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Comparison of VoIP on IPV4 only network and IPV6 only network

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ABSTRACT

The world is moving from ipv4 and going straight to ipv6 because of certain shortcoming in IPV4 such as address space exhaustion, large routing table, security problems, mobility and the quality of service that it ensured. In the coming era every-thing should be a network demanding a huge address space. IPV6 is thought to be the most important protocol for networks because of its availability features and handling the limitation of IPV4 in a better way. The aim of this research is to examine the behavior of IPV4 and IPV6 under various traffic conditions. This will make possible the exchange of information between IPv4-only network hosts and IPv6-only network hosts. The performance metric will be throughput and end to end delay for both the cases.

Keywords: IPV4; IPV6; VOIP; networking; communication;

1. INTRODUCTION

IP is transmission technique for data on internet. Its current address space is 32 bit. Often other protocols are used to complement it in making sure that data has been transferred to its required destination because every device is uniquely identified by IP-address in a network. IP is a connectionless protocol. It is not concerned with the delivery and order of data. Also it does not give any information about packet loss during transmission. So in addition, there is a need of other protocol (IPV6) to cope with these problems.

Routing devices are needed for traffic exchange in interconnected networks. In this scenario the interconnection is performed by routers [15].

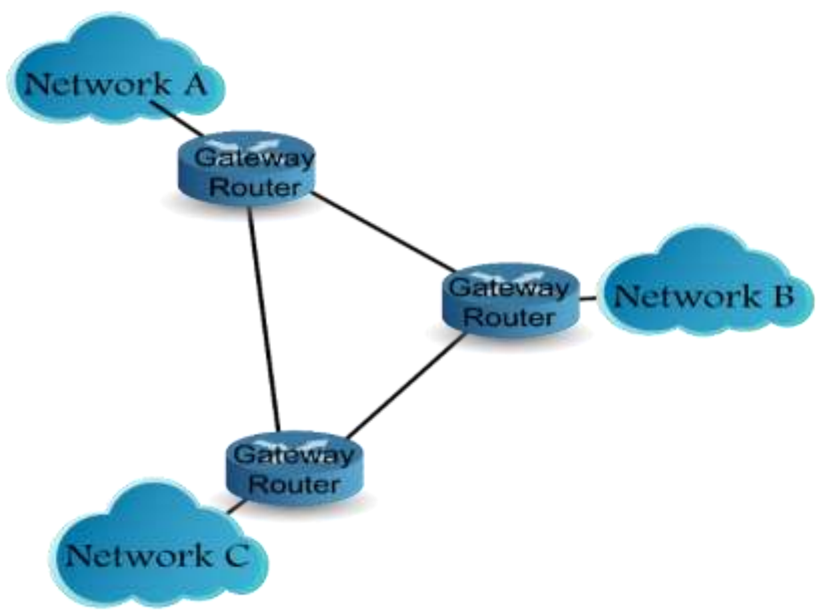

Figure. 1 Networks connectivity [15]

In IP addressing the way to find out destination is quite simple. On Each reception the packet is checked and accepted if it's ID is matched with this host. For routing, the router checks the address of destination and forwards the packet if it is matched and if no match found then other networks is checked by checking the network id in case of no match, packet is sent to default address.

Building routing table is a difficult task usually this is a static table and no specialized devices is used for this purposes, because IP contain routing function in it. In case of dynamic routing the router makes its tables by broadcasting informative messages. Routing protocols determine the shortest path to destination. Based on traffic and routes availability, the routers are updated.

IP version 4 (IPV4), has certain limitations that rose due to internet phenomenal growth and expansion of service. One such problem is its limited address space, which is based on a 32-bit address and an inefficient address allocation mechanism. Other shortcomings include 'best-effort' delivery mechanism, lack of support for Quality of Service (QOS), mobility issues and security issues. All of these demand an improved Internet protocol. Besides, most applications today support IPV4; thus there is a need for these applications to be accessible on IPV6 network. All these issues have been resolved in IPV6 by expanding the address space, which is based on a 128-bit address, introducing Quality of Service (QOS), mobile IPV6 [3] and also improving built-in security using IP Security (IPSec) [4]. But the growth of the Internet shows that the transition from IPV4 to IPV6 is expected to be a long process.

The number of addresses reserved by the RIRs from 1st January 2005 to 2011 is shown in the following scattered graph in the OECD report [14].

