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COMPARISON AND TRANSITION STUDY OF INTERNET PROTOCOL VERSION 4 & 6 (IPV4 &IPV6)

Wajid Aftab
Student, Computer Science Engineering,
SSM College of Engineering & Technology,
Kashmir India

Zubair Ahmad Mir
Student, Computer Science Engineering,
SSM College of Engineering & Technology,
Kashmir, India

Syed Irfan
Assistant Professor, Computer Science Engineering,
SSM College of Engineering & Technology,
Kashmir,India

Abstract: With the evolution of internet over the years the transition from ipv4to ipv6 has become a great necessity. Due to the shortage of ipv4 address space provided by the IANA (internet assigned numbers authority) we are left with no choice but to go for ipv6 transition process. By default, ipv4 and ipv6 network cannot communicate with each other, so we have to provide the facility of communication between them. This facility can be provided by various transition mechanisms which includes dual stack mechanism, tunnelling and NAT protocol translation. This paper demonstrates comparison study between ipv4 and ipv6 and the transition from ipv4 to ipv6.

Keywords: Internet,IPV4,IPV6, transition, NAT-PT

1. INTRODUCTION

The transition from ipv4 to ipv6 in one instance is impossible due to the reason of enormous size of the internet and due to a large number of users of ipv4 address space. Ipv4 addresses are of 32 bits in length that can give us an address space of around 4 billion but these number of addresses cannot be assigned to everyone in the living world which has a population of around 6.5 billion. Initially this problem was overcome by using a concept of sub netting in ipv4 where we divided a large network into smaller ones on basis of host requirements. Further we tried to solve this by using concept of private addresses in ipv4 and the concept of NAT (network address translation). Even by using these techniques we are unable to meet the demands for ip addresses for the current generation henceforth a transition from ipv4 to ipv6 is of great need.

2. IPV4

A defining feature of IPv4 is its 32-bit addresses. Every host and router on the Internet has an IP address that can be used in the *Source address* and *Destination address* fields of IP packets. It is important to note that an IP address does not actually refer to a host. It really refers to a network interface, so if a host is on two networks, it must have two IP addresses. However, in practice, most hosts are on one network and thus have one IP address. In contrast, routers have multiple interfaces and thus multiple IP addresses. The name implies that it is the fourth version of the internet protocol but it was the first to be widely used. The total address space of ipv4 gives 4,294,967,296 unique addresses. [1]

3. LIMITATIONS OF IPV4

The primary limitations in ipv4 are as follows:

1) Less number of ipv4 address. [2]
2) Issues related to QOS
3) Issues related to security
4) Address configuration related issues

.4.IPV6

IETF (internet engineering task force) developed ipv6 to deal with the problem of shortage of ipv4 addresses. Ipv6 is the second version of internet protocol that is being used around the world. It uses 128-bit addresses; a shortage of these addresses is not likely any time in the foreseeable future. However, IPv6 has proved very difficult to deploy. It is a different network layer protocol that does not really interwork with IPv4, despite many similarities. Also, companies and users are not really sure why they should want IPv6 in any case. The result is that IPv6 is deployed and used on only a tiny fraction of the Internet (estimates are 1%) despite having been an Internet Standard since 1998. The next several years will be an interesting time, as the few remaining IPv4 addresses are allocated. The total address space of ipv6 gives us around 2^128. This expansion allows us to have a much larger number of users on the internet. Ipv6 eliminates the need for NAT. [3]

5. ADVANTAGES OF IPV6

The main advantages of ipv6 or main goals of ipv6 are

1) Support billions of hosts, even with inefficient address allocation.
2) Reduce the size of the routing tables.
3) Simplify the protocol, to allow routers to process packets faster.
4) Provide better security (authentication and privacy).
5) Pay more attention to the type of service, particularly for real-time data.
6) Aid multicasting by allowing scopes to be specified.
7) Make it possible for a host to roam without changing its address.
8) Allow the protocol to evolve in the future.
9) Permit the old and new protocols to coexist for years.
10) Guarantees unique IP address by combining LAN and mac addresses
11)The goal of ipv6 is to make NAT unnecessary as it offers single point of failure. [4]

