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Migration to Ipv6 From IPV4 by Dual Stack and Tunneling Techniques

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***Abstract*— The internet can be accessible worldwide which is system of interconnected networks. IPv4 protocol in network enables data sharing between two or more computers which minimize time and energy wastages. In February 2011, all IPv4 addresses had vanished and now we are going for IPv6. Migration technique to IPv6 network is proposed in this project that overcomes all the limitations available in existing IPv4 network. Dual Stack migration and tunneling migration techniques has been proposed in this paper to transmit IPv6 packet through IPv4 network that enables and achieves full convergence in IPv6 network. The application of dual stack and tunneling techniques for migration from IPv4 to IPv6 has been simulated using GNS 3 (Graphical Network Simulator). The transfer of packets across the network for both static and dynamic scenarios has been implemented. The performance parameters like success rate and the minimum, average and maximum round – trip time, latency have been evaluated and analyzed for the transmissions.**

***Keywords*— Internet Protocol, Routers, Switches, Hosts, Dynamic Routing, Static Routing, Open Shortest Path First, Mannual Tunneling.**

I. INTRODUCTION

The internet is a worldwide accessible system of interconnected networks. Two current versions of the Internet Protocol (IP) are provided by Internet Assigned Numbers Authority (IANA) [1-3]. Out of this protocol, IPv4 protocol was already allotted to Regional Internet Registries (RIR) and there is no more IPv4 address to allot and IANA has started issuing the IPv6 address to RIR [4-5]. As they are not directly compatible, there is a competition going on between these protocols [6]. The aim of this paper is to provide the compatibility of IPv6 packets through IPv4. Network providers and users are forced to determine whether to support either one or both protocols for various network services [7-8].

II. SYSTEM ARCHITECTURE AND ANALYSIS

A. IPv4 (Existing System)

IPv4 is the fourth version in the development of the Internet Protocol (IP). IPv4 is a connectionless protocol for use on packet - switched link layer networks (e.g., Ethernet). IPv4 is still by far the most widely deployed internet layer protocol. It operates on a best effort delivery mode. IPv4 is a network that enables data sharing between two or more computers.

B. IPv4 Addressing

IPv4 uses 32-bit addressing. IPv4 can address 232 or approximately 4.3 billion devices. IPv4 is represented in dotted decimal format. These addresses were found to be exhausted by Feb 3, 2011. Network addressing changes by classfull network design, network address translation (NAT) Classless Inter-Domain Routing have contributed to delay. The system defined five classes of addresses namely class A, B, C, D, and E. IPv4 addresses have been freely allocated to growing public and private internetworks.

C. IPv6 (Proposed System)

IPv6 is also known as IPng, IP next generation. IPv6 was developed by the Internet Engineering Task Force (IETF) to deal with this long-anticipated IPv4 address exhaustion. IPv6 also implements the features which is not present in existing IPv4.

D. Need for IPv6

IPv6 is needed to overcome the existing limitations of IPv4. The limitations of IPv4 are less security, more latency, less address space and no auto configuration facility.

E. IPv6 Addressing

IPv6 uses 128-bit addresses which are divided into 8 groups and the 8 blocks into 4 digit hexadecimal numbers separated by colons. This representation is called colon-hexadecimal.

III. Problem Definition

When any organization wants to implement IPv6 network in their service area, it is not possible to implement all of a sudden in entire area. It needs slow migration from IPv4 to IPv6 without affecting the existing service much.

IV. Hardware Tools

The hardware tools used in simulation are routers, switches and hosts.

V. Dual Stack Protocol

In dual-stack, both hosts and routers will communicate with both IPv4 and IPv6. The dual stack hosts use IPv6 address while communicating with IPv6 hosts. It will use IPv4 address for communicating with IPv4 hosts.

VI. Tunneling Protocol

Tunneling protocol is used for secure data transmissions. Tunneling allows private network transmissions to be sent across a public network, such as the internet, through encapsulation process. The encapsulation process means covers the data transmissions in tunneling concept. By using tunneling, it provides a secure path through an untrusted network.

