Ipv4 to Ipv6 Migration Strategies

Rakesh Bendale, Saurabh Naykude, Nilima Nikam

***Abstract*— Over 1000 top websites in the world on 8 June, 2011 took part in an event called "WorldIPv6 Day". As IPv4 Address space is exhausted the need for changing to IP next generation IP. IPv6 is obvious. This paper aims at finding the best method of seamless transition from IPv4 to IPv6 for large enterprise networks. This paper puts forward the broadband dial-up users IPv6 to IPv4 transition proposal, which is based on Dual Stack technology, network address translation (NAT) and at the same time adopting 6to4/ISATAP Tunnel. In addition, it is to run WWW, FTP, Http, DNS and other network application platform in this environment**

***Index Terms*— Dual stack, Nat, Tunneling, Transition technology, Ipv4, Ipv6.**

I. INTRODUCTION

Since the birth of Internet in 1960s, it has completely changed the way of communications forever. With its capabilities, the Internet has already become a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers regardless of geographic location. IPv4 has taken up a big role in such uplifting of capabilities of internet. However, this is also the problem as the IP address is not unlimited and the Internet community is witnessing the exhaust of IPv4 not year by year but day by day, which calls for a solution. The first group of Internet users that would be affected is internet service providers (ISPs), large enterprises, companies, etc. The reason is that they hold the most number of IPv4 for operation and management and before the IPv4 runs out, they will need an appropriate act to handle the exhaustion, and otherwise, the collapse of the worldwide Internet is foreseeable.

II. RELATED TECHNOLOGY PRINCIPLE

A.DUAL STACK

Dual stack technology is the most direct way compatible with IPv4 nodes and IPv6 nodes, application host, routers, another communications node. Dual stack protocol make partial hosts (or routers) equip with two protocol stack, anIPv4 and an IPv6.It can communicate with the system of IPv4, and also do with the system of IPv6. Respectively support for independent IPv4 and IPv6 routing protocols, IPv4 and IPv6routing information calculated in accordance with the respective protocol, and maintain different routing tables. The IPv4 packets forwarding in accordance with the IPv4routing table got from routing protocol; the IPv6 packets (including IPv4 addresses be compatible with IPv6 packet) forwarding in accordance with IPv6 routing table got from routing protocol. Here we are going to implement Dual Stack transition strategy for enterprise or ISP to implement. As "dual stack" word suggests, each network device is able to support IPv4 andIPv6 stack.

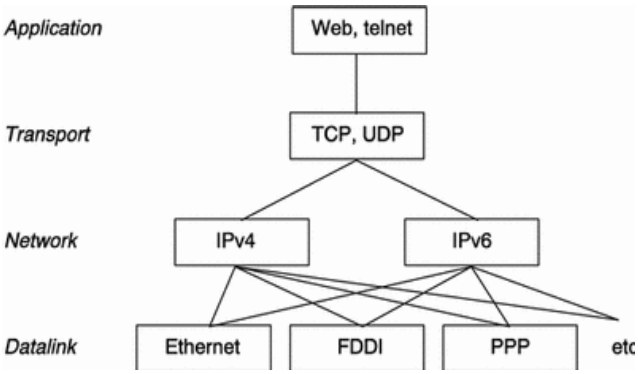

Fig 1: The structure of Dual stack model

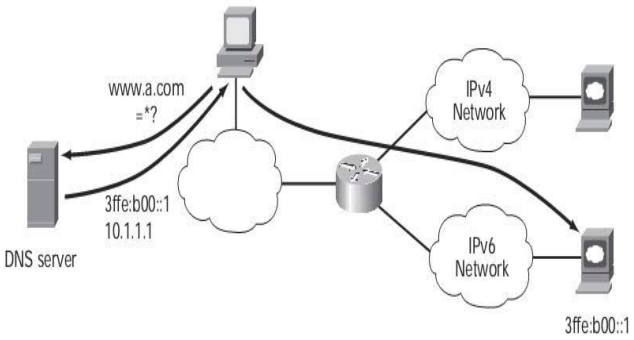

Fig 2: Dual stack operation

B. NETWORK ADDRESS TRANSLATION (NAT)

The meaning of translation is to convert directly protocols from IPv4 to IPv6 or vice versa, which might result in transforming those two protocol headers and payload. This mechanism can be established at layers in protocol stack, consisting of network, transport, and application layers. The translation method has many mechanisms, which can be either stateless or stateful. While stateless means that the translator can perform every conversion separately with no reference to previous packets, stateful is the vice versa, which maintains some form of state in regard to previous packets. The translation process can be conducted in either end systems or network devices.

There are three types of translation strategies acceptably used

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Rakesh Bendale, Computer engineering, Mumbai University/ yadhavrao Tasgaonkar Institute of engineering & Technology/ Saraswati Education Society, bhivpuri karjat, India, Mobile No 9637626212.

