

TESIS^ APPROVAL STATUS FORM

JUDUL: ANALYZING OF FTMK NETWORK PERFORMANCE

SESI PENGAJIAN: 04/05

Saya : TAN BEE HOOI
(HURUF BESAR)

mengaku membenarkan tesis (PSM/Sarjana/Doktor Falsafah) ini disimpan di Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Kolej Universiti Teknikal Kebangsaan Malaysia.
2. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan Fakulti Teknologi Maklumat dan Komunikasi dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. ** Sila tandakan (/)

 SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

 TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Tan Bee Hooi
(TANDATANGAN PENULIS)

Ghazan Bin Mohd
(TANDATANGAN PENYELIA)

Alamat tetap : 711 MK8,
Gertak Sanggul, 11910
Bayan Lepas, Penang.

GHAMAN BIN MOHD
Nama Penyelia

Tarikh : 22.11.05

Tarikh : 22.11.2005

CATATAN: ** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa.
^ Tesis dimaksudkan sebagai Laporan Projek Sarjana Muda (PSM)

raf

TK5105.5 .T36 2005



0000037978

Analyzing of FTMK network performance / Tan Bee Hooi.

ANALYZING OF FTMK NETWORK PERFORMANCE

TAN BEE HOOI

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

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA
2005

DEDICATION

To my beloved parents, siblings and fellow friends...

ACKNOWLEDGEMENTS

I would like to take this opportunity to personally express my deepest appreciation and gratitude. The completion of this project would be impossible without the help of these people. It gives me a great pleasure in completing this project.

First and foremost, I would like to thank my Project Supervisor, Encik Othman Bin Mohd for her concerns, time, advice, guidance and supervision throughout the progress of the project. Her invaluable information and suggestion is much appreciated.

Second, I would like to thank my Project Panel, PM Dr Sharin Sahib & Sahibudin for her time and guidance throughout the progress and completion of this project.

Last but not least, thanks to my family for their love, support and trust.

ABSTRACT

Project Sarjana Muda (BITU 3973) is carried out to do case study on network performance in FTMK faculty of KUTKM. The purposes of this project are to identify the problem of current network connection in KUTKM and to propose a solution to improve the network performance in KUTKM.

The project will help to overcome the slow network problem which is faced by FTMK faculty in KUTKM. Besides that, this project also helps to monitor the current network design and control the usage of network. The importance of this case study is to allow further understanding on the connection of the network and the method to implement network analysis and design.

In conclusion, this project will help to enhance and overcome the existing network problem in FTMK faculty of KUTKM.

ABSTRAK

Projek Sarjana Muda (BITU) yang dijalankan adalah untuk membuat kajian kes berhubung dengan keupayaan sistem rangkaian bagi FTMK di dalam rangkaian KUTKM. Tujuan kajian ini adalah untuk mengenal pasti masalah berkaitan persambungan dengan pemasangan rangkaian, "routing" dan "bottleneck" yang dihadapi sekarang. Seterusnya, mencadangkan penyelesaian dalam memperbaiki masalah berhubung dengan rangkaian di FTMK khususnya di KUTKM.

Projek ini akan membantu untuk mengatasi masalah perlahan semasa melayari internet di fakulti FTMK. Selain itu, projek ini juga membantu dalam mengawasi dan memantau muatan trafik pada rangkaian KUTKM. Kepentingan kes membaca ini membolehkan kefahaman lanjutan ke atas persambungan dan pemasangan sistem rangkaian di KUTKM dan cara melaksanakan penganalisisan dan reka bentuk rangkaian.

Kesimpulannya, projek ini diharap akan dapat membantu dalam meningkatkan lagi pengetahuan saya di dalam bidang yang saya ikuti. Di samping itu adalah diharapkan cadangan kajian oleh pihak tertentu dalam membaiki masalah yang dihadapi pada masa ini.

