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A STUDY OF TRANSITION MECHANISIM FROM IPV4 TO IPV6

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Abstract

The demand of the internet IP address is growing and current version of internet protocols is not capable of dealing with this demand so IETF developed the IPv6 to full fill this huge demand of IP address. The IPv6 was developed to keep two goals in mind one of which was more IP address and the second was Security. The first issue has been addressed but the second issue still has got some concerns. Now the IPv6 is here to replace the internet protocol version 4 which has been used by the millions of nodes and it is not possible for them to change to IPv6 in a single night, the reason for this is the huge area covered by the IPv4 and cost and resources required etc. So there is a requirement of a well thought plan for transition mechanism. It is quite obvious that IPv6 has to work with IPv4 and it will take a long time for IPv6 to completely takeover from IPv4. The process of transition from the present Internet Protocol version 4 to the upcoming Internet Protocol version 6 is in fact one of the most popular topic being contend specially around those people who are working with the idea of IPng (IP Next Generation) . The most important part or phase of the transition process is implementation of IPv6. Which is possible through clear vision and understanding about the network requirement and it also require a higher level of capability of understanding plus clear strategy and mechanism to smoothly move from IPv4 to IPv6. In this report I will focus on the transition mechanisms from IPv4 to IPv6. What are essential requirements for the smooth transition of the network from IPv4 to IPv6.What different mechanisms are available to achieve this transition effectively. I will keep my study limited to the network part only.

1. Introduction

Review of Current State of Proposed Area:

The step of moving from IPv4 to IPv6 is a massive step which has never been done in the past. It is not realist to think of moving from IPv4 to IPv6 in a single night. It requires a well planned transition mechanism. So IPv6 have to work with IPv4 and in order to achieve this task, there are methods which have been developed to achieve this task. In the following research papers we are going to discuss transition mechanisms which are going to make smooth transition possible from IPv4 to IPv6 or form IPv6 to IPv4.

In [1] the author discusses about the transition mechanism from IPv4 to IPv6 and states that a well planned transition mechanism have been developed. Then he tell us about the mechanisms to achieve coexistence of IPv4 and IPv6 are dual protocol stack, incremental and dual service and IPv6 standard support. Then he tells us that if not all, most routers and hosts support multiple protocols. Than for the transition of IPv6 over IPv4 we have IPv4 compatible address, and IPv6-over-IPv4 tunnelling. Then he discusses another mechanism which works for both either it is from IPv4-to-IPv6 transition or IPv6-to-IPv4 transition .i.e. translate IPv4 header to IPv6 header and vice versa.

In [2] the author tells that there are number of mechanisms that have been adopted for the gradual transition of IPv4 to IPv6. In this paper the author recommends to use the tunnelling mechanisms as connection point between IPv6 and IPv4. He also discuses about the management requirement of tunnelling mechanism specially focusing on 6to4.

In [3] we are provided with the analysis of economic consideration which is related with transition from IPv4 to IPv6. The report tells us that transition phase is the major challenge for the implementation of IPv6. Then in this report we are also told that during the transition process there is a need of managing more than one network plus the implementation phase requires the transition plan, detailed review of the network architecture and careful planning. Then in the report different transition approaches are discussed which are dual-stack approach, tunnelling and other transition mechanisms like router between IPv6 and 6to4 network, network that has a global IPv4address or assigns a block of IPv6 address space to any host and third one is the encapsulation of IPv6 packet in the IPv4 packet for its transmission over the IPv4 network.

In [4] the author states that there are many transition mechanisms to support IPv4 and IPv6 transition have been developed. But the practical deployment of these transition mechanisms and their performance is yet to be tested. So they have tested the effects of these transitions from IPv4 to IPv6 on the user application. Then from these test they found that with the small fragmented and translated packet some degradation of performance did happened but minimal performance overhead.

In [5] the author states the new version of internet protocol offers many advantages over IPv4 but this process of moving from IPv4 to IPv6 will take long time. So both of them have to work together. They say that IETF has proposed many transition mechanisms. But most of these mechanisms only provide mechanism initiate session with their own domains. They should support initiation from IPv4 hosts to IPv6 host. For this purpose they have used dual stack transition mechanism from IPv4-to-IPv6.

