Vidya Jyothi Institute of Technology

(An Autonomous Institution)

(Accredited by NAAC, Approved by AICTE New Delhi & Permanently Affiliated to JNTUH)

Aziznagar Gate, C.B. Post, Hyderabad-500 075

Innovative/ Student Centric Teaching Method

2021-22

Faculty Name: Mrs. A Swarna

Course: CN

Class-Section: D

Mode of Innovative Teaching: Journal Review

Description about the mode:

A journal is an instrumental tool for helping students develop their ability to critically examine their surroundings from multiple perspectives and to make informed judgments about what they see and hear. Many students find that writing or drawing in a journal helps them process ideas, formulate questions, and retain information. Journals make learning visible by providing a safe, accessible space for students to share thoughts, feelings, and uncertainties. In this way, journals are also an assessment tool: you can use them to better understand what your students know, what they are struggling to understand, and how their thinking has changed over time.

Topic Handled: IPv4 and IPv6

Outcome of the teaching mode:

Students evaluated, compared and reported result based on the performance of two protocol stacks (IPv4 and IPv6) in terms of various parameters in history, address structure, header's structure, the fields of headers, security, routing protocols, IP address configuration, function of different protocols, etc are analyzed

when the data is being transmitted from being transmitted from one client to another or to a server over a wired network on IPv4 in comparison with the IPv6.

Abstract

Internet protocol (IP) addresses are critical resources for the Internet. Every device that connects to the Internet in the network is given an IP address. The addresses are still assigned using the IPv4 of Internet Protocol.IPv4 has shown to be a reliable protocol compatibility with a wide range of protocols and applications, ease of implementation as well. However, with the intensification in the number of devices (computer, mobile, tablet, routers, server, and so on), there are no more addresses available. Hence A new version is in the implementation process i.e. Internet Protocol Version 6(IPv6).It has been implemented in order to provide new services. This research compares and contrasts features of IPv4, the fields of headers, as well as the structure of headers and explains the limitations of IPv4 and the advantages of IPv6 over the IPv4.

Introduction

The new technology is evolving every day, the new computing devices are into the daily life which require the connectivity of internet. The Internet has become the global need. The Internet Technology or it can be called the **Standard Internet Protocol (IP)** is responsible for connection millions of millions devices across the globe. IPv4 is the 4th version of the Internet Protocol (IP).The IPv4 is the current Internet Protocol that is used to route the Internet Traffic. However, with the escalation of the devices, there is a scarcity of IPv4 addresses i.e. there are less number of IPv4 addresses which are unallocated and this version of Internet

Protocol was not able to satisfy the challenging needs of the Internet. It is causing the major problem Ipv4 address exhaustion

To overcome the problem of IPv4, a new version came out as a solution i.e. IPv6, it has overcame the problem of address exhaustion in IPv4 and it provides other services over the Ipv4. In December 1998, IPv6 became a Draft Standard for the IETF, who subsequently ratified it as an Internet Standard on 14 July 2017. IPv6 uses a 128-bit address allowing 2^{128}, or approximately 3.4×10^{38} addresses.

IPv4

Internet Protocol Version 4 is the protocol which is used in Network Layer OSI for the packet transmission. Ipv4 is the currently using version. Ipv4 is of 32 bit IP address. It has unicast, multicast and broadcast types of addresses. Ipv4 is a connectionless protocol used in packet-switched networks

Advantages of IPv4

- IPv4 is required to encrypt data and maintain privacy. It encrypts data in its address packets as part of its security procedures.
- The IPv4 protocol is easily supported by the majority of topology diagrams.
- In IPv4, the routing mechanism has become more efficient since addresses are merged more effectively.
- IPv4 routing, which is part of the IPv4 protocol, is simply handled by both devices. As a result, almost every significant device will support the IPv4 protocol.
- IPv4 goes to tremendous efforts to guarantee data packets reach their intended destination. This is due to the usage of IPv4 versions in the transmission control protocol.
- The basic goal of IPv4 is to connect various sorts of devices together.

