



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**CAMPUS NETWORK MULTICAST USING HUAWEI**

**ENSP NETWORK SIMULATOR**

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.

by

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## **APPROVAL**

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## ABSTRAK

Karya ini membincangkan tentang rangkaian kampus menggunakan teknik multicasting IP dengan Huawei eNSP rangkaian simulator termasuk protokol multicast, simulator rangkaian, rangkaian kampus dan perisian eNSP sendiri. Tambahan pula, projek ini hanya melaksanakan dalam simulasi sahaja. Terdapat beberapa protokol dalam teknik multicast. PIM adalah salah satu protokol multicast. PIM boleh dibahagikan kepada dua mod: Mod padat (DM) dan Mod jarang (SM). PIM-DM adalah protokol mod multicast padat. Dalam PIM-DM, data dipindahkan melalui "mod push," yang sesuai dengan pengguna yang ramai untuk rangkaian. PIM-SM adalah protokol mod multicast yang jarang. Dalam PIM-SM, data dipindahkan melalui "mod tarik," yang sesuai untuk rangkaian yang luas dengan pengguna tersebar. Dalam projek ini, ia akan cuba untuk melaksanakan protokol multicast yang PIM-DM lawan PIM-SM. IGMP Snoop adalah sangat mudah. Ia membuktikan barangan Rajah multicast dengan memantau mesej IGMP di antara akhir pelanggan dan akhir router. simulasi rangkaian eNSP adalah simulator rangkaian yang dibangunkan oleh Huawei Enterprise Network simulasi. eNSP ialah, extensible, berasaskan Huawei rangkaian grafik platform alat simulasi percuma. Simulasi perkakasan untuk router rangkaian perusahaan, suis dan persembahan yang sempurna adegan peranti sebenar, menyokong simulasi rangkaian berskala besar, juga membuat kita boleh melakukan ujian eksperimen dan belajar teknologi rangkaian dalam hal yang tidak ada peranti sebenar. Untuk projek ini, kami akan digunakan simulator rangkaian ini sebagai platform untuk membina Kampus rangkaian topologi.

## ABSTRACT

This paper is discuss about the campus network using IP multicasting technique with Huawei eNSP network simulator including multicast protocols, network simulators, campus network and eNSP software itself. Furthermore, this project only implements in simulation only. There are several protocols in multicast technique. PIM is one of multicast protocols. PIM can be divided into two modes: Dense Mode (DM) and Sparse Mode (SM). PIM-DM is a dense mode multicast protocol. In PIM-DM, data is transferred through the "push mode," which is suitable with crowded users for the network. PIM-SM is the sparse mode multicast protocol. In PIM-SM, data is transferred through the "pull mode," which is suitable for the wide network with dispersed users. In this project it will try to implement these of multicast protocols which is PIM-DM versus PIM-SM. IGMP Snoop is very simple. It establishes multicast table items by monitoring the IGMP message between the end of the client and the end of the router. eNSP network simulation is network simulator that develop by Huawei Enterprise Network Simulation. eNSP is a free, extensible, Huawei-based graphical network simulation tool platform. Hardware simulation for enterprise network routers, switches and a perfect presentation of a real device scene, support large-scale network simulation, also make us can do experimental test and learn network technology in the case of that there is no real device. For this project, we will use this network simulator as a platform to construct Campus network topology.

## **DEDICATION**

To my beloved parents, Mohd Shuib bin Idris and Zainab Binti Hitam, my supervisor and co-supervisor Ts Fakhrullah bin Idris and Gloria Raymond Tanny, my siblings, my friends, my teachers, and my only one.



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## LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

RP	-	Rendezvous Point
IP	-	Internet Protocols
IPV4	-	Internet Protocols Version 4
IPV6	-	Internet Protocols Version 6
UDP	-	User Datagram Protocol
LAN	-	Local Area Network
VLC	-	Video LAN Client
eNSP	-	Enterprise Network Simulation Platform
PC	-	Personal Computer
LTE	-	Long Term Evolution
OSPF	-	Open Shortest Path First
MOSPF	-	Multicast Open Shortest Path First
BCMCS	-	Broadcast and Multicast Services
RIP	-	Routing Information Protocols
VRP	-	Versatile Routing Platform
WLAN	-	Wireless Local Area Network
PIM-SM	-	Protocols Independent Multicast Sparse Mode
PIM-DM	-	Protocols Independent Multicast Dense Mode
IGMP	-	Internet Group Management Protocols
IPTV	-	Internet Protocol television
GNS3	-	Graphical System Simulator
EIGRP	-	Enhanced Interior Gateway Routing Protocol

