Compared Between Ipv6 And With Ipv4,Differences And Similarities

Z. Z. AbouSalem[(1)],M. A. Ashabrawy[(2)]

[(1)], [(2)]Prince Sattam binAbdulaziz University, Computer Department, KSA

[(2)] Reactors Department, Computer Science, Nuclear Research Center , Atomic Energy Authority Egypt.

deeb2222@hotmail.com, ashabrawy@hotmail.com

Abstract

This paper provides Advantages of using IPv6 and comparison of IPv4 and IPv6,For that, it's critical to understand the differences and similarities, Some points in the near future when the sheer size of billions new devices will throw the IPv6 switch.IPv4 and IPv6, where IPv6 is the enhanced version of IPv4, There are various differences between IPv4 and IPv6 protocol including its features, but the critical one is the number of addresses (Address space) it creates. In my paper, I will explained the main Advantages (differences between both protocols)of IPv6 & IPv4, By giving results that can be obtained through the diffusion of technology.

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Introduction

The IPv4 address contains approximately 4.3 billion addresses and is managed and distributed by the Internet Assigned Numbers Authority (IANA) to the Internet Registries(RIRs) in blocks of up to 16.8 million addresses each. IP version 4 (IPv4) was started in 2011 for a set of unallocated addresses [1]. This depletion led to research and development to the next successor which is Internet Protocol Version 6 (IPV6) [2]. The new version of Internet Protocol 6 (IPv6) is the technology that is designed to address the problem. IPV6 supports approximately 3.4×10^{38} network address which translates to the equivalent of 340 trillion address numbers, ie about 670 quadrillion address per square millimeter of the Earth's surface[3] and [4].

This paper provides information on why IP version 6 (IPv6) becomes the Internet standard instead of Internet Protocol version 4 (IPv4), and what features this protocol has.IPv6 is the next generation of IP protocol. Most computers on the Internet use the IPv4 protocol, which has been considered quite reliable and flexible for 20 years [5]. However, due to the growth of the Internet network, the IPv4 protocol is becoming less convenient due to the limitations it provides. IPv6 is an updated version of IPv4, which gradually replaces the latter as an Internet standard.Most engineers are running IPv4 and IPv6 together. It does so by creating a new version of the protocol which serves the function of IPv4, but without the same limitations of IPv4. IPv6 is not totally different from IPv4: what you have learned in IPv4 will be valuable when you deploy IPv6 [6] and [7].

The main characteristics of this protocol had to be the following:

1. Larger addressing space, structured addresses andno addresses classes.
2. Automatic configuration.
3. Simplified routing.
4. Better structuring options for the networks.
5. Improved security features.
6. Support for real-time and multimedia services

Internet Protocol Version4 (IPV4)

An IPv4 address is a 32-bit address that is usually represented in dotted decimal notation, with a decimal value representing each of the four octets (bytes) that make up the address [8]. For example:

00001001 01000011 01100001 00000010 32-bit address

00001001 01000011 01100001 00000010 4 octets

9 67 97 2 dotted decimal notation (9.67.97.2)

The IPv4 address consists of a network address and a host address. Within the Internet, the network addresses are assigned by a central authority, the Network Information Center (NIC). The portion of the IPv4 address that is used for each of these addresses is determined by the class of address. There are three commonly used classes of IPv4 addresses (see Figure 1) [9].

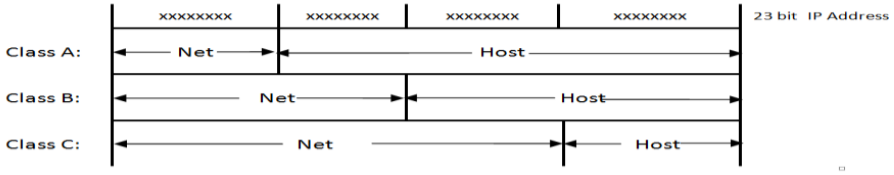

Figure 1. Classes of IPv4 addresses

The class of the address is determined by the first octet of the IPv4 address. Figure 2 shows how the class of address is determined. The figure also shows Class D addresses. Class D addresses represent multicast groups, not network IP addresses. Multicast group addresses consist of the high-order, four bits of 1110 and the remaining 28 bits, which form a multicast group ID[9] and [10].