TABLE OF CONTENT

TOPIC	PAGE
TESIS ^ APPROVAL STATUS FORM	
TITLE PAGE	i
ADMISSION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT	v
ABSTRAK	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
LIST OF ABBREVIATIONS	xv
LIST OF APPENDICES	xvi
CHAPTER I INTRODUCTION	
1.1 Project Background	1
1.2 Problem Statement (s)	2
1.3 Objectives	3
1.4 Scopes	3
1.5 Project Significance	4
1.6 Conclusion	4
CHAPTER II LITERATURE REVIEW AND PROJECT METHODOLOGY	
2.1 Introduction	5
2.2 Fact and Finding	6
2.2.1 Concept and Theory	6
2.2.2 Network Fundamentals	6
2.2.3 Open Systems Interconnection (OSI) Reference	7

Model	
2.2.4 Network Components	8
2.2.5 Network Connections	9
2.2.6 Network Communications	10
2.2.7 Switching And Virtual LANs (VLANs)	12
2.2.8 OPNET	14
2.2.9 IP Network Browser	14
2.2.10 Ultra Packet Sniffer	14
2.3 Project Methodology	15
2.4 Project Requirements	19
2.4.1 Software Requirement	19
2.4.2 Hardware Requirement	20
2.5 Project Schedule And Milestones	20
2.6 Conclusion	23

CHAPTER III ANALYSIS

3.1 Introduction	24
3.2 Analysis of Current System	25
3.2.1 Business Research	25
3.2.2 Problem Analysis	26
3.2.3 Problem Statement	27
3.3 Analysis of To Be System	31
3.3.1 Requirement Analysis	31
3.3.2 Technical Requirement	34
3.3.2.1 Software Requirement	34
3.3.2.2 Hardware Requirement	37
3.3.2.3 Implementation/Deployment Requirement	37
3.4 Conclusion	38

CHAPTER IV DESIGN

4.1 Introduction	39
4.2 Requirement Information	40
4.2.1 User Requirements	40

4.2.2	Financial Requirements	42
4.3	Network Architecture	43
4.3.1	The Hardware Is Use In KUTKM Network	48
4.3.2	Virtual Local Area Network (VLAN)	49
4.3.2.1	Introduction VLANs	49
4.3.2.2	Benefits Of Using VLANs	50
4.3.2.3	Limitations Of VLANs	53
4.3.2.4	VLAN Standard: IEEE 802.1Q Draft Standard	55
4.3.2.5	Conclusion	55
4.3.3	Backbone Wiring	55
4.3.3.1	Horizontal Wiring	56
4.3.3.2	Cable Is Used In Backbone Cabling In KUTKM	56
4.3.3.3	Ethernet Cable Application Used In KUTKM	60
4.3.4	Communication Rack In Certain Department	61
4.3.5	Network Bottleneck Problems	61
4.3.6	Server Farm In KUTKM	63
4.3.6.1	Introduction	63
4.3.6.2	Benefits Of Server Farm	64
4.3.7	Core switch And Switches Using In Network KUTKM	65
4.3.8	AIRONET 350 Using In Network KUTKM	68
4.3.9	Firewall Using In Network KUTKM	69
4.4	FTMK Network Diagram	71
4.5	Network Security	72
4.6	Conclusion	74
CHAPTER V IMPLEMENTATION		75
5.1	Introduction	75
5.2	Software Installation	76
5.2.1	Install Solarwinds	76

5.2.2	Install Ultra Network Sniffer	79
5.3	IP Network Browser	85
5.4	Network Performance Monitor	88
5.5	Bandwidth Monitor	89
5.6	Ultra Network Sniffer	90
5.7	Conclusion	91

