ISSN : 2231-0711

M.Jothilakshmi et al | International Journal of Computer Science Engineering and Technology(IJCSET) | Dec 2014 | Vol 4, Issue 12,384-387

Performance Comparison between IPV4 AND IPV6

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Abstract: The enormous growth of the internet and the way the addresses were assigned (classes A, B and C), resulted in a serious lack of addresses. There are several methods that avoid the total run out of addresses: PPP/DHCP (address sharing), CIDR (classless inter-domain routing) and NAT (network address translation), but do not seem to be enough in a few years. Nowadays IPv6 over IPv4 tunnels are widely used to form the global IPv6 Internet. This paper demonstrates the two tunnels and show when to immigrate from IPv4 to IPV6.While IPv6 is intended to eventually replace IPv4, they are tightly mingled right now. In this paper will be explained the main characteristics of IPv6 & IPv4, as well as the differences between both protocols, and the mechanisms to migrate the networks from IPv4 to IPv6. After this, we will see the some conclusions about the existence of both protocols and the implications that this has in the way the internet works. .Then the risks of immigration are discussed.

KEYWORDS: PPP/DHCP, CIDR, IPv6 , IPv4.

I.INTRODUCTION

Today IPv6 over IPv4 tunnels are widely used to connect large regional IPv6 networks, because it is relatively hard to construct an international or cross-continent native IPv6 network. This makes the characteristics of IPv6 over IPv4 tunnels very vital to the performance of the global IPv6Internet. Migrating from IPv4 to IPv6 in an instant is impossible because of the huge size of the Internet and of the great number of IPv4 users. Moreover, many organizations are becoming dependent on the Internet for their daily work, and therefore they cannot tolerate downtime for the replacement of the IP protocol. Rather than throw the switch, and transition completely from IPv4 to IPv6, 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.

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

- ✓ Larger addressing space, structured addresses and no addresses classes.
- ✓ Automatic configuration.
- ✓ Simplified routing.
- ✓ Better structuring options for the networks.
- ✓ Improved security features.
- ✓ Support for real-time and multimedia services

II. i) INTERNET PROTOCOL VERSION 4 (IPV4)

Internet Protocol version 4 (IPv4) is the fourth version of the Internet Protocol (IP) and it is the first version of the protocol to be widely deployed. Together with IPv6, it is at the core of standards-based internetworking methods of the Internet. IPv4 is still by far the most widely deployed Internet Layer protocol. It uses a 32 bit addressing and allows for 4,294,967,296 unique addresses. Even though the name seems to imply that it's the fourth iteration of the key Internet Protocol, version 4 of IP was the first that was widely used in modern TCP/IP. IPv4, as it is sometimes called to differentiate it from the newer IPv6, is the Internet Protocol version in use on the Internet today, and an implementation of the protocol is running on hundreds of millions of computers. It provides the basic datagram delivery capabilities upon which all of TCP/IP functions, and it has proven its quality in use over a period of more than two decades.

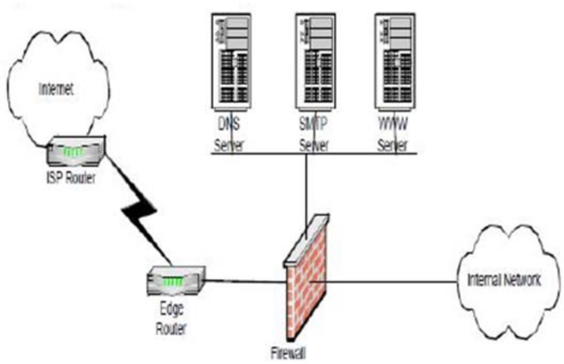

Fig 1: internet protocol version 4(ipv4)

But despite these measures the IPV4 addresses are being consumed at an alarming rate and it is estimated that 2010 would be the last year for IPV4, some sources say they may last until 2012. Primary reason for IPV4 exhaustion 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.

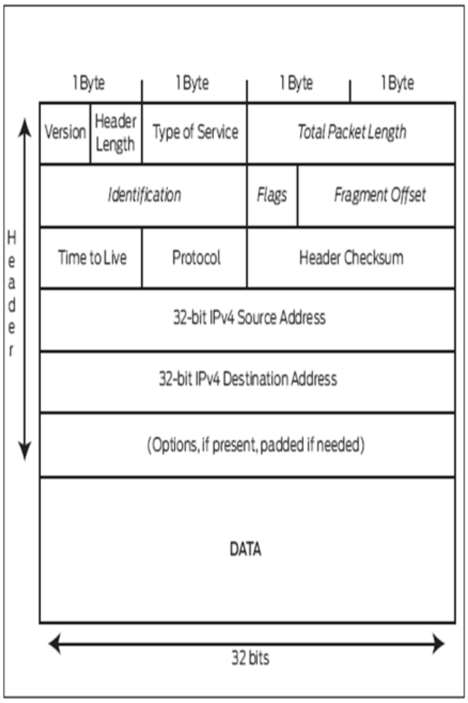

Figure 2 IPv4 Header

ii)INTERNET PROTOCOL VERSION 6 (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 2^{128} (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.

