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Transition Mechanism from IPv4 to IPv6, MIPv6 Simulated Test Bed and Analysis

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Abstract—**Internet Protocol version 4(IPv4) is the emerging technology in the world of internet, which provides a good way of communication between the devices. Due to the rapid growth of devices that are connected to internet leads to evaluation of next generation internet protocol IPv6. Success of IPv4 results in the ipv6 formation.IPv4 has become a victim of its own success. This paper discusses about the implementation of IPv4 architecture in GNS3 simulator and that architecture has been analyzed with different metrics and protocols.**

Keywords— **IPv4, IPv6, MIPv6, GNS3, TCP, UDP**

I. INTRODUCTION

Internet Protocol version 4 (IPv4) is the fourth version of the Internet Protocol (IP).it has been existing since the early 1980's has been widely used till now. In OSI model, the major function of this protocol is to route data over the network and it identifies the hosts based on logical address. This protocol is one of the major protocols in TCP/IP.IPv4 uses the 32-bit logical address. Totally there is 2^32 IPv4 address. It is implemented in each router, end systems, and devices that provide a connection between networks.

In recent years, the production and use of more handheld devices such as tablets, mobile phones including and a large number of computers all connecting to the internet have increased the demand for IPv4 addresses. As there is a limited number of IPv4 address, it is gradually migrating from IPv4 to IPv6. Every device on the Internet needs an IP address to communicate with other devices and the growth of the Internet led to a need for a new alternative for IPv4, because IPv4 cannot provide the needed number of IP address around the world.

Internet Protocol (IPv6 or IPng) is the next generation of IP and it is the successor of IP version 4.The development of IPv6 started in 1991 and was completed in 1997 by the Internet Engineering Task Force (IETF).The official usage of IPv6 was started in 2004 when ICANN added IPv6 addresses to its DNS server. Addressing schemes are required for Data transfers between hosts in the form of packets. Using IPv6 and IPv4 these packets can identify their sources and also find their destinations.

IPv6 address space is much larger than the IPv4 address space so it is the main reason for moving to ipv6.It is increased from 32 bits to 128 bits, in other words, it is drastically increased from 4 billion addresses to 340 trillion trillion trillion of the unique address. The increase in address space will provide unique address and it also contains simple IP header and hierarchical addressing which makes the routing cleaner and easier. the addressing structure is compatible with ipv4 address and allows the working of both. It uses 128 bits addressing format that is represented by 16-bit hexadecimal number fields separated by colons. Due to this less messy and error-free.

In 1992 the Internet Engineering Task Force (IETF) working group added mobility at the network layer which is transparent to higher level protocols like TCP and applications resulting into Mobile IP, which is an add-on in IPv4 and IPv6.these mobile IP are represented as MIPv4 and MIPv6.It introduces the mobility concept to the network layer of TCP/IP by using two addressing concepts for a mobile node (MN) i.e. Home Address (HoA) which is static, which identify the home of a mobile node and Care-of Address (CoA) which is the IP address to identify the MN current location in the foreign network. These two addresses assist the mobility management functionalities in Mobile IP and are associated with Home Agent (HA) and Foreign Agent (FA).

The both ipv4 and ipv6 are implemented in real time environment i.e. test bed which is used to transfer the real-time data, and in simulators which are used to transfer dummy packets. There are many types of network simulators such Cisco packet tracer, network simulator 2, graphical network simulators etc.

II.RELATED WORK

William Stallings ,et al 1996 had discussed ipv6:The new internet protocol has become more popular due to lack of limited address space,security features,lack of functionality in IPv4.The next generation of IP i.e IPv6 will also carry TCP/IP networks and application

Beerappa Rama Chandavarkar,et al 2008 had discussed evaluation on next generation internet protocol i.e internet protocol version 6 from the drawbacks of IPv4. It also discuss development and trends of ipv6.

B.R.Chandavarkar,et al 2012 had discussed Mobile IPv6 (MIPv6) developed by Internet Engineering Task Force (IETF) has mobility management for the packet switched devices of homogeneous wireless networks.

Mobility management of homogeneous networks depends on Received Signal Strength (RSS) which is a network-related parameter. These mobility management of heterogeneous networks, not only depends on network related parameters, but also on battery power, terminal-velocity, user-user profile & preferences location information and QoS & service-service capabilities etc.

Olabenjo,et al 2014 discuss the evolution of Internet Protocol version 4 (IPv4), its features, issues, and limitations. It also discuss Internet Protocol version 6 (IPv6) tends to solve some more issues including the differences between these two protocols and transition.