Limitations of IPv4

- *The scarcity of address space* - as the number of different devices linked to the Internet grows exponentially, the address space becomes increasingly scarce.
- *Inadequate protocol extensibility* - the IPv4 header is too small to accommodate the requisite amount of extra parameters
- *The problem of communication security*: there are no controls in place to prevent access to information stored on the network. IPv4 was never intended to be secure.
- *Lack of service quality support* - information about bandwidth placement is not supported, and delays essential for smooth functioning of particular network applications are not supported
- *Geographical limitations* - the United States developed the Internet, and it is also responsible for the allocation of IP addresses. Nearly half of all addresses are set aside for the United States.

Ipv6

IPv6 is the Internet's future, and we won't be able to grow without it. IPv6 has been in use since 1996, but adoption in the real world has been slower than expected. IPv6 may not appear to be necessary right away to others. After all, most of your applications are still functional, and your Internet experience has largely remained same. However, this is beginning to change. When IPv6 isn't available and there aren't enough IPv4 addresses, some large applications already fail.

World IPv6 Launch, organized by the Internet Society in 2012, brought together major Internet Service Providers (ISPs), home networking device makers, and Web companies from around the world to permanently activate IPv6 in their products and services. Since then, the use of IPv6 has skyrocketed. For example, almost 25% of Google users use IPv6; about 50% of all traffic from some regions is sent via IPv6; and nearly all customers to several major mobile networks use IPv6.

IPv6 has 128 bit addresses and has a much larger address space than 32-bit IPv4 which offered us a bit more than 4 billion addresses

Advantages

- Routing is more efficient and hierarchical with IPv6 since it minimizes the size of routing tables. Fragmentation is handled by the source device, not the router, in IPv6 networks, employing a protocol for determining the path's maximum transmission unit.
- More efficient packet processing — Unlike IPv4, IPv6 does not have an IP-level checksum, which means the checksum does not need to be regenerated at each router hop.
- IPv6 provides multicast rather than broadcast for directed data flows. Multicast allows traffic-intensive packet flows to be transmitted simultaneously to numerous destinations, conserving network bandwidth.
- IPv6 has IPsec security embedded in it, which provides confidentiality, authentication, and data integrity.
- Assistance With New Services
- True end-to-end communication at the IP layer is restored by eliminating Network Address Translation (NAT), enabling new and valuable services. Peer-to-peer networks are becoming easier to set up and manage, and services like VoIP and QoS are becoming more reliable.

Limitations

- *Problems with the System*-The IPv6 routing must be enabled according to the operating system. Long IP addresses must be filled in manually when entering data. Because most IP addresses are fairly long and contain letters and numbers, the addresses would have to be remembered.
- *Network Topology Drawings Have a High Level of Complexity*-IPv4 addresses were short, making them easier to set out on a topology diagram. Fitting prefixes inside the IPv6 protocol gets more difficult. In the case of IPv6, the text is scarcely readable.

- *Upgrading the equipment*-Because business networking devices aren't designed for IPv6 adoption, they'll need to be upgraded. This isn't confined to companies that update their products on a regular basis. Many companies are required to bring in an expert opinion. i.e., a consultant to make the transition as painless as possible, as even the most reliable software may require a pricey upgrade.
- *Changes in Local Networking*-Because Local Network Management entails providing IP addresses to individual devices, manually allocating new IP addresses is a difficult operation.
- *There is a lot of ambiguity in the IP schemes*.-Due to the lack of backward compatibility, confusion may arise during the move from IPv4 to IPv6. To properly shuffle between multiple protocols, Internet service providers must pay to offer IPv6.

