



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**A STUDY OF MULTICAST PROTOCOL EFFICIENCY IN A
CAMPUS NETWORK ENVIRONMENT USING eNSP**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Telecommunications) with Honours.

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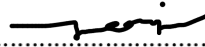
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APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:



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ABSTRAK

Dalam era digitalisasi ini, rangkaian komputer memainkan peranan penting dalam kehidupan kita. Ini membolehkan pengguna di rangkaian berkongsi maklumat atau sumber dan berhubung antara satu sama lain. Dengan teknologi multicast, setiap reka bentuk komunikasi rangkaian yang melibatkan penghantaran maklumat kepada beberapa penerima dapat memanfaatkan kecekapan lebar jalurnya. Walau bagaimanapun, tujuan projek ini adalah untuk menerapkan protokol multicast dalam topologi rangkaian kampus dengan menggunakan eNSP dan mengkaji kecekapannya. Projek ini akan diuji melalui proses penstriman video yang dihantar dari satu pelayan ke beberapa pelanggan. Selain itu, projek ini tidak akan menggunakan apa-apa pelaksanaan perkakasan dan ini hanya termasuk pada simulasi. Protokol multicast yang digunakan terutamanya dalam projek ini adalah Protokol Multicast Dense Mode (PIM-DM) dan Protokol Independent Sparse Mode (PIM-SM) selain daripada Open Shortest Path First (OSPF) dan Internet Group Management Protocol (IGMP). Pelaksanaan perisian tersebut merangkumi simulator rangkaian Huawei eNSP dan penganalisis rangkaian Wireshark. Projek ini dapat mengurangkan kos dan menjimatkan masa kerana hanya berlaku dalam simulasi. Walaupun hanya dalam simulasi, penyelidik akan dapat melihat bagaimana ia berfungsi dalam realiti proses penstriman video.

ABSTRACT

In this era of digitalization, the computer network plays a crucial role in our lives. It lets users on the network to share information or resources and connect with each other. With multicast technology, any design of network communication that involve the transmission of one message from a source to multiple receivers will have the efficiency benefits of its bandwidth. However, the purpose of this project is to apply multicast protocol in a campus network topology by using eNSP and to study their efficiency. This project will be tested through a delivered video streaming process from one server to multiple clients. Besides, this project will not use any hardware implementation and it is including only on the simulation. The multicast protocol mainly used in this project are Protocol Independent Multicast-Dense Mode (PIM-DM) and Protocol Independent-Sparse Mode (PIM-SM) other that Open Shortest Path First (OSPF) and Internet Group Management Protocol (IGMP). The software implementation is including Huawei eNSP network simulator and Wireshark network analyzer. This project is able to reduce costs and save time as it only happens in simulation. Although only in simulation, the researcher will be managed to see how it works in the reality of the video streaming process.

DEDICATION

This project is especially dedicated to my beloved parents, Allahyarham Ismail Bin Mat Isa and Siti Mariam Binti Md Zain, my supervisor and co-supervisor, Ts. Fakhrullah Bin Idris and Ts. Gloria Raymond Tanny, my siblings, my friends, and my lecturers.



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TABLE OF CONTENTS

	PAGE
TABLE OF CONTENTS	x
LIST OF TABLES	xiii
LIST OF FIGURES	xv
LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES	
xixx	
CHAPTER 1 INTRODUCTION	1
1.1 Project Background	1
1.2 Objectives of Project	3
1.3 Scope of Project	3
1.4 Problem Statement	4
1.5 Thesis Arrangement	5
CHAPTER 2 LITERATURE REVIEW	6
2.1 Introduction	6
2.2 Multicast Routing and Protocols	6
2.3 The difference of Multicast Routing Protocol	10
2.4 Campus Network	17
2.5 Huawei eNSP Network Simulation	22
2.6 Wireshark Network Analyzer	27