In [6] the author describes IPv6 transition mechanism in terms of design and implementation in the high speed routers and he recommends DSTM mechanism, IPv6-over-IPv4 tunnelling and IPv4 and IPv6

dual stack in novel architecture. Also they state in this paper that they performed performance tests and they found it extensively improvement and efficient.

In [7] the author is discussing the deployment and the testing of IPv6 in very high speed broadband network (VTHD) which was funded by French government. Taking up the issue of implementation he discusses high speed broadband network advantages and the problems faced in this process. He also states that due to different architectures there are many transition mechanisms which are Dual stack, Tunnelling and Translation mechanism in which IPv6 packet is converted to IPv4 packet and vice versa.

In [8] the author says that due to the growing number of electronic devices the IPv6 is irritable for the home network which requires end-to-end connectivity. He further states that due to late deployment of IPv6 in the public network transition mechanism and tunnelling are required. In the paper he has proposed the deployment strategy of the transition mechanism and then evaluates the performance of the IPv6 network using home server over the test-bed.

In [9] the author says that the IPv6 has been developed to replace the current IPv4 by the IETF. In order to make it functional with the IPv4 many transition mechanisms have been proposed by the IETF. In paper they have used two transition mechanisms and then their impact on the end user application using metrics like host CPU utilization, through put and latency. The two transition mechanisms used in this paper are IPv6 in IPv4 tunnelling mode and 6-over-4.

In [10] the author first of all focused on evaluation of IPv6 its comparison with the IPv4, its plug and play advantage and at the end it discusses about the deployment strategy. The book further states that the successful deployment of IPv6 can further boost the growth of internet. This book can serve as guide in transition of new internet protocol to the people who are working in the field of transition.

In this paper [11] the author states that moving from IPv4 to IPv6 is not simple and straight forward because they both are not compatible to each other, so in order to perform this task there is a need of transition mechanism. Then he further states that there are many transition mechanisms which are proposed by the IEFT. In their research they have chosen Dual stack Transition Mechanism for the implementation of IPv6 and tested it on IPv6 test-bed.

In [12] the author states that IPv6 draws the attention of US Department of Defence and they plan to employ in all IP networks by 2008, but there are certain issues in the IPv6 that needs to address before they do this. Then he focused on the two fundamental transition mechanisms problem which are not yet solved one is operation of IPv4 only system on IPv6 only core network and other one is non-invasive migration of essential legacy IPv4 only system to IPv6. Then he presents a low cost and simple solution this problem which is use of IPv4/IPv6 proxy translation device.

In [13] the author states that although it's been long time since IPv6 have been developed but still IPv4 is most commonly used protocol and due to constant change the transition process can take longer than expectations. He discusses about the currently available transition mechanisms and he states that in most cases there are more than one transition mechanisms in use. This paper presents a practical approach to manage the co-existence of more than one transition mechanism.

In [14] the author present IPv6 transition mechanism based on end to end tunnel as a new technique because he states that all the present transition mechanism do answer all

the questions or problems that occurs during linking networks so he presents end to end tunnelling as answer to these problems which is easy method to deploy the transition mechanism of IPv6 services and is expandable.

In [15] the author states that the future of IP network is IPv6 due to its improved services but for certain time IPv4 and IPv4 will coexist meanwhile when transition process is taking place. In this paper the author has used dual stack transition mechanism to study the network performance using four types of traffic; MPEG-4 IPv6 for both video and audio, FTP IPv6, VoIP IPv4 and Internet IPv4 and to evaluate the performance of the network they have used parameter like Mean End to End delay, Bandwidth, Throughput and the percentage of packet drop and all of this simulation is performed on ns-2. They found after this experiment that when the traffic intensity in IPv6 increases the Bandwidth for IPv6 also increases on the expense of decrease of bandwidth of IPv4. But on the other hand this is not the case with IPv4 due to its lower priority.

