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A Comparative Analysis on Internet Protocols in Cloud-Mobile Environment

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ABSTRACT

In today's era, new technologies are emerging day-by-day that provides reliable and satisfactory access to the user's needs. On-demand and flexible computing techniques have been into craze to numbers of Internet users. This technique is formally known to be Cloud Computing that ensures an efficient basis to make access to shared resources at different geographical locations when dealt in combination with IP and its versions. Since this technology needs low maintenance and management cost, is accepted world-wide by several business enterprises. To accomplish the goals for higher reliability, OPNET IT GURU EDUCATION VERSION 14.5 is being used. The performance for two IP addressing formats is being compared by measuring certain parametric factors, such as queuing delay, throughput and utilization.

***Index Terms*:** Cloud Computing, Queuing Delay, Utilization, Throughput, PPP, Digital Signal, Internet Protocol, IP Routing Protocol, IPv4, IPv6, RIPng, OSPF, IS-IS.

I. INTRODUCTION

Cloud Computing [1] is a technology that provides a facility to access resources and to ensure to use Internet facility on an on-demand basis. Cloud computing is an on-demand computing that allows multiple users and organizations to make use of the shared resources and access to applications placed at a distance farther to them geographically.

The idea of cloud computing provides with a virtual environment that makes possible for an organization to perform a speed-up IT operation to be done. This functionality is one of the demanding facilities to be used. This is because it doesn't need to maintain each and every data to be stored; data is usually stored and accessed through a cloud or virtual network.

Success of cloud computing technology can be because it needs not to be maintained or managed with extra infrastructure a cost which is formally needed in establishing any physical network. Due to low maintenance and infrastructural costs, this has been claimed as most useful and efficient network.

Due to following features cloud computing has led to growth in an IT world, out of them some can be: Scalability, services at cheaper cost, availability and accessibility of resources, high performance, etc. with an automatic failure recovery service.

Cloud computing is a subset for Service-oriented Architecture (SOA) [10] i.e. it works on terms and conditions set in SOA which helps user to gain solutions to their problems in accessing services, resources globally by making use of the standards set priory by SOA.

Besides this, cloud computing has characteristics too in other fields, such as: Device independence, agility, cost reduction, location independence, maintenance, performance, scalability, elasticity, productivity, security, reliability. Five essential terminologies of cloud computing can be as following:

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1.1 *On-demand self-servic*- User need to make or wait for any human intervention to access or take as granted to access any service needed.

1.2 *Resource pooling*- A virtual pool is maintained of all the resources in a shareable mode to all the users as on on-demand methodology.

1.3 *Broad network access*- Standard mechanisms are made to available to network that provide to remotely access functionalities to user.

1.4 *Rapid elasticity*- The user is not provided with limitation to make access of services. He is allowed to make use for an unlimited time for any quantity.

1.5 *Measured servic*- Both the provider and user will be acknowledged about the usage of resource, type of services used every-time.

Furthermore, the paper is sectioned as follows: II. Mobility architecture, Internet Protocols (IP) [3], Routing Internet protocol (RIP) [4] and its types, Digital Signaling. III. Simulation process i.e. defining scenarios to analyze; two scenarios are made: Simple Internet Protocol version-4 (IPv4) [3] with RIP next generation (RIPng) [4] and Internet Protocol versio-6 (IPv6) [3] with RIPng, Open Shortest Path First (OSPF) [5] & Intermediate System-to-Intermediate System (IS-IS) [6]. IV. Analysis for these two proposed scenarios i.e. discussing about the performance of network in each of the scenario. V. Conclusions and References for the text and idea.

II. USEFUL WORK

Cloud computing supports an architecture that follows a distributed environment. A distributed environment can easily be established through cloud computing as it provides an appropriate architecture by providing such facilities to number of users such that they can make easy access to their resources and can easily access for required applications. A distributed environment can be composed of separated, but inter-connected, autonomous network segments, each of which is capable enough to operate through cloud computing. Besides this, to build up a network, a reliable connection need to be maintained consisting of a peer-to-peer connection for proper synchronization of resources and files in a distributed environment. To prepare a peer-to-peer linking or inter-connection protocol is being used i.e. Point-to-Point Protocol (PPP) [7].