One of the goals of IPv6's address space expansion isto make NAT unnecessary, improving total connectivity, reliability, and flexibility. IPv6 will re-establish 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.

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.

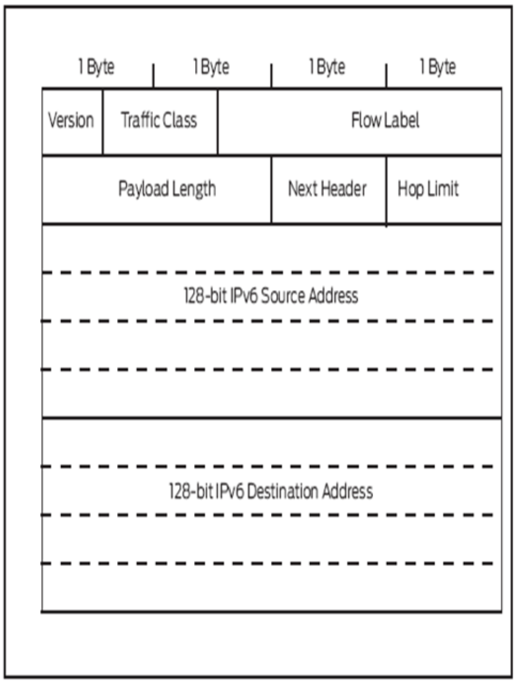

Figure 3 IPv6 Header

III .DIFFERENCE BETWEEN IPV4 AND IPV6

IPV4	IPV6
32-bit (4 byte) address supporting 4,294,967,296 address (although many were lost to special purposes, like 10.0.0.0 and 127.0.0.0)	128-bit (16 byte) address supporting 2^{28} (about 3.4 x 1038) addresses
NAT can be used to extend address limitations	No NAT support (by design)
IP addresses assigned to hosts by DHCP or static configuration	IP addresses self-assigned to hosts with stateless address auto-configuration or DHCPv6
IPSec support optional	IPSec support required
Options integrated in header fields	Options supported with extensions headers (simpler header format)
Supports globally unique "public" addresses	Supports globally unique unicast addresses

IV.QUALITY OF SERVICE CONCERN IN IPV4

Now a days internet users are not only limited with browsing and searching data. Current users are well aware of text and voice and video chat and video conferences and online video libraries. This kind of communication need real time data transfer for quality of service. Normally for these kind of services we use UDP (User Data-gram Protocol) or TCP (Transmission Control Protocol).IPv4 TOS field has limited functionality and, over time, has been redefined and locally interpreted. Additionally, payload identification that uses a TCP or UDP port is not possible when the IPv4 packet payload is encrypted.

V.I)NEED OF IPV6 AND ADVANTAGES

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 you don't enable it right away.

ii) ADVANTAGES OF IPV6

- IPv6 offers the potential to build a much more powerful Internet, with vastly larger scale compared to the current situation. Addresses in IPv4 have only 32 bits, allowing for only about 4 billion addresses, compared to 128-bit IPv6, with some 340 trillion, trillion, trillion addresses.
- The shortage of IPv4 addresses has caused widespread use of private address spaces, which are not directly accessible from the Internet. Devices with IPv6 addresses and IPv6 connectivity can be directly reachable by their address.
- Such an approach gives rise to the potential to move beyond an "Internet of desktops" to an "Internet of devices" where device to device communication becomes possible.
- With an IPv6 enabled router is appropriate

VI. TRANSITION MECHANISMS OF IPV4 AND IPV6

The transition between the IPv4and the IPv6 will be a long process during both protocols coexist and also it is unreasonable to expect that many millions of IPv4 nodes will be converted overnight.

That's why some mechanisms where designed:

A. Dual Stack mechanism
B. Tunneling mechanism
C. Translation mechanism

A . DUAL STACK MECHANISM

Allows IPv4 and IPv6 to coexist in the same hosts and routers for supporting interoperability between IPv4 and IPv6.

IPv6 nodes which provide a complete IPv4 and IPv6 implementations are called "IPv6/IPv4 nodes" or "dual stack nodes". IPv6/IPv4 nodes have the ability to send and receive both IPv4 and IPv6 packets.