CHAPTER VI TESTING

6.1	Introduction	92
6.2	Test Plan	93
6.2.1	Test Organization	93
6.2.2	Test Environment	94
6.2.3	Test Schedule	95
6.3	Test Strategy	95
6.3.1	Classes of Tests	96
6.4	Test Design	97
6.4.1	Test Description	97
6.4.2	Test Data	97
6.5	IP Network Browser	98
6.5.1	Scan an IP Address Range	99
6.5.2	Scan a subnet	100
6.6	Network Performance Monitor	101
6.6.1	Current Traffic	101
6.6.2	TraceRoute – MACLAP SERVER	102
6.6.3	Node Detail	103
6.6.4	Interface Detail	104
6.6.4.1	Interface Detail Of Bandwidth Setting	104
6.6.4.2	Detail Of Interface	105
6.7	Bandwidth Monitor	107
6.7.1	Calculating Bandwidth	109
6.8	Ultra Network Sniffer	110
6.8.1	Capturing Network Packet	110
6.9	MAC Address Discovery	121

6.10	Solution To Network Collision	122
6.11	Applying New Network Diagram	124
6.12	Network Diagram	125
6.13	Simulation using OPNET	125
6.14	Conclusion	129

CHAPTER VII PROJECT CONCLUSION

7.1	Observation on Weaknesses and Strengths	130
7.2	Propositions for Improvement	131
7.3	Conclusion	131

BIBLIOGRAFI	133
APPENDIX A	136
APPENDIX B	137
APPENDIX C	138
APPENDIX D	141
APPENDIX E	166
APPENDIX F	172
APPENDIX G	184

LIST OF FIGURES

NO	FIGURES TITLE	PAGES
Figure 2.1	Logically defined networks (VLANs)	13
Figure 2.2	Logical communication between users	13
Figure 2.3	Implementation Cycle for the Waterfall Methodology	16
Figure 2.4	Gantt Chart	Appendix A
Figure 3.1	Statistic Using Network During Lecture	27
Figure 3.2	Statistic Using Network During Lecture (Cont)	27
Figure 3.3	The process Model for Requirements Analysis	32
Figure 4.1	HDLC Frame Structure showing flags, header (address and control), data and trailer (CRC-16)	46
Figure 4.2	Overall Network Diagram for KUTKM	48
Figure 4.3	Logically Grouped VLANs	50
Figure 4.4	Basic Switch Bottleneck	63
Figure 4.5	FTMK Network Diagram Before August 2005	71
Figure 4.6	FTMK Network Diagram After August 2005	72
Figure 4.6	A DMZ	74
Figure 5.1	Detail MACLAP_SERVER	86
Figure 5.2	Detail of FTP_STUDENT	86
Figure 5.3	Sunftmk	87
Figure 6.1	IP Address Range	98

Figure 6.2	The result after Scan Address Range	99
Figure 6.3	Subnet for Subnet Address 10.1.60.253 and Subnet Mask 255.255.255.0.	100
Figure 6.4	Current Traffic Loads of sunftmk, FTP_STUDENT and MACLAP_SERVER	101
Figure 6.5	Max Traffic Loads of sunftmk, FTP_STUDENT and MACLAP_SERVER	102
Figure 6.6	Trace 10.1.60.143	103
Figure 6.7	Interface Detail Of Bandwidth Setting	104
Figure 6.8	Detail Of Interface	104
Figure 6.9	Capturing Network Packet	110
Figure 6.10	Network Packets per seconds and Byte per seconds	111
Figure 6.11	Protocol Statistic	116
Figure 6.12	MAC Traffic Statistics	117
Figure 6.13	MAC Statistics	118
Figure 6.14	IP Traffic Statistics	119
Figure 6.15	IP Statistics	120
Figure 6.16	Size Distribution	121
Figure 6.17	MAC Address	122
Figure 6.18	Network Diagram	125
Figure 6.19	Current Network Design Of Vlans 60	126
Figure 6.20	New Network Designed of VLANs 60	129