PPP is one of the data link (layer 2) protocols that are generally used to connect two nodes with each other in a leased-line manner, maybe through a cable. PPP provides with three additional facilities to provide higher levels of reliability, such as transmission encryption, connection authentication and compression techniques [8]. There are two main carrier systems that use PPP protocol to prepare a peer-to-peer connection. These can be:

2.1 *Digital Signal 1*- DS-1 [9] is also known as T1 line. DS1 is just a bit pattern on a physical T1 link. It follows a bit rate of 1.544 Mbps in a serial manner.

2.2 *Digital Signal 3*- DS-3 is an updated version for DS-1 type carrier, formally known as T-3 carrier. Simply, DS-3 is a combination of several DS-1 carrier lines, which provides a greater data rate per second i.e. 44.736 Mbps. It consists of at-most 28 T1 channels. It makes use of coaxial cable mainly.

To build boundaries to a network, a protocol namely, IP, is needed so that an information is to travel from one geographic location to another, from one source to another destination not matter whether the networks are established in a distributed manner. IP is a protocol that provides a structure to each and every packet so travelling in a network. The data packet usually consists of a source address, destination address and relevant confirmation which need to be encrypted; all three are encapsulated to form an IP format. The two formats for IP can be:

2.3 IPv4: IPv4 is a fourth version of IP, which is a connectionless protocol. Since IPv4 is a connectionless protocol, hence it doesn't guarantee of whether the packets are properly sequenced, no duplicate packets are received at destination. It provides an address space of 32-bit. On looking at these factors an exhaustion to IPv4 was encouraged, it is replaced by a newer version of data packet format i.e. IPv6 format.

2.4 Ipv6: This is an updated version for basic IPv4 format version of data packets. IPv6 protocol is the most recent format to specify the IP packet. This is accomplished with route traffic identification, location identification with additional support for optimization of each delivery of service. IPv6 uses 128-bit to encapsulate the necessary in a data packet.

IPv6 provides an optimum ways to delivery of data packets to their defined destinations. A protocol named as RIP is used to facilitate a routing mechanism by collecting number of hops in-between any pair of devices. A hop count [4] is maintained each time a packet is to send, justifying whether a destination device is reachable or not. The routing process is generally processed by making use of routing tables at each of the router present in a network. A routing table usually consists of a table defining all the possible paths between devices in a network.

Besides usage of RIP, several other versions are also assigned to ensure highest levels of reliability and efficient working environment. These can be as follows:

2.5 RIPng: It is a version of RIP protocol. RIPng protocol supports IPv6 environment with additional authentication.

2.6 OSPF: This version usually operates in an autonomous network and is known as an interior routing protocol. It has been a most widely used protocol by several enterprise networks. A topological structure is to be made defining link availability and its reliability. This is supported by IPv6 protocol.

2.7 IS-IS: This protocol is most efficient because it relies on maintaining the best possible ways to route each encapsulated data packet. This is responsible to make a data packet move into a network where devices are linked via physical aspects by using a packet-switched transfer mechanism.

III. SIMULATION

This section is one of the useful sections, as it provides the basis for making an appropriate comparison between the two disclosed IP versions. The simulation is conducted on the basis of proposed simulation [11] scenarios for each of the two versions.

The simulation environments for both the scenarios differ by their assigned protocol set and also by their address format that specify a version to encapsulate every data packet.

Both the environments consists an IP Cloud that connects several autonomous segments of a network with each other and allows them to make access to allotted applications and shared resources. 16 wireless stations that are connected through two routers are made to move in a network with fixed trajectories for each station. Each router is enabled with the Base Station System (BSS) [2]. BSS is a service that is responsible to collect information from stations and move to the network by appropriate encoding methods. Each station is only communicating to the associated BSS. The routes are made to connect to outer network via firewall. Two Cisco 4000 routers are being used to filter to assure reliability in communication. Cisco 4000 routers [12] are the most powerful routers till date. They provide higher levels of performance. Largely, these routers have been into encouraged by business enterprises because it saves money for them by accomplishing all its work done in just few minutes.it can automate the configuration, management and monitoring methods for the network. DS-3 links are being used to connect each of the Cisco 4000 routers to the other networks through an IP Cloud.