23 bit address		xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
Class A	min max rang	0xxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
		00000000			
		01111111			
		1 – 126	(decimal notation ; 0 and 127 are reserved		
Class B	min max rang	10xxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
		10000000			
		10111111			
		128 - 191	(decimal notation)		
Class C	min max rang	110xxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
		11000000			
		11011111			
		192 - 223	(decimal notation)		
Class D	min max rang	1110xxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
		11100000			
		11101111			
		224-239	(decimal notation)		

Figure 2. Determining the class of an IPv4 address

As shown in Figure 2, the value of the bits in the first octet determine the class of address, and the class of address determines the range of values for the network and host segment of the IPv4 address. For example, the IPv4 address 9.67.97.2 would be a class A address, since the first two bits in the first octet contain B'00'. The network part of the IPv4 address is 9 and the host part of the IPv4 address is 67.97.2. But despite these measures the IPV4 addresses are being consumed at an alarming rate Primary reason is huge growth in number of internet users,mobile devices using Internet connection and always on devices such as ADSL modems and cable modems. This brings us to the development and adoption of IPV6 as an alternate solution [4] and [11].

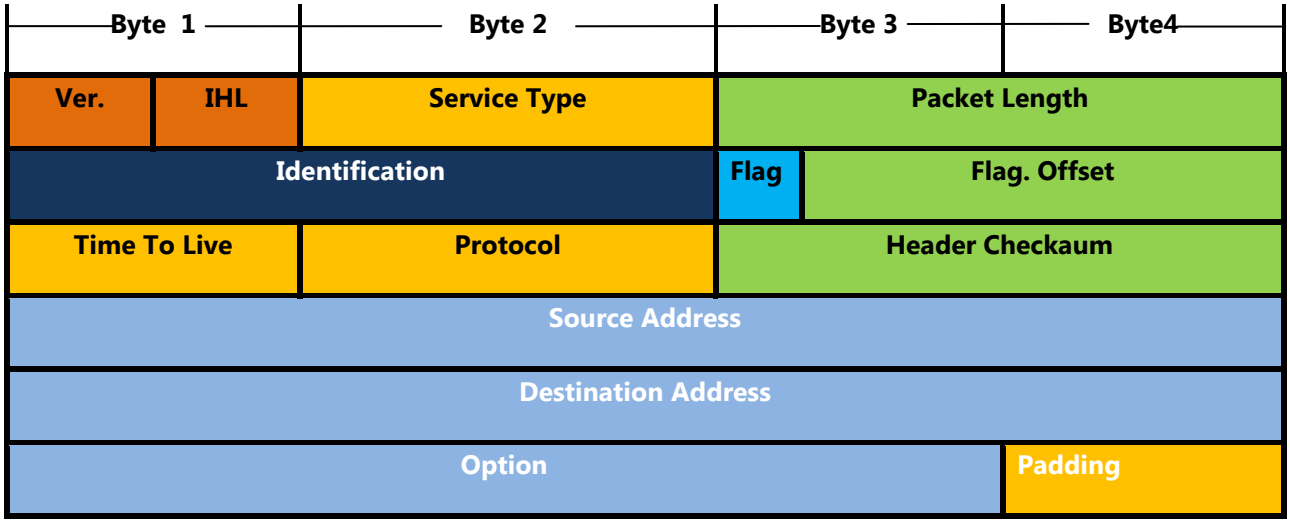

Figure 3 IPv4 Header

Internet Protocol Version6 (IPV6)

Internet Protocol version 6 (IPv6) is a version of the Internet Protocol (IP) intended to succeed IPv4, which is the protocol currently used to direct almost all Internet traffic. Like IPv4, IPv6 is an internet-layer protocol for packet switched internetworking and provides end-to-end datagram transmission across multiple IP networks. While IPv4 allows 32 bits for an IP address, and therefore has 2^{32} (4 294 967 296) possible addresses, IPv6 uses 128-bit addresses, for an address space of 2128 (approximately3.4×10^{38}) addresses. This expansion allows

for many more devices and users on the internet as well as extra flexibility in allocating addresses and efficiency for routing traffic. It also eliminates the primary need for network address translation (NAT), which gained widespread deployment as an effort to alleviate IPv4 address exhaustion [12].