2.7	Summary of the Chapter 2	33
CHAPTER 3 METHODOLOGY		35
3.1	Introduction	35
3.2	Progress of Projek Sarjana Muda 1 (PSM 1)	35
3.3	Gantt Chart	37
3.4	Equipment Implementation	38
3.4.1	Router AR1220	38
3.4.2	Switch S3700	39
3.4.3	End Device (Client)	40
3.4.4	Multicast Source (MCS)	41
3.5	Multicast Protocols Implementation	41
3.5.1	Open Shortest Path First (OSPF)	41
3.5.2	Internet Group Management Protocol (IGMP)	42
3.5.3	Protocol Independent-Dense Mode (PIM-DM)	42
3.5.4	Protocol Independent-Sparse Mode (PIM-SM)	42
3.6	Software Implementation	43
3.6.1	eNSP Software	43
3.6.2	Wireshark Software	44
3.7	The Project Flowchart of PSM	46
3.8	The Design Project of Projek Sarjana Muda (PSM)	48

CHAPTER 4	RESULTS AND DISCUSSION	49
4.1	Introduction	49
4.2	The Campus Network Topology Design	50
4.3	The Configuration of Network Elements in Campus Network	51
4.3.1	IP Address Subnetting	51
4.3.2	Protocol Recognition and Network Configuration Testing	58
4.4	The Simulation of Multicast Campus Network	71
4.5	Wireshark Analysis Multicast Data Traffic	72
4.5.1	PIM-DM Data Traffic Analysis	73
4.5.2	Comparison for PIM-DM Protocol Data Traffic on each Interface	80
4.6	Discussion	81
CHAPTER 5	CONCLUSION AND FUTURE WORK	84
5.1	Overview	84
5.2	Conclusion	84
5.3	Future Work Recommendation	85
REFERENCES		86
APPENDIX		89

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	Comparison Between Different Types of Multicast.	9
2.2	The Diversity of Utilization in Multicasting.	10
2.3	Comparison of Multicast Routing Protocols	11
2.4	The Difference of Multicast Protocol.	16
2.5	The comparison of Campus Network.	21
2.6	The Equipment Address.	25
2.7	The Difference Usage of Huawei eNSP.	26
2.8	The Comparison the Usage of Wireshark Software.	32
3.1	Projek Sarjana Muda 1 (PSM 1) Gantt Chart	37
4.1	All the possible subnet mask of /28 networks for 192.168.1.1	51
4.2	IP Address Range of /28 Networks on Clients	52
4.3	IP Address Range of /28 Networks on Client Interface from Router	52
4.4	IP Address Range of /30 Networks on Multicast Server and Routers	53
4.5	Ping Test from Client 1 until Client 16 to Multicast Server	56
4.6	PIM-DM Interface Verbose Details	59
4.7	IGMP Interface Verbose Details	64

4.8	IGMP Group Details	66
4.9	Multicast Routing Details	67
4.10	PIM Interface Details	68
4.11	IGMP Interface Details	69
4.12	RPF (Reverse Path Forwarding) Details on Router	70
4.13	Data Traffic Comparison for PIM-DM Protocol on each Interface	80



LIST OF FIGURES

FIGURE	TITLE	PAGE
1.1	Multicast in PIM-DM	2
2.1	SDN Experimental Implementation Results	7
2.2	The Campus Network Architecture of NCT	9
2.3	IPv6/IPv4 Multicast Network Topology Performance.	13
2.4	The Network Configuration by using OPNET Modeler	14
2.5	The usage of RP for The Conventional of PIM-SM and The Extended of PIM-SM.	15
2.6	The IPFRR Mechanism with The New of PIM-SM	16
2.7	Backbone Logic Diagram of University Campus Network	18
2.8	Distributed Deployment of Log Collection	19
2.9	Topology of Campus Network.	20
2.10	Mesh Terminal and Routers of The Networking Systems	21
2.11	Network Topology with IP Multicasting Implementation.	23
2.12	WLAN Topology.	24
2.13	Performance of EDCA Simulation Experiment Analysis Results	25
2.14	Result diagram of Protocol Analysis	28
2.15	Process of Attacks.	29
2.16	Peer-To-Peer Security Diagram.	31
2.17	Flowchart of Capture P2P Data by Wireshark	31

