

## TESIS<sup>^</sup> APPROVAL STATUS FORM

JUDUL: \_\_\_\_\_

SESI PENGAJIAN: \_\_\_\_\_

Saya \_\_\_\_\_  
(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

\_\_\_\_\_  
(TANDATANGAN PENULIS)

\_\_\_\_\_  
(TANDATANGAN PENYELIA)

Alamat tetap : \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Nama Penyelia

Tarikh : \_\_\_\_\_

Tarikh : \_\_\_\_\_

CATATAN: \*\* Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa.

<sup>^</sup> Tesis dimaksudkan sebagai Laporan Projek Sarjana Muda (PSM)

**VIRTUAL LOCAL AREA NETWORK  
FOR CONTROL NETWORK TRAFFIC**

**CHEAH CHOON WAH**

This report is submitted in partial fulfillment of the requirements for the  
Bachelor of Information and Communication Technology (Computer Network)

**FACULTY OF TECHNOLOGY AND COMMUNICATION TECHNOLOGY  
KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA**

**2004**

## ADMISSION

I admitted that this project title name of  
**VIRTUAL LOCAL AREA NETWORK  
FOR CONTROL NETWORK TRAFFIC**

is written by me and is my own effort and that no part has been plagiarized without  
citations.

STUDENT : \_\_\_\_\_ Date : \_\_\_\_\_  
(CHEAH CHOON WAH)

SUPERVISOR : \_\_\_\_\_ Date : \_\_\_\_\_  
(MUHAMAD SYAHRUL AZHAR SANI)

## DEDICATION

To my beloved parents CHEAH KIM CHUAR and TIOW SWAN CHOO ,  
thanks for blessing their son and give him the best ever have....

## ACKNOWLEDGEMENTS

First, I would like to thank the KUTKM for giving us such a great opportunity to carry the Project Sarjana Muda PSM I (BITU 3973) and PSM II (BITU3983) in special semester, especially to MUHAMAD SYAHRUL AZHAR SANI, thank for giving good advise and guide to complete the report. His constructive guidance, tireless assistance, advice and patience in helping me to complete this PSM are appreciated. He volunteers his valuable time to help me put my best foot forward. He is willing to share the invaluable and specific guidance, knowledge and skills with me. His kindly and friendly during every personal meeting really impressed me.

Taking this opportunity, I would like to thank, all of the lecturers in KUTKM that gives their cooperation during my PSM by providing me with the required needs. Without their cooperation, I would not be able to go through the phase smoothly.

My deepest gratitude and appreciations to Mr Sim Moh Seng (CIM Development / Network Section Manager). Thank for giving me full trust of and willing to provide me information for the projects, and support and assistance throughout the period of my research in NS. Many opinions and advices from his ease and fasten my progress for my tasks and projects.

Furthermore, I would like to acknowledge my profound gratitude for National Semiconductor Sdn Bhd for accepting me as a reference for the project research and giving me the chance to learn while completing my PSM research.



## ABSTRACT

Virtual Local Area Network (VLAN) is a technology to logical grouping of network resource and user connected to a administrative network on a switch. The project is to create network design and build a simulation VLANs base on National Semiconductor Sdn. Bhd(NSEM). Current NSEM network design can define as flat network, it is one large broadcast domain. By creating VLANs on NSEM network, their will separate broadcast domain into smaller broadcast domain within a switch, by assigning different ports in the switch to different subnetworks. This will reduce unnecessary broadcast traffic on network. VLANs can potentially reduce the cost associated with moves, adds and changes, in addition to reducing the cost for unused ports on non-VLAN hub and switches. Therefore by grouping certain user or server can be accomplishing, without physical boundary, it enhance network security and also easy management for network administrator. The project help to research proof of concept VLAN technology can reduce broadcast traffic, virtual grouping resource or user, network security, network enhancement. Methodology use to development of project is Model-Driven Development (MDD), the strategy and approach to achieving some goal presented as a framework in which related processes made up of activities or steps are grouped. Each phase have own guideline rather than as a strict set of instructions. Create a simulation VLAN environment and testing under windos98/XP/2000 operating system. The project brings advantage and may recover new method or strategy to creating a VLAN.

