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Performance Evaluation and Comparisons for IPv4&IPv6 using mpls Technologies

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Abstract: *Multiprotocol Label Switching (MPLS) is deployed by many service providers in their IPv4 networks. Service providers want to introduce IPv6 services to their customers, but changes to their existing IPv4 infrastructure can be expensive and the cost benefit for a small amount of IPv6 traffic does not make economic sense. This paper presents a comparative study between MPLS, ipv4, and ipv6 over voice.*
Keywords: *Mpls, Ipv4, Ipv6,delay, traffic dropped, traffic in out, throughput and utilization*

I. Introduction

In today's communication systems, the Internet Protocol Version 4 (IPv4) has reached it limits on various front, and a transition to the new version of IPv6 is imminent [1]. J. L. Shah et. al. [2] have listed various benefits of IPv6 over the IPv4 that include, a larger address space (128 bits), inbuilt stateless auto configuration support, smaller packet header size, inbuilt support for IPSec Security, efficient Support for Mobility, better packet forwarding, support for Real Time Multimedia and QoS, and support for Multicast and Any cast Traffic. The major challenge for the deployment of IPv6 systems is the migration from IPv4 based systems [1]. The cost include that due to the migration for equipment as well as operational downtime cost. As discussed in [3-4], various techniques have been proposed to minimize these impacts to existing systems. The performance of the network can be investigated by looking at network errors such as jitter, datagram or packet loss, latency, poor transfer rates, and bandwidth quality. Data compression, encryption and other means of traffic engineering are some of the approaches that can be done to improve network performance [5].

The brief list of specification of the IPV4 and IPV6 protocols along with migration task are presented below:

A. Ipv4

IPv4 uses 32-bit addresses, which is about 4,294,967,296 unique addresses. These unique addresses are reserved for special purposes such as local networks or multicast addresses, thus reducing the number of addresses that can be allocated as public Internet addresses.

B. Ipv6

The IPv6 (Internet Protocol Version 6) consists of 128 bits address. It is developed in order to overcome the address limitation space in IPv4 which offers quite a few enhancements and possibilities. Additionally, the IPv6 also offers much more new advance technology such as bigger address space, advance encryption and authentication, support for mobile devices, built in security, peer to peer VPN and many more [6].

C. Migaration

Tunneling is one of the mechanisms that are used for transition between IPv4 and IPv6 to completely automate IPv6 connectivity in IPv4 current infrastructure. There are two types of tunneling whether using configured tunneling:

1. Manual Tunnels:

The configuration of manual tunnels is one of the simplest ways to perform because these types of tunnels are limited to a single source and destination.

2. Dynamic multipoint tunnels:

It is another migration technique that can be used, and it is called dynamic because it is not required to specify the end-point IPv4 address as it is being automatically determined.

There is another advanced mechanism of IPv6 to IPv4 tunneling which is using Multiprotocol Label Switching (MPLS). The MPLS protocol offers better routing delivery for packet switching from one network node to the next based on short path labels rather than long network addresses hence avoiding lookups in a routing table [7]. Basically, the MPLS is based on packet labeling process where each routing decision rely on information that is contained in the label. The Label Switching Router (LSR) will route the packet to the suitable Label Switching Path (LSP) for a delivery process based on that information [8].

In this article, a network simulator OPNET 14.5 is used to report on network delay, packet loss, and throughput parameters on MPLS networks based on IPV4 and IPV6 protocols.

II. Methodology

OPNET 14.5 has been employed to simulate two scenarios of MPLS with IPV4 and another case with IPV6. To analyze the traffic between source and destination three parameters delay, Packet dropped and throughput has considered to evaluate the network performance for MPLS network based on IPV4 and IPV6.

III. Results And Discussion

D. Packet drop/Loss

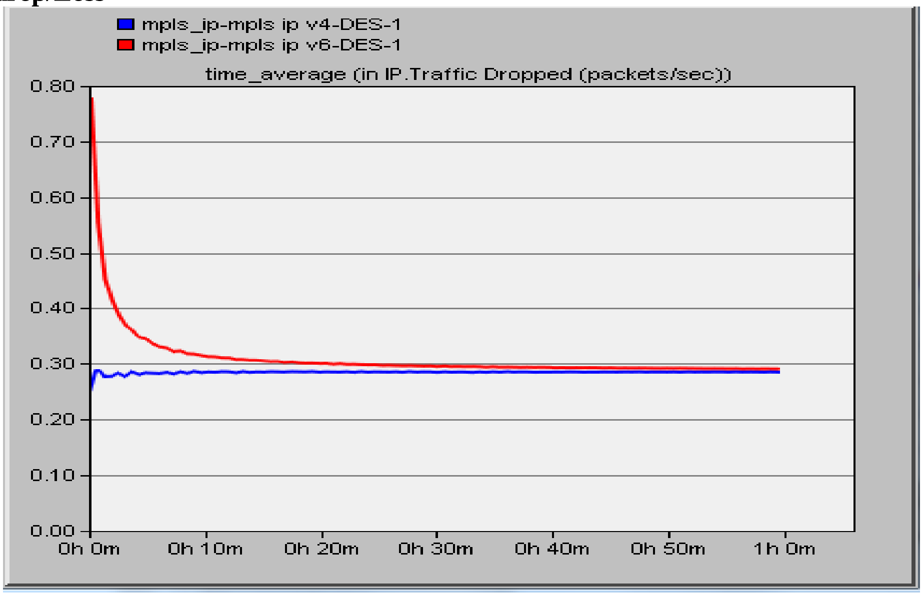

Figure (1): Network delay simulations of IPV4 and IPV6.