Comparison between IPv4 and IPv6

Differences

S. no	Based on	IPv4	IPv6
1	Year of Deployment	1981	1999
2	Length of address	32 bits(4 bytes)	128 bits(16 bytes)
3.	Total Number of addresses	4,294,967,296 unique addresses	340,282,366,920,938,463,463,374,607,431,768,211,456 unique addresses
4	Notation	Each IPv4 address is represented in four sets decimal digit which is divided by dots(.) and the limited area of each set is from 0 to 255 Example	Each IPv6 address is represented in eight hexadecimal digit sets which is divided by colons (:) Example : DB85:0402:0000:0000:0000:C2FF:DF2E:7006

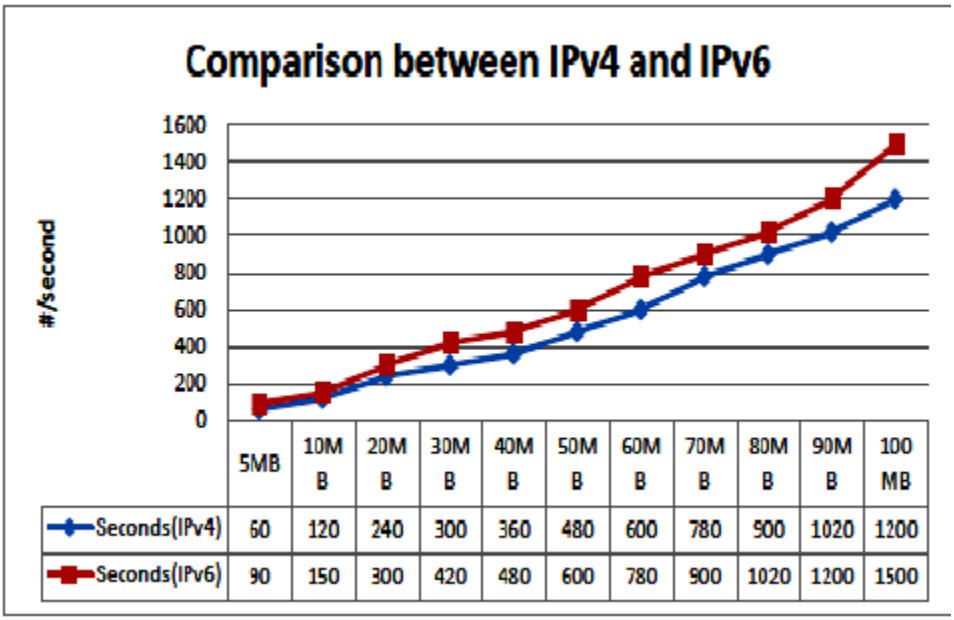
		192.157.12.6	
5.	Type of Addresses	Broadcast: The Pack is sent to all hosts Unicast: The packet is sent to only one host Multicast: The packet is sent to some specific hosts	Multicast : The Packet is sent to number of Hosts Unicast : The Packet is sent to only one host Anycast : A number of interfaces is defined in this scenario as destination, but the packet is routed through one of the hosts.
6.	Configuration	IP address is configured by either DHCP or manually	One of the most important characteristics of IPv6 is auto configuration. It's known as "plug and play," and it lets a node to select its own settings. It address on its own. There are two ways to do this. 1.IPv6 auto configuration: Those who are stateless auto configuration: in this situation, the address is automatically configured. It is not necessary to manually configure the host. Routers, on the other hand, don't always require a lot of power Configuration. 2.The authoritative : This type of setting is known as auto configuration. Auto configuration is the same as DHCP. The IP addresses of a host's guests are obtained in this