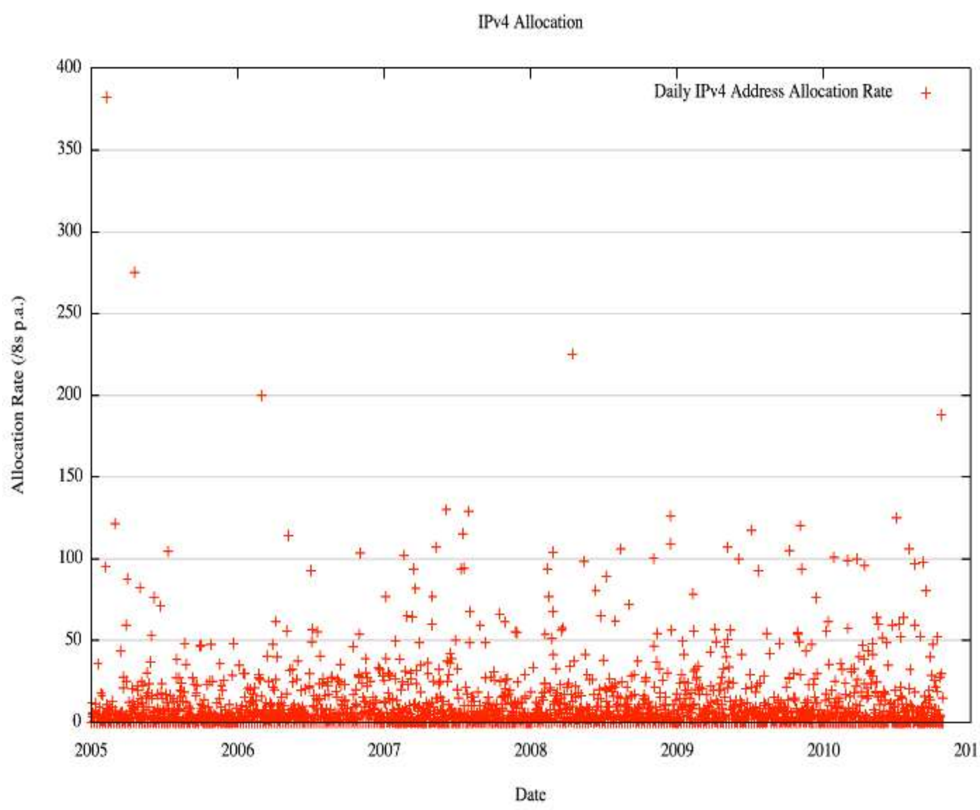

Figure. 2 IPv4 Address Reservations (2005 to 2011)[14]

The graph shown is a congested one. So it is better to take logarithmic value for the single data points, as shown in the figure below.

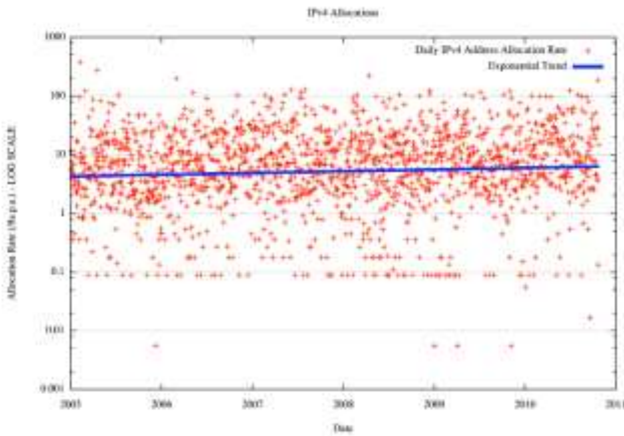

Figure. 3 Log scale of IPv4 Address reservations: (2005 to 2011) [14]

Compatibility of IPV6 with IPV4 may result a successful transition from IPV4 to IPV6, which may be achieved by implementing certain mechanisms in IPV6 hosts and routers. But unfortunately there is no such method that IPV6 routers directly deal with IPV4 traffic. The current existing networks are written in IPV4 with a huge cost so there is reluctance to convert it to IPV6. Also the transition is not an immediate process it may take many years. [5~7].