2.18	Viavi Corp. Hardware as an Observer.	32
3.1	Flowchart of PSM 1 Progress.	36
3.2	Router AR1220 in Simulation.	38
3.3	Switch S3700 in Simulation.	39
3.4	Client as an End Device in Simulation.	40
3.5	Multicast Source (MCS) in Simulation.	41
3.6	eNSP Network Simulator Software.	43
3.7	The Wireshark Network Analyzer Software	44
3.8	Wireshark Packet Data Captured.	45
3.9	The Flowchart of Projek Sarjana Muda (PSM).	47
3.10	The Campus Network Topology Design.	48
4.1	Campus Network Topology Design	50
4.2	IP Address Range by Classes	54
4.3	OSPF Protocol Command Configuration	55
4.4	Multicast Streaming Video from Multicast Server (at the top and left side) to the Client 1 until Client 8.	71
4.5	Multicast Streaming Video from Multicast Server (at the top and left side) to the Client 9 until Client 16	72
4.6	A Client from Block H (192.168.1.113) query to join the multicast group (225.1.1.1) using IGMPv2 protocol	73
4.7	Client 1 (192.168.1.2) has join the multicast group (225.1.1.1) using IGMPv2 protocol	73

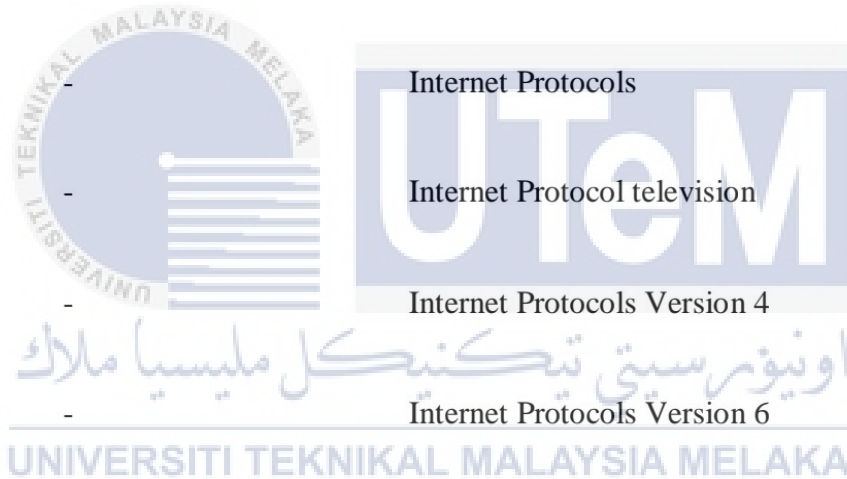
4.8	Client 8 (192.168.1.51) has leave the multicast group (225.1.1.1) using IGMPv2 protocol	73
4.9	a) Router 1 to Multicast Server IO Graph, b) Router 2 to Client Interface (GigabitEthernet0/0/1) IO Graph, c) Router 4 to Router 3 IO Graph	75
4.10	Protocol Hierarchy from Multicast Server	75
4.11	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/0) from Router 1	76
4.12	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/1) from Router 1	76
4.13	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/0) from Router 2	76
4.14	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/1) from Router 2	76
4.15	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/0) from Router 3	76
4.16	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/1) from Router 3	76
4.17	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/0) from Router 4	77
4.18	Protocol Hierarchy of Clients Interface (GigabitEthernet0/0/1) from Router 4	77
4.19	Router 1 to Multicast Server Conversation Data	78
4.20	Client 1 and Client 2 to Multicast Server Conversation Data	78

4.21	Router 1 to Multicast Server Endpoint Data	78
4.22	Client 15 and Client 16 to Multicast Server Endpoint Data	78
5.1	Projek Sarjana Muda 1 (PSM 1) Gantt Chart	89
5.2	Projek Sarjana Muda 2 (PSM 2) Gantt Chart	90

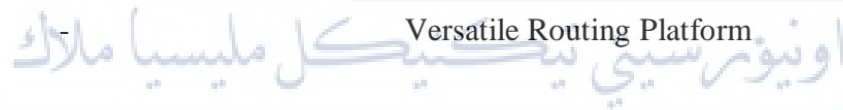


LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

eNSP	-	Enterprise Network Simulation Platform
GNS3	-	Graphical System Simulator
IGMP	-	Internet Group Management Protocols
IP	-	Internet Protocols
IPTV	-	Internet Protocol television
IPV4	-	Internet Protocols Version 4
IPV6	-	Internet Protocols Version 6
LAN	-	Local Area Network
LTE	-	Long Term Evolution
MOSPF	-	Multicast Open Shortest Path First
MTRSA	-	Multi-Tree Routing State Assignment
OSPF	-	Open Shortest Path First
PC	-	Personal Computer