			way.DHCPv6 interfaces through a DHCPv6 server-a collection of addresses that have been assigned to the interfaces. Auto-configuration is more convenient and less time-consuming and huge installations are manageable
7	Fragmentation	A packet should be split if it is too large for the following link. Fragmentation is caused by sender and forwarding routers in IPv4.	Sender fragments the packet in IPv6
8	Quality of Service	For TCP/IP applications, QoS allows you to specify packet bandwidth and priority. To put it another way, QoS stands for Quality of Service. A method of transferring multimedia, music, speech, and video in a packet has good quality, although with IPv4 there are some limitations. There's no guarantee that all QoS requirements will be met. The devices that are compliant are compatible with a different device	A field known as the Flow Label field exists in IPv6. This parameter specifies how particular packets are identified and carried by routers. The Flow Label field allows routers to identify and manage packets that originate from a certain host and end at a specific destination The following are the goals of QoS mechanisms : - This is a real-time application. - There is less latency and "jitter." - Increased resiliency to packet losses. - Retransmissions aren't as crucial as they formerly were. - The time link is more important.
9	Mobility	Mobility and handover are not supported by IPv4. It indicates that if a mobile node's position changes, the node's address must be re-established.	MIPv6 is a protocol that allows for quicker routing, handover, and hierarchical mobility.

		MIPv4 (Mobile IPv4) is a protocol that is used by mobile devices.	
10	Security	Tunnelling between two networks limits security.	Data security is provided by IPv6, which includes end-to-end support for user identification, data encryption, and data integrity.
11	Routing protocols	RIP,RIP-2,IGRP,EIGRP,OSPF2,OSPF-3,MOSPF,ISIS,DVMRP,PIM,EGP,BGP-4	RIPng,OSPF-3,EIGRP,IS-IS,PIM,BGP4
12	Address Resolution Protocol (ARP)	ARP looks for physical addresses that are associated with an IPv4 address, such as the MAC or link address.	To obtain MAC addresses, ARP is replaced by a function of Neighbour Discovery Protocol utilising IMCPv6.
13	Domain Name Service (DNS)	Host address resource entries in DNS are used to map host names to IPv4 addresses and vice versa.	It uses host addresses (AAAA) resource records in DNS to convert the name of the host to IPv4 addresses and vice versa.
14	Dynamic Host Configuration Protocol (DHCP)	DHCP is used to assign dynamic IP addresses to devices on a network using IPv4.	The Dynamic Host Configuration Protocol version 6 (DHCPv6) is a network protocol for assigning IP addresses to hosts running Internet Protocol version 6 (IPv6).
15	File Transfer Protocol (FTP)	FTP allows you to send and receive data over the internet.	FTP doesn’t support IPv6
16	Internet Control Message Protocol (ICMP)	ICMP is used by network devices to deliver error messages, such as ICMP destination unreachable messages, as well as informational messages, such as ICMP echo request and reply messages.	IPv4 uses it in a similar way, however ICMPv6 has certain additional features, such as packet processing error reporting, diagnostic activity, the Neighbour Discovery process, and IPv6 multicast membership reporting.

17	Internet Group Management Protocol (IGMP)	ICMP Router Discovery allows hosts to discover their default gateway router in order to reach devices on various networks, and IGMP is used to share and update information about host membership in certain multicast groups. Furthermore, hosts can distinguish between a desire to collect multicast traffic from a given source or collection of sources.	Multicast Listener Discovery (MLD) is used to create multicast listeners (particular nodes that are designated to collect multicast packets destined for specific multicast addresses) on direct-attached networks.
18	Network address Translation (NAT)	The process of assigning a public IP address to network devices, such as firewalls, is known as NAT. The goal of NAT is to reduce the number of public addresses. NAT provides users with private IP addresses, allowing a group of users to access the internet using a public IP address.	Ipv6 don't require NAT