Pablo Gil,et al 2014 discuss how GNS3 simulator is used for students to learn about computer networks.It shows how we can develop online labs by using these simulators and what type of parameters can be measured. It also shows how simulators make our life easier in implementing the different scenarios.

The following section deals with IPv4 Architecture, Implementation and analysis in different metrics.

III. Architecture

The following scenario is implemented in the Gns3 simulator by using IPv4 and also the same scenario can be created by using test bed in which real time data transfer takes place.

The architecture in figure 1 contains two routers, each router is connected with 3 nodes by the help of switch. Router and Nodes are assigned with unique IP address and communication takes place based on that IP address.

It can be also implemented in the real-time test bed in that we can transfer the real-time data through the network and analyze that data in different metrics.

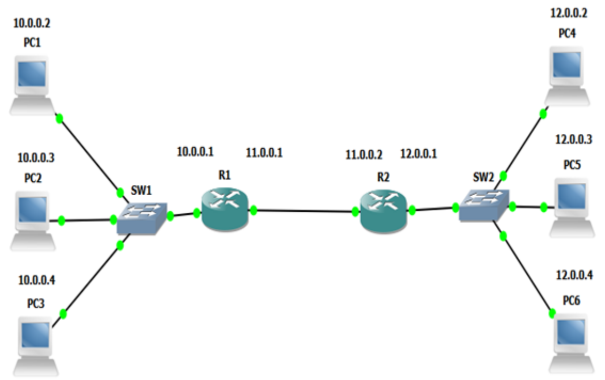

Figure 1: An architecture for IPv4

IV. Implenentation Of Ipv4 Arvhitecture In Gns3

The implementation of ipv4 architecture takes place by using commands .First configure nodes and routes and then IP routing table for routers.

Nodes are configured by using IP address and then saving it. Command used for it is *ip <IPADDRESS> <MASK> <GATEWAY>*. During configuring routers gateway is not necessary.

For adding a route from R1 to R2 assign only next hop address to the packet. For adding static routes command is: ip route <NETWORK> <NETWORK MASK> <NEXT HOP INTERFACE>. Now communication between the devices takes place.

Generally communication takes place in the form of ICMP messages. Here the transferring data by using different type of protocols like TCP and UDP takes place. Capturing data transmission can be done by using the capturing tool called wireshark. The comparison is shown in the following section.

V. Analysis

When we communicate between the nodes the number of messages and total details are captured by using the tool Wireshark. This wire shark captures all the details and generates pcap files. By using this we can analysis different metrics and generate graphs.

1) Round Trip time: Round-trip time (RTT), also called round-trip delay, is the time required for a signal pulse or packet to travel from a specific source to a specific destination and back again.RTT for 5, 50,100 packets are shown below.