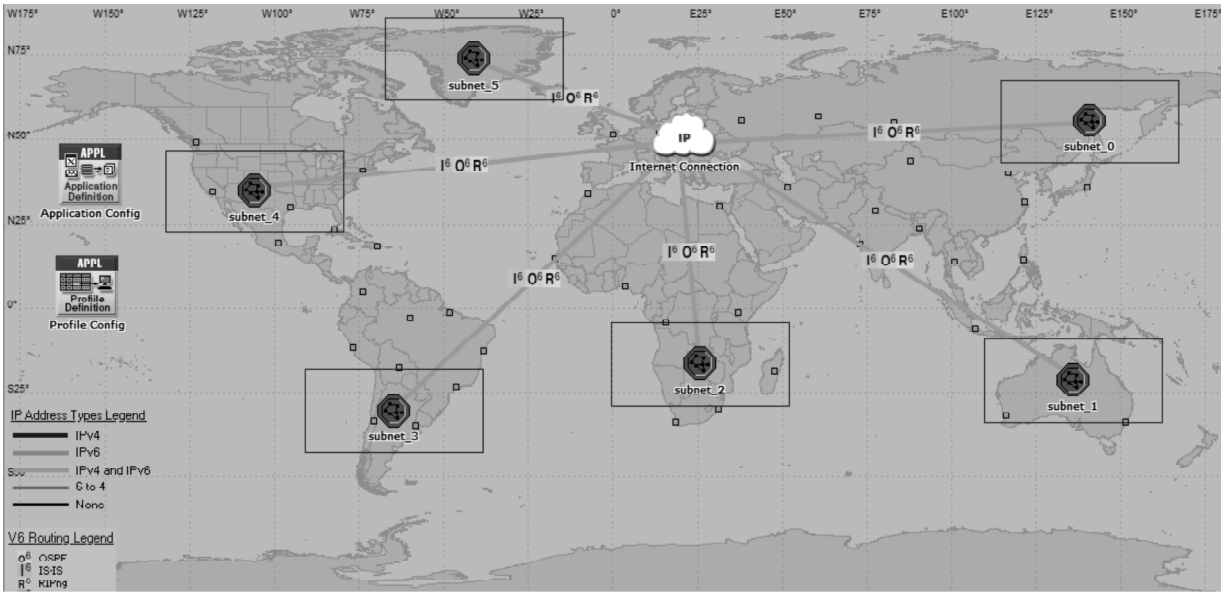

Figure 1: Internet Connection following cloud-based network

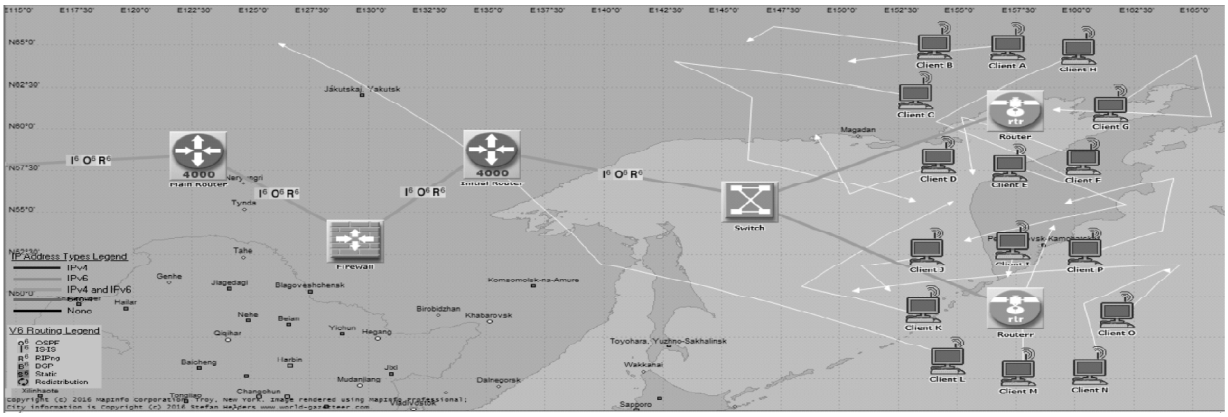

Figure 2: Simple Autonomous Network

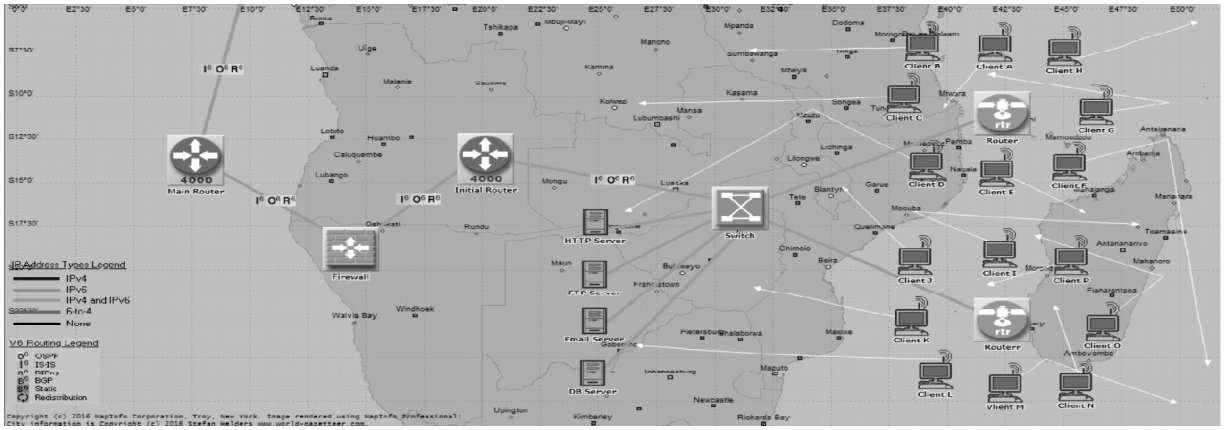

Figure 3: Autonomous Network defining Applications

Two scenarios are made that describes the best possible ways to justify an architecture needed to compute in a cloud computing technology. The two scenarios can possibly be:

3.1 Simple IPv4 with stations in Mobility: In this scenario, IPv4 address format is supported. All the stations are intended to use an IPv4 version for every data packet to be encapsulated.

3.2 IPv6 with RIPng, OSPF and IS-IS with stations in Mobility: In this scenario an IPv6 environment is encouraged. The stations will be using version 6 address formats. Three protocols are also implemented to assure efficient processing of applications and communication, mainly RIPng, OSPF, IS-IS are associated to an IPv6 environment.

Figure 1, 2, 3 represents the parts of simulation environment i.e. architecture to a parent network, a simple autonomous segment and with application servers.

IV. ANALYSING THE SIMULATION

This section is represented for analyzing the proposed scenarios in simulation environment. Performance of both the proposed scenarios need to be measured on certain parametric basis, these would be: queuing delay, throughput and throughput. These three factors are to be analyzed for every possible scenario and the analysis is conducted to measure the performance for Internet Connection and Firewall [13] in each two autonomous networks (Subnet 2 and Subnet 5). The analysis would be as follows:

4.1 Queuing Delay: A term queuing delay [14] can be defined as the amount of time needed by a data packet to reach to its assigned destination device. This is the time spent by every data packet waiting for its successful delivery to its destination before a timeout has occurred. Fig. 4, 5 represents the queuing delay in an IP Cloud and firewall device in both the addressing formats.

