Performance Comparison of IPv4 and IPv6 using Windows XP and Windows 7 over Gigabit Ethernet LAN

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ABSTRACT

In this Research Paper, We have evaluated the performance of IPv4 and IPv6 using Windows XP and Windows 7. In this study TCP (Transmission Control Protocol) Throughput and UDP (User Datagram Protocol) Throughput have been compared for protocol IPv4 and IPv6. Experimental results showed that Windows XP provides better results for UDP Throughput than Windows7 & Windows7 can provide better results for TCP Throughput than Windows XP. Results indicated that IPv4 have superior results in terms of TCP throughput and UDP throughput as compared to IPv6.

Keywords

IPv4, IPv6, Windows XP, Windows 7, Gigabite Ethernet.

1. INTRODUCTION

The rapid growth of the use of internet increases the address consumption rate. Due to less addresses in IPv4 it exhausts more, which is overcome by using IPv6. The IPv6 have a total of 2^{128} addresses and IPv4 have 2^{32} addresses [1]. IPv6 have some advantages over IPv4, for examples, hierarchical addressing, built-in security feature, better support for quality of service (QOS), and new header format [2]. So everyone is updating to IPv6 due to which Hardware vendors and software developers are making hardware and software respectively that support both IPv4 and IPv6 [3,4]. But these changes are slow and have to face some problems [4]. The performance shown by IPv4 and IPv6 is varying which is depend on the operating system used [5]. As the bandwidth use by different applications is very high such as VOIP technology, so most of the networks are using Gigabit Ethernet. It is essential to calculate the performance of IPv4 and IPv6 on different operating systems over Gigabit Ethernet LANs [1].

Due to discontinued mainstream support of windows XP, users are shifted to windows 7. Although many users still remain on windows XP due to software that run only on XP. But with the increase in use of windows 7, the software vendors are developing software that can support windows 7 as well as windows XP, so most of users are going to be updated to windows 7. The proposed study intends to examine the performance of both the IPv4 and IPv6 protocols in two different platforms, namely Microsoft Windows XP and windows 7. Our experiments were conducted using two systems with same configuration.

2. RELATED WORK DONE

1. Narayan et al [4] evaluated the performance difference of IPv4 and IPv6 by using Windows XP and Windows Server 2003. In their experiment results showed that for small packet sizes, the difference in the performance of IPv4 and IPv6 was approximately 10.3% lower than theoretical value and for large packet size the difference was 1.3% higher than theoretical value. The throughput difference between windows XP and server 2003 was 5% for UDP and TCP protocol.

2. Visoottiviseth et al [2] compared the performance of ISATAP implementations by using three operating systems namely Windows 2003, FreeBSD 5:3 with KAME IPv6 protocol stack, and RedHat 9:0 with USAGI IPv6 protocol stacks. By using iperf program they compared the performance of IPv4 and IPv6, and ISATAP protocols on these operating systems. They found that IPv4 had highest data throughput for TCP and UDP then IPv6 and ISATAP. The results also showed that RedHat 9.0 had the highest performance and didn't have large packet loss then Windows 2003. They also founded that as the packet loss begins the uses of CPU at sender and the receiver was about 30%, and for router it was almost 100%.

3. Kolahi et al [6] compared the performance of IPv4 and IPv6 on windows vista and Windows XP. They calculated RTT and throughput of TCP. The results showed that for both IPv4 and IPv6 the bandwidth provided by Windows Vista is higher than XP.

4. Narayan et al [7] compared the performance difference of two versions of IP using windows vista, linux Ubuntu. They measured the throughput, delay, jitter and CPU usage. The results showed that for TCP traffic the value of Jitter was lower for Windows Vista than Linux Ubuntu. For almost all packet sizes, the CPU usage for Windows Vista was higher sometimes almost double than other operating system.

5. Kolahi et al [1] evaluated the performance of IPv4 and IPv6 over Gigabit Ethernet by using Windows Vista and Windows Server 2008 as operating systems. The performance study was carried out by calculating RTT and throughput of TCP and UDP. They found that TCP throughput produced by IPv6 was higher for packet sizes of 128-640 bytes on Peer-Peer network and higher throughput on client-server network for packet size of 896-1408 bytes. They also found that in Peer – Peer network for TCP and UDP IPv4 had highest bandwidth in all cases.

