Research Paper

A TEST-BED FOR NETWORK PERFORMANCE EVALUATION OF IPV4 & IPV6 IN NETWORK LAYER PROTOCOL

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Abstract

This paper represents in a test-bed performed to measure and evaluates the performance of IPv4 and IPv6 network. The installation and running the test-bed was done for IPv4 and IPv6, using three metrics, bandwidth, packet loss and jitter. The result is that, the bandwidth size will lead to loss some packets during the streaming, while jitter leads to non-sequential packet arrival to the destination. The overall results indicate that the IPv4 network performs better than IPv6 network in term of bandwidth and packet loss. The IPv6 network performs better than IPv4 network in term of jitter. The IPv6 occur high bandwidth compare to IPv4. So the IPv6 network needs component that provide a high performance in network.

Key Terms: IPV4, IPV6, Performance, packet loss, jitter.

1. Introduction

In these days the internet is main goal for everyone and every company in the global. The internet become over wanted, we can see that in the normal life, each person have many devices connected to the internet such as (smart phone / I-pad/ laptop...etc) ,so every one person holding several of deferent IP address and the total number of address of IPv4 is less than the number of population in the global and same as we said before each person have more than one device so this make the network performance is low so they convert toIpv6 to improve the performance of the networks. No one can deny that the change from IPv4 to IPv6 is not uncomplicated, whereas the users already
feel at ease about using IPv4. The main goal in this project is design an experimental network and make test in order to use this network in evaluating the performance of IPv4 and IPv6 towards other applications. From here we can analyze the results and notice the effect by these two IPs (IPv4 and IPv6) on other application, and the work can be started by doing some optimizing to give the best performance on the next generation IPv6. In this work the main goal is implementing test-bed network to test the performance of the two networks (IPv4 Vs IPv6) and we are using metrics to define the network performance and this metrics are end-to-end delay, jitter and packet loss.

1.1 Problem Statements

In the previous year’s there are many researches done to measure and evaluate the performance of the IPv4 and IPv6 networks. However, in the previous researches they did not use the parameters that is been used in this research which are jitter and packet loss and end to end delay. Each packet that is been transmitted through the network needs a unique Identifier to forward the packets to the destination. IPv4 and IPv6 are two types of identifiers that can be used to define the source address and the destination address of the packets.

This research work tends to answer the following questions:

- Are the different sizes of 128 bits header length of the IPv6 address and 32 bits header length of IPv4 address effect the IP performance in term of packet loss, jitter and end-to-end delay?
- Are the different functionality and size of packet header in IPv4 and IPv6 give the significant effect to the performance of TCP and UDP data transmission?

1.2 Objectives

The main research objectives are:

- To build a network between two host for IPv4 and IPv6.
- To investigate significant differences between IPv4 and IPv6 in term of packet loss, jitter which these parameters affect the performance of data transmission.
- To analyze the performance of IPv4 and IPv6 during data transmission which are sending Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) within the same network environment?

1.3 Methodology

In this research the methodology start with define experiment. We have two experiments in this research.

A. IPv4 experiment
B. IPv6 Experiment

The second step is to run the experiments in this step we execute the experiment in the real network (home network). Third step is collecting the output this step to get the experiments results. Step four is analysis of the output in this step we are going to study the data that we collected and the result of the study will be comparison between the IPv6 results and Ipv4 results. The last step is reporting the results this step showing all the information about experiments and result of the study.

2. Performance Tools

The maturities of network have found that in order to measure the network performance, real-world tools is needed to monitor and analyses network behavior. In the recent years, open source software is becoming more popular among network administrator and also end-users. Most software can be freely downloaded from the Internet. Many free applications are becoming more available and can easily be downloaded; configured and used to help us determine network performance. The free applications open the opportunities to researchers and network administrators to do serious research in this field without need to think about spending money to buy network performance tools. Most of the open source applications are written for Unix platform. Distributors such as Redhat, Mandrake, FreeBSD, Fedora are example of open source operating system available today that use Unix platform. With the popularity of free Unix distributions, everyone can have Unix platform and can run network-monitoring tools without any expensive cost.

There are many network performance tools available today. Some of the most popular tools are NetPerf, dbs, Jperf, Pathrate, Netttest, NetLongger, tcptrace, ntop and many more. In this research, JPerf is used to measure network performance.
3. **JPerf 2.0.2**

Jperf was developed by NLANR/DAST as a modern alternative for measuring maximum TCP and UDP bandwidth performance. Jperf allows the tuning of various parameters and UDP characteristics. Jperf reports bandwidth, delay jitter, datagram loss.

![JPerf Interface](image)

**Figure 3: JPERF interface**

4. **Results and Discussion**

In this step we present the comparison results for IPv4 and IPv6 network protocol using TCP and UDP. The metrics used to measure the performance of the network are bandwidth for the TCP and for the UDP is jitter and packet loss.

4.1 **Bandwidth**

Figure 4 shows the bandwidth in TCP for the IPv4 and IPv6 scenarios.

![Average Bandwidth](image)

**Figure 4: Bandwidth**
As shown in the figure, the average bandwidth in IPv4 is 56364 kbps and the average bandwidth in IPv6 is almost 61297 kbps. From the result we found that IPv6 has about 1% to 2% higher bandwidth rate compared to IPv4 network. So the packet size in IPv6 is larger than the packet size in IPv4.

4.2 Packet Loss

Figure 5 shows the Packet loss in UDP for the IPv4 and IPv6 scenarios.

Figure 5: Packet Loss

From the result, we found that IPv6 has occurred higher packet loss rate (the maximum percentage is 0.8%) compared to IPv4 network (the maximum percentage 0.4%). It is due to the processing header overhead of IPv6. Thus, new packets will wait in the router buffer while the router processing another packets. The buffer will be full if the router take long time to process and transmit the packets.

4.3 Jitter

Figure 6 shows the Jitter in UDP for the IPv4 and IPv6 scenarios.

Figure 6: Jitter
From the result, we found that IPv4 has incurred higher jitter rate compared to IPv6 network. The highest jitter occur in IPv4 is 0.8 ms and the highest jitter occur in IPv6 is 0.3 ms. So the transmission process take a long time to transfer the packets from the server to the client in IPv4 compare to the transmission process in IPv6 network.

5. Conclusion

This chapter introduced the software installation and running the test-bed. Then the second part was for the results and discussion of the results. The test-bed was done for IPv4 and IPv6, using three metrics, bandwidth, packet loss and jitter. The bandwidth size will lead to loss some packets during the streaming, while jitter leads to non-sequential packet arrival to the destination. And the third part of this chapter makes the comparison of the results. The overall results indicate that the IPv4 network performs better than IPv6 network in term of bandwidth and packet loss. The IPv6 network performs better than IPv4 network in term of jitter. The IPv6 occur high bandwidth compare to IPv4. So the IPv6 network needs component that provide a high performance in network.

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