UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ANALYSIS AND MODERNIZATION OF LOCAL AREA NETWORK (LAN)

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM)for the Bachelor Degree of Engineering Technology (System Computer) With Honours

By

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfilment of the requirements for the degree of Bachelor Degree of Engineering Technology (System Computer) with Honours. The member of the supervisory is as follow:

…………………………

Dr. Jamil Abedalrahim Jamil Alsayaydeh

(Project Supervisor)

ABSTRAK

Routing protocol seperti Enhanced Interior Gateway Routing Protocol (EIGRP),Routing Information Protocol (RIP) and Open Shortest Path First(OSPF) adalah jenis-jenis routing protocol yang dibincangkan didalam projek ini. Ketiga-tiga jenis routing protocol ini dalam kategori distance vector protocol dan ketiga-tiga ini di bawah interior gateway protocol. Setiap jenis routing protocol digunakan dikawasan network yang tersendiri. Untuk enhanced interior gateway routing protocol (EIGRP) ia berdasarkan pembahagian dari algoritma yang dikemaskini dan berasaskan cisco. Routing information protocol (RIP) saiz routing protocol itu sendiri adalah terhad dan mengunakan konsep kiraan hop dengan mengunakan pengiraan unit metric. Akhir, open shortes path first (OSPF), mengunakan algoritma yang akan mencari dan kira jalan singkat untuk menghantar data antara node. Project ini akan mengunakan perisian cisco packet tracer dan menganalisis ciri-ciri dan prestasi seperti, convergence time, round trip time dan throughput.

ABSTRACT

The routing protocol such as Enhanced Interior Gateway Routing Protocol (EIGRP),Routing Information Protocol (RIP) and Open Shortest Path First(OSPF) is type protocol that been discuss in this paper. This three type of protocol is under distance vector protocol which is all three type are interior gateway protocol.each type of protocol applied to specific network of environment. It will transmit data on network. for the enhanced interior gateway routing protocol (EIGRP)its based on the diffusing of update algorithm and its developed by cisco. Routing information protocol (RIP) the size of routing are limited and used hop count with metric calculation. Lastly, open shortes path first (OSPF), used the algorithm that calculate the shortest route of node. This project will be used the cisco packter tracer software to run and analyze the characteristic and the performance such as, convergence time, round trip time and the throughput.

DEDICATION

Dedicated with deepest love to:

My beloved family for their support and love

My dearest friends

To my supervisor Dr. Jamil Abedalrahim Jamil Alsayaydeh

Thanks for support and help me for this project

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First of all, thanks to the Mighty God for giving me the strength to finish this final year project.

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LIST ABBREVIATIONS

LAN   -   local area network

IEEE   -   institute electrical electronic engineers

RIP   -   routing information protocol

EIGRP-   -   enhancement interior gateway routing protocol

OPNET   -   software provide performance for computer network

OSPF   -   open shortest path first

IS-IS   -   intermediate system to intermediate system

IGRP   -   interior gateway routing protocol

DR   -   designated router

BDR   -   backup designer router

ABR   -   area border router

DUAL   -   diffusing update algorithm

MAC   -   media

CPT   -   cisco packet tracer

DNS   -   domain name servers

DHCP   -   dynamic host configuration protocol

GB   -   gigabit

RTT   -   round trip time

TTL   -   time to live

CHAPTER 1

INTRODUCTION

1.1   Overview

Nowadays, network is the important things that able people connect by each other. Year by year, networks was developing rapidly with the latest technology. For communication, e-commerce transactions, or information sharing. Network can be broadly categorizes according to their size, which helps to determine the scope and intended application. Different network implement by different ways.

Routing protocol one of on network layer, the function of routing protocol is to specify how the routers communicate with each other's, determine the best routing path to destination. A small network topology is needed to evaluate the impact of routing behaviour. The achievement of routing protocol is to observe the fast convergence, flexible, accurate and robust. From this project, analyse and compare the performance of three routing protocol: Routing Information Protocol (RIP), Open Shortest Path Frist (OSPF), and Enhanced Interior Gateway Routing Protocol (EIGRP).

