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AN ANALYSIS OF NETWORK PERFORMANCE AT KEMENTERIAN PERUMAHAN DAN KERAJAAN TEMPATAN USING OPNET MODELER

ANAS IMRAN BIN GHAZALI

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

FACULTY OF INFORMATION AND COMMUNICATION TCHNOLOGY
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DECLARATION

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ABSTRACT

The world of information technologies experienced an explosive period of growth toward the end of the 20th century with the widespread availability of the Internet and the development of the World Wide Web. On top of that, we can see that the network sake is very important nowadays because without that people could not communicate each other in free medium. So this thesis intends to analyze the network performance at Kementerian Perumahan dan Kerajaan Tempatan (KPKT). It will explain about the network performance, network traffic, bandwidth utilization and packet management analysis that will be done using simulation software. In this project, it will show what the major problems that happening at KPKT and how to overcome the problems as to improve the network performance. Different simulation software also had been differentiated, as to choose the best simulation software for map and produce the analysis result. A detail network design also had been generated based on the network of KPKT. All the analysis result will be the useful for KPKT as for their future implementation.

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ABSTRAK

Dunia teknologi maklumat kini telah berkembang dengan pesatnya pada abad ke-20 dengan perkembangan keupayaan Internet dan pembangunan dunia web meluas. Sehubungan dengan itu, kita dapati bidang rangkaian adalah amat penting pada masa kini kerana tanpa rangkaian Internet manusia tidak dapat berhubung antara satu sama lain dengan bebas walaupun berada dikawasan atau benua yang berbeza. Projek ini dicadangkan adalah untuk menganalisa keupayaan rangkaian di Kementerian Perumahan dan Kerajaan Tempatan (KPKT). Projek ini juga menerangkan bagaimana keupayaan rangkaian, trafik rangkaian, penggunaan jalur lebar dan analisa penggunaan paket dimana ia dilakukan dengan menggunakan perisian penyerupaan. Di dalam projek ini juga, ia menerangkan apakah masalh utama yang berlaku di KPKT dan cara untuk mengatasi masalah rangkaian itu. Perbezaan perisian penyerupaan akan dibezakan kerana untuk memilih perisian yang terbaik untuk menghasilkan keputusan analisis. Maklumat penuh mengenai pelan rangkaian juga akan dihasilkan. Segala keputusan analisa akan dicadangkan kepada KPKT adalah untuk meningkatkan keupayaan rangkaian. Segala keputusan analisa akan memberikan faedah kepada KPKT untuk dilaksanakan pada masa akan datang.

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LIST OF ABBREVIATIONS

ABBREVIATIONS	FULL TERMS
LAN	Local Area Network
MAN	Metropolitan Area Network
WAN	Wide Area Network
KPKT	Kementerian Perumahan dan Kerajaan Tempatan
R&D	Research and Development
MAC	Medium Access Control
GUI	Guided User Interface
IP	Internet Protocol
IPv6	Internet Protocol version 6
MPLS	Multi Protocol Label Switching
TCP	Transmission Control Protocol
VINT	Virtual InterNetwork Testbed
ATM	Asynchronous Transfer Mode
VoIP	Voice over Internet Protocol
OSPF	Open Shortest Path First
PC	Personal Computer
QoS	Quality of Service
DBMS	Database Management System
CPU	Central Processing Unit

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OSI	Open Systems Interconnection
RAM	Random Access Memory
VLAN	Virtual Local Area Network
BTM	Bahagian Teknologi Maklumat
FTP	File Transfer Protocol
KPP	Ketua Penolong Pengarah
PP	Penolong Pengarah
DB	Database
HTTP	Hypertext Transfer Protocol
HTML	hypertext markup language
FTMK	Fakulti Teknologi Maklumat dan Komunikasi
WEB L	Web Low
WEB M	Web Medium
WEB H	Web High
Email H	Email High
Database M	Database Medium
Database H	Database High
Print C	Print Color
Print T	Print Text
PSM	Projek Sarjana Muda

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CHAPTER I

INTRODUCTION

1.1 PROJECT BACKGROUND

Computer network comes in different scale such as LAN, MAN, and WAN. They also come in various protocols, topologies and architectures. There is no computer network that is perfect. Network analysis is the process of capturing network traffic and inspecting it closely to determine what is happening on the network. A network analyzer decodes, or dissects the data packets of common protocols and displays the network traffic in human-readable format. A network analyzer can be a standalone hardware device with specialized software, or it can simply be software that you install on your desktop or laptop computer. Network analyzers are available both free and commercially. Differences between network analyzers tend to depend on features such as the number of supported protocol decodes the user interface, and graphing and statistical capabilities.