One of the goals of IPv6's address space expansion isto make NAT unnecessary, improving total connectivity, reliability, and flexibility. IPv6 will reestablish transparency and end-to-end traffic across the Internet. The new IPv6 addresses are large and cumber some to deal with, so IPv6 reduces the number of people who have to read and write them [13]. A second major goal of IPv6 is to reduce the total time which people have to spend configuring and managing systems. An IPv6 system can participate in "stateless" auto configuration, where it creates a guaranteed-unique IP address by combining its LAN MAC address with a prefix provided by the network router – DHCP is not needed [14].

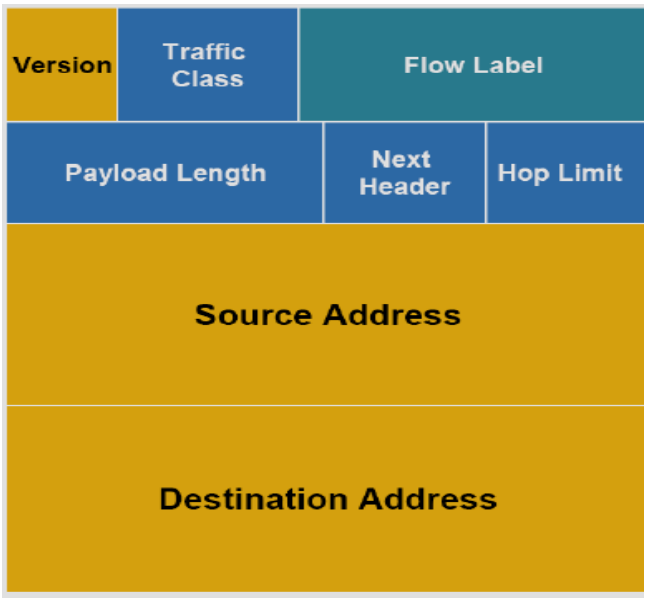

Figure 4 IPv6 Header

Advantages of IPV6

The main advantage of IPv6 is that this system creates a sufficient number of numbers not only to address the crisis of deferred IPv4 addresses, but also to prevent any future crisis. In the computer industr,In addition, IPv6 addresses will basically be an additional measure, not a revolutionary change in the existing IPv4 system [15]. Nevertheless, for network technicians and other professionals, a number of other features do provide:

- More efficient routing without packet fragmentation;
- Built-in Quality of Service (QoS) technology, which detects delay-sensitive packets;
- Eliminating NAT to expand the address space from 32 to 128 bits;
- Built-in IPsec support (use of IPsec is optional);
- Auto configure addresses to simplify network administration;
- Improved header structure with less processing costs.

Cloud computing is now fundamental to most enterprises, providing cheap, powerful resources such as databases, applications, security and system administration that cannot be afforded individually [16]. IP addresses are critical for orchestrating cloud processes. To commission or decommission cloud virtual machines, multiple IP addresses need to be reserved or freed up with blinding speed. The IPv4-based Internet, increasingly hamstrung by NATs, cannot provide such functionality, and the required numbers of addresses simply do not exist in IPv4.The Internet of Things, the concept of communicating networks of independent devices, is estimated to reach twenty to thirty billion devices by 2020. Every networked device needs an

address, and IPv4 has a hard limit of 4.3 billion. IPv6 has 340,282,366,920,938,000,000,000,000,000 billion addresses.

IPv6 is the only technology that can scale to deal with massively distributed cloud infrastructure and the Internet of Things[8] and [17].

Almost all current device operating systems have working IPv6, many with IPv6 enabled by default. See Wikipedia's comparison of IPv6 support in operating systems, and the IPv6 for Microsoft Windows FAQ. There is far more IPv6 traffic on most networks than commonly recognised. If enterprise firewalls have not been expressly configured to handle IPv6, then the enterprise is vulnerable to malicious traffic, no matter how sturdy the old IPv4 defaces are. IPv6 is on by default, and can be accidentally or deliberately used to bypass usage and security policies [18].