All topology in this project are different, it will simulate on Cisco Packet Tracer. All three topology will simulate and collect the statistic such as convergence time and routing traffic sent.

Lastly, study how the limitation could be existing and the network implementation of routing protocol. Furthermore, find for the best way to modified for future work.

1.2   Problem Statement

Imagine that there's are almost 25-30 port of transmission control protocol with various internet protocol and the network needed to check the of router

functioning, to check the computer for malfunctioning network card, or any problem with network access such as, speed of network, accessing the email or cant share the drive. Also know how to analyse the failure of network and to get a better performance.

1.3   Objectives

The objectives of this project are as follows:

1. To analyse protocol of local area network.
2. To applied simulation environment local area network.
3. Study of local area network and type of protocol.

1.4   Scope

This project will be focus on analysis of routing protocol of local area network. There is three type of protocol that will be analyse, which is OSPF (open shortest path first), EIGRP (enhanced interior gateway routing protocol) and RIP (routing information protocol). The simulation will demonstrate the performance of each protocol. Certain feature of analysis observes from this project.

1.5   Thesis Outline

Chapter 1 discuss on the background of the project, objectives, scope of the project, problem statement, methodology and also the thesis outline.

Chapter 2 focuses on literature reviews of this project based on journals and other references.

Chapter 3 mainly discuss on the system design of the project. Details on the progress of the project are explained in this chapter.

Chapter 4 presents the results of the project. The discussion focused on the result based on the experiment.

Chapter 5 concludes overall about the project. Future recommendations and commercialization are also discussed in this chapter.

CHAPTER 2
LITERATURE REVIEW

2.1   Introduction

This chapter will be discussing in depth about the present local area network and routing protocol.

2.2   Network

Developments towards the establishment of computer networks complemented the stand-alone computer. Traditional stand-alone computers formed the basis for the establishment of computer networks. A computer network comprises any number of computers that are linked together. A network can be confined to a single building, utilising data cables as linking devices. Where greater distances are involved, the computers that constitute a network are linked by means of satellite links, telephone lines or fibre optic cables. When computers are linked together, information can be moved between them swiftly and efficiently. The information moves directly between computers rather than through a human intermediary. A network also allows for information to be backed up at a central electronic location. It is difficult to maintain regular back-ups on a number of stand-alone computers and important information can be lost by mistake. Routing protocol is how the route of communicate with each other, disseminating information that enable to select the route between any nodes on computer network. The routing algorithm are responsible for selecting the best path for communication that a border way routing protocol is language router speaks with their routers in order to share the information and reach the ability and the status of network. . Metrics such as a path bandwidth, reliability, delay, current load of path are used by routing algorithm to determine the optimal path to destination.

2.3   Related Studies

This will be discuss about the previous research has done by others. This can be as a guideline to be referring and also be applied for this project.