## ABSTRAK

*Virtual Local Area Network (VLAN)* merupakan cara untuk mengumpul peralatan rangkaian and pengguna rangkaian dengan menggunakan *switch* yang boleh menguruskan rangkaian. Projek ini adalah merancang rangkaian dan juga membuat satu simulasi dengan merujuk kepada rangkaian semasa di National Semiconductor Sdn. Bhd(NSEM). Pada masa ini rangkaian di NSEM merupakan *flat network*, dan satu *broadcast domain* yang besar. Dengan adanya VLANs ia dapat memecahkan *broadcast domain* yang besar kepada kumpulan rangkaian yang lebih kecil. Ini dapat mengurangkan pembelanjaan untuk segala penyelenggaraan seperti memindah, menambah dan mengubah *unused ports on non-VLAN hub and switches*. Dengan itu pengumpulan kepada pengguna dan juga *server* dapat dilaksanakan tanpa halangan fizikal, dan itu juga dapat mengetatkan keselamatan rangkaian serta pengawalan kepada rangkaian itu sendiri. Projek dapat membantu ketepatan teknologi VLAN iaitu mengurangkan *broadcast traffic*, virtual mengumpul peralatan dan pengguna, keselamatan rangkaian dan menambah kelancaran rangkain. Projek menggunakan metodologi Model-Driven Development (MDD), strategi ini dapat menunjukkan pencapaian rangka, iaitu menggambarkan proses-proses dan aktiviti-aktiviti. Setiap langkah mempunyai penunjuk lebih baik daripada syarat-syarat yang dihalang. Simulasi VLANs adalah dalam keadaan pengoperasian windows98 /XP /2000. Projek VLAN dapat membawah kebaikan, iaitu menjumpai cara-cara atau strategi baru untuk membuat VLAN.

## TABLE OF CONTENTS

CONTENT	PAGE
TESIS^ APPROVAL STATUS FORM	
VITURAL LOCAL AREA NETWORK(VLAN)	i
ADMISSION	ii
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
ABSTRACT	v
ABSTRAK	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	xi
LIST OF FIGURES	xii
LIST OF ACRONYMS	xiii
LIST OF APPENDICES	xvi
CHAPTER I INTRODUCTION	
1.1 Preamble/Overview	1
1.2 Problem statements	2
1.3 Objective	4
1.4 Scopes	4
1.5 Contributions	5
1.6 Expected Output	5
CHAPTER II LITERATURE REVIEW	
2.1 Introduction	6



2.2	Fact and Finding	6
2.2.1	Theory Of VLANs Works	7
2.2.2	Discussion a case study 1	11
2.2.3	Discussion a case study 2	12
2.3	Summary	13

### CHAPTER III PROJECT PLANNING AND METHODOLOGY

3.1	Introduction	14
3.2	High-Level Project Requirements	15
3.2.1	Project Facilities Requirement	15
3.2.2	Software Requirement	15
3.2.3	Hardware Requirement	16
3.3	System Development Approach	16
3.3.1	Preliminary Planning Phase	18
3.3.2	Problem Analysis Phase	19
3.3.3	Requirements Analysis Phase	20
3.3.4	Decision Analysis Phase	21
3.3.5	Design Phase	22
3.3.6	Construction Phase	24
3.3.7	Implementation Phase	25
3.3.8	Operation And Support	26
3.4	Project Schedule and Milestones	27
3.4.1	Work Breakdown Structure	28
3.4.2	Gantt Chart	28
3.5	Summary	28

### CHAPTER IV ANALYSIS

4.1	Introduction	30
4.2	Analysis Of Current System	31
4.2.1	Business Process	31
4.2.2	Problem Analysis	32
4.2.3	Problem Statements	34

