next generation IP. This is currently being used at few places the address format of this version is shown in figure 2.

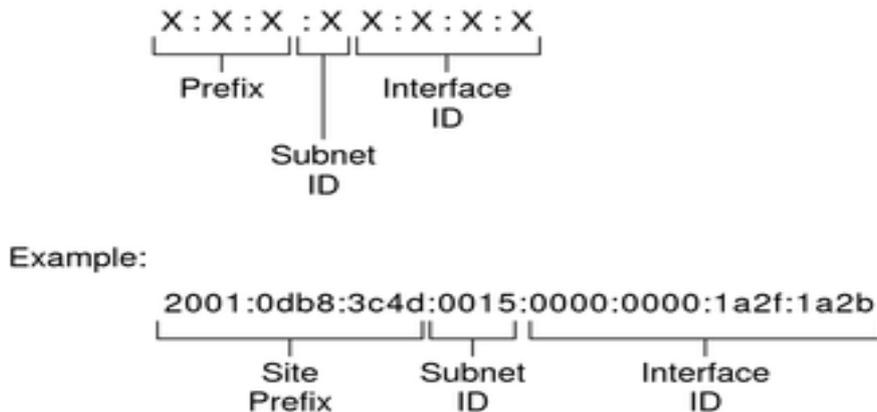


Figure 2. IPv6 Address Format[4]

Site prefix: - This is first three leftmost fields of address it occupies 48bits. This is used to describe the public topology that is allocated by ISP or RIR

Subnet ID: - This is the field just after site prefix which occupies 16bits ID which is allocated to site. This ID is usually allocated by private topology also known as site topology.

Interface ID:-This is the rightmost four fields which occupies 64 bits which is referred as a token. The interface ID is either automatically configured from the interface's MAC address or manually configured in EUI-64 format.

Consider again the address in figure 2:

E.G 2001:0db8:3c4d:0015:0000:0000:1a2f:1a2b

1. The first 48 bits, 2001:0db8:3c4d, contain the site prefix, representing the public topology.
2. The next 16 bits, 0015, contain the subnet ID, representing the private topology for the site.
3. The right most 64 bits, 0000:0000:1a2f:1a2b, contain the interface ID.

IV. HEADER OF IPV4 AND IPV6

The figure 3 shows two header formats first format is for IPv4 and second is for IPv6 different colours are used to express difference and similarity.

Few main changes which are seen in two headers are listed below:-

- A. Types of services are replaced by traffic class and a new field flow label.
- B. Time to live in IPv4 is replaced by hop limit in IPv6.
- C. Protocol in IPv4 is replaced by next header in IPv6.
- D. Source address size increased from 32 bit (IPv4) to 128 bit (IPv6).
- E. Destination address size increased from 32 bit (IPv4) to 128 bit (IPv6).
- F. Few fields like options padding flags etc. are removed from IPv6 which are available in IPv4

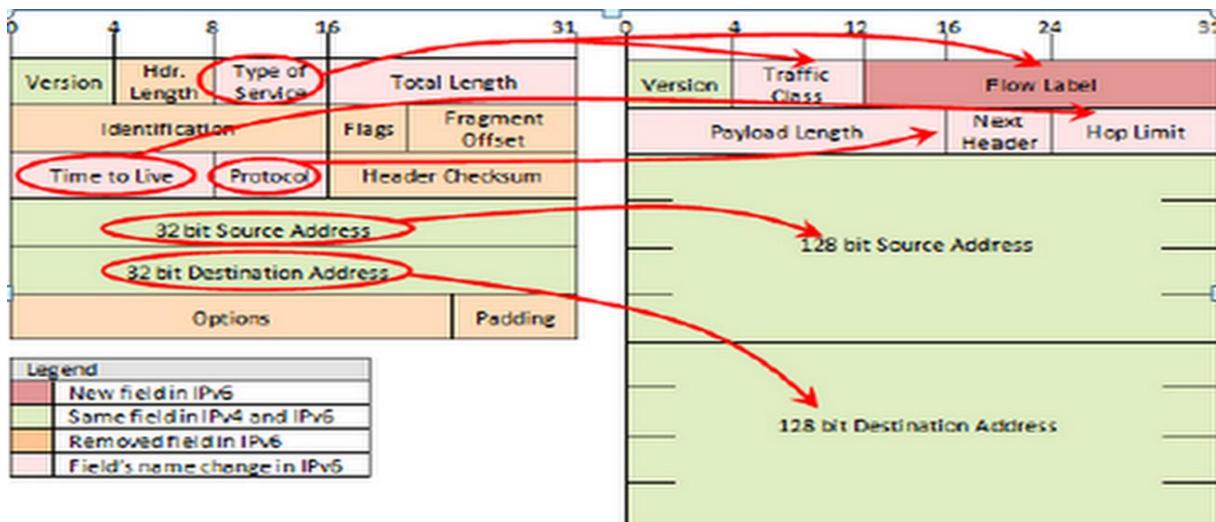


Figure 3. Headers of IPv4 and IPv6[5]