Explanation of how Findings will be Evaluated/Validated:

This report is a study of Transition mechanism from IPv4 to IPv6. This report can be evaluated on these bases that how successfully and efficiently the migration from IPv4 to IPv6 can be achieved. The factor which must be kept in mind under all circumstances is the impacts of this transition on the end users application because this is the point where client can be affected. There are many approaches to perform this process of transition but we have to evaluate the impact of these approaches on the end-to-end application performance using the real world settings [9].

A Project Plan:

Task	Possible start	Length	Type	Dependent on...
1. Selection of topic and report planning	week 1	5 days	sequential	
2. Gathering information and Searching different research papers on IEEE	week 2	3 day	sequential	1
3. Started writing report	week 3	2 weeks	parallel	2
4. Detailed analysis of Topic and resources needed	week 1	2 weeks	sequential	1
5. Writing risk analysis and Ethical, Legal, and Professional Issues	week 1	1 weeks	sequential	4
6. Documentation	week 4	1 weeks	sequential	3

A Risk Analysis:

The good assessment about the IPv4 to IPv6 transition mechanism will give us a reliable expectation about the risk assessment of network. If we are moving from one network to other we should keep in mind that I would not be free of risk. So if we have clear understating of the network we should also known about potential shortcoming of the network, technology, cost and the people

who are related with this task e.g. staff. In case of IPv6 transition if something goes wrong can affect the growth of internet. Before doing any practical implementations of transition process backup should be available and ready to use [16].

Resources Needed:

1. Hardware

This is a project where investigation is done on transition mechanism from IPv4 to IPv6 since I am doing a study based on concept there is a necessity of networking and computer equipments is necessary

1. Cisco Routers
2. Cisco Multilayer routers
3. Servers
4. Computer terminals
5. And a proper network infrastructure to simulate the concept

2. Software

1. NS2 simulation software for network and traffic engineering simulation
2. Microsoft Project for project scheduling
3. Microsoft word for document preparations
4. Packet trace to simulate the routers

3. People

1. People with the knowledge of routing and switching and network infrastructure
2. People with the knowledge of IPv4 to IPv6 transition mechanism and knowledge of protocols

4. Permissions

No specific permission is required while carrying out research on transition mechanism from IPv4 to IPv6 just you have to follow the standard procedures and guidelines specified by IETF.

. Training Needed

. Additional training is necessary in NS2
. Training on Cisco router configurations

. Security of Project Confidentiality

Except normal security requirement implemented in the IPv6 and IPv4 the security and Project Confidentiality requirements highly depends upon the factor like for which department, organization and government you are doing research e.g US Defense department

Ethical, Legal, and Professional Issues:

. Data Protection

The data protection is the way of keeping the data safe that is to ensure the personal data held in a hard file or computer system is cannot be processed without the knowledge of that particular person[16].

In the process of writing this report we had the concern of under Data Protection Act 1998 because we may used the data from different sources like IEEE, IETF, IEEE Computer Society all this data are used in the concern of academic purposes and with permissions since research is done reviewing number of research papers where the Author has the copy right and the information of the authoress are have to be not used any other purposes other than academic reference.

The information of researchers or academics funding organizations and financial data are kept secure and fairly and lawfully processed and processed for the particular or limited purposes [17].

The information from above mentions candidates are not transferred in any circumstances out of the boundary of the project or countries without adequate protection [17].

. Intellectual Property

"Intellectual property (IP) is a legal field that refers to creations of the mind such as musical, literary, and artistic works; inventions; and symbols, names, images, and designs used in commerce, including copyrights, trademarks, patents, and related rights. Under intellectual property law, the holder of one of these abstract properties has certain exclusive rights to the creative work, commercial symbol, or invention by which it is covered". (WIKIPEDIA the free Encyclopaedia).