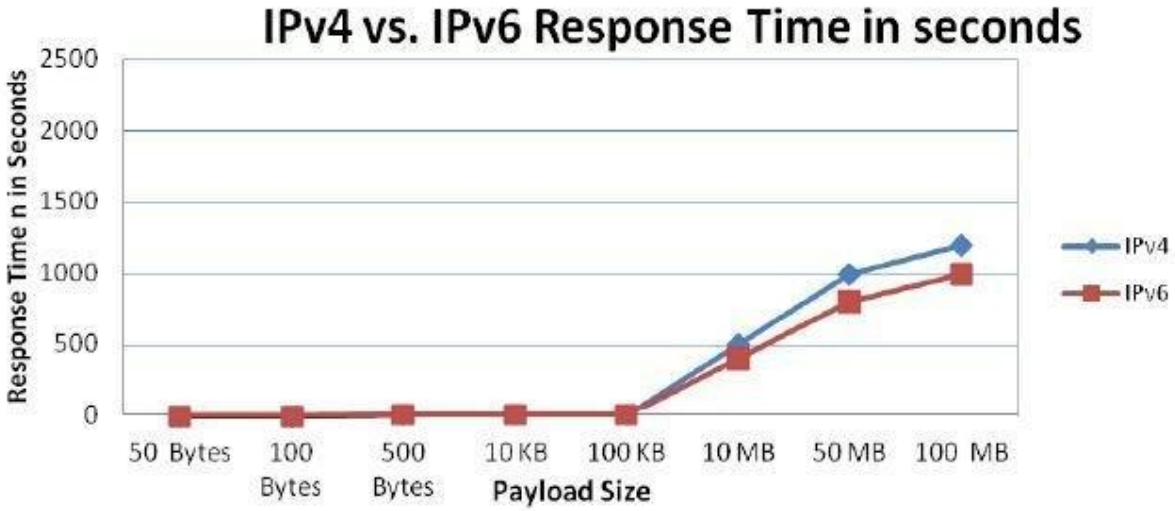
19. Throughput: The amount of data moved successfully from one place to another in a given time period



	5MB	10MB	20MB	30MB	40MB	50MB	60MB	70MB	80MB	90MB	100 MB
Seconds(IPv4)	60	120	240	300	360	480	600	780	900	1020	1200
Seconds(IPv6)	90	150	300	420	480	600	780	900	1020	1200	1500

The above graph shows the variation in the throughput using file transfer protocol.

The IPv4 consumes less time to send the more data. Hence Throughput is more in IPv4 than IPv6

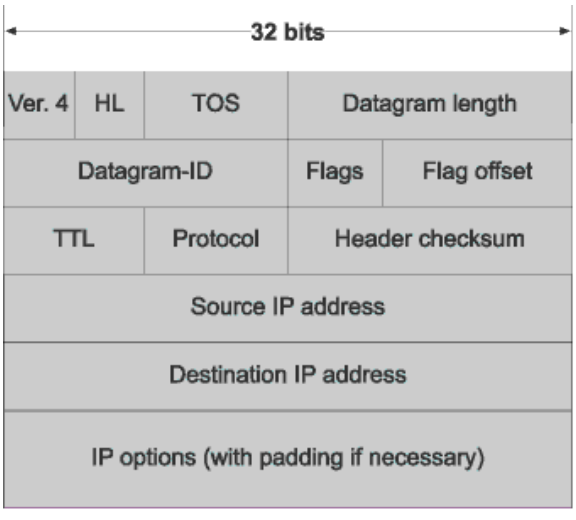


The Response time of IPv6 is less than the ipv4.we can conclude that IPv6 is more efficient in response than the IPv4

