

**PERFORMANCE ANALYSIS OF IPv4 TO IPv6 TUNNELING
MECHANISMS**

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JUDUL: PERFORMANCE ANALYSIS OF IPv4 TO IPv6 TUNNELING

MECHANISMS

SESI PENGAJIAN: 2010/2011

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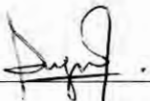
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**PERFORMANCE ANALYSIS OF IPv4 TO IPv6 TUNNELING
MECHANISMS**

AYUNI HAMIZAH BINTI ABDUL RAHMAN

This report is submitted in partial fulfilment of the requirements for the Bachelor of
Computer Science (Computer Networking)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

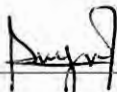
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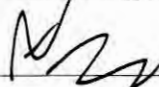
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DECLARATION

I hereby declare that this project report entitled
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MECHANISMS**

is written by me and is my own effort and that no part has been plagiarized without citations.

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DEDICATION

To my lovely *bonda* Rosnilah binti Johan and
supportive *ayahanda* Abdul Rahman bin Rejab.

ACKNOWLEDGMENTS

Firstly, I really be grateful to Allah S.W.T. because give the opportunity to me to undergo this learning process in healthy and safely condition.

I would like to thanks to my beloved family that is always besides me and encourage me to work smart and do the best as I can. Then, I would like to thanks to my supervisor, Mr Erman bin Hamid for all guidance, support, advice and cooperation that he gave to me along of journey to accomplish Projek Sarjana Muda (PSM) successfully. He inspired me greatly to work in this project and thanks a lot with his willingness to motivate me to not be give up if any problems come.

Plus, thanks also to my faculty department that provide this subject because from this subject, I get a lot of knowledge and make me more independent in order to get new understanding regarding to my project. I also would like to thank to my friends and other faculty members those heir understandings and supports on me in completing this project. I really appreciate all the cooperation given in order for me to go through along this journey.

ABSTRACT

The project “Performance Analysis of IPv4 to IPv6 Tunneling Mechanisms” is a study on selected types of tunneling configuration which are host-to-host tunneling configuration and router-to-router tunneling configuration. Both tunneling configuration will be tested and analyzed in order to indicate which tunnel is give the best performance in network environment. They are measured based on several parameters like latency, throughput, packet rate, and jitter. Plus, each parameter will undergo testing process by using different size of packet with number of samples data will be taken. The software needed to measure all parameters already identify at the beginning of the project. At the end of this project, final conclusion on which types of tunneling configuration provide the best performance will be gathered and this finding can be used as references for who are interested to explore more in this field.

ABSTRAK

Projek “Analisa Prestasi Mekanisma Terowong IPv4 kepada IPv6” adalah kajian untuk jenis konfigurasi terowong yang terpilih iaitu konfigurasi terowong komputer ke komputer dan konfigurasi terowong router ke router. Kedua-dua konfigurasi terowong ini akan diuji dan dianalisa untuk mengenal pasti terowong yang memberikan keputusan yang terbaik dalam dunia rangkaian. Konfigurasi terowong ini akan diuji berdasarkan beberapa parameter seperti jumlah bit yang dihantar dalam masa satu saat, durasi masa yang diperlukan untuk melakukan penghantaran paket dari satu komputer ke komputer yang lain, kadar paket yang dihantar dalam masa satu saat, dan perbezaan masa antara satu durasi masa penghantaran paket dengan durasi masa penghantaran paket yang seterusnya. Tambahan lagi, setiap parameter akan menjalani proses pengujian dengan menggunakan saiz paket yang berbeza dan beberapa sampel data akan diambil dari pengujian tersebut. Perisian yang diperlukan untuk menguji kesemua parameter telah dikenal pasti pada awal permulaan projek ini. Di akhir projek ini kesimpulan berdasarkan jenis konfigurasi terowong yang terbaik akan diperolehi dan penemuan dari kajian ini boleh digunakan sebagai rujukan kepada sesiapa yang mahu mengkaji dengan lebih mendalam dalam bidang ini.