Figure 1. shows a comparison of traffic drop between ipv4 (shown in blue) and ipv6 (shown in in red). It can be noted that the IPV6 protocol results in higher packet delay when compared to IPV4 protocol.

E. Throughput

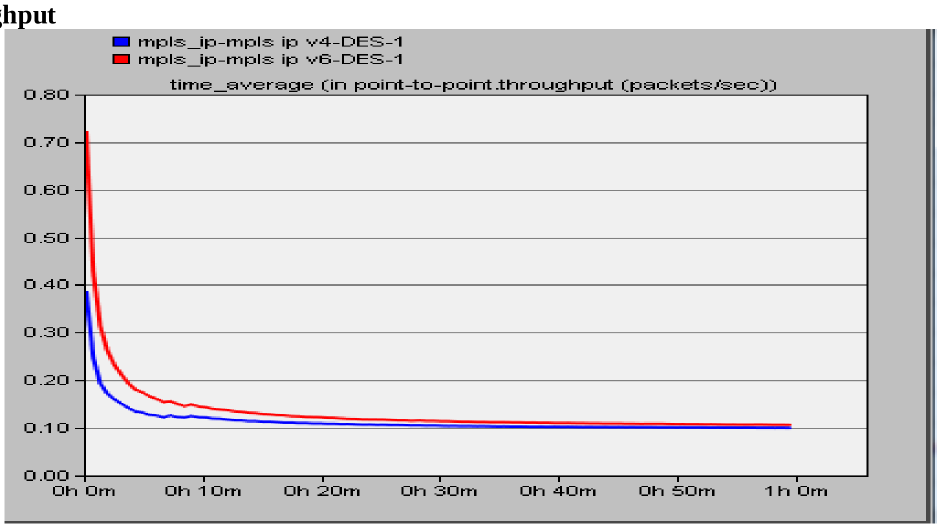

Figure (2): Throughput simulations of IPV4 and IPV6.

Figure 2 represent the throughput of IPV4 (Blue) and IPV6 (Red). The graph shows that IPV6 presents higher throughput when compared to the IPV4. This leads to the fact that IPV6 has better performance in case of high traffic volume.

F. Delay

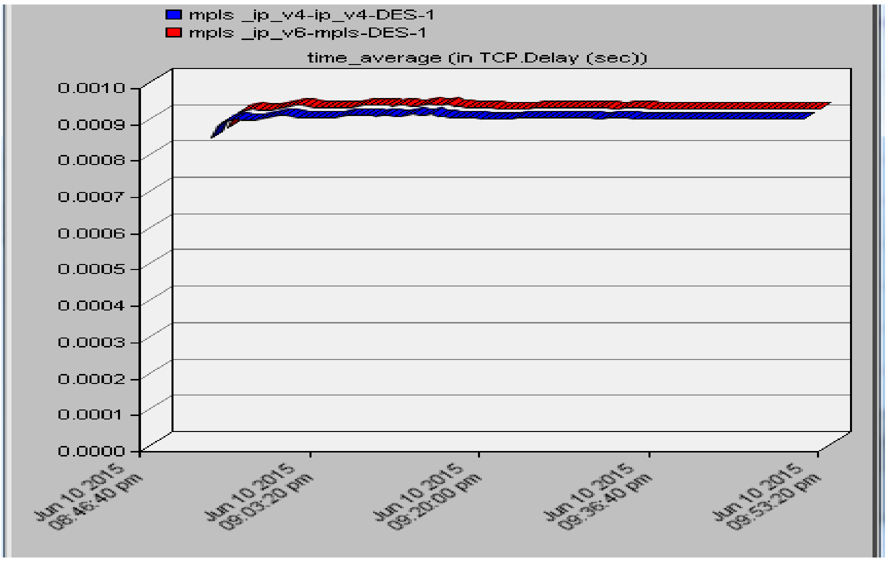

Figure (3): Delay simulations of IPV4 and IPV6.

Figure. 3 shows that IPV6 in the MPLS suffers from higher delay compared to the IPV4 in MPLS. This can be attributed to the longer header length in the IPV6 protocol and will result in high packet delay. The IPV4 protocol has shorter header leading to lower packet delay.

IV. Conclusions

The simulation of packet drop/loss, throughput, and packet delay is used to evaluate the IPV4 and IPV6 within MPLS protocols. The simulation is executed with OPNET14.5 network simulator. It is found that the IPV6 within MPLS shows higher packet loss, higher throughput, and higher delay. On the other hand, IPV4 in MPLS have the lowest throughput compared to IPV6,while in the same time have less delay and packet dropped to the traffic. Thus it is recommended to use IPV6 protocols in applications that require high bandwidth performance while it is not suitable for real time applications due to the higher packet loss and delay.

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