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Transition mechanism from IPv4 to IPv6 -A Review

Suresh Kumar Jha[1], Amit Mishra[2], Nitesh agarwal[3]
Jodhpur Institute of Engineering and Technology, Jodhpur

ABSTRACT

In the present scenario by increasing the number of devices connected with internet Ipv4 addressing method is not capable to fulfilling the requirement of IP addresses. With the number of IPv4 addresses almost completely consumed, the implementation of IPv6 has become a necessity for many organizations. However, it is not all that feasible to just switch everything over to IPv6 without some type of transition. This paper gives focus to the methods that can be used to transition to IPv4 from IPv6.

Keywords:- *IPv4, IPv6, protocol, tunneling, dual stack*

INTRODUCTION

For switching to IPv4 to IPv6 instantly is impossible because of the giant size of the Internet and of the large number of IPv4 users. Whatever, 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. The migration from IPv4 to IPv6 must be implemented node by node by using auto configuration procedures to eliminate the need to configure IPv6 hosts manually. This way, users can immediately benefit from the many advantages of IPv6 while maintaining the possibility of communicating with IPv4 users or peripherals. Consequently, there is no reason to delay updating to IPv6!

IPV6 TRANSITION METHODS

These are the main methods that can be used when transitioning a network from IPv4 to IPv6; these include:

- **Dual Stack** – Running both IPv4 and IPv6 on the same devices
- **Tunneling** – Transporting IPv6 traffic through an IPv4 network transparently
- **Translation** – Converting IPv6traffic to IPv4 traffic for transport and vice versa.

DUAL STACK

The simplest approach when transitioning to IPv6 is to run IPv6 on all of the devices that are currently running IPv4. If this is something that is possible within the organizational network, it is very easy to implement. However, for many organizations, IPv6 is not supported on all of the IPv4 devices; in these situations other methods must be considered.[1]

TUNNELING

Most people with some networking knowledge are familiar with the concept of tunneling; a given packet is encapsulated into a *wrapper* than enables its transport from a source to destination transparently where it is decapsulated and retransmitted. There are a number of different tunneling methods that exist for IPv6, many that are integrated as part of Cisco and other manufactures certification tests. The following list shows the different available tunneling methods:[1]

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- **Manual IPv6 Tunnels** – A manually created IPv6 tunnel is configured between two routers that each must support both IPv4 and IPv6. Incoming traffic that is destined for networks on the other side of the tunnel is encapsulated on the source router and tunneled through IPv4.