2.3.1   Comparison of RIP, OSPF and EIGRP routing protocol based on OPNET

In this research paper is about the comparison of the routing protocol by using the OPNET software as a simulation. Know that routing protocol is a language of router that speaks to other router in order to share the information about the reachability information. The aim of this research is to understand the characteristic of the protocol network that can be used to make a better performance for the local area network. By theoretically, the configuration of the routing protocol will be done on the router of each mode. The design of the topology of the LAN network followed by the configuration of protocol. As the result of this paper research show that which protocol will be the best protocol based on convergence duration and traffic sent.
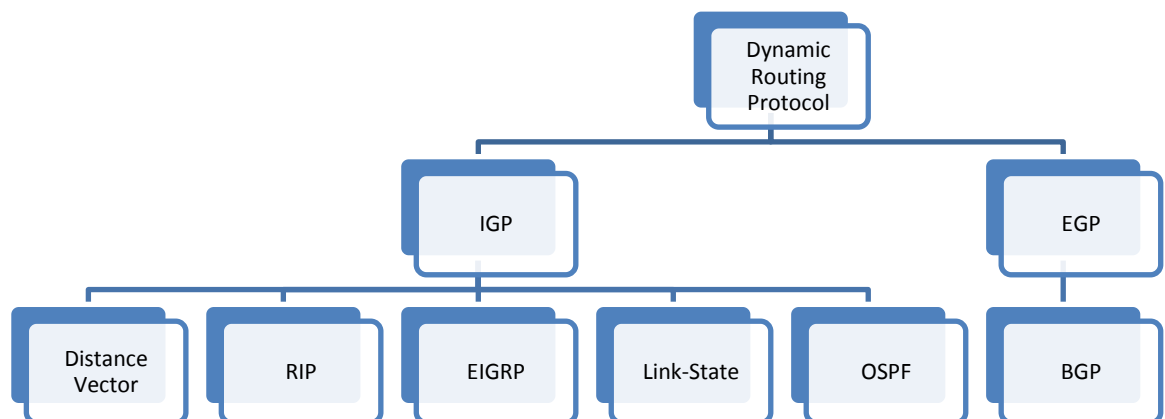

Figure 2.3.1.1: Hierarchy of routing protocol

2.3.2   Type of protocol

Routing protocol is how to router will communicate with each other, disseminating information that enable to select routers between nodes. By determine the suitable protocol; the slow connection can be improved by installing the routing protocol.

As it can see, there a lot type of routing protocol used for configuration network. The primary type of routing protocol is link sate and distance vector protocol. The link state protocol track the status and the connection of each link and produce calculated metric. Know whether a link is up or down and how fast it is and calculates a cost, the link state require more processing power and memory. Link state will advertise the link, and the SPF algorithm will generates the routes based on information. The link state protocol advertise routing updates only if occur which used bandwidth more effectively. While for the distance vector protocol, use to determine for the best path to remote the network. The distance usually a number of routers to destination. It will sent complete routing table to each neighbour. The distance vector protocol are simpler to configure and just need a little management, but then the susceptible for routing loops and coverage are slower than link state

Link state		Distance vector
Send to link state information only	**Destination**	Sends to entire routing table
Fast convergence	**Converge**	Slow convergence
Less susceptible to routing loops	**Susceptible**	Susceptible to routing loops
Always uses multicast for routing updates	**updates**	Update sent using broadcast
Know the entire network topology	**Topology existence**	Doesn't know the network topology
Hard to configure	**Configuration**	Simple to configure
OSPF and IS-IS	**example**	RIP and IGRP

Table 2.3.2.1: comparison link state and distance vector

2.3.2.1　　　　open shortest path first (OSPF)

Open shortest path first is used to discover that RIP isn't going to work for their larger network or if need a very fast convergence, it's a most widely used IGP, mean one routing domain or autonomous system. If in multiple building and department, all the connected together and sharing two redundant internet links. All of building on-site is part of same autonomous system, but with the OSPF, they have concept of area which allow further segmentation. In a nutshell, OSPF is a fast-converging, link-state IGP used by millions. OSPF forms adjacencies with neighbours and shares information via the DR and BDR using Link State Advertisements. Lastly, Areas in OSPF are used to limit LSAs and summarize routes. Everyone connects to area zero, the backbone of the connection. OSPF are able to detect with fast detection of changes in topology and very fast re-establishment of routes without loops. Its low overload that use updates that inform about changes on routers and the division of traffic by several equivalent routes.
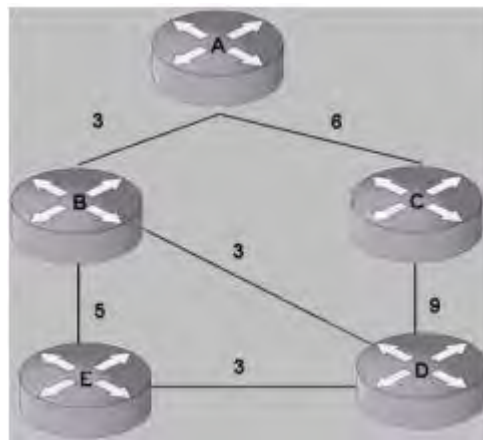
Figure 2.3.2.1.1: simple structure of OSPF