Need of IPV6

Here's the list of indicators that it may be time for you

to consider or integrate IPv6

- Your IPv4 network or NAT implementation needs to be fixed or extended.
- You are running out of address space.
- You want to prepare your network for applications that are based on advanced features of IPv6.
- You need end-to-end security for a large number of users and you do not have the address space,
- or you struggle with a NAT implementation.
- Your hardware or applications reach the end of their lifecycle and must be replaced. Make sure

you buy products that support IPv6, even if youdon't enable it right away.

Transition mechanisms of IPV4 AND IPV6

IPv4 and IPv6 networks are not directly interoperable, which means that a transition mechanism is needed in order to permit hosts on an IPv4 network to communicate with hosts on an IPv6 network, and vice versa. The videos below will help you understand some of these techniques.

That's why some mechanisms where designed:

1- 6in4:

6in4 is a tunneling technique. You can manually set up a 6in4 tunnel. Figure 5: Tunneling mechanism

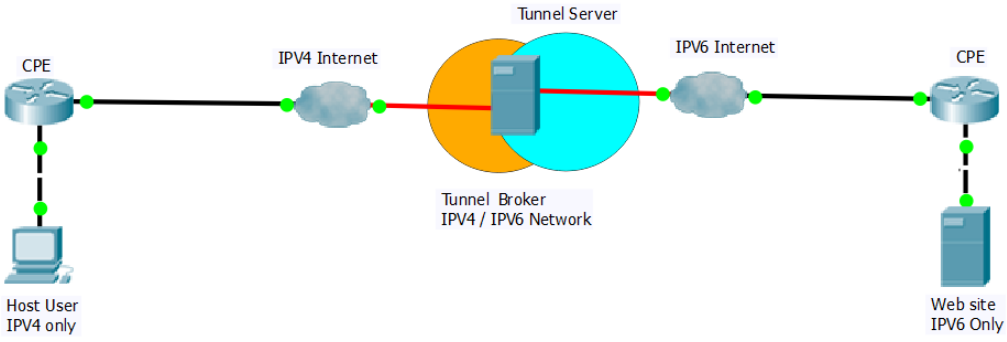

Figure 5: Tunneling mechanism

2-NAT64

NAT64 is a transition mechanism based on Network Address Translation (NAT) that makes it possible for IPv6-only hosts to talk to IPv4-only servers. NAT64 can be useful for mobile providers.Figure 6:transition mechanism

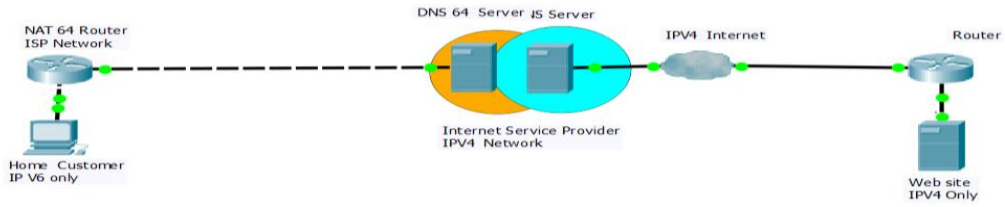

Figure 6:transition mechanism

3- DS-Lite

DS-Lite allows an ISP to give access to IPv4-only services for customers that have only

native IPv6. This mechanism could be useful for DSL or cable providers .Figure 7: Dual stack mechanism

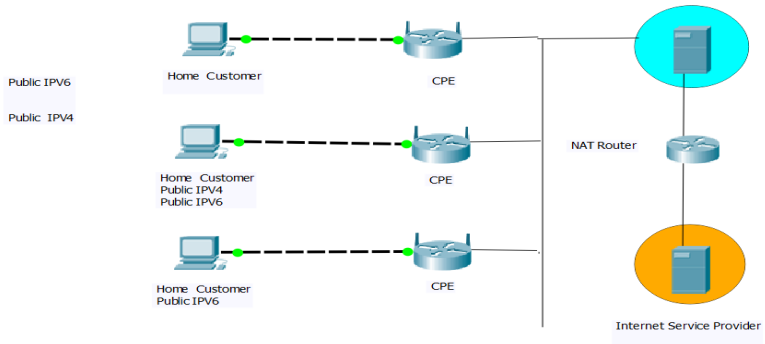

Figure 7:Dual stack mechanism

Comparison between IPV4 ANDIPV6

IPv6 was designed not to deviate from the existing internet protocol, it was designed to enhance and resolve the problem of the widely deployed protocol, like address space depletion, security. IPV6 also eliminate some feature in IPv4 which is not necessary as an enhancement like NAT technology which violate end to end connection on the internet. Below are some of the performance differences of the two version of protocol difference between IPv6 and IPv4. You can use this table (1)to quickly view summary information, IP functions and how to use IP addresses in Internet IPv4 and IPv6 protocols [19].