Saurabh Naykude, Computer engineering, Mumbai University/ yadhavrao Tasgaonkar Institute of engineering & Technology/ Saraswati Education Society, bhivpuri karjat, India, Mobile No 8655799024.

Nilima Nikam, Computer engineering, Mumbai University/ yadhavrao Tasgaonkar Institute of engineering & Technology/ Saraswati Education Society, bhivpuri karjat, India, Mobile No 9890768120.

- NAT-PT
- NAT64 (IVI/Stateless NAT) with DNS64
- NAT64 (Statefull NAT) with DNS64

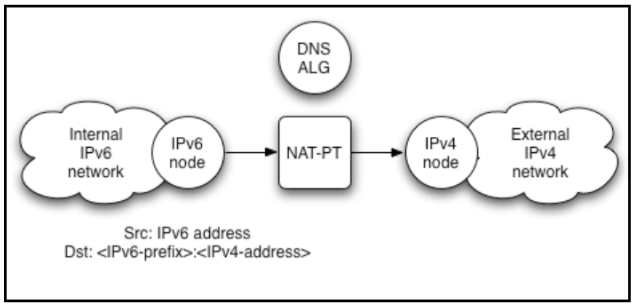

Fig 3: NAT-PT topology

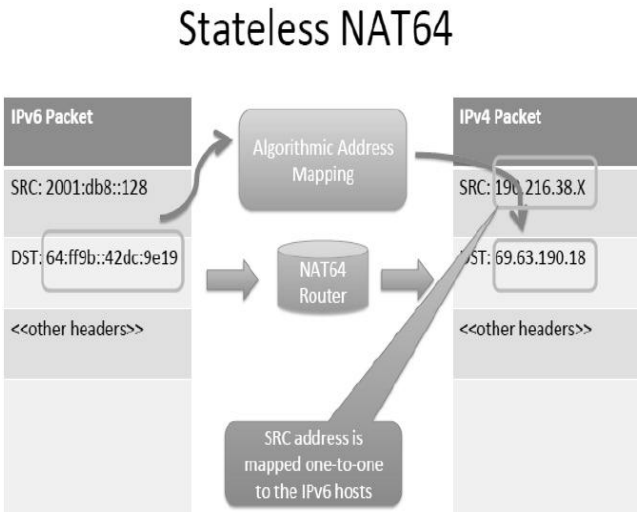

Fig 4: Stateless NAT64 Header Translation

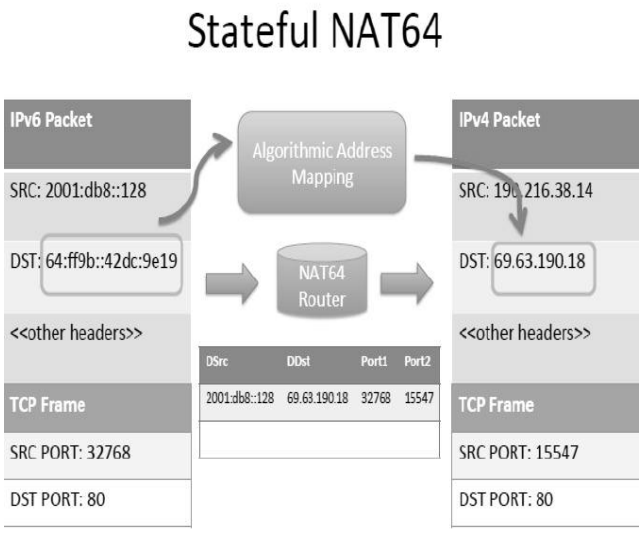

Figure 5: Statefull NAT64 Header Translation

C. TUNNELING

A variety of tunneling technologies has been developed to support Ipv4 over Ipv6 as well as Ipv6 over Ipv4 tunneling. These technologies are generally categorized as configured or automatic. Configured tunnels are predefined, whereas automatic tunnels are created and torn down "on the fly". In general, tunneling of Ipv6 packets through an Ipv4 network entails prefixing each Ipv6 packet with an Ipv4 header. This enables the tunneled packet to be routed over an Ipv4 routing infrastructure. The entry node of the tunnel, a router or a host, performs the encapsulation.

There are two types of tunnels

- Manual tunnels
- Automatic tunnels

MANUAL TUNNELS

As tunnels can be created manually or automatically. Manual tunnels are manually configured but configuration is required at the both ends of the tunnel. Administrator will always know how his tunnels are created. From management perspective, manual tunnels are good for implementation but from configuration perspective they are little bit more tedious to work with.

AUTOMATIC TUNNELS

Automatic means that tunnel configuration is carried out with no additional management. This method is considered as the most popular choice in the field of automatic tunneling technique. When in operation, this mechanism will have IPv6 traffic tunneled upon IPv4 networks within isolated 6to4 networks.