2.3.2.2   Routing information protocol (RIP)

Its relatively old but commonly used interior gateway protocol created for use in small network. Used a broadcast user datagram protocol to exchange routing information. The router that running router information can receive a default network via update from another router that running the router information. RIP also implement a limit number of router allowed in path from source to destination to prevent routing loops.

2.3.2.3   Enhance interior gateway routing protocol (EIGRP)

EIGRP or enhance interior gateway routing protocol same as IGRP but with the enhance version. The convergence and the operating efficiency have been improve significantly, also the architecture of the retaining existing have been improve from the IGRP. The diffusing update algorithm (DUAL) it's a algorithm that use to obtain the loop-freedom on every instant throughout a route computation and this will allow all router involved in topology change to synchronize at same time. For the EIGRP, hey have four basic components which is protocol dependent modules, DUAL finite state machine, neighbour discovery or recovery and reliable transport protocol. For the neighbour discovery or recovery ti will process the router that use to dynamically learn of other router in the directly attached network. The neighbours become unreachable or inoperative if the router are not discover. As long the packets are received, a router can determine that a neighbour is exist and functioning, so the neighbouring router can exchange the routing information. The reliable transport will make sure all the packets are success sent to other. It will support intermixed transmission of the multicast or unicast packet. Know that the bandwidth of utilization issue has been addressed by the implementing partial and frequent update, so only a topology change occurs the routing information get sent and regarding to processor utilization, the feasible successor technology greatly reduces the total processor utilization by requiring only at the router were effected by topology change to perform route re-computation.

2.4   Local Area Network

A local area network (LAN) is a number of computers connected to each other by a cable in a single location such as a single healthcare organisation or group of organisations forming one institution. This allows for data transfer and communication within an organisation or institution. Usually, local area network used in small area cover such as in classroom or office. Local area network only needs a single broadcast medium, relatively the small number of stations. Local area network also covers in short distance which is in 1kilo meter between computer and its make error free with the high speed communication possible. Basically, local area network connect computer by using the 5 layers of internet model. 3 upper layer such as network, transport and application, and the 2 sub layer such as medium access control and logical link control. Medium access control (MAC) will coordinate access to shared medium that provide connectionless transfer of datagrams but for the logical link control, need to provide the extra flow and error control to upper layer.
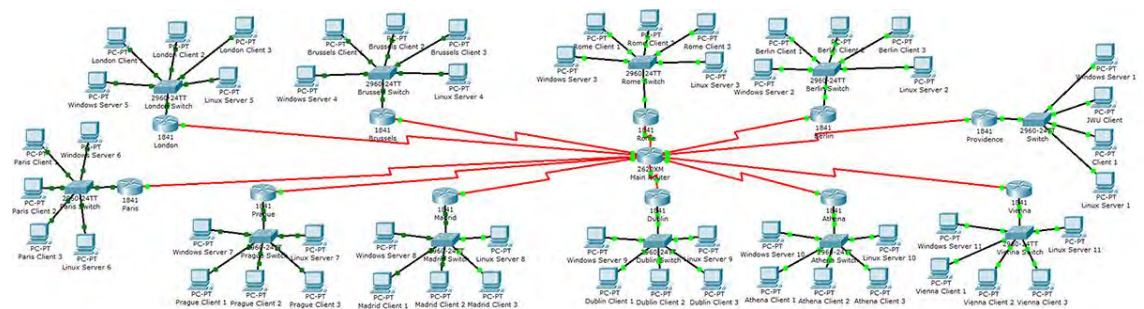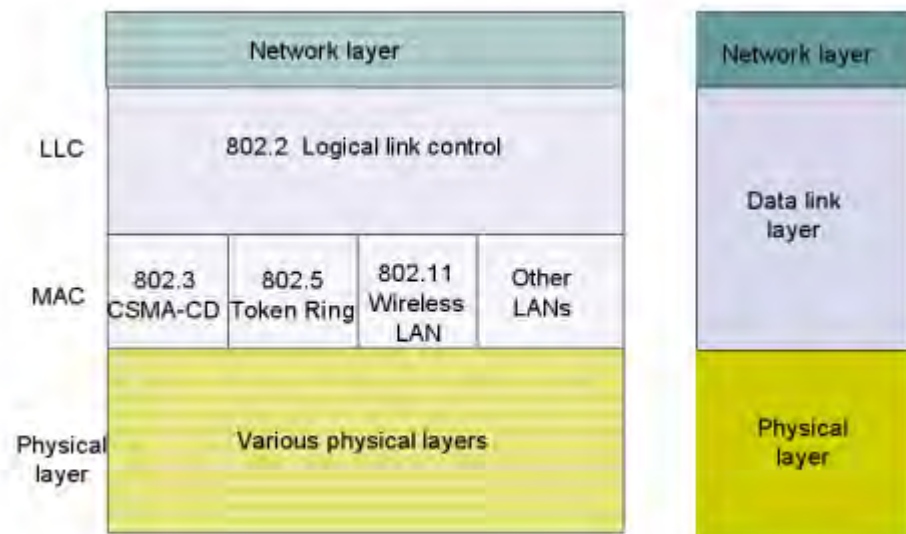