Table (1): how to use IP addresses in Internet

IPv4	IPv6
Invented 1981	Invented 1997
Has 32-bite (4-bytes) address space	Has 128-bite (16-bytes) address space

IPv4	IPv6
IPsec is not necessary	IPsec necessary
NAT is used	NAT is not used
Has a variable length20-60 byte	Has a fixed length 40 byte
Has 12 field inside the header	Has 8 field inside the header
Use Time to Live as field name	Use Hop Limit as field name
Use dotted decimal notation as address format: 1.0.3.0.6.0.3.0	Use string notation as address format: 1:A:2:4:E:1:3:7
Use 0.0.0.0.0.0 as unknown address	Used :: unknown address
It use 127.0.0.1 as loopback address	It use ::1 as loopback address
It uses224.0.0.0/4 as Multicast address space	It uses FF00::/8 as Multicast address space
Must support DHCP or be configured manually	Does not require DHCP or manual configuration, it is auto configuration plug-and-play
Has broadcast for all the host on the network	There is no broadcast instead it used group of multicast
It does not give data priority	It prioritize data

The Migration from IPV4 TO IPV6

The years from 1997 to 2000 will be characterized by the adoption of IPv6 by ISPs and users. During 1997,users could still have problems related to the newness of products, but starting from 1998, IPv6 will be part of mass-produced protocols distributed on routers, on workstations, and on PCs. At that point, organizations will begin to migrate , less or more gradually, to IPv6 .The key goals of the migration are as follow:

- IPv6 and IPv4 hosts must interoperate.
- The use of IPv6 hosts and routers must be distributed over the Internet in a simple and progressive way, with a little interdependence.
- Network administrators and end users must think that the migration is easy to understand and implement.
- A set of mechanisms called SIT (Simple Internet Transition) has been implemented; it includes protocols and management rules to simplify the migration. The main characteristics of SIT are the following:
- Possibility of a progressive and nontraumatic transition: IPv4 hosts and routers can be updated to IPv6, one at a time, without requiring other hosts or routers to be updated simultaneously.
- Minimum requirements for updating: The only requirement for updating hosts to IPv6 is the availability of a DNS server to manage IPv6 addresses. No requirements are needed for routers
- Addressing simplicity: When a router or a host is updated to IPv6, it can also continue to useIPv4addresses

Conclusion

The current trend in the development of telecommunications networks will be the transition of the Internet to IP version 6, the obvious advantage of which is the increased address space compared to IPv4. If the IPv4 protocol has 2 ^ 32 addresses, then IPv6 has 2^128 addresses. IPv6 contains many and functional improvements, especially in the field of routing. Addressing now has a hierarchical structure, which facilitates the transmission of packets over the network. Also at the IP level there is no more calculation of checksums, which allows routers do not break packets, saving processing time. There were also new QoS and multicast capabilities, and IPSec became mandatory. Maximum size packets in the sixth version of the protocol can reach 4 GB, which will undoubtedly lead to changes in the principles of data transmission in the future .In my experience, we can say that the creation of IPv6 tunnel connections is a viable way to organize the interaction of large networks. At the same time, numerous small networks can use additional means, in particular, automatic tunneling or the 6-to-4 mechanism, which will allow them to connect to the Internet through IPv6 at minimal cost and find an IPv6 provider that suits them. However, based on the results of the work of the experimental network IPv6 Public College, seriously rely on the high quality and reliability of tunnels difficult, if only because one tunnel can hide a long route IPv4, passing through several networks with their specific problems. The most high-quality solution, no doubt, is a real connection to the provider by IPv6.

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