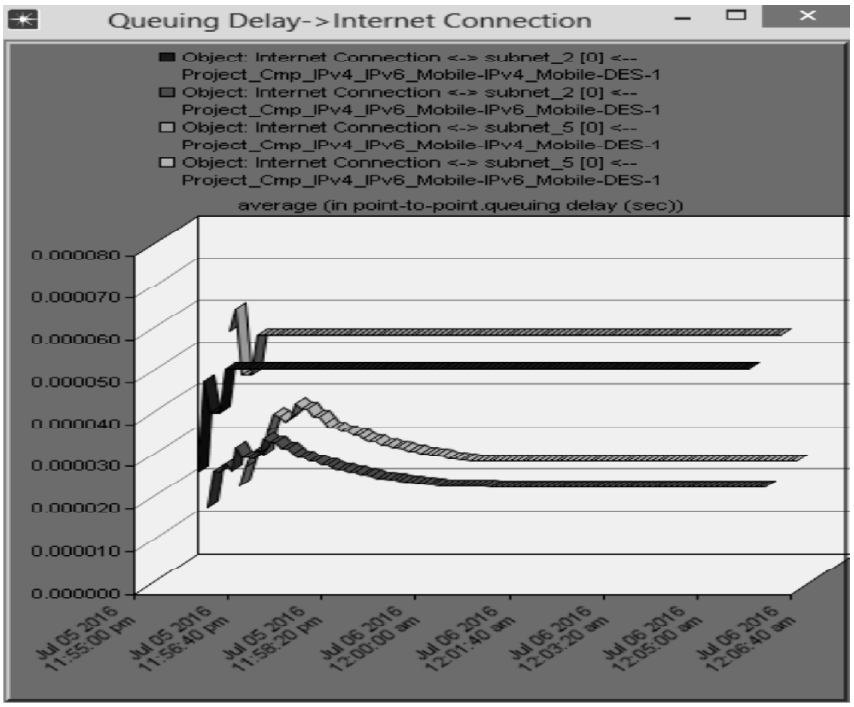

Figure 4: Internet Connection (Subnet 2 and Subnet 5): Queuing Delay

Fig. 4 is depicting a queuing delay in an IP Cloud or Internet Connection for two subnets i.e. Subnet 0 and Subnet 5. It is clearly justified in the graph that IPv6 performs much better than IPv4 environment. This is because IPv6 supports much larger number of addresses than an IPv4 can persist. The queuing delay has decrease in much more significant way.

Fig. 5 depicts queuing delay for firewall in both the subnets following both the address schemes. It shows queuing delay which is point-to-point delay for the routers so connected with each of the firewall. It is seen that here too IPv6 performs in much better manner than IPv4.

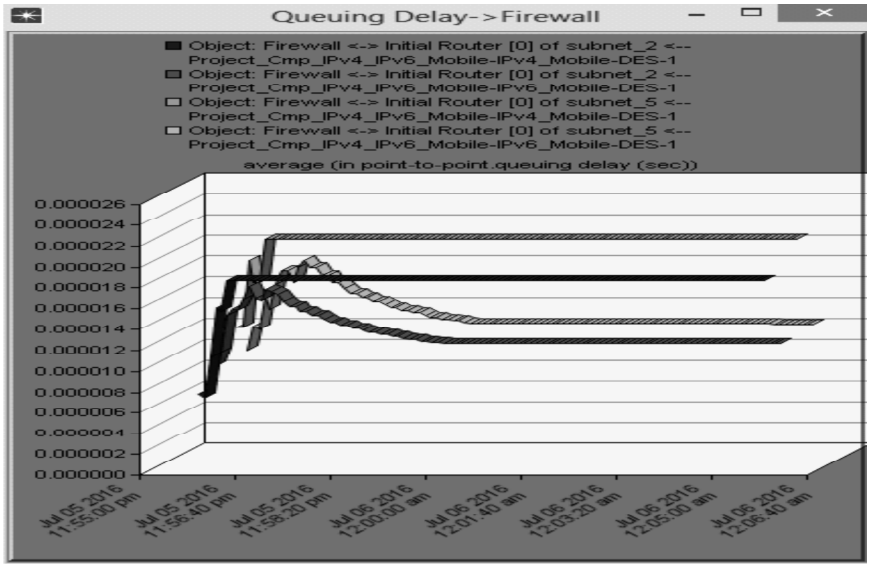

Figure 5: Firewall (Subnet 2 and Subnet 5): Queuing Delay

4.2 *Throughput*- Throughput [8] can be defined as a rate of performance that justifies the number of successful transmissions while communication is being established. The rate of proportion to every successful transmission is said as throughput. Fig. 6, 7 represents throughput for Internet Connection or IP Cloud and firewall in both the addressing formats.