A comparison between IPV4 and IPV6 header overhead is given and the overhead of transition mechanisms is studied. In Myung-Ki Shin et al. [8], the impact of IPV6 transition mechanisms on user application is discussed. The experimental results show that though performance overheads are minimal, but translation packets degrade some performance. In S. Narayan et al. [9], the comparison of two versions of IP with two different O/S. The performance metrics were throughput, CPU utilization, Delay and jitter. It was found that performance is also affected by O/S choices. For small packet size there is no difference between the two version of IP, but as the packet size increases a slightly difference in throughput can be seen. In J. Govil et al. [5], examines some transition mechanisms and its constraints. They discussed one of the transition mechanisms i.e. 6 over 4 mechanisms, the 6 over 4 used the IPv4 multicast tunneling. This mechanism is ideal for small networks but arises the scalability issues. In R. Yasinovskyy et al. [10], comparison of VoIP on both types of LAN using background UDP traffic. They analyzed that more Packet loss in IPv6 than IPv4 in overloaded conditions but have poor voice quality in overloaded condition for both. Thus, exploring this area with a wide variety of real time and other applications on different types of traffic was significant. Besides, we also want to show a comparative performance evaluation of these applications considering both IPV4 and IPV6 network.

2. PROBLEM STATEMENT

In this research thesis, a comparative study of the behavior of IPv4-only network and IPV6-only networks will be carried out. The performance metric will be throughput and end to end delay.

Comparison of VOIP performance will be analyzed on IPV6 and IPv4 LANs in the presence of varying levels of background UDP traffic.

3. MODEL JUSTIFICATION

Two sites A and C are simulated in the scenario. There are two sites in the network, Site A and Site C and are connected to IPv4 backbone. Router A and C have defaults routes to site D. Router in site D IPv6 network has static route to destination for which next hop is set to Router A or D. Any packet destined for A or C will be sent to Router B.

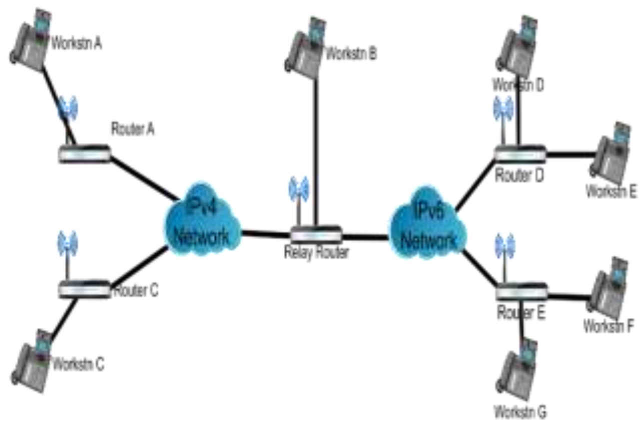

Figure. 4 Scenario of the proposed system

For all the links, the traffic intensity in both directions is set to T1.