There has been no work done till date on Windows XP and Windows 7 over Gigabit Ethernet. In this paper, IPv4 and IPv6 are compared by using GIGABYTE ETHERNET. The parameter we use is the throughput of UDP and TCP by using packet sizes from128 byte to 1408 bytes.

The organization of this paper is as follows. In the next section the network setup is discussed. Section four covers the results and the last sections include the conclusion, future scope followed by the references.

3. NETWORK SETUP

In our test lab we used two systems with configuration given in Table 1

Table 1: System Configurations

CPU	Intel (R) Pentium(R) D
RAM	1 GB
NIC	Broadcom Net link(TM) Gigabit Ethernet
Hard Drive	160 GB

These two computers were directly connected through cross-over cable without using any router, switch or hub as shown in figure 1.
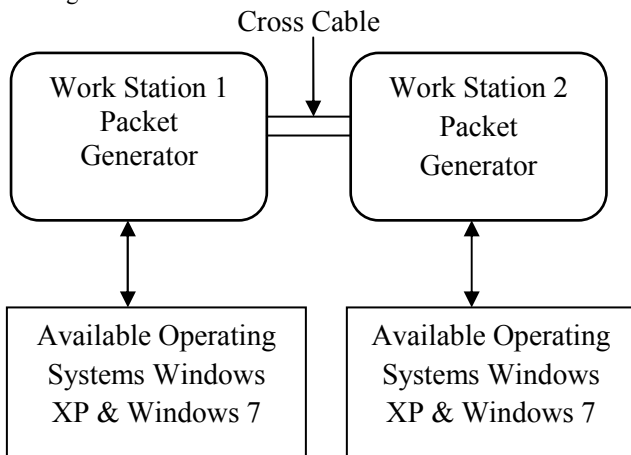
Figure 1: Experimental Set up Design

First the operating system windows XP was installed on both the computers. As Windows XP has IPv4 only, so IPv6 was installed and enabled when it was in use. Firstly IPv4 was configured in windows XP and data was collected. Then IPv6 was installed, enabled and configured and again data was collected. Then windows 7 was installed on both the computers and data for IPv4 and IPv6 was collected. IP Traffic - Test & Measure tool was used to evaluate the performance of IP stack. This tool was preferred because it uses the windows TCP/IP stack [8]. IP Traffic - Test & Measure tool was installed on both the computers. IP traffic generates packets of different sizes at sender side and sends it to receiver side and measure the performance metrics.
 In this research, the metrics measured was throughput for TCP and UDP traffic. To ensure high data accuracy, one million packets of sizes from 128 to 1408 bytes were sent 40 times.

4. RESULTS

The throughput of TCP and UDP of IPv4 and IPv6 is compared by using packets of sizes between 128 bytes to 1408 bytes on Windows XP and Windows 7 by using Gigabyte Ethernet.
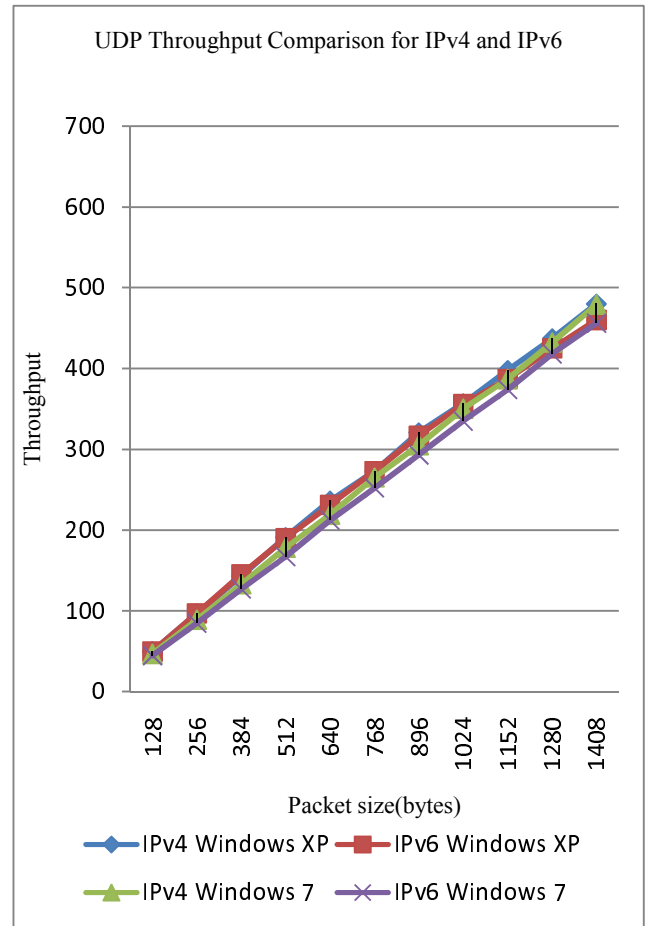
Figure 2: UDP Throughput Comparison for IPv4 and IPv6

