Migration Of Ipv4 To Ipv6

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Abstract—The next Generation Internet Protocol which was called IPng or IPv6 which was designed by IETF for replacing the older version of Internet Protocol IPv4. Technologies are being developed by IETF to successfully integrate the IPv6 into the current systems. This work would evaluate three strategies namely Dual Stack Method, Header Translation, Tunneling. This study aims at finding the best method of seamless transition from IPv4 to IPv6 for large enterprise networks. The project involves the various methods and strategies which service providers can adopt for migrating to IPv6 without affecting their existing IPv4 network and services. Literature survey is done on IPv4 and IPv6 which shows that a lot of work is being carried out in IPv4 to IPv6 migration. In this thesis, we have created a heterogeneous network in which an IPv4 and IPv6 nodes coexists with the best migration strategy in place which is reliable and suited to various enterprise scenario. Exhaustive study on IPv4 to IPv6 migration is presented using various scenarios which are used to demonstrate the seamless connectivity between IPv6 and IPv4 clients with various services deployed over each network node.

Keywords—IPv4, IPv6, Dual Stack, Tunneling, Header Translation.

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 enterprisers, 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. Now what comes for the solution, answer is IPv6. IPv6 has a large pool of addresses and is not quite exhaustible for few decades. If comparing IPv4 and IPv6 we can see that IPv4 has $2^{32}$ addresses and IPv6 has $2^{128}$ addresses, so one can assume how large the pool is. So when there is a solution there are challenges which come by, challenge is how to coaxially work IPv4 and IPv6. So the design of strategies came up as a need for institution to cope up with the change and adapt the new version of IP. This thesis will focus on the same strategies and come up with the best transition or migration from IPv4 to IPv6.

II. LITERATURE SURVEY

One of the biggest challenges in the deployment of IPv6 is how to migrate IPv4-based infrastructures to those supporting IPv6 [2]. It is impractical and costly to replace existing IPv4-based networking
infrastructures with IPv6 [4]. Over the last decade, IETF (Internet Engineering Task Force) has been working on the deployment of IPv6 to replace the current IPv4 protocol [3]. To ensure a smooth and successful integration of IPv6 into existing networks, the IETF IPng Transition Working Group has been working on several transition strategies, tools, and mechanisms [3]. In general, these transition mechanisms encapsulate IPv6 packets into IPv4 packets and transport them over an IPv4 network infrastructure. We expect to rely on these transition strategies as the Internet shifts from the traditional IPv4 to an IPv6-based Internet while retaining both IPv4 and IPv6 throughout the transition phase. The MAN from IPv4 to IPv6 smooth transition is imminent, while taking advantage of existing network facilities resources and saving investment should also be fully considered [1].

2.1 Advantages of IPv6:
- Large address space
- Better support for security
- Better support for mobility
- Modern design for routing
- Auto configuration
- Secure Communication
- Backward Compatibility

III. SYSTEM ARCHITECTURE

In this proposal, our motivation is to design a viable solution:
1. To enable transparent end-to-end IP communication between IPv4 nodes and IPv6 nodes.
2. To be capable of scalable deployment.
3. To enable IPv4 based applications to run in IPv6 networks seamlessly. In order to achieve these goals and enable incremental deployment of IPv6 networks within the IPv4 based Internet, we have proposed solutions.
a) Dual Stack Strategy
b) Header Translation
c) Tunneling

The diagram shown below is the System architecture for the given thesis. We will discuss about the flow of the Architecture. Firstly the flow of the architecture is bi-directional as the transition is done in both ways i.e from IPv4 to IPv6 and IPv6 to IPv4.

The IPv4 System can seamlessly connect to IPv4 systems and same is the case with IPv6, but what when the communication between IPv4 and IPv6 which cannot be accessed directly. Hence the intermediate technologies are required so as to route any form of Data packet through different Network, Systems as well as Over Internet.

Now about Input to the System, Input to the System could be any User Input which could be any kind of Data, File, E-mail or just a Ping. When the questions are about Output the output would the Undisturbed and Error free data which was as Input. Strategies would be implemented by configuring the routers so as they route the data packets from source to the desired destination without a thought of whatever IP type network it belongs to.
3.1. Dual Stack Strategy
Network Layer consist of both IPv4 and IPv6 and Dual Stack happens there. Stack means, “A stack is a type of data structure, a way of storing information in a computer. When a new object is entered in a stack, it is placed on top of all the objects which are previously entered. The term "stack" can also be short for a network protocol stack. In networking, connections from computer to computers are made through a series of smaller connections. These connections, or layers, behave like the stack data structure, in that they are built and disposed of in the same way”. The term “Dual-stack routing” refers to a network that is dual IP, that is to say all routers must be able to route both IPv4 and IPv6.

3.2. Header Translation
The meaning of translation is to change or convert directly protocols from IPv4 to IPv6 or vice versa, which might result in changing those two protocol headers and payload. This mechanism can be established at layers in protocol stack, which consist of network, transport, and application layers. The translation method has many mechanisms, which are stateless or stateful. Stateless depict that the translator can perform every conversion separately with no reference to previous packets, stateful is the total opposite, which maintains some form of state in regard to previous packets. The translation process can be conducted at end systems or network devices.
3.3. Tunneling

A many kinds of tunneling technologies has been developed to support Ipv4 over Ipv6 as well as Ipv6 over Ipv4 tunneling. These technologies are mostly categorized as configured or automatic. Configured tunnels are predefined, whereas automatic tunnels are created and destroyed “on the fly”. In general, tunneling of Ipv6 packets through an Ipv4 network comes with prefixing each Ipv6 packet with an Ipv4 header. This enables the tunneled packet to be routed over an Ipv4 routing infrastructure.

Tunnels are categorized in two types:

- Automatic Tunnels
- Configured or Manual Tunnels

3.4. Comparison

<table>
<thead>
<tr>
<th></th>
<th>Advantages</th>
<th>Disadvantages</th>
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<tbody>
<tr>
<td>Tunneling</td>
<td>- Configure tunnel endpoints only</td>
<td>- Face another problem of NATs</td>
</tr>
<tr>
<td></td>
<td>- Simple deployment</td>
<td>- Take more time and CPU</td>
</tr>
<tr>
<td></td>
<td>- No additional management</td>
<td>- Harder to troubleshooting &amp; network management</td>
</tr>
<tr>
<td>Translation</td>
<td>- The router is used as a translation communicator</td>
<td>- Limitations similar to IPv4 NAT</td>
</tr>
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<td></td>
<td>- Solve network interoperability problems</td>
<td>- Reduction in the overall value and utility of the Network.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Harder to control on alarger scale</td>
</tr>
<tr>
<td>Dual Stack</td>
<td>- Easy to implement</td>
<td>- Two routing tables</td>
</tr>
<tr>
<td></td>
<td>- Low cost</td>
<td>- Additional memory and CPU</td>
</tr>
</tbody>
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Figure 3. Header Translation Mechanism

Figure 4 Tunneling Mechanism

Table 1 Comparison
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.

REFERENCES