# CHAPTER 1

## INTRODUCTION

### 1.1 Project Background

Everything in our daily lives has turned to the digital era with the great developments in the field of Internet and technology. As part of our lives, the value of the Internet has increased significantly. It helps to create a new technology known as Campus Network using IP multicasting technique with Huawei eNSP Network Simulator. There are several network simulators in the field of networking, such as Cisco Packet Tracer, Graphical Network Simulator 3 (GNS3), Huawei eNSP, and so on. This project will only apply in simulation. The network simulator will be use for this project is Huawei eNSP.

IP multicasting is a technique used to send Internet Protocol datagrams to a collection of interested recipients for a single transmission. It is the multicast type specific to IP and is used for media streaming and other implementation of networks. It uses uniquely held IPv4 and IPv6 multicast address blocks. This project was using Huawei eNSP network simulation. There are two method of IP multicasting which is one-to-many and many-to-many. Multicast efficiently uses network infrastructure by demanding the source to deliver a packet only once, even though it needs to be delivered to a significant number of receivers. Typically network switch hubs and routers will take care of replicating the packet to achieve multiple destinations at the very same time. The protocol used in IP Multicasting is User Datagram Protocol (UDP). Alternatively, the use of dependable multicast protocols is Pragmatic General Multicast (PGM). It has been developed to overcome message loss and it also has loss detection and retransmission. The multicast group address is used by the sources and the receivers to send and receive multicast messages. Internet Group Management Protocol (IGMP) is the protocols commonly used by recipients to join the IP Multicast group. With routing protocols based on shared trees, a multicast distribution tree is built for that group once the receivers join a particular multicast IP group. Protocol Independent Multicast (PIM) is the most widely used protocol for this. There are varieties of PIM executions which is Sparse Mode (SM),

Dense Mode (DM) and Source Specific Mode (SSM). On top of that, PIM-SM is widely used during the time 2006 but SSM and Bidir are easier and scalable variation developed. Bidir is one of the PIM executions which is in Bidirectional Mode it contains Bidir or it called Sparse-Dense Mode (SDM).

A campus network is a computer network or topology that made up of interconnection of local area network (LAN). It usually contains network switches, routers, and computers. For nowadays transmission media it usually used optical fiber but sometimes it used a copper plant. Campus network usually apply in large area, which is in enterprise, university, and so on.