6. TYPES OF ADDRESSES IN IPV6

1) Global unicast address:
- It's like public IP in ipv4
- Addresses which start with 2000::/3

2) Unique local:
- It's like private IP in ipv4
- Addresses that start with FC00::/7

3) Multicast:
- Addresses that start with FF80::/8

4) Link local:
- Addresses that start with FE80::/10
- It can only communicate on one link
- It's given itself we don't have control over it

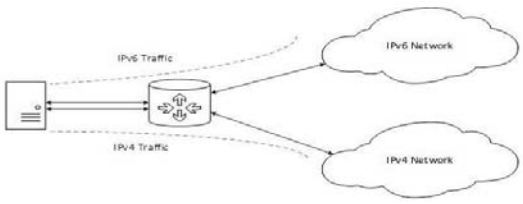
5) Loopback:
- Ipv6 calls it as ::/1
- Similar to 127.0.0.1 in ipv4
- Can be used to check ipv6 stack

7. TRANSITION FROM IPV4 TO IPV6

Some of the technologies that ensure smooth transition from ipv4 to ipv6 are

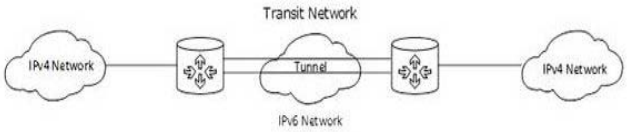
1) Dual stack routers
2) Tunnelling
3) NAT protocol translation

- **Dual stack routers**: Here the router is installed with both ipv4 and ipv6 addresses configured on its interfaces facing towards the network of relevant ip scheme



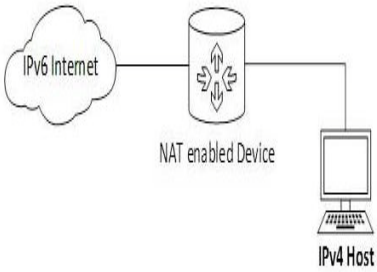
Here we have a server having ipv4 and ipv6 address configured and it can now communicate with the hosts of both the networks with the help of a dual stack router.

- **Tunnelling:** In a scenario where we have got two different networks running at two different ends tunnelling provides a better solution where the user data can route through a non-supported IP version



The above diagram shows how two remote ipv4 networks can communicate via a tunnel where the transit Network was on IP v6. The basic operation of tunnelling is the encapsulation and decapsulation.For ipv6 some of the encapsulation manners are GRE (Generic routing encapsulation)[5],MPLS(Multiple protocol label switching)[6].

- **NAT protocol translation:**



The method of transition to ipv6 is with the help of NAT – PT (network address translation –protocol translation) enabled device. In the above diagram host with ipv4 address sends a packet to an ipv6 server on internet that does not understand ipv4 address. In this case NAT-PT device helps to communicate between them. Here when ipv4 host sends an ipv4 packet to the ipv6 server the NAT-PT device strips down the ipv4 header and attaches an ipv6 header and passes it through the internet. When there is a response from the ipv6 server to the ipv4 host, the device does the opposite operation.

8. CONCLUSION

Migration from ipv4 to ipv6 is not possible to take place instantaneously due to the size of internet and the number of users having ipv4 addresses. Thus the transition from ipv4 to the ipv6 is going to be a very slow process and is going to take lots of time, it's not something that would be accomplished overnight

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8. BIOGRAPHIES

Wajid Aftab, is pursuing B.E Degree from SSM College of Engineering & Technology in Computer Science Engineering, J&K, India. His field of interest is networking.

Zubair Ahmad Mir, is pursuing B.E Degree from SSM College of Engineering & Technology in Computer Science Engineering, J&K, India. His field of interest is networking.

Syed Irfan, working as Assistant professor in SSM college of engineering and technology in the department of Computer Science Engineering. Completed M. tech Bharath institute of higher education and research Chennai & currently pursuing PhD. Areas of interest are Databases, cloud computing,software engineering and networking.