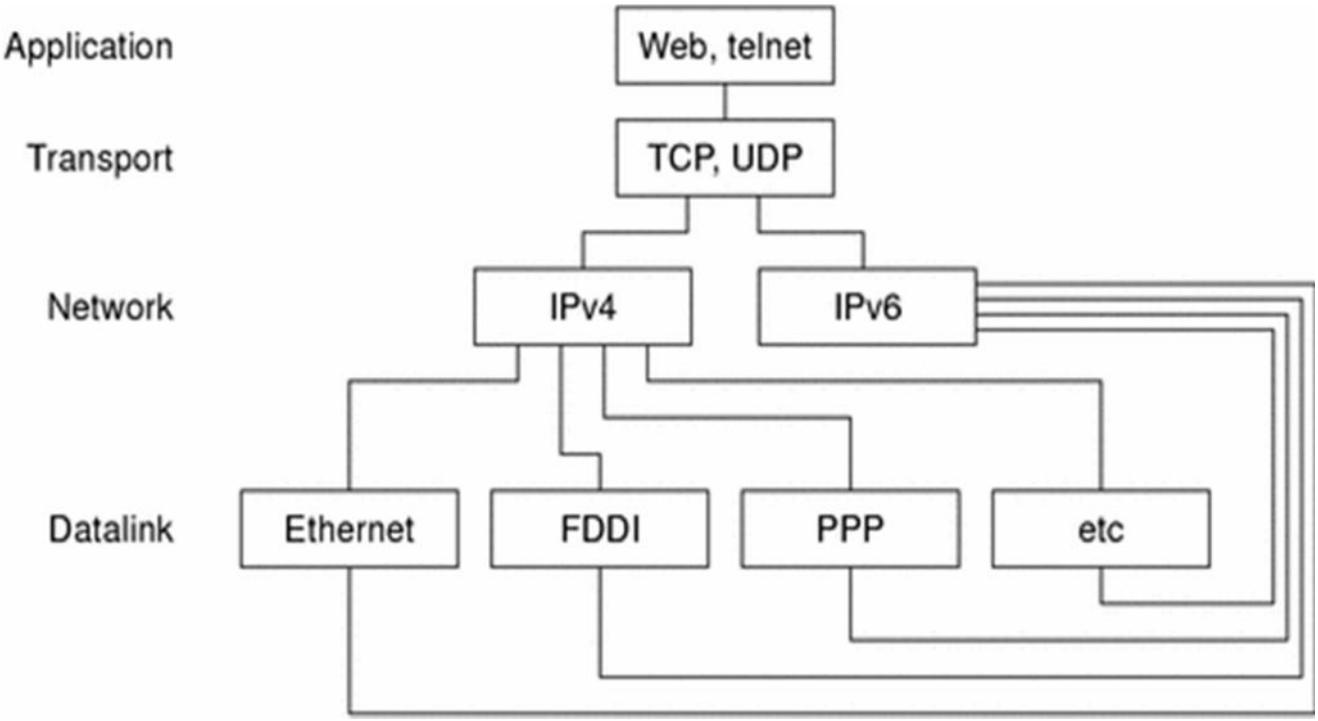

Figure-1 Dual-Stack Protocols

- **Generic Routing Encapsulation (GRE) IPv6 tunnels** – GRE is a protocol that was developed by Cisco and for the purposes of IPv6 tunneling operates and is configured very much the same as manual tunnels. GRE itself is able to be used to tunnel over a diverse number of network layer protocols other than IPv4. When dealing with IPv6, a GRE tunnel can be used to tunnel IPv6 over IPv4 or IPv4 over IPv6. As with manual tunnels, when configuring GRE tunnels both the source and destination must be manually configured and each must support both IPv4 and IPv6.
- **6to4 Tunnels** – As the name suggest a 6to4 tunnel allows IPv6 to be tunneled via IPv4. Unlike the previously discussed tunneling methods, the 6to4 method is automatically set up using the 2002::/16 IPv6 address space. The IPv4 address for the edge routers is embedded in an IPv6 address that is created.
- **IPv6 rapid deployment (6rd)** – The 6rd method was derived from the 6to4 method but allows the implementer to use the IPv6 block that was assigned to it.
- **IPv4 Compatible Tunnels** – The IPv4 Compatible tunneling method is very similar to 6to4 tunneling; both provide a mechanism to tunnel IPv6 over IPv4. The major difference is how the IPv4 address is embedded inside the IPv6 address that is used by the edge device.[1][2]
- **Intra-Site Automatic Tunnel Addressing Protocol (ISATAP) Tunnels** – Again, like the other tunneling mechanisms, the ISATAP method transport IPv6 traffic over IPv4; unlike other methods the ISATAP method is intended for use inside a site and not between two dual stacked edge devices. Communications between IPv6 hosts is handled through a central IPv6 capable device.