 Figure 2 shows the UDP throughput of IPv4 and IPv6 on a Windows XP and Windows 7 Gigabit Ethernet network. For Windows XP, for the packet size between 128 bytes to 256 bytes IPv4 and IPv6 have same throughput as we increase packet size to 384 bytes IPv6 performs better with the difference of 2Mbps, for packet size between 512 bytes to 640 bytes IPv4 performs better with the highest difference of 5Mbps, for packet 768 bytes both have same performance, but as we increase the size of packet from 896 bytes to 1408 bytes IPv4 performs better with the highest performance of 22Mbps.
For Windows 7, IPv4 performs better for all packet size than IPv6 with the smallest performance difference of 2 Mbps and highest performance difference of 23 Mbps.
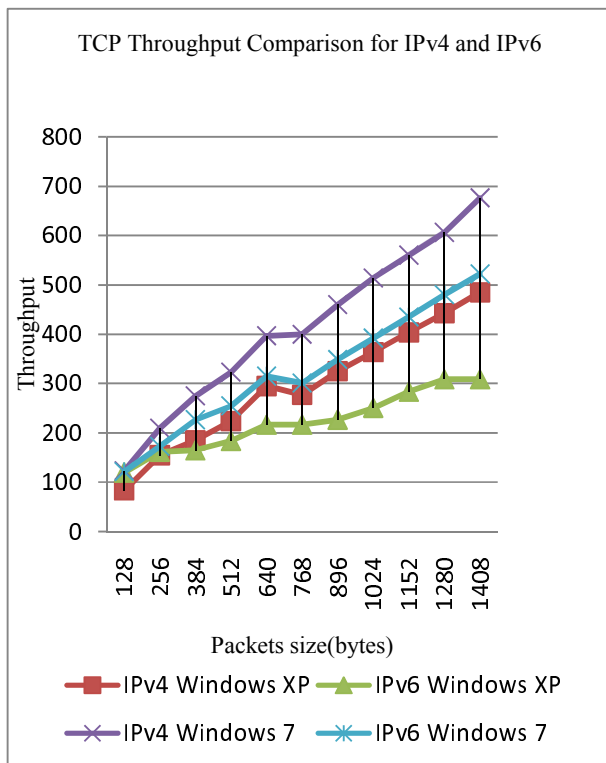
Figure 3: TCP Throughput Comparison for IPv4 and IPv6

Figure 3 shows the TCP throughput of IPv4 and IPv6 on a Windows XP and Windows 7 Gigabit Ethernet network. For Windows XP, for the packet size from 128 bytes to 256 bytes IPv6 performs better with the lowest performance difference of 7 Mbps. But as we increase the packet size IPv4 performs better than IPv6 better with the highest performance difference of 176 Mbps.

For Windows 7, for all packet size IPv4 performs better than IPv6 with the lowest performance difference of 16Mbps for small packets but, as we increase the size of packet the performance difference is increase to the highest difference of 154 Mbps.

5. CONCLUSION & FUTURE SCOPE

In this paper we compare IPv4 and IPv6 on windows XP and Windows 7 in terms of UDP and TCP Throughput. We concluded that IPv4 performs better results than IPv6 for both operating systems in terms of UDP and TCP Throughput. But

In windows XP for TCP Throughput IPv6 performs better than IPv4 for packet size from 128 bytes to 384 bytes. But as we increase packet from 384 bytes to 1408 bytes IPv4 performs better. Future works include the comparison of IPv4 and IPv6 on Windows 7 and other operating system by using fast and Gigabit Ethernet LAN's. We can also extend this study with different types of transmission media.

6. REFERENCES

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