4.3	Analysis of to be System	35
4.3.1	Functional Requirement	35
4.3.2	Non-Functional Requirement	36
4.3.3	Technical Requirement	37
4.3.3.1	Software Requirement	37
4.3.3.2	Hardware Requirements	41
4.3.3.3	Implementation/Deployment Requirement.	42

## CHAPTER V DESIGN

5.1	Introduction	44
5.2	Preliminary/High Level Design	44
5.2.1	Raw Data/Pilot Review	45
5.3	System Architecture	45
5.4	Logical Design	46
5.5	Physical Design	55
5.4	Summary	60

## CHAPTER VI IMPLEMENTATION

6.1	Introduction	61
6.2	Hardware Configuration Management	61
6.2.1	Hardware Setup	62
6.2.1.1	Cisco Catalyst 2950G-12-EI Specification	62
6.2.1.2	Cisco Router 2610xm Specification	64
6.2.2.1	Cisco Catalyst 2950G-12 Configuration	64
6.2.2.2	Cisco Catalyst 2950G-12 Configuration	76
6.3	Describe hardware functionalities	85
6.3.1	Describe Catalyst Router 2610XM hardware functionalities	85
6.3.2	Describe hardware functionalities Catalyst 2950	86
6.4	Security	87
6.4.1	Security policies and plan	87
6.4.2	Software and hardware necessary to implement the policies	89

6.4.3 Backup	91
6.5 Development Status	92

## CHAPTER VII TESTING

7.1 Introduction	94
7.2 Test Plan	95
7.2.1 Test Organization	95
7.2.2 Test Environment	95
7.2.3 Test Schedule	96
7.3 Test Strategy	96
7.3.1 Classes Of Tests	97
7.4 Test Design	97
7.4.1 Test Description	98
7.4.2 Test Data	98
7.5 Test Case Results	105

## CHAPTER VIII PROJECT CONCLUSION

8.1 Observation on Weaknesses and Strengths	107
8.2 Propositions for Improvement	107
8.3 Conclusion	108

BIBLIOGRAPHY	109
--------------	-----

APPENDIXES	111
------------	-----

6.4.3 Backup	91
6.5 Development Status	92
CHAPTER VII TESTING	
7.1 Introduction	94
7.2 Test Plan	95
7.2.1 Test Organization	95
7.2.2 Test Environment	95
7.2.3 Test Schedule	96
7.3 Test Strategy	96
7.3.1 Classes Of Tests	97
7.4 Test Design	97
7.4.1 Test Description	98
7.4.2 Test Data	98
7.5 Test Case Results	105
CHAPTER VIII PROJECT CONCLUSION	
8.1 Observation on Weaknesses and Strengths	107
8.2 Propositions for Improvement	107
8.3 Conclusion	108
BIBLIOGRAPHY	109
APPENDIXES	111

## LIST OF TABLES

TABLE NO	TITLE	PAGE
Table 3.1:	Software Requirement	15
Table 2.2:	Hardware Requirement	16
Table 5.1:	IP Address range	47
Table 5.2 :	VLANs ID And Location	51
Table 5.3:	Device Name	54
Table 5.4:	Interface IP Address	56
Table 5.5:	Physical Connectivity Information	56
Table 6.1:	Mode in switch and router	62
Table 6.2:	Cisco Catalyst 2950G-12 (vlanswitch1) Configuration	66
Table 6.3:	Configuration Cisco Catalyst 2950G-12 (vlanswitch2)	72
Table 6.4:	Cisco Router 2610XM (router2610-1) Configuration	77
Table 6.5:	Cisco Router 2610XM (router2610-2) Configuration	81
Table 6.6:	Switch Model And IOS	90
Table 6.7:	Router Model And IOS	91
Table 6.8:	The Implementation Status	93
Table 7.1:	VLANs Test Schedule	97
Table 7.2:	Cisco Catalyst 2950G-12 Test vlanswitch1	99
Table 7.3:	Cisco Catalyst 2950G-12 Test vlanswitch2	100
Table 7.4:	Cisco Router 2610XM router2610-1 Test	101
Table 7.5:	Cisco Router 2610XM router2610-2 Test	102
Table 7.6:	System Integration Test	103
Table 7.7:	VLANs Functionality Test	105
Table 7.8:	Test Case Results Simulation VLANs	107