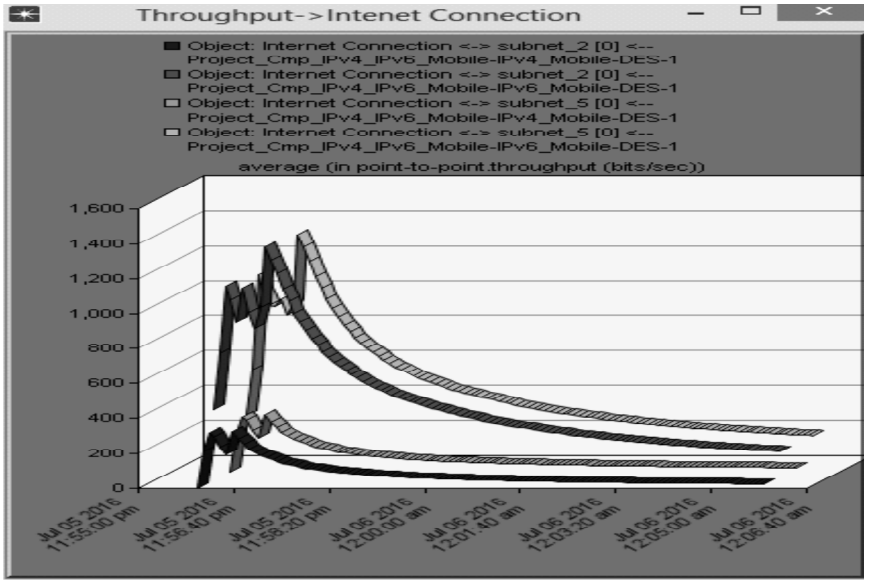

Figure 6: Internet Connection (Subnet 2 and Subnet 5): Throughput

Fig. 6 represents throughput in an Internet Connection or IP Cloud. It is clearly visible that the performance for two subnets is gradually increased when it is made to dealt with IPv6 environment. IPv4 didn't not performed much better, because it may not be able to assign addresses to numbers of data packet sent. As numbers of data packet are increased, performance is decreased for IPv4 format.

Fig. 7 represents throughput in firewalls of the two subnets. Throughput for IPv6 is gradually increased, the reason for this is implementation of OSPF and IS-IS protocols that helps in achieving higher rate of performance.

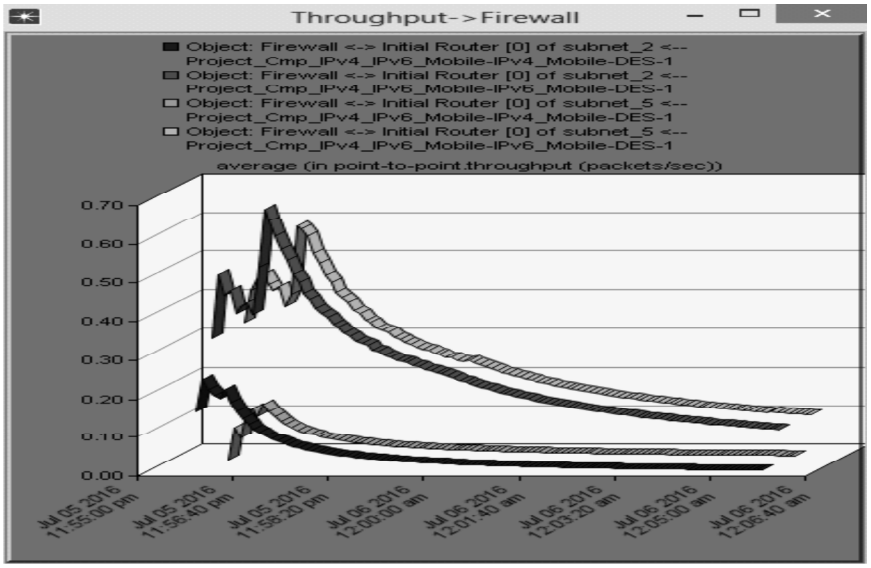

Figure 7: Firewall (Subnet 2 and Subnet 5): Throughput

4.3 Utilization- Utilization [8] is one of the factors that directly depend upon rate of throughput. The higher the rate of throughput is the higher will be utilization for any network. Utilization can be defined as the success rate where maximum throughput factor is achieved.