TABLE OF CONTENTS

CHAPTER	SUBJECT	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF FIGURES	xii
	LIST OF TABLES	xiv
	LIST OF APPENDICES	xv
CHAPTER I	INTRODUCTION	
	1.1 Project Background	1
	1.2 Problem Statements	2
	1.3 Objectives	2
	1.4 Scopes	3
	1.5 Project Significance	5
	1.6 Expected Output	5
	1.7 Conclusion	5

CHAPTER II	LITERATURE REVIEW AND PROJECT	
	METHODOLOGY	
2.1	Introduction	6
2.2	Literature Review	7
2.2.1	Domain	7
2.2.1.1	Types of Transition Mechanisms	7
2.2.1.2	How Tunneling Works?	8
2.2.2	Keywords	9
2.2.2.1	Internet Protocol (IP)	9
2.2.2.2	Internet Protocol Version 6 (IPv6)	10
2.2.2.3	IPv4 to IPv6 Transition Mechanisms	11
2.2.2.4	Host-to-Host Tunneling Configuration	12
2.2.2.5	Router-to-Router Tunneling Configuration	12
2.2.3	Previous Research	13
2.2.3.1	Research 1: Evaluating IPv4 to IPv6 Transition Mechanism	13
2.2.3.2	Research 2: IPv4/IPv6 Transition Mechanisms	16
2.2.3.3	Research 3: Performance Evaluation Between IPv4 and IPv6 on MPLS Linux Platform	21
2.3	Proposed Solution	23
2.3.1	Project Methodology	23
2.3.1.1	Analyze Requirements	24
2.3.1.2	Develop Logical Design	24
2.3.1.3	Develop Physical Design	24
2.3.1.4	Test, Optimize and Document Design	25
2.3.1.5	Implement and Test Network	25

2.3.1.6 Monitor and Optimize Network Performance	25
2.4 Project Schedule and Milestones	26
2.5 Conclusion	28

CHAPTER III ANALYSIS

3.1 Introduction	29
3.2 Problem Analysis	30
3.2.1 Network Architecture	31
3.2.1.1 Host-to-Host Tunneling Configuration	31
3.2.1.2 Router-to-Router Tunneling Configuration	32
3.2.2 Logical Design	34
3.2.3 Physical Design	35
3.2.3.1 Host-to-Host Tunneling Configuration	35
3.2.3.2 Router-to-Router Tunneling Configuration	36
3.3 Requirement Analysis	38
3.3.1 Hardware Requirement	38
3.3.2 Software Requirement	39
3.3.3 Quality of Data	40
3.4 Conclusion	42

CHAPTER IV**DESIGN**

4.1 Introduction	44
4.2 Possible Scenarios	45
4.2.1 IPv6 to IPv4-tunnel	45
4.2.2 Configured-tunnel	46
4.2.3 Host-to-Host Tunneling Configuration	47
4.2.4 Router-to-Router Tunneling Configuration	48
4.3 Conclusion	49

CHAPTER V**IMPLEMENTATION**

5.1 Introduction	50
5.2 Network Configuration Management	51
5.2.1 Configuration Environment Setup for Host-to-Host Tunneling	51
5.2.2 Configuration Environment Setup for Router-to-Router Tunneling	55
5.3 Hardware Configuration Management	58
5.3.1 Hardware Setup	58
5.4 Conclusion	59

CHAPTER VI	TESTING	
	6.1 Introduction	60
	6.2 Test Plan	
	6.2.1 Test Organization	61
	6.2.2 Test Environment	61
	6.2.3 Test Schedule	63
	6.3 Test Strategy	65
	6.4 Test Result and Analysis	66
	6.4.1 Latency Analysis	66
	6.4.2 Throughput Analysis	68
	6.4.3 Packet Rate Analysis	70
	6.4.4 Jitter Analysis	71
	6.5 Conclusion	72
CHAPTER VII	PROJECT CONCLUSION	
	7.1 Conclusion of Tunnel Performance	73
	7.2 Observation on Weaknesses and Strengths	74
	7.3 Propositions for Improvements	75
	7.4 Contribution	75
	7.5 Conclusion	76
REFERENCES		77
BIBLIOGRAPHY		78
APPENDICES		79