VII. Mannual Tunneling

A manual tunneling is configured manually. It is used for providing stable connections between two edge routers or end system and edge routers for providing connections to remote IPv6.

VIII. Design Of Dual Stack Network

Design of dual stack technique is done for transferring of data from IPv4 network to IPv6 network in both static and dynamic routing, which will support both kind of addressing and packets. This network consists of five routers and four switches. By transferring of packets from one router to another router we can calculate round trip time – minimum, average, maximum for both IPv4 and IPv6. We can analyze the result whether IPv4 or IPv6 as least round trip time.

IX. Design of Tunneling Network

Designing of tunnelling technique is done for transferring of data from IPv6 network of node R1 to another IPv6 network of node R5 through IPv4 network of node R3 and vice versa in this paper. Here the IPv6 and IPv4 are designed by enabling the OSPF protocol. When data is sent from IPv6 network of node R1 to dual stack of node R2, where dual stack adds IPv4 header with IPv6 packet and allows passing through tunnelling over IPv4 network to another dual stack of node R4. This dual stack of node R4 will remove the IPv4 header from received IPv6 packet and allows this packet to reach the destination IPv6 network of node R5. We have implemented by using manual tunnelling technique.

X. Routing Protocols

A. *Static Routing*— Routing in which the routing table entries will remains unchanged. Static routing table contains information which is entered manually. It cannot be updated automatically. The table should be updated manually by the administrator.

B. *Dynamic Routing*— Routing in which the routing table entries should be updated automatically by the routing protocols. Dynamic routing table is updated periodically by using dynamic routing protocols like OSPF**.** Whenever there is a change in internet like shutdown of router or breaking of link, Dynamic routing protocols should be updated in all the tables in the routers automatically.

C. *Open Shortest Path First*— Open Shortest Path First (OSPF) is an adaptive routing protocol for Internet Protocol (IP) networks. It uses a link state routing algorithm and falls into the group of interior routing protocols, which will operate within a single autonomous system.

XI. Graphical Network Simulator

GNS 3 is a graphical network simulator that allows simulation of complex networks, for providing complete and accurate simulations. It is a strongly linked with dynamics - a Cisco IOS emulator.

XII. Performance Metrics For Tunneling Technique

$$\text{Latency} = \frac{Average\ round\ trip\ time\ for\ packet}{2}\ (\text{ms})$$

Latency is the delay from the input into a system to desired output.

$$\text{Throughput} = \frac{\textit{Packet size}}{\textit{Latency}} \text{ (M bits/s)}$$

Throughput is defined as a ratio of packet size to the latency.