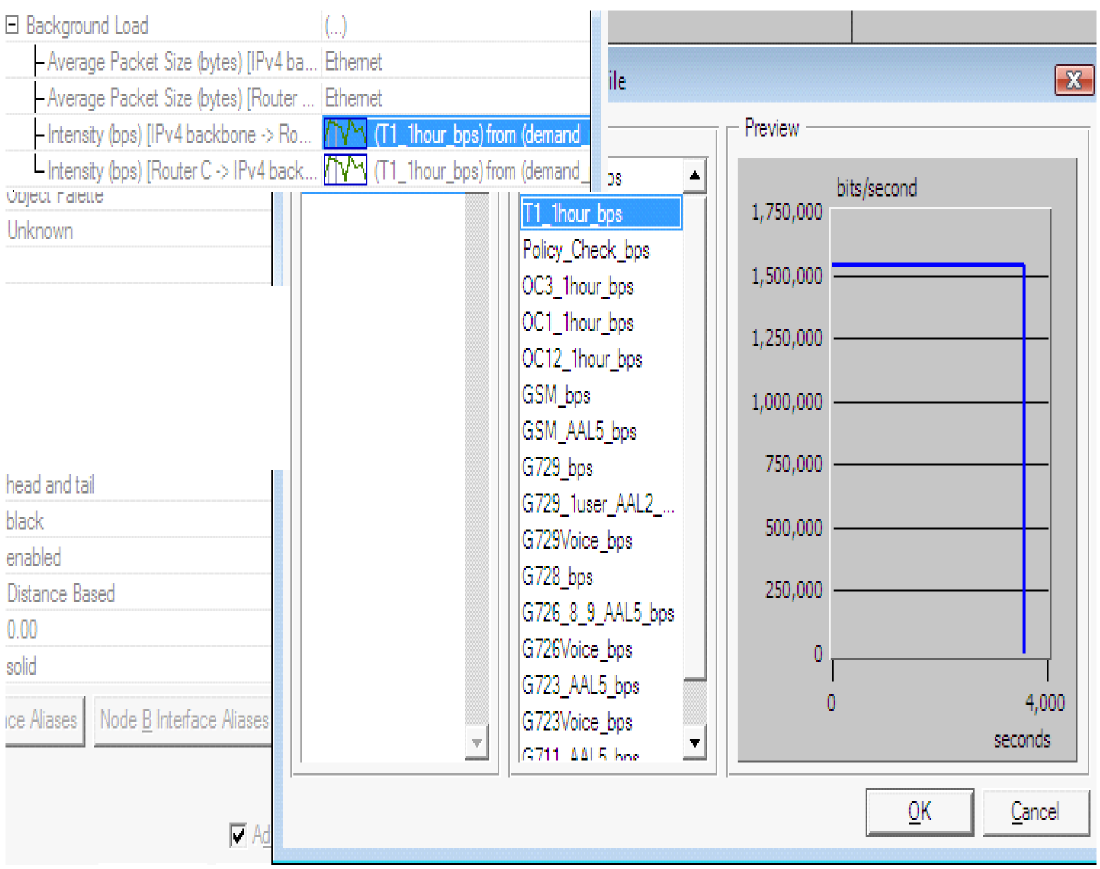

Figure. 5 Background Load

4. VISUALIZATION

While Packet end-end delay for all voice call made to workstation D from workstation A, B and C are given in Table 1.

Table. 1 Voice Called Party. Packet End-to-End Delay (sec)

. Object Name	End to End	Std Dev
wkstn D < wkstn C->wkstn D	0.060207	3.3307E-06
wkstn D < wkstn A->wkstn D	0.060202	3.3964E-06
wkstn D < wkstn B->wkstn D	0.060098	1.6172E-06

The calling from workstation D to all other workstations is almost same. The End-to-End Delay for workstation D to workstation B is lower than the other called parties, because workstation B is connected to 6Bone network. The above table shows that the delay in ipv6 is almost 49% less than ipv4. The percentage end to end delay can be calculated by dividing the standard deviation of workstation C-D / workstation B-D. (1.6172E-06 / 3.3307E-06).

Table. 2 Voice Calling Party. Packet End-to-End Delay (sec)

Object Name	End to End	Std Dev
wkstn C < wkstn C->wkstn D	0.060208	3.43E-06
wkstn A < wkstn A->wkstn D	0.060202	3.38E-06
wkstn B < wkstn B->wkstn D	0.060098	1.58E-06

The other parties called to workstation D in the graph are almost same but the table shows a little difference. The workstation B calling to workstation D is lower than other calling parties to workstation D. From above two tables the standard deviation for call between B and D is half than the other two. This means IP calls in Ipv6 environment are more stable.