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Encapsulation of IPv6 packet in IPv4 header	9
2.2	Homogenous IPv6 Network	14
2.3	Heterogeneous IPv4 and IPv6 Network (IPv6 in IPv4 Tunneling)	14
2.4	Heterogeneous IPv4 and IPv6 Network (6-over-4 Tunneling)	14
2.5	Configured-tunnel Testbed	17
2.6	IPv6 to IPv4-tunnel Testbed	18
2.7	Tunnel Broker Testbed	19
2.8	Network Design and Implementation Cycle	23
3.1	Concept of Host-to-host Tunneling Configuration	32
3.2	Concept of Router-to-router Tunneling Configuration	33
3.3	Logical Design	34
3.4	Physical Design (host-to-host tunneling Configuration)	36
3.5	Physical Design (router-to-router tunneling Configuration)	38
4.1	IPv6 to IPv4-tunnel	45
4.2	Configured-tunnel	46

4.3	Host-to-host tunneling configuration	47
4.4	Router-to-router tunneling configuration	48
6.1	Host-to-host tunneling configuration test environment	62
6.2	Router-to-router tunneling configuration test environment	62
6.3	Latency analysis graph	67
6.4	Throughput analysis graph	69
6.5	Packet rate analysis graph	70
6.6	Jitter analysis graph	71

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	Project Schedule and Milestones	26
6.1	Testing Summary	64
6.2	Testing Schedule	65
6.3	Latency performance comparison	67
6.4	Throughput performance comparison	68
7.1	Summary of Tunnel Performance	73

LIST OF APPENDICES

APPENDIX	TITLE
A	Project Gantt Chart
B	Installation and Configuration
C	Command for Parameter Testing
D	Tables of Data

CHAPTER I

INTRODUCTION

1.1 Project Background

Nowadays, the amounts of address spaces that can be supported by Internet Protocol Version 4 (IPv4) become exhausted and depleted. So, in order to overcome this problem, the Internet Engineering Task Force (IETF) of the Internet SOCIety (ISOC) decided to introduce a new IP addressing which is known as IP version 6 (IPv6) or IPng (ng = Next Generation) (Wegner and Rockell, 1999).

Even there is already have the alternative solution for this problem, it is quite difficult to change the whole IPv4 implementation with the IPv6. Plus, it will take time to do that particular process. In order to make the IPv6 packet can go through in IPv4 network environment, the IETF has developed the transition mechanisms for implementing a transition strategy. There are three types of IPv6 transition mechanism that can be implemented. They are dual stack, tunneling and translation mechanisms (Huston and Telstra, 2003). The only transition mechanism that will be covered in this project is tunneling mechanism.

According to RFC 2893, there are three ways to tunnel IPv6 traffic between IPv6/IPv4 nodes over an IPv4-only infrastructure. They are router-to-router, host-to-router and router-to-host, and host-to-host tunneling configuration (Davies, 2008). In this project, the experimental and evaluation that will be covered only on router-to-router and host-to-host of tunneling configuration.

1.2 Problem statements

Even both tunneling configuration which are router-to-router and host-to-host is do the same function which is allow the IPv6 packet to be encapsulated in IPv4 packet to go through the IPv4 network environment, there is still have a differences between them in several aspect or criteria. We do not know which tunneling configuration given a better output in user application performance. So, the performance for both of them will be analyzed and evaluated in order to get the best conclusion on which one of them is give the best performance. The performance evaluation will be done by using particular software based on several parameters.

1.3 Objectives

The objectives of the project are:

- i. To analyze performance between two types of tunneling configuration which are host-to-host and router-to-router tunneling configuration.
- ii. To analyze tunneling configuration performance that is control by several parameters which are throughput, latency, packet rate and jitter.

- iii. To produce a summary and best conclusion based on the comparison between two different tunneling configurations which one give the best performance compared to the other one.