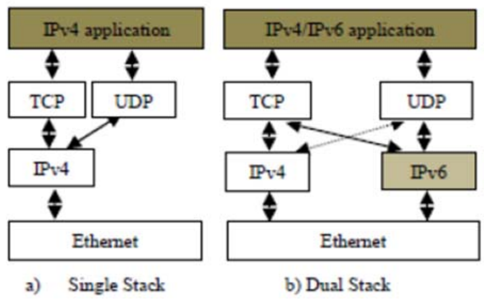

Fig 4: Dual stack mechanism

B.TUNNELING MECHANISM

IPv6 packets are transmitted over IPv4 network via IPv6 tunnel. Data is carried through an IPv4 tunnel using encapsulation, in which IPv6 packet is carried inside an IPv4 packet.

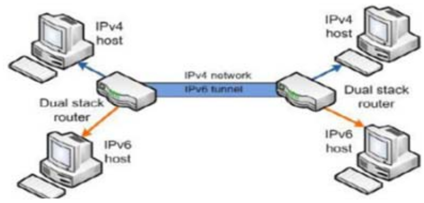

Fig 5: Tunneling mechanism

C. TRANSLATION MECHANISM

Allows IPv6 nodes only to communicate with IPv4 nodes only. As a node with IPv4 address cannot understand a node with IPv6 address a translator is needed for the communication between the two.

Translation mechanism maps addresses between IPv4 and IPv6 using some protocols in the gateway to translate internet protocols.

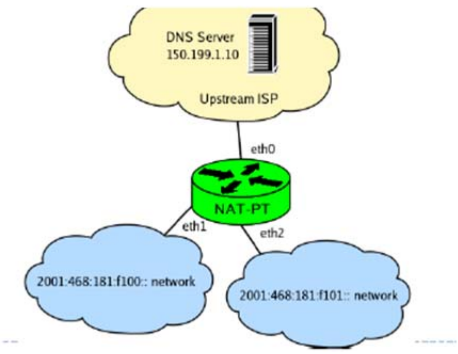

Fig 6: Translation Mechanism

VII.SECURITY

A: IPV6

The main point of IPv6 **addressing** is the 128 bits addresses, which give a wide addressing space (more than 10^{38} addresses). In this case, the addresses are assigned to interfaces, and it is possible that one interface has multiple addresses.

There are 3 different types of IPv6 addresses:

Unicast: identifies a single interface. A packet with an address of this type in the destiny is delivered only to that interface.
Multicast: identifies a set of interfaces. A packet with this address as destiny, is delivered to all the interfaces of the set.
Anycast: identifies also a set of interfaces, but in this case, a packet with this kind of address as destiny, is delivered only to one interface of the set. Usually the next interface, according to the routing protocol.
The **auto configuration** is a very important feature of IPv6, as it provides that a node can configurate its address by itself. This characteristic is what allows to say that IPv6 is "plug & play". There are 2 different ways of auto configuration in IPv6, the stateless address auto configuration, and the stateful auto configuration.

B: IPV4

While in IPv4, the security was not included in the original protocol itself (IPsec extension), in IPv6, the security is a part of the protocol itself, and provides the same features like IPv4 and IPsec. IPsec is obligatory in IPv6, and provides authentication and encryptation in the network layer, what means that is implemented transparently in the network infrastructure. Another important characteristic of IPsec is that it is an end-to-end technology, so in IPv6, with the wide addressing space, it is possible to have secure communications base on the E2E model

VIII. 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 use IPv4addresses..

IX. Conclusion

Migrating from IPv4 to IPv6 in an instant is impossible because of the huge size of the Internet and of the great number of IPv4 users. Moreover, many organizations are becoming more and more dependent on the Internet for their daily work, and they therefore cannot tolerate downtime for the replacement of the IP protocol. As a result, there will not be one special day on which IPv4 will be turned off and IPv6 turned on because the two protocols can coexist without any problems. In this paper we investigate when to immigrate from IPv4 to IPv6 and the risks of this immigration. In the case of much larger scale future networks (such as in the Comcast example above), industry will face significant challenges.

In an Australian example, Telstra is rumoured to be using Class A private address space to address NextG devices, which would limit their capacity to grow a market beyond Australia. In summary, IPv6 has significant cost advantages in current networks, and in developing the larger scale networks required by industry.Apart from the fact of the co-existence of IPv4 and IPv6, it also has to be taken into account that there are another protocols that have to be adapted to IPv6 too, for example:

- ✓ ICMPv6 (Internet Control Message Protocol)
- ✓ DNS (Domain Name Service)
- ✓ DHCPv6 (Dynamic Host Configuration Protocol)
- ✓ RIPng for IPv6 (Routing Information Protocol)
- ✓ OSPF for IPv6 (Open Shortest Path First)
- ✓ FTP (File transfer Protocol)

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