XIII. Simulation Results

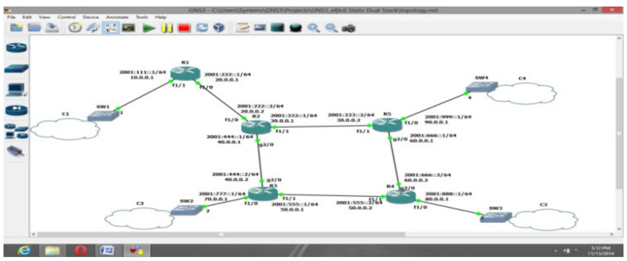

Fig. 1. Dual Stack – Static Routing Network

Fig. 2. Router – 1 Configuration

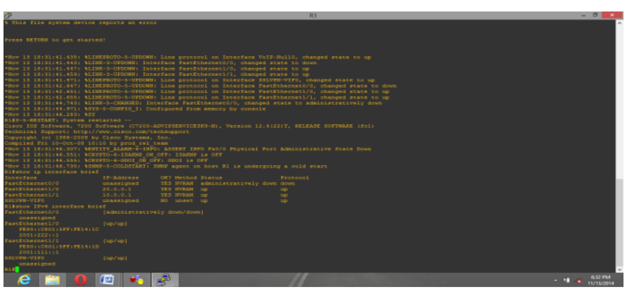

Fig. 3. Router 1 – status of the protocol of IPv4 and IPv6

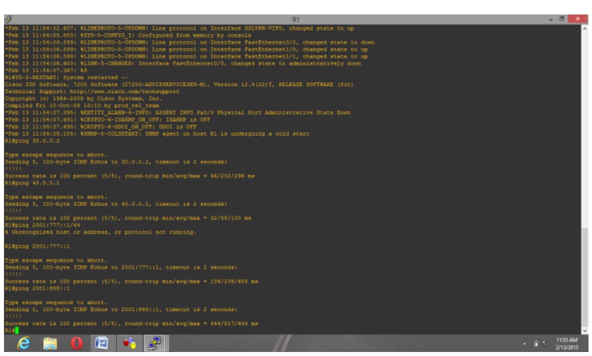

Fig. 4. Router – 1 Round Time Status

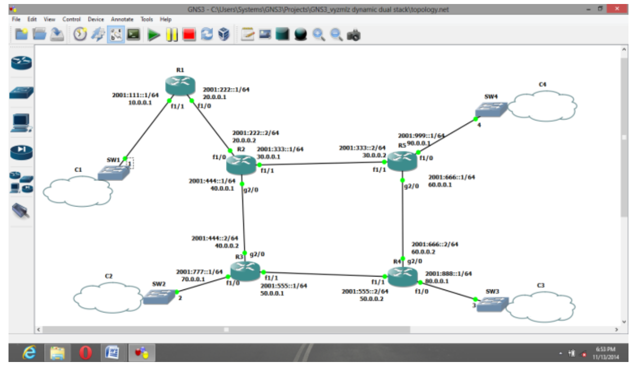

Fig. 5. Dual Stack – Dynamic Routing Network

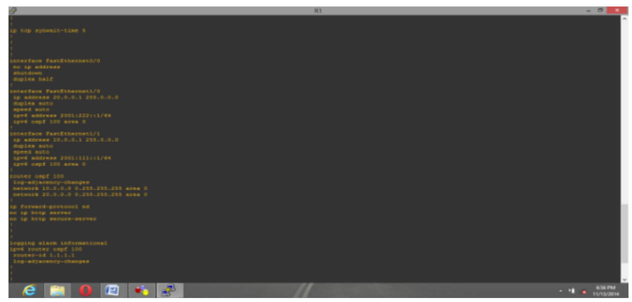

Fig. 6. Router – 1 Configuration

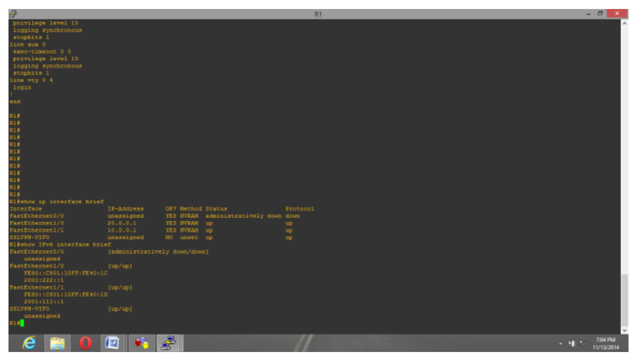

Fig. 7. Router – 1 Status of the Protocol of IPv4 and IPv6

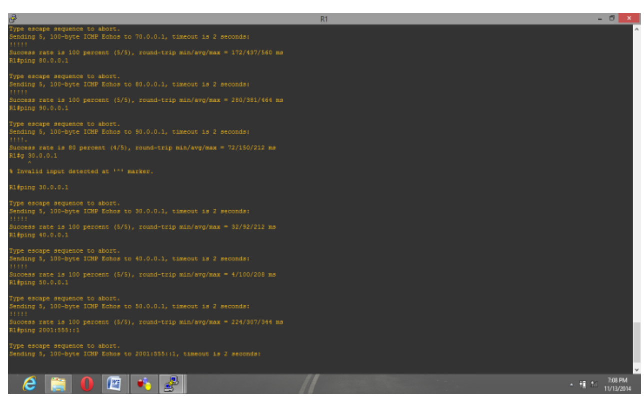

Fig. 8. Router – 1 Round Time Status

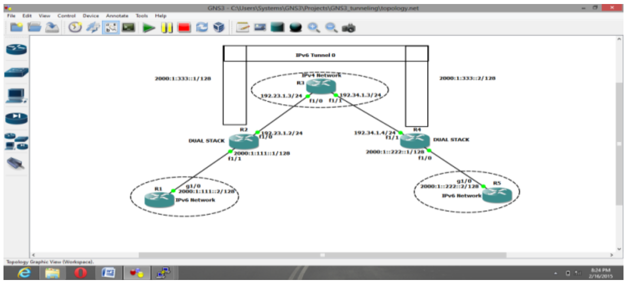

Fig. 9. Architecture of Tunneling Network

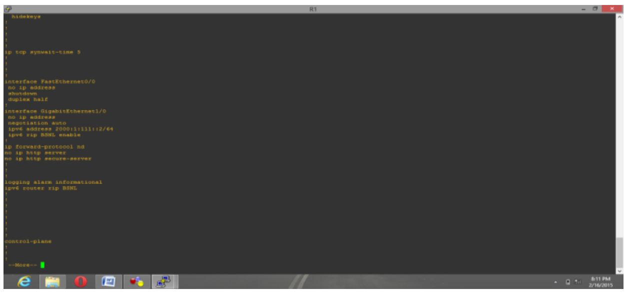

Fig. 10. Configuration of Router 1 in IPv6 Network

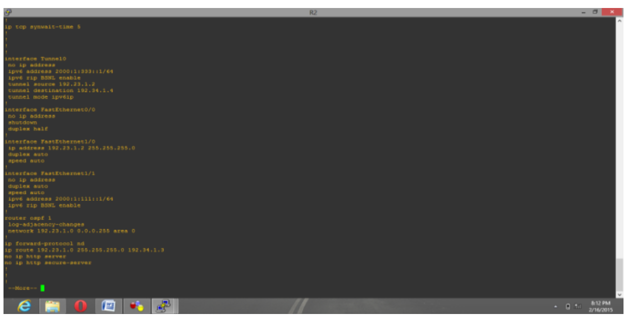

Fig. 11. Configuration of Router 2 in Dual Stack

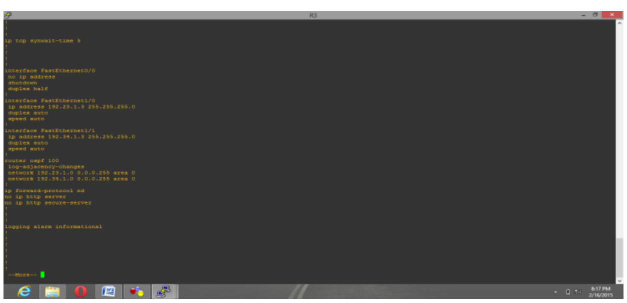

Fig. 12. Configuration of Router 3 in IPv4 Network