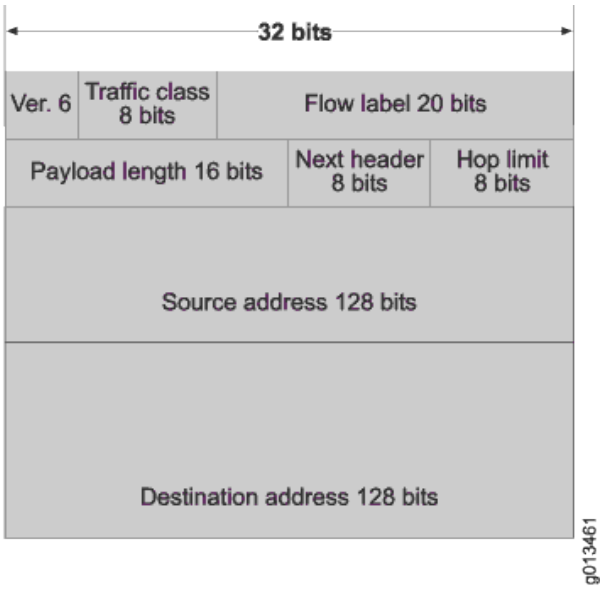
Similarities

- IPv4 and Ipv6,Both are Internet Protocol versions
- IPv4 and Ipv6, Both support manual IP assignment.
- IPv4 and Ipv6, Both can provide security features inbuilt or optionally.
- IPv4 and Ipv6, Both have the Packet Header part.
- IPv4 and Ipv6, Both can transmit fragmented packets.
- IPv4 and Ipv6, Both can have broadcasting, multicasting related features.

Comparison between Header Formats of IPv4 and IPv6



IPv4 header



IPv6 header

S.No	IPv4 header Field name	Size(bits)	Description	IPv6 header Field name	Size(bits)	Description
1.	Version	4	This field always contains the decimal value 4 - 0100	Version	4	This field always contains the decimal value 6-0110
2	Header length	4	It contains the length of the IP header	There is no header length	___	_____
3.	Type of service	8	It is used for Quality of Service (QoS).	Traffic class	8	These eight bits are split into two sections. The most critical 6 bits are utilised for Type of Service, which informs the Router about the services that should be offered for this packet. For Explicit Congestion Notification, the least significant

						two bits are used (ECN)
4	There is no flow label	___	_____	Flow label	20	This label is intended to keep the packets in a communication flowing in a logical order. The source assigns a label to the sequence to aid the router in determining if a packet belongs to a given information flow.
5	Total length	16	It contains the total length of the datagram	Payload length	16	Payload is composed of Extension Headers and Upper Layer data.
6	Identification	16	It is used for the identification of the fragments of an original IP datagram	Identification field is removed	__	_____

7	Flags	03	Used for fragmentation	Flag field is removed	__	____
8	Fragment offset	13	It indicates the position of a fragmented datagram in the original un fragmented IP datagram.	Fragment offset is removed	___	___
9	Time to live	8	It indicates the maximum number of hops a datagram can take to reach the destination	Hop Limit	8	This field is used to stop packet to loop in the network infinitely
10	Protocol	8	It tells the network layer at the destination host to which protocol the IP datagram belongs to.	Next Header	8	This field is used to indicate either the type of Extension Header, or if the Extension Header is not present then it indicates the Upper Layer

11	Header checksum	16	It contains the checksum value of the entire header	Header Checksum is removed	___	Handled by upper layer protocols
12	Source address	32	It contains the logical address of the sender of the datagram	Source Address	128	It contains the logical address of the sender of the datagram
13	Destination address	32	It contains the logical address of the receiver of the datagram	Destination address	128	It contains the logical address of the receiver of the datagram
14	options	No fixed size	This field is used for several purposes such as- Record route Source routing Padding	_____	_____	Added to extension header
15	No Extension Headers	___	___	Extension Headers	No fixed size	The Fixed header has only required information. The information which is required or rarely used is

						stored in extension headers

Conclusion

I have compared the IPv4 and IPv6 and their header formats. The IPv6 has made a lot of changes in the world. We have 2 to 3 devices for every individual now a days and in the IPv4 there are only few address available. This would probably become the shortage and lead to the black market where lot of money need to be invested to buy the IP addresses and this would affect every individual who has a device with internet connection and world would have been faced many issues. As it was recently introduced, many devices work only with the IPv4 and the upcoming are compatible to the IPv6 it is really a challenging task to connect devices of IPv4 to IPv6. Though we are having the different techniques such as dual stack, tunneling still there are compatibility issues with the collaboration of both versions. The IPv6 has overcome the issue of address exhaustion of IPv4 and security issues as well. When Digitalization, increasing of technology and the internet connected devices increases then the development and deployment of new internet protocol versions are must.

By

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CSE-D,3rd YEAR

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