## LIST OF FIGURES

FIGURE NO	TITLE	PAGE
Figure 2.1:	Port-based VLANs	7
Figure 2.2:	MAC Address-based VLANs	9
Figure 2.3:	Layer 3 (or protocol)-based VLANs	10
Figure 4.1:	Current NSEM network	32
Figure 5.1:	VLANs Architecture	45
Figure 5.2:	VLANs Design	47
Figure 5.3:	NSEM overall view	48
Figure 5.4:	NSEM 3 <sup>rd</sup> floor	49
Figure 5.5:	NS 2 <sup>nd</sup> floor	50
Figure 5.6:	NS First Floor	50
Figure 5.7:	NSEM Sub Building First Floor/Second Floor	51
Figure 5.8:	3 <sup>rd</sup> Floor	52
Figure 5.9:	2 <sup>n</sup> Foor	52
Figure 5.10:	1 <sup>st</sup> Floor	53
Figure 5.11:	Sub Building Near NSEM Main Building	53
Figure 5.12:	Logical View Of Simulation VLANs	54
Figure 5.13:	Physical View Of Network Design	55
Figure 5.14:	The Assume LANs Network Design	58
Figure 5.15:	The Simulation VLANs Network Design	59
Figure 6.1:	Print screen of backup configuration file	92

## LIST OF ACRONYM

ACROYMN	DESCRIPTION
[A]	
[B]	
[C]	
CSI	Computer Security Institute's
[D]	
DDOS	Distributed Denial Of Service
DCOM	Distributed Component Object Model
DTEs	Data-Terminal Equipment
DCE	Data-Communication Equipment
[E]	
[F]	
FTMK	Fakulti Teknologi Maklumat dan Komunikasi
FTP	File Transfer Protocol
[G]	
GUI	Graphic User Interface
[H]	
HTTP	HyperText Transfer Protocol
[I]	

IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers.
IP	Internet Protocol
IPX	Internetwork Packet eXchange
ICMP	Internet Control Message Protocol
IDF	Intermediate Distribution Frame
<b>[K]</b>	
KUTKM	Kolej Universiti Teknikal Kebangsaan Malaysia
<b>[L]</b>	
LAN	Local Area Network
<b>[M]</b>	
MAC	Medium Access Control
ME	Millenniums
MDD	Model – Driven development
MSFC	MultiLayer Switch Feature Card
MDF	Main Distribution Frame
<b>[N]</b>	
NSEM	National Semiconductor (Melacca)
NETBIOS	Network Basic Input/Output System
<b>[P]</b>	
PC	Personal Computer
PSM I	Projek Sarjana Muda Satu
PSM II	Projek Sarjana Muda Dua
POP	Post Office Protocol
<b>[R]</b>	
RPC	Remote Procedure Call
RAD	Rapid Application Development Model
RADIUS	Remote Authentication Dial-In user Service.
RIP	Routing Information Protocol

	<b>[S]</b>	
SDLC		System Development Life Cycle
SMTP		Simple Mail Transfer Protocol
SSH		Secure Shell
	<b>[T]</b>	
TACACS		Terminal Access Controller Access Control System
TCP		Transmission Control Protocol
TTL		Time To Live
	<b>[U]</b>	
UTP		Unshielded Twisted-Pair
UDP		User Datagram Protocol
	<b>[V]</b>	
VLAN		Virtual Local Area Network
VTP		Virtual Trunking Protocol
	<b>[W]</b>	
WBS		Work Breakdown Structure