V. COMPARITION BETWEEN IPV4 AND IPV6:-

Parameter	IPv4	IPv6
Addresses length	32 bit	128bit
Address notation	Decimal	Hexadecimal
Address types	Unicast, multicast, and broadcast.	Unicast, multicast, and any cast
IP Sec	Optional	Inbuilt
Fragmentation	Done by sender and forwarding routers	Only by sender
Checksum field in header	Available.	Unavailable
Configuration	Manual (static) or dynamic (DHCP)	Auto configuration
File transfer protocol	allows you to send and receive files across networks	FTP is not supported.
IP header length	Variable length 20-60 bytes	Fixed length 40 bytes
IP header options	Various options available.	Header has no options available.
LAN connection	It can be used by an IP interface to get to the physical network.eg token ring ,Ethernet etc.	IT can be used with any Ethernet adapters and is also supported over virtual Ethernet between logical partitions
Loopback address	127.0.0.1	::1
Maximum Transmission Unit (MTU)	576 bytes	1280 bytes
Network Address Translation (NAT)	Supported	Unsupported
Packet filtering	Supported	Unsupported
Telnet	Telnet allows you to log on and use a remote computer	Does not support
Transport layers	TCP, UDP, RAW	Same transport layer exist in IPv6
Virtual private network (VPN)	allows you to extend a secure, private network over an existing public network using IPsec	VPN is not supported

Table 2. Difference between IPv4 and IPv6 [6][7]

VI. PERFORMANCE FACTORS:-

In this section the various performance issues are discussed, the different issues are as below :-

A. Address Space:-

In comparison with IPv4, IPV6 is having much more address spaces. Additionally the address bit structure is more simplified in the version 6 of IP. It also uses the Flow level field which is new in IPv6 that provides the series of the packet while data transmission. Thus, comparing with the IPV4, IPv6 can give more services.

B.Throughput:-

The throughput for the protocols is known by measuring its packet size in bytes. But is seen that throughput levels of both the protocol increase with increase in size of packet. While comparing the case of the connectionless service of both the protocol, IPV4 provides the high throughput when number of packets is increased.

C.Security Issues:-

In Comparison with the IPV4, the IPv6 offers intermediary proxies, plug and play services. The IPv4 is purely based on the local host connections. The IPv6 provides the end to end connection on the network. Hence it delivers the connection

oriented services that offer the higher security to the data on the transmission link. As IPv6 provides peer to peer connection many application like VOIP is easier to use. IPv6 has built-in Auto-configuration mechanisms that allow users to communicate with one another. Also IPsec is inbuilt in IPv6 which provides more security in comparison with IPv4.

D. Jitter Value:-

IPv6 tunnels can be built on IPv4 networks and initially all IPv6 nodes will follow the dual stack approach means that they will support both IPv4 and IPv6 at the same time. Variation in the jitter value between packets arriving at the destination can be calculated and result will be like IPv6 has lower jitter values while it holds the connection oriented services.

VII. LIMITATIONS OF IPV4

Limitations of IPv4 are as below:-

1. Scarcity of IPv4 Addresses:-

Limited amount of IP address of this version is available and almost this all are going to be over so we need new version which can comply with our need of more addresses.

2. Security Related Issues:-

Internet Protocol Security (IPsec) provides security for IPv4 packets, but Internet Protocol Security (IPsec) is not built-in and optional.

3. Address configuration related issues:-

Networks and also internet is increasing and many new computers and devices are using IP to get connected to internet. The configuration of IP addresses has to be done by static or dynamic but this method should be easier than it is currently available.

4. Quality of service (QoS):-

QoS relies on 8bit field known as Type of Service (TOS) which has limited functionality and payload identification is not possible when the IPv4 datagram packet payload is encrypted [8].

VIII. ADVANTAGES OF IPV6

Advantages of IPv6 are as below:-

1. More Efficient Routing:-

IPv6 reduces the size of routing tables and makes routing more efficient and hierarchical.

2. More Efficient Packet Processing:-

IPv6's has simplified packet header which makes packet processing more efficient. Compared with IPv4, IPv6 contains no IP-level checksum, so the checksum does not need to be recalculated at every router hop [9].

3. Directed Data Flows :-

IPv6 supports multicast rather than broadcast. Multicast allows bandwidth-intensive packet flows to be sent to multiple destinations simultaneously, saving network bandwidth [9].

4. Simplified Network Configuration:-

Address auto-configuration is built in to IPv6. A router will send the prefix of the local link in its router announcements.

5. For New Services:-

As Network Address Translation (NAT) is eliminated we are able to get end-to-end connectivity at the IP layer which enables us for new and valuable services.

6. Security:-

IPsec which provides confidentiality, authentication and data integrity is built-in, because of their potential to carry malware are blocked by firewall.

7. Mobility:-

IPv6 makes it possible to assign several addresses to one network interface at the same time which allows users to access the different network at anyplace in world [10].

IX. CONCLUSION

As we know that today mainly all devices which are connected to internet uses IPv4 but due to lower address space we have to go with an alternative version of IP address which provides huge number of new connection to internet known as IPv6, also it is seen that it provide better security (IPsec) in comparison with IPv4. All IPv6 has many benefits and also complexity is reduced too much extent. Still more research are going on the IPv6 conversion and soon almost all devices will be working on it.

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