Computer simulation on the other hand is the discipline of designing a model of an actual or theoretical physical system, executing the model on a digital computer, and analyzing the execution output. By analyzing or simulating a computer network, we can identify its weakness, or identify the opportunity for improvement. Slow internet connection, unable to access email, unable to share drive and computer not functioning properly are the most common problem. If we want to know what devices burden the network excessively, who uses the bandwidth and how, what devices are located within

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your network and how it affects the network, then analyzing or simulation is the best way to get the answer.

This thesis is mainly about analyzing a network, identify its problem or its weakness and come up with a solution to improve it. The network choosen is from Kementerian Perumahan dan Kerajaan Tempatan (KPKT), a government ministry located in Pusat Bandar Damansara, Kuala Lumpur. Opnet Modeler Simulation will be the software used for this project. This project will take in account the information collected from the officer incharge of the network and the user of the network in the ministry. The exact network design will be mapped in the simulator, and as the result, the simulator will generate information that will be vital in designing a new network. Designing a totaly new network may not be nessasary, as maybe only a little adjustment in the current design is required. When analyzing the network, it will focus majorly on the network performance, network behavior and network bandwith. The result of this thesis can and will be used as a proposal to improve the current network

1.2 PROBLEM STATEMENT

At KPKT, they are having few problems related to their computer network. They do not have a complete logical or physical design of their computer network.Without the design, it is difficult to manage, and plan for future expansion or improvement.

Next problem is slow internet access. This problem is considered normal by the staff of the ministry because they never really felt the internet response time is low except in the morning of after office hours. This problem is proberly caused by the bandwidth, or many pc crampt into one cable to access the internet. This causes packet drop. This causes problem as the mimistry staff does use the internet for working purposes, and slow internet will always slow down their progress.

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Database accesss is also a problem in this ministry. It is very slow, for example the database query response time is high . Database is really important in this ministry because registration, enforcement, and other activity happens everyday. It is belived the heavy usage of database contributes the most to the network congestion.

Besides internet, the staff also complaints about the email service or sharing large file through the local network are slow and sometimes fails. The cause of this problem is maybe similar to the one above.

1.3 OBJECTIVE

There are three main objective in this project. These objective determains weather this project is successful or not. These objective are all directly related in the process of inproving the computer network at KPKT. The objectives are:

1.3.1 Generate Logical and Physical Network Diagram Based on the Original Network

This process is to identify every device or hardware connected to the network and maps it on to a logical device. In the same time, identify where every item is located and map in on to a physical design.

1.3.2 Analyze the existing network

This process is done by mapping the existing design into the OPNET simulator. The analysis will focus on the database response performance and the point to point link utilization. Information on the behavior of the network will be

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find out or asked from staff and the officer in charge .This information is important to get the most accurate result from this analyzing process.

1.3.3 Improving the network performance

After identifying the weakness or problems on the computer network of KPKT, the process of designing a new network or altering the existing network for improvement begins. The new design must also run pass the simulation program to compare performance with the existing network

1.4 SCOPE

This network analysis will be done at KPKT. This project will include activity such as identifying hardware used to produce the logical and physical network design of KPKT. Although there are few problems in KPKT's computer network, this project will focus on the database service, such as its query response time. We will also be looking at the bandwidth utilization in this network.

This project needs plenty of information to be accurate. Observation will be done on the behavior of user of the computer network. Relevant data is required to assure the result of the simulation is accurate. All this data and the network design itself will be mapped in the simulator. The results will be analyze and an improved network design will be created.

This new design or this prototype will go through the same process as the original network, it will be tested in the simulator. If the design is successful in improving the KPKT's current network, it will be suggested or be used as a proposal to improve the ministry computer network.

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1.5 PROJECT SIGNIFICANT

Network analysis will definitely help the administrator of the network in case of any problems. It is easier to locate or identify problem with the aid to the analysis result. For example the admin can identify which device is more utilize than the other, this will help because a device more frequently used have higher probability to fail or damage.

This network analysis was very important in that it help to understand the complexity and differences of each network and systems they support in the ministry. Analysis also provides data upon which various decisions are made, and these data can be documented as part of an audit trail for architecture and design process.