## LIST OF APPENDICES

APPENDIX	TITLE	PAGE
	APPENDIX 1.1: National Semiconductor Electronic Malacca	112
	APPENDIX 3.1: The Model- Driven Development Route	113
	APPENDIX 3.2: Work Break down Structure	114
	APPENDIX 3.3: Work Break down	115
	APPENDIX :3.4 Gantt Chart	117
	APPENDIX 4.1: NSEM OPERATION FLOW CHART	118
	APPENDIX 4.2: Source Code UDP SERVER	119
	APPENDIX 4.3: Source Code UDP CLIENT	121
	APPENDIX 6.1: Cisco Catalyst 2950G-12 Specification	124
	APPENDIX 6.2: Cisco Router 2610XM Specification	126
	APPENDIX 6.3: Cisco Catalyst 2950G-12 Configuration(vlanswitch1)	128
	APPENDIX 6.3: (vlanswitch1) Configuration Cisco Catalyst 2950G-12	131
	APPENDIX 6.4: Cisco Catalyst 2950G-12 Print Screen Configuration(vlanswitch2)	134
	APPENDIX 6.5: (vlanswitch2) Cisco Catalyst 2950 Configuration File	137
	APPENDIX 6.6: Print screen of configure router2610-1	139
	APPENDIX 6.7: (Router2610-1) Cisco Router 2610XM Configuration File	142
	APPENDIX 6.8: Print screen of configure router2610-2	143
	APPENDIX 6.9: (Router2610-2) Cisco Router 2610XM	145



## Configuration File

APPENDIX 7.1: PING to Cisco Catalyst 2950G-12 Interface	146
10.1.65.1	
APPENDIX 7.2: Print screen vlanswitch1 interface fa0/12 is up	147
APPENDIX 7.3: PING to Cisco Catalyst 2950G-12 Interface	147
10.1.45.1	
APPENDIX 7.4: Print screen vlanswitch2 interface fa0/12 is up	147
APPENDIX 7.5: Print screen PING all router2610-1 interface	147
APPENDIX 7.6: Print screen ' show run'	148
APPENDIX 7.7: Print screen ' show int fa0/0.1 ,fa0/0.2 ,fa0/0.3'	148
APPENDIX 7.8: Print screen PING all router2610-2 interface	149
APPENDIX 7.9: Print screen ' show run'	149
APPENDIX 7.10: Print screen ' show int fa0/0.1 ,fa0/0.2 ,fa0/0.3'	150
APPENDIX 7.11: UDP Test	150
APPENDIX 7.12: APPENDIX 7.12: PC 7 UDP SERVER	154
APPENDIX 7.13: Print screen command 'show vlan'	154
APPENDIX 7.14: Print screen command 'show vlan'	155
APPENDIX 7.15: Print Screen PC 1 UDP Server	155
APPENDIX 7.16: Print Screen PC 2 UDP Server	156
APPENDIX 7.17: Print Screen PC 7 UDP Server	157
APPENDIX 7.18: Spynet Network Traffic Capture	158
APPENDIX 7.19: Print Screen Monitoring UDP Network Traffic	158
APPENDIX 7.20: Print Screen monitoring computer in network	159

# CHAPTER I

## INTRODUCTION

### 1.1 Preamble/Overview

Project Virtual Local Area Network (VLAN) is to design a efficient network design that enhancement on current National Semiconductor, Malacca (NSEM) network business need, and setup practical a simulation environment.

National Semiconductor Sdn Bhd is located at Batu Berendam Free Trade Zone in Malacca. See Appendix 1.1: for NSEM building. It builds on 7.8 acres land, its manufacturing area covers 26,000 square feet, Assembly Facilities covers 14,500 square feet and lastly Testing Facilities covers 11,500 square feet. When NSEM was established, it only has a few hundred employees compare to 2500 by the time now. As the company name mentioned, National Semiconductor Electronics Malacca, NSEM produce the most advanced state of the art technology and manufacturing process among the industries of semiconductor.

The organization of research, choose is National Semiconductor Sdn Bhd (NSEM) network. This is because the current NSEM network environment is use range IP class B. The main problem is extraneous traffic issue, this is because broadcast activity occurrence by every communication on NSEM network. Therefore Virtual Local Are Network is the solution and enhancement for NSEM current network.