LIST OF ABBREVIATIONS

KUTKM	-	Kolej Universiti Teknikal Kebangsaan Malaysia
FTMK	-	Faculty Teknologi Maklumat Dan Komunikasi
VLAN	-	Virtual Local Area Network
LAN	-	Local Area Network
OSI	-	Open Systems Interconnection
MIB	-	Management Information Base
STP	-	Spanning Tree Protocol
SNMP	-	Simple Network Management Protocol
ICT	-	Information And Communication Technology
DNS	-	Domain Name System
DHCP	-	Dynamic Host Configuration Protocol
PC	-	Personal Computer
DMZ	-	Demilitarized Zone
HDLC	-	High-level data link control
ISL	-	Inter-Switch Link Protocol
PSM	-	Projek Sarjana Muda
CPU	-	Central Processing Unit
TCP/IP	-	Transmission Control Protocol/Internet Protocol
UTP	-	Unshielded Twisted Pair
IEEE	-	Institute of Electrical and Electronic Engineers
SPP	-	Serial Port Profile
POF	-	Plastic Optical Fiber
NIC	-	Network Interface Card

LIST OF ABBREVIATIONS

KUTKM	-	Kolej Universiti Teknikal Kebangsaan Malaysia
FTMK	-	Faculty Teknologi Maklumat Dan Komunikasi
VLAN	-	Virtual Local Area Network
LAN	-	Local Area Network
OSI	-	Open Systems Interconnection
MIB	-	Management Information Base
STP	-	Spanning Tree Protocol
SNMP	-	Simple Network Management Protocol
ICT	-	Information And Communication Technology
DNS	-	Domain Name System
DHCP	-	Dynamic Host Configuration Protocol
PC	-	Personal Computer
DMZ	-	Demilitarized Zone
HDLC	-	High-level data link control
ISL	-	Inter-Switch Link Protocol
PSM	-	Projek Sarjana Muda
CPU	-	Central Processing Unit
TCP/IP	-	Transmission Control Protocol/Internet Protocol
UTP	-	Unshielded Twisted Pair
IEEE	-	Institute of Electrical and Electronic Engineers
SPP	-	Serial Port Profile
POF	-	Plastic Optical Fiber
NIC	-	Network Interface Card

LIST OF APPENDICES

APPENDIX	TOPIC	PAGE
A	GANTT CHART (PSMI)	136
B	GANTT CHART (PSMII)	137
C	IP NETWORK BROWSER	138
D	NETWORK PERFORMANCE MONITOR	141
E	BANDWIDTH MONITOR	166
F	SIMULATION USING OPNET	172
G	CISCO TOOLS	184

CHAPTER I

INTRODUCTION

1.1 Project Background

Kolej Universiti Teknikal Kebangsaan Malaysia (KUTKM) was established on December 1, 2000. It was established under Section 20 of the University and University College Act 1971 (Act 30) under the Orders of Kolej Universiti Teknikal Kebangsaan Malaysia (Incorporated) 2001. KUTKM is a PUBLIC UNIVERSITY (IPTA). It is a pioneer in the use of the "Practice and Application Oriented" teaching and learning method for technical education in Malaysia.

KUTKM has five faculties namely Electrical Engineering, Electronic and Computer Engineering, Mechanical Engineering, Manufacturing Engineering, and Information and Communication Technologies. The academic programs offered by the university are conducted in a way where equal emphases are given to theoretical and practical aspects of the discipline. The teaching and learning approaches at the university are practice and applications oriented and involve:

- Competency development
- Action-based learning
- Simulation of real situations and problems
- Solving industry related problems

This project is to study on network performance at faculty FTMK using Network Performance Monitor. Network Performance Monitor is a real-time network monitor that can track network latency, bandwidth usage, packet loss, traffic and other network statistics.

Currently, when students surf the internet at FTMK, they are facing network slow problem. Because of that, this project is to study on the performance of network at faculty FTMK and to identify the problem. This project is also to identify traffic bottlenecks at faculty FTMK. Since a server has to support multiple clients, it often has bottleneck problem, it will slow down the speed of the network in KUTKM.

1.2 Problem Statement (s)

The university are consists of 5 faculties and 12 departments. The concept of study offered by the university is conducted in a way where equal emphases are given to theoretical and practical. So, the connection to the network is very important to the members of the university.