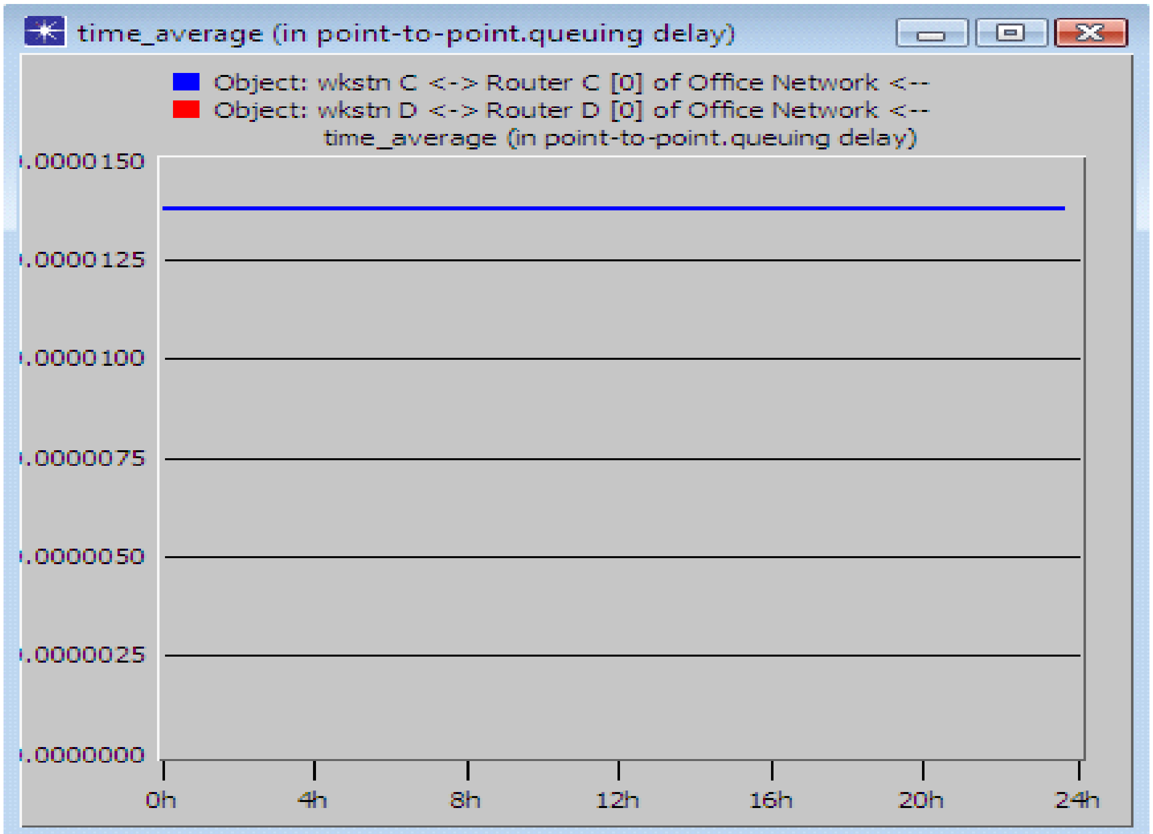

Figure. 6 Point to point queuing delay

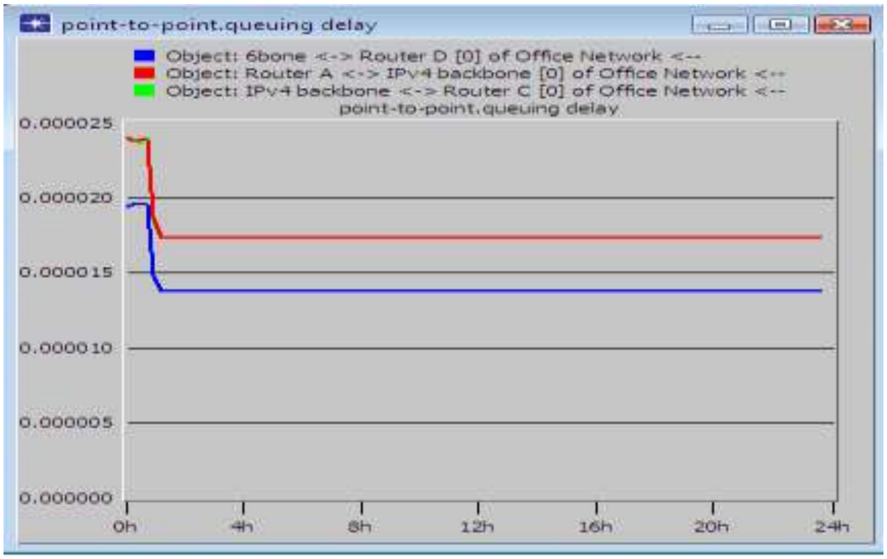

Figure. 7 Point to point queuing delay

4.1 Voice calls made to workstation D

Now let break up the packet delay variation graph for voice calls made to workstation D. The calling from workstation D to all other workstations is almost same. The End-to-End Delay for workstation D to workstation B is lower than the other called parties, because workstation B is connected to 6Bone network. The end to end delay can be measured with the station that uses tunneling i.e. the call from workstation 'C' to 'D' and one that don't use tunneling i.e. the call from workstation 'B' to 'D'. The above table shows that the delay in IPV6 is almost 49% less than IPV4. The percentage end to end delay can be calculated by dividing the standard deviation of workstation C-D / workstation B-D. (1.6172E-06 / 3.3307E-06).

Table 3 shows the queuing delay of the IPV4 and IP.