PIM-SM	-	Protocols Independent Multicast Sparse Mode
PIM-DM	-	Protocols Independent Multicast Dense Mode
RP	-	Rendezvous Point
RIP	-	Routing Information Protocols
SDN	-	Software Define Networking
SMTE	-	Scalable Multicast Traffic Engineering
UDP	-	User Datagram Protocol
VLC	-	Video LAN Client
VRP	-	Versatile Routing Platform
WLAN	-	Wireless Local Area Network



CHAPTER 1

INTRODUCTION

1.1 Project Background

These days, the computer network plays a crucial role in our lives. It lets users on the network to share information or resources and connect with each other. However, in multicast technology, any design of network communication that involve the transmission of one message from a source to multiple receivers will have the benefits of bandwidth reduction. Besides, the simulation will be used for the purpose of this project. In this project, the Network Simulator would apply the Huawei eNSP software.

According to (Golecha, A., Karanje, S., and Abraham, J., 2017) proposed that there should be one multicast source and one or more network destinations. At least one participant of the team is involved in obtaining a datagram of multicast from the source. The address of the group will identify the members of the group. Multicasting explores its use in applications such as radio or video broadcasts, video conferencing, and so on, which send the same data to several recipients at once. The paper mentions that the Protocol Independent Multicast Dense Mode (PIM DM) and Protocol Independent Multicast Sparse Mode (PIM SM) are the multicasting routing protocols that perform better and more effectively than the other protocols.

Subsequently, an article proposed by (Li, X. and Jiang, T., 2014) states that the network resources with centralization features is the main features of the campus network in according to different patterns of geographical distribution. The campus network covers a wide geographical area, the size of the network is diverse, and the multi-administrative campus network is used to

measure requirement of computing in the specific large scale. Typically, campus network operates on CERNET architecture that is high demand for network connection and can cause certain constraints. The implementation is not very complex in terms of the principle of logical design.

However, the article proposed by (Chen, J. *et al.*, 2019) addressed that the Enterprise Network Simulation Platform (eNSP) is a freeware and scalability software provided by Huawei. It is mainly to simulate router, switch, firewall, WLAN, and any others of equipment on the enterprise network. It is also friendly interface and provides a real of equipment to support the networking in large scale. This software can able the users for design the enterprise network even if does not have any equipment for real life.