Figure 2.4.1: example of local area network connection.

Figure 2.4.2: the structure of network layer.

2.5   LAN Topology

Local area network contain several type topology connection, it a geometric representation of nodes. Network topology represent in two ways, one is physical topology that defines the way in which a network is physically laid out and other one is logical topology that defines how data actually flow through the network. Cisco Packet Tracer (CPT) (Jain 2015) is multi-tasking network simulation software to perform and analyse various network activities such as implementation of different topologies, select optimum path based on various routing algorithms, create DNS and DHCP server, sub netting, analyse various network configuration and troubleshooting commands. In order to start communication between end user devices and to design a network need to select appropriate networking devices like routers, switches, hubs and make physical Connection by connection cables to serial and fast Ethernet ports from the component list of packet tracer. Networking devices are costly so it is better to perform first on packet tracer to understand the concept and behaviour of networking.

2.5.1 Star topology

A star network eliminates the need for each network node to make routing decisions by localizing all messages routing in one central node. This leads to a particularly simple structure for each of the other network nodes. This topology is an obvious choice if the normal pattern of communication in the network conforms to its physical topology, with a number of secondary nodes communicating with one primary node. For example, the star is an obvious topology to support a number of terminals communicating with a time-sharing system, in which case the central node might be the time-sharing machine itself.

However, the normal pattern of communication is not between one primary node and several secondary nodes, but is instead more general communication among all of the nodes, then reliability appears as a possible disadvantage of the star net. Clearly, the operation of the network depends on the correct operation of the central node, which performs all of the routing functions, and must have capacity sufficient to cope with all simultaneous conversations. For these reasons, the central node may be a fairly large computer. The cost and difficulty of making the central node sufficiently reliable may more than offset any benefit derived from the simplicity of the other nodes.

Star topology able to reduce the chance of network failure by connecting all of the system to central node. When applied to a bus-based network, this central hub rebroadcast all transmission received from any peripheral node to all peripheral node on network, sometimes including the originating node. The entire peripheral node may thus communicate with all other by transmitting to and receiving from. The central node only. The failure of transmission line linking any peripheral node to the system will be unaffected. Moreover, there some advantage of the star topology, which is it able to give a good performance, scalable and easy to set up and to expand. They only contain a very little effect on network, also be easy to detect the faulty.