Base on current network facilities that are already installed in KUTKM since 2001, there are a lot of problems that they are facing. The problems are:

- Network is slow when surfing to the internet at FTMK.
- Unable to connect to the network due to connection problem.

1.3 Objectives

Essentially, the new network is designed to achieve the following objectives:

- To identify current network problem faced by the faculty when they are using KUTKM network.
- To study and improve the performance of the existing design based on the current device that they are using.
- To analyze the network problem.
- To propose new network design for faculty of ICT and to improve reliability.
- To propose possible improvement.

1.4 Scopes

When users online at FTMK faculty, they will face the problem of slow network. For this project, the current design of the network in the faculty needs to be analyzed to find out the problems before proposing a solution to improve it. The type of cables, VLAN, type of backbone, topology, spanning tree protocol, problem of the broadcast and the type of device to be used will need to be considered.

The scopes of this project will cover items below:-

- i. To identify the problems faced when users online at FTMK.
- ii. To analyze the current logical and physical design of network in FTMK faculty.
- iii. To study the network performance in FTMK faculty.
- iv. To propose a new network design based on current design.

1.5 Project Significance

For this project, the current network design for KUTKM I will be analyzed to identify current network problem and propose a possible improvement to the network connection in KUTKM. After the improvement, users in KUTKM can enjoy a higher speed internet service. The users will seldom face server or network down problems.

1.6 Conclusion

The main purpose of this project is to identify the network problem of KUTKM, to understand the design based on the current network design and to propose the possible improvement for KUTKM connection network. Base on that, a new network design will be proposed to improve the problem they are facing. Hope that this project can help the network administrator of KUTKM in solving the problem that they are facing.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

In order to redesign the network design of Faculty of Information Communication And Technology, a research has been conducted in order to help to understand. The research was mainly conducted through the Internet and reference from network design and protocols books was also done.

To begin with, network analysis and design have traditionally been considered art, combining an individual's particular rules on evaluating and choosing network technologies, knowledge about the technologies, services and protocols can be meaningfully combined, experience in what works and what doesn't, along with selections of network architectures.

I begin my project by applying a system methodology to networking. This methodology is relatively new and in the final section, the network architecture is used as input for the network design process, where technology selection and connectivity are determined.

2.2 Fact and Finding

2.2.1 Concept and Theory

The network analysis and design consists of many concepts and theories. The network analysis and design covers everything like local area network, backbone network, functional design process, logical design process and physical design process.

These theories are important and must be comprehend before the development of the network analysis and design can begin.

2.2.2 Network Fundamentals

The types of networks are very important. The design and operational characteristics of each type are presented, followed by a description of the architecture and standards associated with most organizational networks. Since networks vary in size and scope, we can classify networks based on design complexity.

Remote access technologies enable a station to connect to a LAN over extended distances, using telecommunications circuits. In general internetwork fundamentals is an internetwork connects LANs in the same way a LAN connects PCs. An internetwork can be used to link two or more existing LANs.

2.2.3 Open Systems Interconnection (OSI) Reference Model

In general, communication on a LAN or an internetworking takes place at many levels. The objective of the OSI model is to provide a structured approach for the development of all types of networks. The Open Systems Interconnection model is a layered framework for the design of network systems that allows for communication across all types of computer systems. It consists of seven separate but related layers, each of which defines a segment of the process of moving information across a network. The seven layers are:-

- i. **Layer 7 – Application**
Provide services to the users of the OSI environment. It provides services for FTP, transaction server, network management, etc.
- ii. **Layer 6 – Presentation**
Performs generally useful transformations on data to provide a standardized application interface and to provide common communications services. It provides services such as encryption, text compression and reformatting.
- iii. **Layer 5 – Session**
Provide the control structure for communication between applications. It establishes, manages and terminates connections (sessions) between cooperating applications.
- iv. **Layer 4 – Transport**
Provide reliable, transparent transfer of data between end points. It provides end-to-end error recovery and flow control.