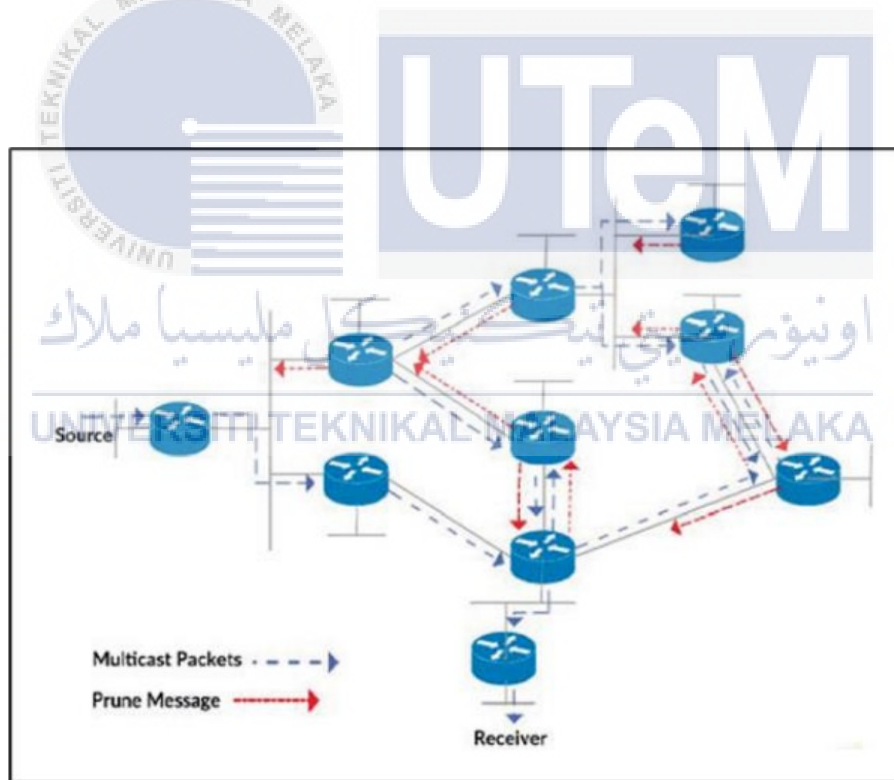


Figure 1.1: Multicast in PIM-DM. (Golecha, A., Karanje, S., and Abraham, J., 2017)

1.2 Objectives of Project

There are several objectives for this project:

1. To design the network topology of campus network and able to deliver video streaming to the clients using eNSP.
2. To compare the different types of multicast protocols implementation that mainly used Protocol Independent Multicast-Dense Mode (PIM-DM).
3. To study the efficiency of multicast protocols configuration on similar campus network topology.

1.3 Scope of Project

Even so, the scope of this project ultimately encompasses a whole university or campus. But for this research, it comprises several networking equipment which are most important to be used in the design of the campus network such as network switches, routers, and clients. The number of network elements used are as following; four routers, eight switches and sixteen clients. Moreover, fibre optic and copper will be link to all equipment in the transmission media for this project. There are also two software of eNSP and Wireshark that will be implemented to execute this project. Thus, to reinforce this campus network design, we will implement the multicast protocols with different types of configuration and study their efficiency.

1.4 Problem Statement

Unlimited access to the networking world beyond the campus is one of the biggest purposes for building a campus network for all faculties, students, and staff. The worldwide electronic environment also has on-campus access to services and resources such as e-mail use, involvement in web forums, access to bibliographic and full text document content and information sharing. All these teachers, students and staff will easier able to work if they are able to access the Internet from their device. Indeed, many of the advantages, such as the web's potential for instructional use or as a campus-wide information system "intranet," that can only be noticed if everybody on campus provides exposure to it.

Most Internet operation requires fairly slow transmission of characters or text files. The development of Web usage for graphics, audio, and full motion video are leading higher demand for campus network efficiency. Before to design a campus network, we should predict the increasing demand for more network usable capacity, as well as stronger security, fidelity and optimized the service quality.

However, such excessive multicast streams would cause the cache and connection bandwidth of the switches to be wasted. But the cache and link bandwidth are necessary for transmitting application streams with less packet loss, latency, and jitter. Besides, the packets data are will likely happen duplicated at an exponential rate, it also will be leading to extremely bandwidth requirements and overhead of routing.

In addition, simulation of the eNSP network software is rarely used and known whether in the field of education or in the field of work. This means that eNSP software need to be more explore and we can figure out the best functionality of this network simulation compared to any other network simulations such as GNS3 and Cisco Packet Tracer. eNSP software encompasses of

an actual network equipment in the simulation. This would let the users to understanding and easy to manage the function and setup of related equipment in real life.

1.5 Thesis Arrangement

The first chapter introduces the probability of this project to be promptly clarified. The project background emphasized about the multicast technology, multicast protocols, campus network and eNSP software. This chapter also will explain the objectives, scope of project, problem statement and thesis arrangement of this project.

The second chapter is about the study of literature from previous researches that gather the information, techniques, and several features of the multicast technology. This chapter consists of multicast routing and protocol, campus network, eNSP software and Wireshark software that related and can be develop in this project. This chapter also based on articles, journals, and international research sources.

The third chapter will be exploring the different approaches to information-gathering. This chapter is a method that should be taken, and comprehensive studies reports that would be conducted to achieve this project's aim or objective. This section also determines the methods used to complete the mission, as well as details the project progress.

The fourth chapter will produce the expected results of this project. This chapter will analyze and observe all the output data from the implemented software.

The fifth chapter is the last chapter that will consists of the conclusion from all of this project. This chapter will be related the objectives of this project and provides some recommendations for the future research.