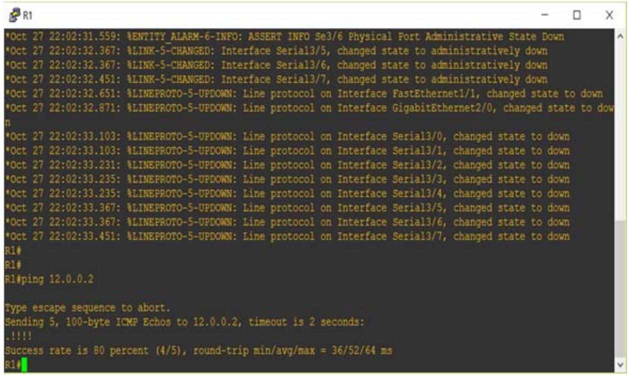

Figure 2: RTT for 5 packets

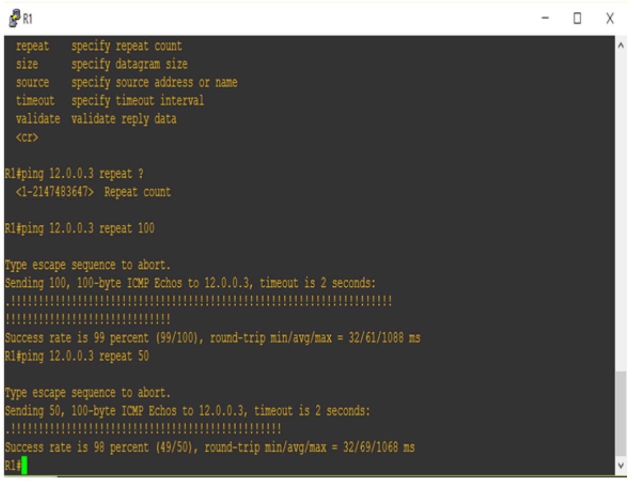

Figure 3: RTT for 50 packets

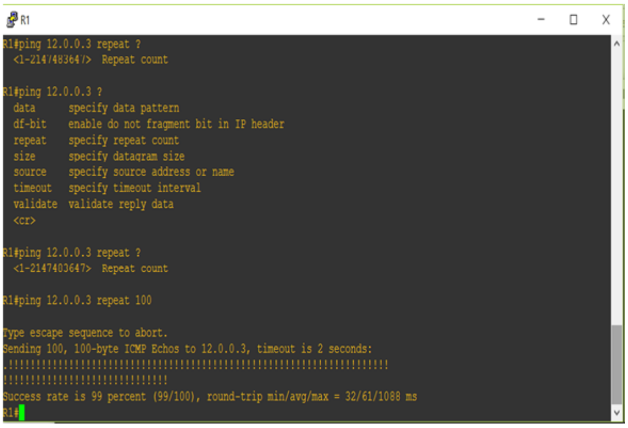

Figure 4: RTT for 100 packets

2) Protocol Distribution: The comparison of message transfer in different protocols is shown below.

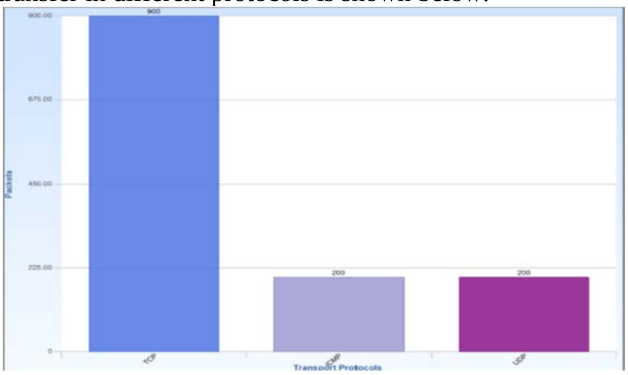

Figure 5: TCP vs ICMP vs UDP

3) Bandwidth Over Time: Bandwidth over time is defined as the amount of data that can be transmitted in a fixed amount of time.

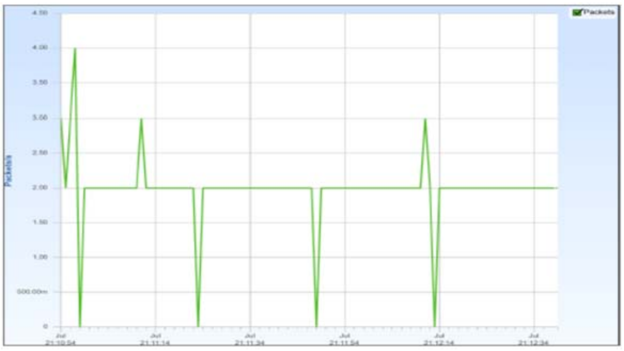

Figure 6: ICMP

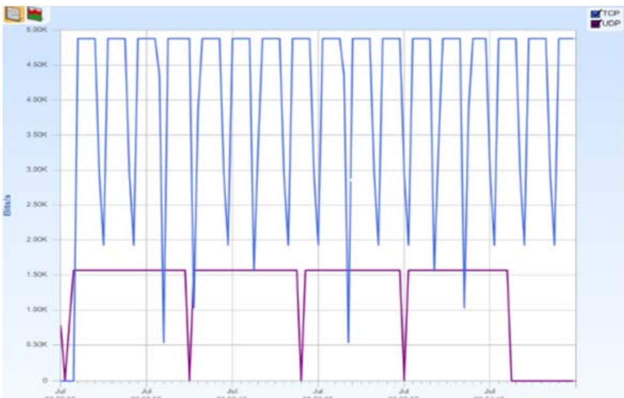

Figure 7: TCP vs UDP

VI. Conclusion

The architecture for the home and foreign network have been implemented by using IPv4 in GNS3 simulator for transferring of dummy packets. These packets are tested and analyzed by using different type of protocols such as TCP, UDP and round trip time is also calculated by sending 'N' number of packets. In future the architecture is implemented by using IPv6 protocol with mobility (MIPv6) and their results are captured by using Jperf tool in which real time data transfer takes place.

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