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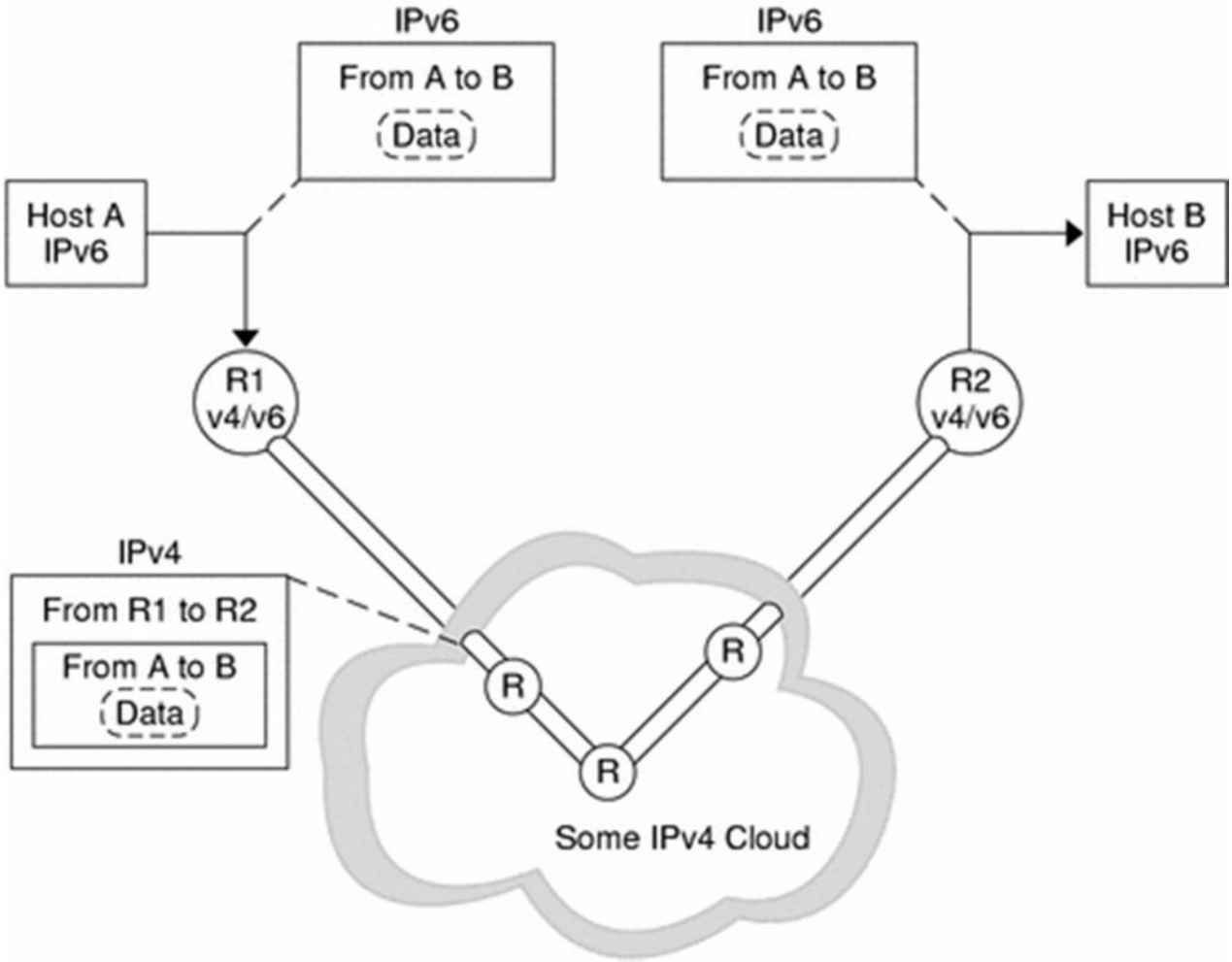

Figure -2 Tunneling mechanism

TRANSLATION

Unlike the above discussed tunneling methods, a translation method provides a way to translate IPv6 to IPv4 traffic and vice versa. When using translation, the traffic is not encapsulated but is converted to the destination type (be that IPv4 or IPv6). There are two methods that are typically used with translated IPv6 networks; these include:

- **Network Address Translation**—Protocol Translation (NAT-PT) – The NAT-PT method enables the ability to either statically or dynamically configure a translation of a IPv4 network address into an IPv6 network address and vice versa. For those familiar with more typically NAT implementations, the operation is very similar but includes a protocol translation function. NAT-PT also ties in an Application Layer Gateway (ALG) functionality that converts Domain Name System (DNS) mappings between protocols.
- **NAT64** – One of the main limitations to NAT-PT was that it tied in ALG functionality; this was considered a hindrance to deployment. With NAT64 also came DNS64, both of which are configured and implemented separately; when these were defined and accepted the use of NAT-PT was depreciated. NAT64 offers both a stateless and stateful option when deploying, the later that keeps track of bindings and enables 1-to-N functionality.