Here in this project and to write this report we have used number of academic resources such as research papers, white papers web sides etc. Where

- The academic resources have been used are with the permission of Library Services since the University is and the Student are the members of IEEE, IET, IEEE Explore and all the resources are used for academic purposes.
- The software are to be use in this project are Network Simulation 2(NS2) is a open software and we have to use more software for simulation and report writing such as MATLAB, Microsoft Word , Microsoft Project and some other resources since we are using in university under the License or either in personal computers have to be with license software and tools

3. Computer Misuse.

Since the project assessed based on the results of practical implementation and computer simulation so it is directly related use of computers and other networking equipments most of the time the testing is done in university laboratory so it is always a must to follow the code of conduct of using university lab and equipments

4. Code of Ethics

4.1 IEEE Code.

In this report I have used IEEE portal for the academic reference for download academic journals and proceedings, however there with the authorization and concern of IEEE through library service and these information are used only for the academic reference otherwise not commercial purposes and also since I am investigating on a IETF Transition mechanism from IPv4 to IPv6 are only used for academic purpose

.2 Human Adults

N/A

.3 Human Children.

N/A

References:

Lee, D. C., Lough, D. I., Midkiff, S. F., Davis IV, N. J., & Benchoff, P. E. (2000). *The next generation of the Internet: Aspects of the Internet Protocol Version 6*. Virginia Polytechnic Institute and State University.

Koutepas, G., Douitsis, A., Philippides, D., & Maglaris, V. (2004). *An approach for the administration and security of IPv6 transition mechanisms: An SNMP MIB for 6to4*. National Technical University of Athens, Greece.

Perset, K., Huston, G., Conrad, D., Grossetête, P., Woodcock, B., Bagnulo Braun, M., Durand, A., & Bataille, V. (2008). *IPv6 deployment: Current status and challenges*. Organisation for Economic Co-operation and Development (OECD).

Shin, M.-K., Kim, H.-J., Santay, D., & Montgomery, D. (2004). *An empirical analysis of IPv6 transition mechanisms*. Proceedings of the International Conference on Information Networking.

Park, E.-Y., Lee, J.-H., & Choe, B.-G. (2004). *An IPv4-to-IPv6 dual stack transition mechanism supporting transparent connections between IPv6 hosts and IPv4 hosts in integrated IPv6/IPv4 networks*. Proceedings of the International Conference on Advanced Communication Technology.

Yang, M., Kim, T., & Kim, S. (2005). *Deploying and evaluating IPv6 transition mechanisms in next-generation routers*. Electronics and Telecommunications Research Institute (ETRI).

Adam, Y., Fillinger, B., Astic, I., Lahmadi, A., & Brigant, P. (2005). *Deployment and test of IPv6 services in the VTHD network*. Proceedings of TERENA Networking Conference.

Park, M. H., Kim, J. T., & Paik, E. H. (2005). *Deployment strategy and performance evaluation of the IPv6 home network using the home server*. Electronics and Telecommunications Research Institute (ETRI).

Raicu, I., & Zeadally, S. (2003). *Evaluating IPv4 to IPv6 transition mechanisms*. Proceedings of the 10th International Conference on Telecommunications.

Huitema, C. (1996). *The new Internet protocol*. Prentice Hall.

Tahir, H. M., Taa, A., & Md. Nasir, N. B. (2005). *Implementation of IPv4 over IPv6 using dual stack transition mechanism (DSTM) on 6iNet*. Universiti Utara Malaysia.

Green, D., Fiuczynski, M. E., & Jankiewicz, E. (2003). *IPv6 translation for IPv4 embedded systems*. Proceedings of the IEEE Military Communications Conference (MILCOM).

Hsieh, I.-P., & Kao, S.-J. (2004). *Managing the co-existing network of IPv6 and IPv4 under various transition mechanisms*. National Chung-Hsing University, Taiwan.

Hong, S., Ko, N., Ryu, H., & Kim, N. (2005). *New IPv6 transition mechanism based on end-to-end tunnel*. Proceedings of the Asia-Pacific Advanced Network Conference.

Sanguankotchakorn, T., & Somrobru, M. (2005). *Performance evaluation of IPv6/IPv4 deployment over dedicated data links*. Asian Institute of Technology, Thailand.

Doyle, J. (1998). *Routing TCP/IP* (Vol. I, 2nd ed.). Cisco Press.

Doyle, J., & Carroll, J. (2005). *Routing TCP/IP* (Vol. II). Cisco Press.

Doyle, J. (2002). *OSPF and IS-IS: Choosing an IGP for large-scale networks*. Cisco Press.