This analysis will help determined the exact amount of performance required to maintain a trouble free network. So, incase the hardware requirement is not enough, the admin can choose to upgrade it, but not spending on unnecessary requirement or technology.

By having an improved and successful design tested by the simulator, it will help the ministry if the ministry decides to upgrade the network. They can defiantly plan their budget accurately with the help of this analysis.

1.6 EXPECTED OUTPUT

The first outputs of this project will be the logical and physical design of the ministry's current network. The network diagram is very important in this project.

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Next, after the simulation process, we will see graphs, data's, diagrams, charts and tables on the performance of the computer network of KPKT. All this information will be analyze and a new network will be design. The new design will also produce an output like the current network. Both this result will be compared and used to prove the differences in the two designs

1.7 CONCLUSION

As stated above, this project aims to analyze the computer network of KPKT. The logical and physical design will be prepared and mapped into simulation software, Opnet Modeler Simulation and it will be generate graph, diagram and tables.

Result of this analysis will be used to design a new and improved network. It can and will be used to demonstrate or used as an explanation in order to convince the higher management for a computer network upgrade.

This project will defiantly show the difference between simulated network and real network. It can be a useful guideline for students or other researches studying in networking R&D.

Next chapter will be focusing on the methodology of this project and also literature review on this issue.

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CHAPTER II

LITERATURE REVIEW & PROJECT METHODOLOGY

2.1 INTRODUCTION

Computer networking is the discipline concerned with communication between computer systems. Such communicating computer systems consist a computer network and these networks generally involve at least two devices capable of being networked with at least one usually being a computer. The devices can be separated by a few meters such as Bluetooth or nearly unlimited distances such at the internet. Computer networking is sometimes considered a sub-discipline of telecommunications and information technology.

A computer network is any set of computers or devices connected to each other. Examples of networks are the Internet, a wide area network that is the largest to ever exist, or a small home local area network (LAN) with two computers connected with standard networking cables connecting to a network interface card in each computer.

For this project the analysis that intend to be discuss here is were analyze a network performance of network, in terms of the traffic, the network bandwidth, the network utilization and all the devices in the network, functioning as a unit and not as autonomous units.

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A method to understand networks analysis and their participants is to evaluate the location of all the devices and connectors in the network. Measuring the network location is finding the centrality of a node. These measures help determine the importance, or prominence, of a node in the network.

This chapter will explain the methodology that will be used for this project. It will be focusing on the methodology for the project, the requirement of this project and also will be discussing some topic related to this project.

2.2 FACT AND FINDING

2.2.1 Defining Network Simulation

In computer network research, network simulation is a technique where a program simulates the behavior of a network. The program performs this simulation either by calculating the interaction between the different network entities such as host, routers, data links and packets using mathematical formulas, or actually capturing and playing back network parameters from a production network. Using this input, the behavior of the network and the various applications and services it supports can be observed in a test lab. Various attributes of the environment can also be modified in a controlled manner to asses these behaviors under different conditions. When a simulation program is used in conjunction with live applications and services in order to observe end-to-end performance to the user desktop, this technique is also referred to as network emulation.

R. Currier in his article Test-drive your network designs explains that network simulators have grown in maturity since they first appeared as performance, management and prediction tools. Simulators are normally used as network management tools, for which packet level analysis is not commonly employed. However, more studies are

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needed to establish guidelines for researchers so that they may select and customize a simulator to suite fine-grained packet level analysis.

Network simulators are used to predict the behavior of networks and applications under different situations. Researchers use network simulators to see how their protocols would behave if deployed. It is typical to use a network simulator to test routing protocols, MAC (Medium Access Control) protocols, transport protocols, and applications. Companies use simulators to design their networks and applications to get a feel for how they will perform under current or projected real-world conditions.

This section below will discuss a few well known computer network simulator.

2.2.1.1 OMNet++

OMNeT++ is a public-source, component-based, modular and open-architecture simulation environment with strong GUI support .Its primary application area is the simulation of communication networks and because of its flexible architecture, it has been successfully used in other areas like the simulation of IT systems, queuing networks, and hardware architectures. OMNeT++ is rapidly becoming a popular simulation platform in the scientific community as well as in industrial settings. Several open source simulation models have been published, in the field of internet simulations such as IP, IPv6, and MPLS, mobility and ad-hoc simulations and other areas.

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