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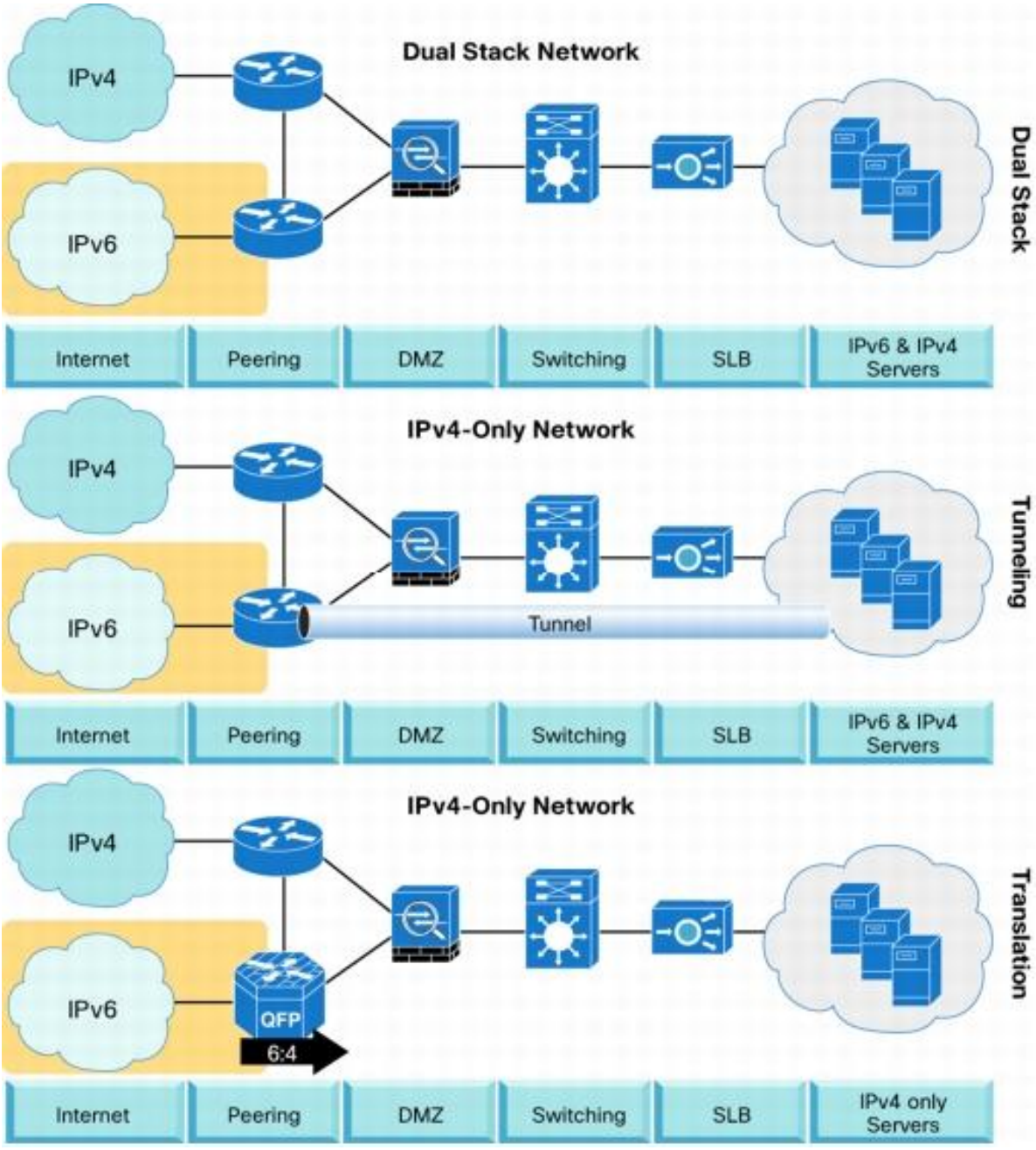

Figure 3.IPv6 Transition Techniques[2]

STATISTICS

Google collects statistics about IPv6 adoption in the Internet on an ongoing basis. We hope that publishing this information will help Internet providers, weite owners, and policy makers as the industry rolls out IPv6.The below statistics shows two types of analysis one is based on IPv6 adoption and another is per-country ipv6 adoption.[2]

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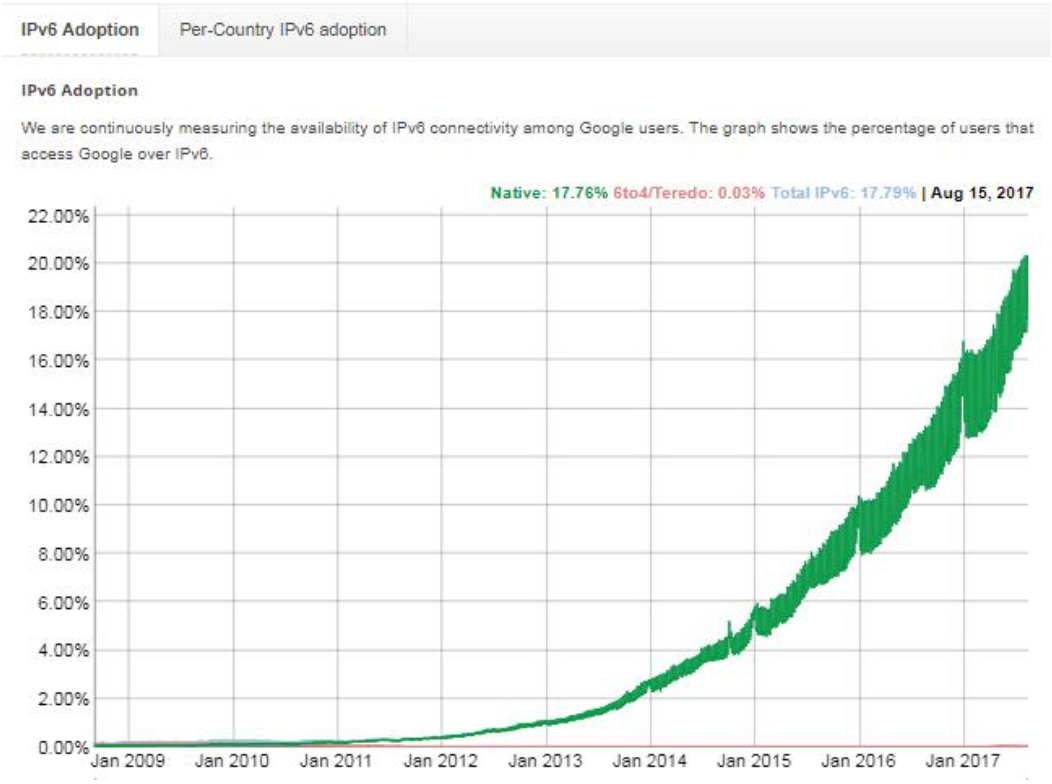