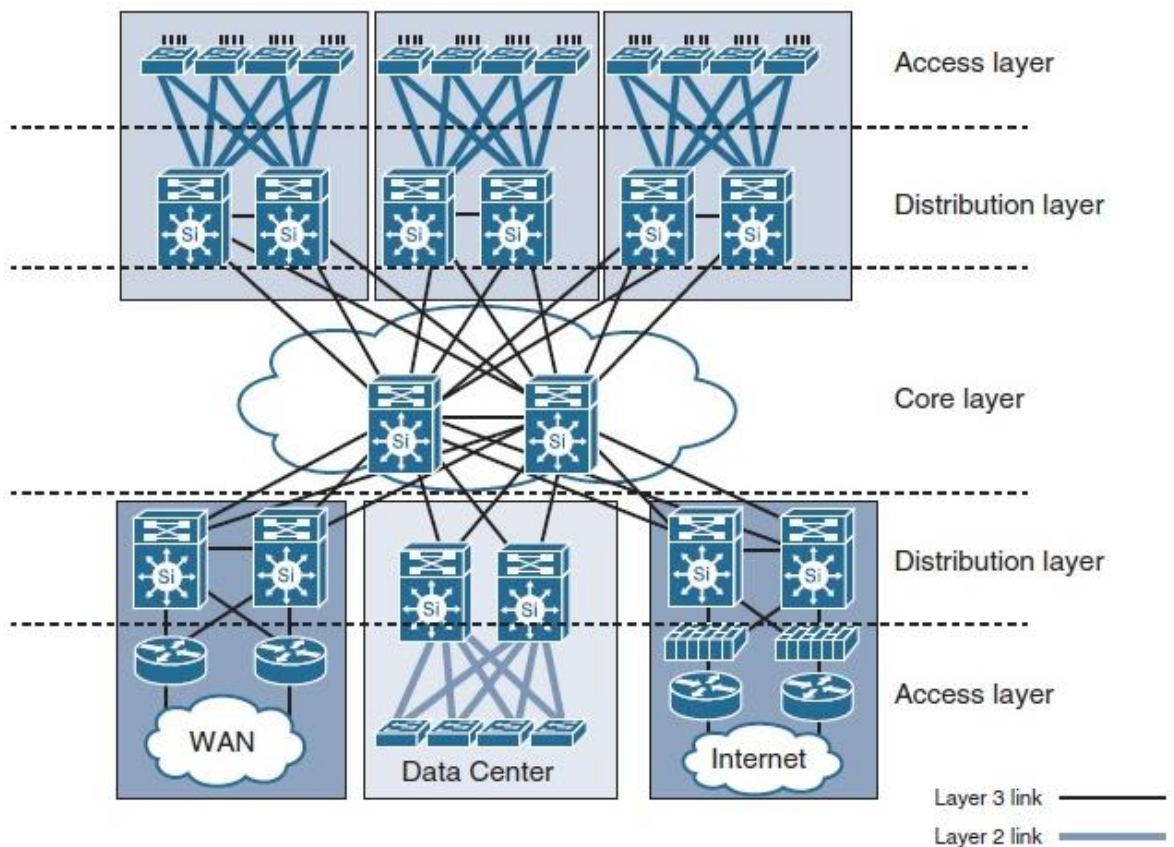


Figure 1.1: Typical topology for Campus Network

## 1.2 Problem Statement

Networking is a large field of work and in education, networking is one of the toughest subjects to learn it. There are several network simulators has been used for an educational purpose or in a working field. Most popular for educational purpose is a Cisco Packet Tracers. That because Cisco Packet Tracer is easier to learn compare to other simulators, however the tools in Cisco Packet tracers is not effective when come to troubleshooting compare to Graphical Network Simulator 3 (GNS3) because of the functionality for GNS3 is closely mimics a real network. That has been prove in journal comparative study on networking simulation tools using correlation analysis that proposed by (Chua *et al.*, 2018) stated that The results revealed that PT is comparable in the effectiveness of practical laboratories with respect to the practice of configurations, depending on the measurements used for the study. However, GNS3 is regarded as a tool that is more efficient in troubleshooting as it provides functionality that closely imitates an actual network. Results demonstrated proof of the exchange of skills from two behaviours and identified GNS3 as receiving a higher level of information exchange.

Furthermore, Huawei eNSP network simulation is not popular whether in education field or working field. That because Huawei eNSP is a new network simulation compare to other network simulators which is Cisco Packet Tracer and GNS3. Huawei eNSP is published in 2013 and it contain with a real network equipment in the simulation. That will help users to quickly become familiar with real-life equipment, understand and master the operation and configuration of related products. So, we apply this project using a Huawei eNSP network simulation. The network that we design is campus network using IP multicasting technique.

### **1.3 Objectives**

The main objective for this thesis will be to:

1. To design campus network topology using Huawei eNSP network simulation
2. To apply the IP multicasting technique in campus network topology using Huawei eNSP network simulation.
3. To able distribute the video streaming to all client using Multicast Protocols.
4. To analyse the performance of multicast protocol PIM-SM versus PIM-DM in Campus Network simulation.

### **1.4 Scope of Work**

Scope of this project eventually a whole campus or university however, this project only applies in simulation only. In this design of network campus, it contains a networking equipment which is network switches, routers and server. For the transmission media, this project will used optical fiber and copper plant to connect all devices.

### **1.5 Project Contribution**

The main motivation of complete this project because of project using a Huawei eNSP network simulator is rare and less people do it. As we know, multicast is an alternative way of broadcasting and unicasting. Multicast also can save bandwidth usage while transmitting the data.

## 1.6 Thesis Structure

In Chapter 1, it will be clarifying quickly about the possibility of the project. Task background will be examined in this part. This part will be focused on the layout of the project, indicating the objective, the issue articulation, and the scope of the project.

In chapter 2, this area is about the thought or idea, speculation, and some characteristics for protocols of IP multicasting, Implementation of IP multicasting, multicast technique is more saving bandwidth compare to unicast, comparison of network simulators, network simulators used for educational purpose, campus network and Huawei eNSP network simulator that used as a part of this project.

In chapter 3, this segment will clarify about the technique or methodology. Methodology chapter is a step that should be pursue and detailed reports of studies that should be finished to accomplish the target or objective. This section discloses the methodology taken to finish the task and it consist the detail about the development of this project.