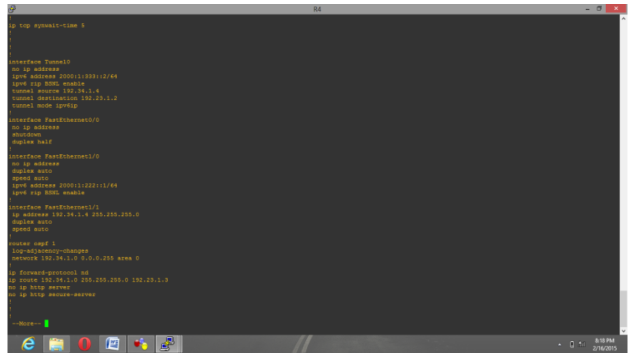

Fig. 13. Configuration of Router 4 in Dual Stack

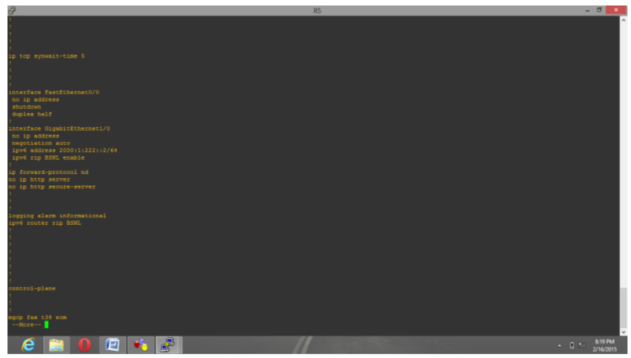

Fig. 14. Configuration of Router 5 in IPv6 Network

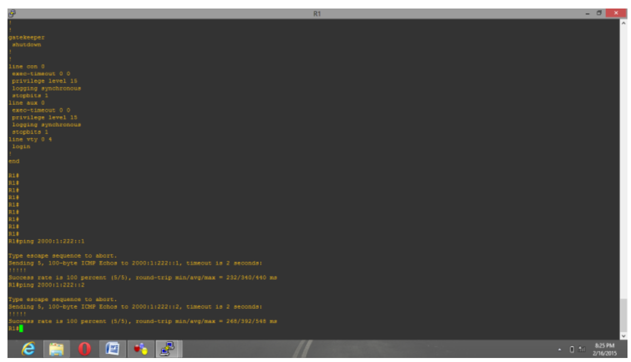

Fig. 15. Router 1 Round Trip Time Status

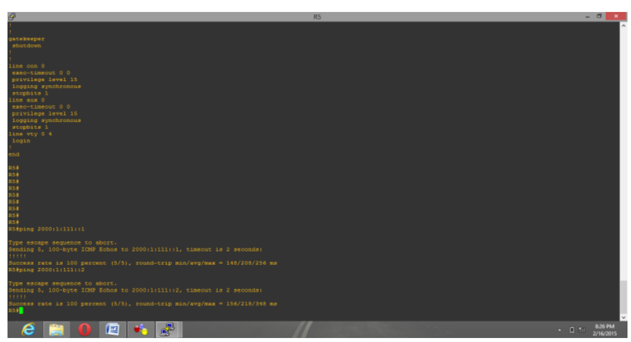

Fig. 16. Router 5 Round Trip Time Status

XIV. Performance Comparisons

Table 1. Performance Comparison of Static and Dynamic Dual Stack

Dual Stack Techniques	*Success Rate*	*Round Trip Time (ms)*		
		Minimum	*Average*	*Maximum*
Static IPv4	100	268	316	376
Static IPv6	100	280	381	464
Dynamic IPv4	100	172	230	448
Dynamic IPv6	100	224	307	344

Table 2. Performance Comparison for Latency between IPV6 and IPV4 in Tunneling Technique

Packet Size	*IPv6*		*IPv4*	
	Latency (ms)	*Throughput (M bits/s)*	*Latency (ms)*	*Throughput (M bits/s)*
100	22	4.54	56	1.78
100	27	3.70	30	3.33
100	37	2.70	62	1.61
100	32	3.12	67	1.49

XV. Conclusion

The application of dual stack technique for migration from IPv4 to IPv6 has been studied. The transfer of packets across the network for both static and dynamic scenarios has been studied. The success rate and the minimum, average and maximum round –trip time have been analyzed for the transmissions through dual stack technique. Dynamic IPv4 has least minimum & average round trip delay and Dynamic IPv6 has least maximum round trip delay. The application of tunnelling technique for migration from IPv4 to IPv6 has been studied. The transfer of packets across the manual tunnelling network has been performed. The success rate, packet size and the minimum, average and maximum round – trip time have been analyzed for the transmissions through manual tunnelling technique. Latency and throughput for both IPv6 and IPv4 are calculated and analyzed. IPv6 has the least latency while comparing with the latency of IPv4 and the throughput depends upon the latency. So we are migrating to IPv6 network from IPv4 network.

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