1.4 Scopes

The main scope of the project is only two types of tunneling configuration that will be analyzed here which are host-to-host and router-to-router. This project involved two workstations and two routers. The operating system that will be used in this project is Windows Server 2008 as well as it can support dual stack and IPv6 infrastructure. The connection between workstation and router is used RJ45 cable; meanwhile, connection between routers is used serial cable. At router, there do not involve any routing protocol but static route is used to add new routing table information on the router. Furthermore, routers that will be used are Cisco 2800 whereby they can support IPv6 features. If there is no this capability in the router, the operating system of the router need to be upgraded. The software used is ping utilities, Wireshark, and D-ITG. They are installed in both workstations in order to measure several parameters. This project is conducted by analyzing the performance based on several parameters. They are:

a) **To analyze performance of tunneling mechanism by throughput**

Throughput can be defined as the total amount of work done in a given time. It is also known as bandwidth (Patterson and Hennessy, 2008). The performance will be measured in bits per second (bps) (Raicu and Zeadally, 2003). This parameter is analyzed by using Wireshark software.

b) To analyze performance of tunneling mechanism by latency

Latency or delay is one of performance metrics that is used to indicate how long the message takes to travel from one host to another host. It is measured in terms of time (Peterson and Davie, 2007). The performance will be measured in milliseconds (ms) per RTT (round trip time) (Raicu and Zeadally, 2003). The method that is used for its evaluation is ping utilities.

c) To analyze performance of tunneling mechanism by packet rate

Packet rate can be defined as a number of packets that is transmitted on the wire over a specific time. Each value of packet rate is different and depends on the bandwidth that is supported by Ethernet (Karlin and Peterson, 2002). This metric is measured in units of packets per second (pkt/s). D-ITG is used to analyze packet rate performance.

d) To analyze performance of tunneling mechanism by jitter

Jitter is one of the metrics that is measured in this project. The meaning of jitter is a variation in the delay of received packets. Some of the causes of jitter are improper queuing that lead to delay between packets vary each other and cannot remain constant (www.cisco.com). It is measured in units of seconds (s) by using D-ITG (Distributed Internet Traffic Generator).

1.5 Project Significance

As a user, they really need and want that their work is done in a minimum of time as well as they can. The latency, throughput, jitter and many more can indicate whether the method that they are using in tunneling mechanism gives the best performance or not. Through this project, it can help to compare which one of them has the best performance for tunneling the IPv6 packet.

1.6 Expected Output

The expected output in this analysis project is the best tunneling configuration can be finalized and concluded after doing the comparison between both of them (host-to-host and router-to-router) based on parameters measured.

1.7 Conclusion

In this chapter, there consist of explanations about the project background, problem statements, objectives, scope, project significance and expected output from the project. The project background gives the overview on what the project is going to do. Meanwhile, problem statements state the problem occur that made up the project to be developed. In objectives, it gives what the output is going to achieve at the end of the project. The scope part explains what is being use in the project plus the parameters that will control the performance analysis. The advantages of the project were explained in project significance. In the next chapter, the Literature Review and Project Methodology are focused on the findings of the project that is analyzed.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

This chapter is discussed and focused on literature review and project methodology. A literature review take part in the discussion on researches that already done before by others debates based on the selected area of study. It is include the searching, collecting, identifying, analyzing and drawing conclusion through several kinds of researches. All these things are mainly gather from journals, articles, books, web pages and technical reports. The revision done is all about IPv6 transition mechanism that focuses on tunneling mechanism.

Meanwhile, project methodology is discussed on steps involve to undergo the experiment. All the approach that have been used in previous researches is justify and describe on how it will being applied in this project. Plus, Top-Down Network Design has been chosen primarily to be used in project methodology.

2.2 Literature Review

This part consists of the previous researches that related with this project. The information gathered will fully utilize and use in order to undergo this project.

2.2.1 Domain

The domain of the project is IPv6 transition mechanism that is focus on tunneling mechanism. There are involves two types of tunneling configuration which are host-to-host and router-to-router. Both types of configuration are analyzed in order to conclude which one is the best method or technique in tunneling mechanism. The evaluation process is control by several parameters such as throughput, latency, packet rate, and jitter.

2.2.1.1 Types of Transition Mechanisms

The transition mechanism method is one of a significant method that is used today in order to implement the new network protocol which is Internet Protocol version 6 (IPv6) in IPv4 network environment. As well as the exhausted of IPv4 nowadays, it is quite difficult if we want to fully change the network protocol with IPv6. That is why the transition mechanism is developed. Actually, there are three