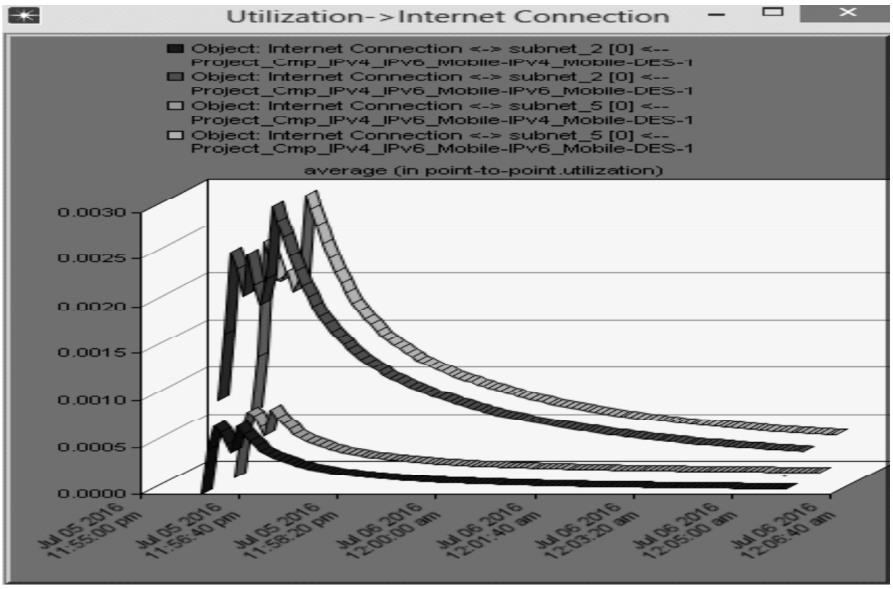

Figure 8: Internet Connection (Subnet 2 and Subnet 5): Utilization

Fig. 8 represents utilization factor in Internet Connection for two named subnets. Since there can be seen a higher factors to utilization in IPv6 environment. This is due to a protocol so engaged with stations for point-to-point reliability. IPv6 has achieved highest utilization rate due to its property that is can provide methods to dynamic routing which can be judged to check for its reliability while error has occurred.

Fig. 9 represents utilization factor in firewall for two subnets. This is seen that as operations are being performed, the utilization is increased and is then reached to a constant level. This is done due to usage of IS-IS protocol that is responsible to provide reliability in a point-to-point communication and this communication is facilitated in all autonomous network in both the address formats.

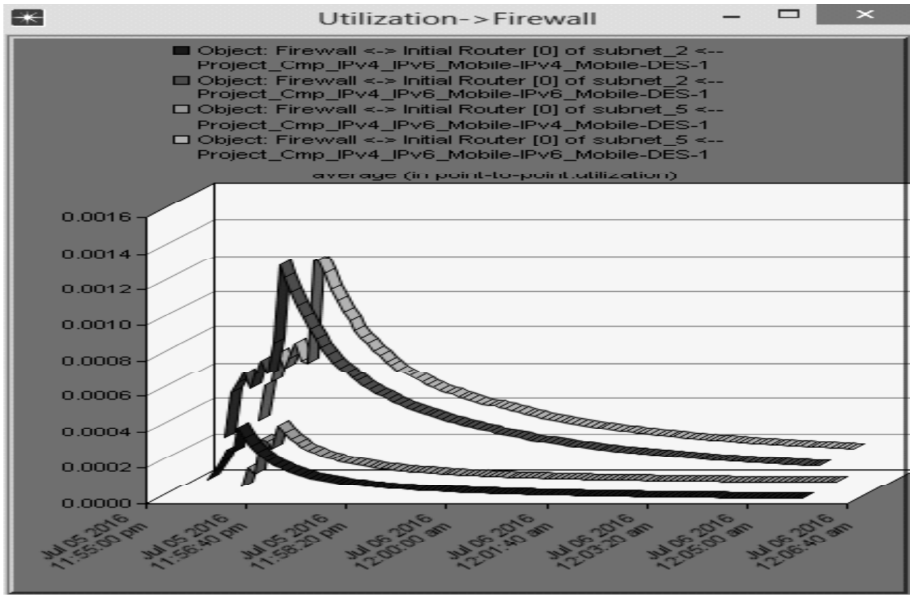

Figure 9: Firewall (Subnet 2 and Subnet 5): Utilization

V. CONCLUSION

The overall simulation and analysis in paper is based on referencing performance based on two familiar address formats, namely: IPv4 and IPv6 protocol formats. The simulation is performed to check for reliability by comparing of a particular protocol in a scenario where protocol assigned are different and stations are meant to mobile in several autonomous network segments. The analysis section very clearly explains the performance factor for both the address formats i.e. IPv4 and IPv6. It has been seen that IPv6 performs much better than simple IPv4. This is because there is much more availability of addresses in IPv6 format. A greater reliability and efficient communication is achieved when IPv6 is upgraded to an association with routing protocols, namely: RIPng, OSPF, and IS-IS. With an association with these three protocols, an point-to-point efficient and reliable communication is achieved following with reduced, increased throughput then to respond with increased utilization. So it is recommended to use IPv6 addressing formats rather to use basic IPv4 format for efficient communication.

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