TYPES OF AUTOMATIC TUNNELS

- 6to4 (RFC 3056)
- 6RD (RFC 5569)
- Teredo (RFC 4380)
- ISATAP (RFC4214)
- TSP (RFC 5572)

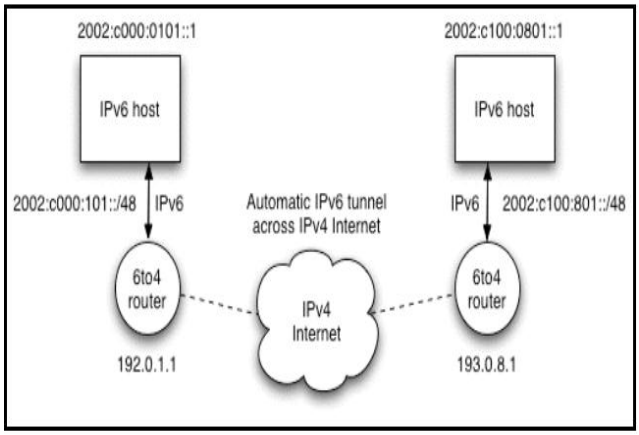

Fig 6: 6to4 tunnel

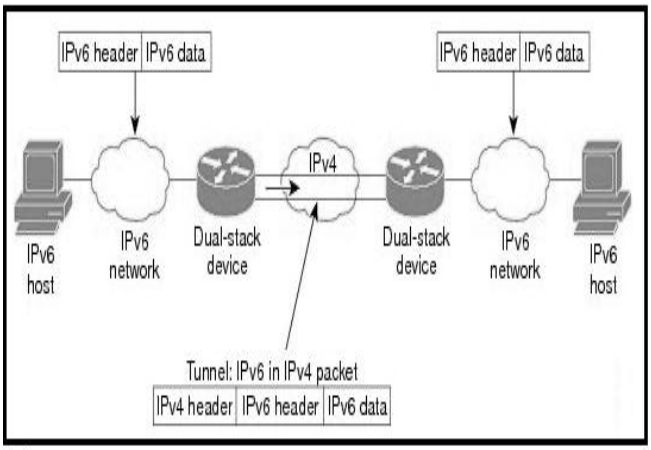

Fig 7: ISATAP Tunnel

III. SUMMARY OF TRANSITION TECHNOLOGIES

	Advantages	**Disadvantages**
Tunneling	-Configure tunnel endpoints only - Simple deployment -No additional management	- Face another problem of NATs - Take more time and CPU Power - Harder to troubleshooting and network management
Translation	- The router is used as a translation communicator -Solve network interoperability problems	-Limitations similar to IPv4 NAT - Reduction in the overall value and utility of the Network. - Harder to control on a larger scale
Dual Stack	- Easy to implement - Low cost	-Two routing tables -Additional memory and CPU

TABLE 1: Transition Technology Comparison

IV. CONCLUSION

The first objective was to understand current IPv6 transition methods based on knowledge about IP in general as well as IPv4 and IPv6 in particular. The authors learned that global IPv4 free pool was completely exhausted now; the transition to IPv6 would be a must for near future. There are three transition methods that were most applied i.e. dual stack, translation and tunneling. Each of them has its own advantages and disadvantages. Dual stack seems to be the best method. It is flexible because it utilizes both IPv4 and IPv6 at the same time on routers and easy to handle. Translation method makes the network vulnerable, as the whole networks will collapse if something bad happens to the routers in the transition process. Tunneling adds more complications to network management and has troubles with security attacks, which will not make executives happy.

V. FUTURE WORK

There are various areas for further study based on this thesis. Firstly, a study with a larger sample or more cases could be done for better results. Another topic could be to find the critical factors for the failure of IPv6 deployment in general or large network size enterprises. Additionally, study on IPv6 for mobile devices can be considered. Since the transition problem will be faced for many years from now, studies can be done into better translation mechanism, tunneling overhead reduction, better firewall solution. Case studies on business aspects of IPv6 need to be done.

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AUTHOR'S PROFILE

Rakesh Bendale, Computer engineering, Mumbai University/ yadhavrao Tasgaonkar Institute of engineering & Technology/ Saraswati Education Society, bhivpuri karjat, India, Mobile No 9637626212.

Saurabh Naykude, Computer engineering, Mumbai University/ yadhavrao Tasgaonkar Institute of engineering & Technology/ Saraswati Education Society, bhivpuri karjat, India, Mobile No 8655799024.

Nilima Nikam, Computer engineering, Mumbai University/ yadhavrao Tasgaonkar Institute of engineering & Technology/ Saraswati Education Society, bhivpuri karjat, India, Mobile No 9890768120.