The project develop under Fast Methodology (Model Driven Development Route), it choose because suitable to the project VLAN, and it is one of the oldest or most use approaches to analyzing and designing information system is based on modeling.

## 1.2 Problem Statements

The problems on current NSEM LANs, are network device include computer workstation, network printer, server and machinery adapter to network that connected to each other by means of a switch and router. These network devices are primarily used to transmit incoming data throughout the network. In most cases, if two individuals were to send data simultaneously, a collision would occur and all the data transmitted would be lost. This collision would continue to propagate throughout the network by the switches, making it necessary for the original data to be sent again. LAN segments are formed with workstations, by switch. These are commonly known as collision domains because collisions remain within that segment.

A broadcast domain or LAN is the area in which broadcasts and multicasts are confined. Therefore, one or more LAN segments can be incorporated in a single LAN. The physical connection between the, workstations, switches, and routers determines broadcast and collision domains, meaning that everyone participating in the LAN must to in the same location. As the result, busy traffic often be the problems of NSEM network.

NSEM network administrators are forced to spend much of their time dealing with moving users and workstations. Although there are tools that facilitate network management, costs for network management represent a considerable financial load for an average company. The costs for network management rise with each additional network user and with the demand for higher flexibility of the network.



Due to leak management, it increase of cost to maintain and waste all kind of resource such as human recourses, time relocate and more.

The disadvantage of flat network, are broadcast message will send to all network device in the network. It is dangerous if a computer / workstation / machinery is infected by W32.Blaster. W32.Blaster is worm that exploits the DCOM RPC vulnerability. All infected workstation/machinery are aggressive to perform distributed denial of services DDOS to Microsoft update server. This cause whole network traffic be came very busy then slow down the network or bring down workstation/machinery. Beside above disadvantage, under a flat network every network device receive broadcast message, this highly expose to everyone confidential information such as plain text password include, telnet password, email password, ftp password. Other such as email content, credit card number, account number and more.

VLAN is a technology to logical grouping of network resource and user connected to a administrative network on a switch. It provides easier administration, giving way to the constraints of physically connected networks. Just as individuals belong to multiple workgroups, individual workstations and servers can participate in multiple VLANs. Broadcast domain can be defined without the use of router, but are used if there is a need to communicate between two VLANs.

Every single information change is document like, switch name, where it locate, switch port label to which VLAN group are document for future reference, this ensure when the information need, it can be search immediately. Therefore it enhance network management With VLAN can solve all the problem above.

### 1.3 Objective

- i. To shrink broadcast domain, VLANs reduce size of broadcast domain. Therefore reducing extraneous traffic and improving the efficiency of the whole network by segment current NSEM network.
- ii. To simplify network administrative, adding, moving, removing network device can be dealt with quickly and conveniently from the management console rather than the wiring closet. This enable the management run smoothly without any doubt making any decision relate change on NSEM network.
- iii. To enhanced network security, VLANs create virtual boundaries that can only be crossed through a router. The standard, router-based security measures can be used to restrict access to each VLAN as required.

### 1.4 Scopes

- i. Design a new network design, the design a new network diagram base on current NSEM intranet, and with VLAN technology enhancement.
- ii. Build a simulation according a part of design, Build a VLANs simulation environment in KUTKM Cisco Lab that similar to the network design. Cisco Router and Cisco Catalyst Switch are equipping, and client of the simulation network is few computers with windows XP as operating system platform.



- iii. VLAN configuration, port-based VLAN with 802.1Q VLAN encapsulation. A VLAN Trunking Protocol (VTP) domain is create to multicast messages to inform all other switches in the VTP domain.

**1.5 Contributions**

The new network design solve major networking difficulty that often occurrence in NSEM network.

**1.6 Expected Output**

The result expected is few VLANs are create. Each VLANs have own VLAN id. Each VLAN's node (computer, network printer etc.) belong to a single broadcast domain. Broadcast traffic from one node in a VLAN reaches ever other node in the same VLAN and broadcast traffic does not travel from one VLAN to other VLANs.