Table. 3 Point to point Queuing Delay

Object Name	Queuing Delay	Std Dev
Router A <-> IPv4 backbone [0] -->	0.00002414	1.3076E-06
Router A <-> IPv4 backbone [0] <--	0.000024067	1.2931E-06
wkstn D <-> Router D [0] <--	0.000013771	1E-10
wkstn D <-> Router D [0] -->	0.000013789	4.7E-09

The point to point queuing delay for workstation D to Router D (IPV6) is minimum than workstation A to Router A (IPV4).

Table 4 gives information about throughput:

Table. 4 Point to point throughput

Object Name	Mini	Avera	Maximum	Std Dev
wkstn D <-> Router D [0] <--	96.45	109.13	113.96	2.164
wkstn D <-> Router D [0] -->	96.27	109.07	115.34	2.383
wkstn A <-> Router A [0] <--	31.35	36.47	40.13	1.208
wkstn A <-> Router A [0] -->	32.2	36.31	39.07	1.107

The throughput value of workstation D to Router D (IPV6) is almost three times than workstation A to Router A (IPV4). The other parties called to workstation D in the graph are almost same but the table shows a little difference. The workstation B calling to workstation D is lower than other calling parties to workstation D.

5. CONCLUSION

This work is comparison of performance of IPV4 only and IPV6 networks. The parameter used for performance evaluation is throughput and mean end-to end delay. There is also a comparison of VOIP performance for both networks. The End-to-End Delay for workstation D to workstation B is lower than the other called parties, because workstation B is connected to 6Bone network. The delay in ipv6 is almost 49% less than ipv4. The throughput for IPV6 is almost three times improved than IPV4, so from all these results the IPV6 is a suitable choice for the network in the coming era.

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REFERENCES

1. S. Deering and R. Hinden, "IP version 6 Addressing Architecture" *IETF RFC* 4291 Feb. 2006.
2. R. Hinden and S. Deering, "Internet Protocol Version 6 Specification" *IETF RFC 2460*,Dec, 1998
3. B. Carpenter, K. Moore "Connection of IPv6 Domains via IPv4 Clouds" *Request for Comments: 3056*, February 2001
4. Krishna Chakraborty, Nitul Dutta, S R Biradar "Simulation of IPv4-to-IPv6 Dual Stack Transition Mechanism (DSTM) between IPv4 Hosts in Integrated IPv6/IPv4 Network" *International Conference on Computers and Devices for Communication*, 2009
5. Mohd. Khairil Sailan, Rosilah Hassan, Ahmed Patel "A Comparative Review of IPV4 and IPV6 for research Test Bed" *International Conference on Electrical Engineering and informatics*, 2009.
6. C. Perkins, D. Johnson and J. Arkko, "Mobility Support in IPv6", *IETF Internet Draft*, 2003.
7. G. C. Kessler, "IPv6, The Next Generation Internet Protocol," *the Handbook on Local Area Networks, pub. Auerbach,* August 1997.
8. Jivesh Govil, Jivika Govil, et al, "On the Investigation of Transactional and Interoperability Issues between IPv4 and IPv6" *IEEE EIT Proceedings*, vol-2, PP200-203. 2007.
9. Jivesh Govil, Jivika Govil, Navkeerat Kaur, Harkeera Kaur, "An Examination of IPV4 and IPV6 Networks: Constraints and Various Transition Mechanisms" IEEE 2008.
10. David Green, Marc E. Fiuczynski, Ed Jankiewicz "IPV6 translation for IPV4 embedded systems"
11. Myung-Ki Shin et al., "An Empirical Analysis of IPv6 Transition Mechanisms", *ICACT*, PP 20-22, Feb. 2006.
12. Shaneel Narayan, Peng Shang, Na Fan, "Performance Evaluation of IPV4 and IPV6 on Windows Vista and Linux Ubuntu" *International Conference on Network Security, Wireless Communications and trusted Computing*. PP653-656, 2009
13. Roman Yasinovskyy, Alexander L.Wijesinha, Ranesh k.karne, and Ghulam Khaksari "A comparison of VOIP Performance on IPV6 and IPV4 Networks" *IEEE/(AICCSA) ACS Interational Conference on Computer Systems and Applications*, pp. 603-609, 2009.
14. OECD report, Internet Addressing: Measuring Deployment of IPV6, OECD Ministerial Meeting, April 2010.
15. Oulu, "IPV6 – THE NEXT GENERATION INTERNET PROTOCOL", *ECC report 78 with in CEPT* March 2006.

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