Figure 4. IPv6 adoption

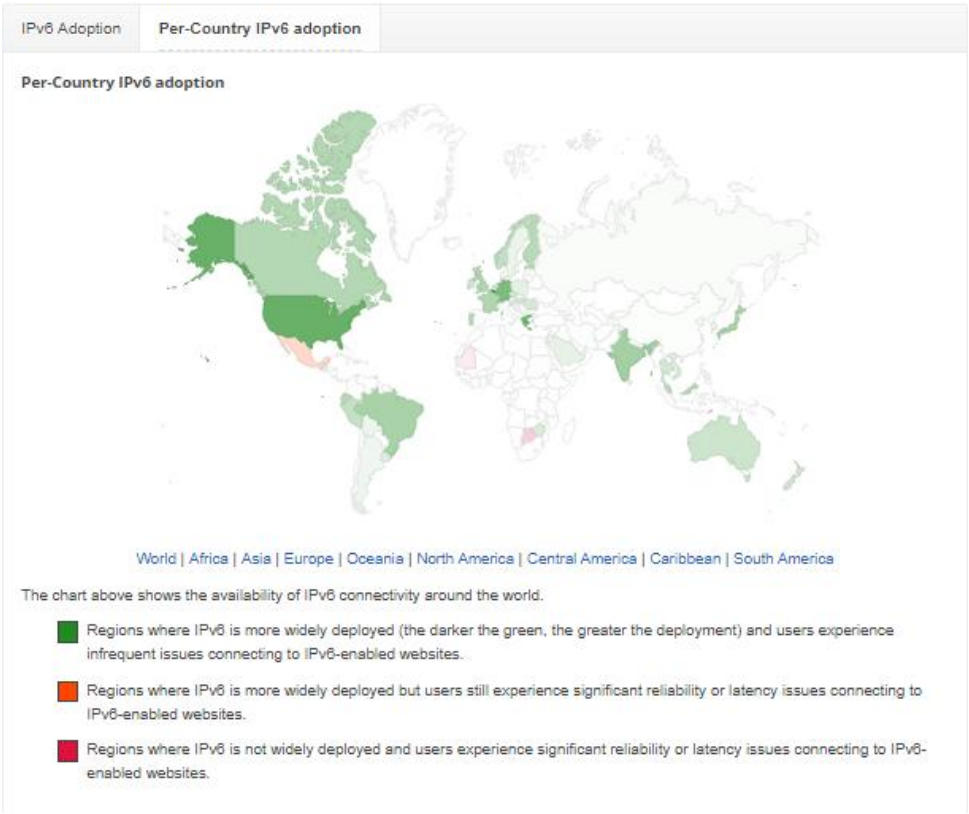

Figure 5. Per Country IPv6 adoption

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CONCLUSION

One of the most important parts of implementing IPv6 is being able to gracefully transition from IPv4. This in itself is a giant undertaking and cannot simply happen in a short amount of time. The methods discussed in this paper can each be used as options when beginning an IPv6 deployment and should each be looked over for applicability depending on the specific requirements of an organization. Hopefully the information contained within this paper provides the reader a starting point to this process. The selection of an IPv6 transition mechanism depends greatly on the current status of an organization's network and how fast they want to transition their devices from IPv4 to IPv6. Those larger companies that have tens of thousands of network devices will most likely transition a piece at a time following the experience level of each department. The transition to IPv6 is coming, and all those network engineers reading this paper should become experts in IPv6 as quickly as possible. The process of converting networks from IPv4 to IPv6 will shortly become a large-scale request, and those with the correct skills will be in demand, a fact even more important in the current economy.

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