



الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
بِوَسِيْلَتِي اِسْلَامُهُ اَنْبَارًا يَجْنِبُنَا مُلْكِيْنَا

A Hybrid Information System - NIT (Network, Information & Telecommunication) for Petroleum Companies

Prepared By:

AZMIL BIN AB.AZIZ

9724935

Prepared For:

DR. AHMAD FAIZUL BIN SHAMSUDDIN

This thesis is submitted in partial requirement of Degree in

Bachelor of Management Information System

International Islamic University Malaysia

Department of Management Information system

International Islamic University Malaysia

ACKNOWLEDGEMENTS

First of all, I would like to thank the Almighty God for giving me the energy, concentration and compulsion for me to complete this project.

Thanks to people at Caltex especially Mr.Zainal Abidin Ahmad from Caltex's Information System Department (ISD), Ms. Fazilah Mohd Noor, Human Resource Officer, Caltex Malaysia, for their great assistance. The same goes to Petronas' Mr. Abd Rahman Ishak, Manager, Research and Projections, Mr. Abdul Murad Ishak, Senior Executive of IT Network Support and Mr. Mohd Isa Bin Maarof, Senior Executive of Network Support.

Million of thanks for my advisor, Dr.Ahmad Faizul Shamsuddin for his advice and for guiding me to the right path.Dr.Ahmad Faizul is well known for someone who loves to share his knowledge and experiences with his students.

Last but not least, to my parents for their love and care.

May Allah bless our efforts and lead us to the life full of 'barakah', InshaAllah.

قَالُوا يَا قَوْمَنَا إِنَّا سَمِعْنَا كِتَابًا أُنزِلَ مِنْ
بَعْدِ مُوسَىٰ مُصَدِّقًا لِّمَا بَيْنَ يَدَيْهِ يَهْدِي إِلَى
الْحَقِّ وَإِلَىٰ طَرِيقٍ مُّسْتَقِيمٍ ﴿٣٠﴾

They said, "O our people! We have heard a Book revealed after Moses, confirming what came before it: it guides (men) to the Truth and to a Straight Path. (30: 26)

ABSTRACT

The purpose of this Final-Year Project is to analyse the impact of Information System – NIT (Network, information and Telecommunication) on Petroleum Companies. Basically, petroleum companies have a wide range of network and telecommunication system that helps them coordinate various divisions of their businesses in different locations. This is particularly important since petroleum companies' daily operation can simply be disrupted due to a network and telecommunication failure. Consequently, network and telecommunication failures may well cost them millions of ringgit.

For comparison purposes, I've analysed two major petroleum companies, which are Petronas (Malaysian based) and Caltex (American based). The first part discusses the network & telecommunication employed by Petronas and my proposals of improving their communication network. The second part discusses how Caltex efficiently exploits their information and network system tools to increase their performance. The idea is to search a hybrid Information System which could be universally applied by Petroleum Companies. While Petronas provide a more technical information with regard to their network and telecommunication system, Caltex tends to provide a more simple explanation which concerns most of their daily activities.

HYPOTHESES

The hypotheses for this final year project are as followings:

Petroleum companies do not utilise their network, information and telecommunication system efficiently.

Petroleum companies can significantly improve their network, information and telecommunication system by applying hybrid information system and enterprise network in their organization.

CONTENTS

PART A - PETRONAS

1.INTRO	
1.1 ABOUT PETRONAS	2
1.2 PETRONAS MANAGEMENT	3
1.3 ORGANIZATION CHART	4
2.PREVIEW OF PETRONAS' INFORMATION SYSTEM	
2.1 NETWORK IN PETRONAS	5
2.2 NETWORK IN PETRONAS - EXPLANATION	9
2.3 PETRONAS COMMUNICATION NETWORK	12
3.HYBRID INFORMATION SYSTEM CONCEPT	
3.1 GROUND COMMUNICATION NETWORK LAYOUT - A PROPOSAL	14
3.2 ASYNCHRONOUS TRANSFER MODE (ATM) IN PETRONAS	18
3.3 ATM DESIGN	21
3.4 IMPROVING BACKBONE PERFORMANCE	23
4.SECURITY FEATURES	
4.1 SECURITY IMPLEMENTATION	24
4.2 PETRONAS NETWORK SECURITY	26
4.3 THE MANAGED FIREWALL SOLUTION	32
5.NETWORK MANAGEMENT	
5.1 ENABLING COMMUNICATIONS	35
6.CONCLUSION	36

PART B - CALTEX

1.INTRO	
1.1 CALTEX:AN INTRODUCTION	38
1.2 CALTEX IN MALAYSIA	39
2.CALTEX'S INFORMATION SYSTEM LAYOUT	
2.1 INFORMATION SYSTEM DEPARTMENT (ISD)	40
2.2 TYPES AND FUNCTIONS OF THE INFORMATION SYSTEM	42
2.3 A THOROUGH ANALYSIS OF INFORMATION SYSTEM	45
3.NETWORK FEATURES	
3.1 INTERNETWORK PERFORMANCE MONITOR	56
4.IS SOLUTION	
4.1 HOW THE INFORMATION AND NETWOK SYSTEM HELP CALTEX TO ACHIEVE THEIR GOALS?	71
4.2 DIFFICULTIES AND CHALLENGES	73
4.3 IS SOLUTIONS FOR CALTEX	75
PART C - OVERALL CONCLUSION	78
PART D - APPENDIX	

PART 1

PETRONAS

ABOUT PETRONAS

PETRONAS, short for Petroliam Nasional Bhd, is Malaysia's national petroleum corporation incorporated on 17 August 1974. Wholly-owned by the Government, the corporation is vested with the entire oil and gas resources in Malaysia and entrusted with the responsibility of developing and adding value to these resources. PETRONAS has since its inception grown into a fully integrated oil and gas entity engaged in a broad spectrum of petroleum and related value-adding business activities in both the upstream and downstream sectors. Today, with over 100 subsidiaries and associated companies, the PETRONAS Group operates in more than 20 countries around the world and is ranked among the Fortune Global 500 companies.

PETRONAS' MANAGEMENT

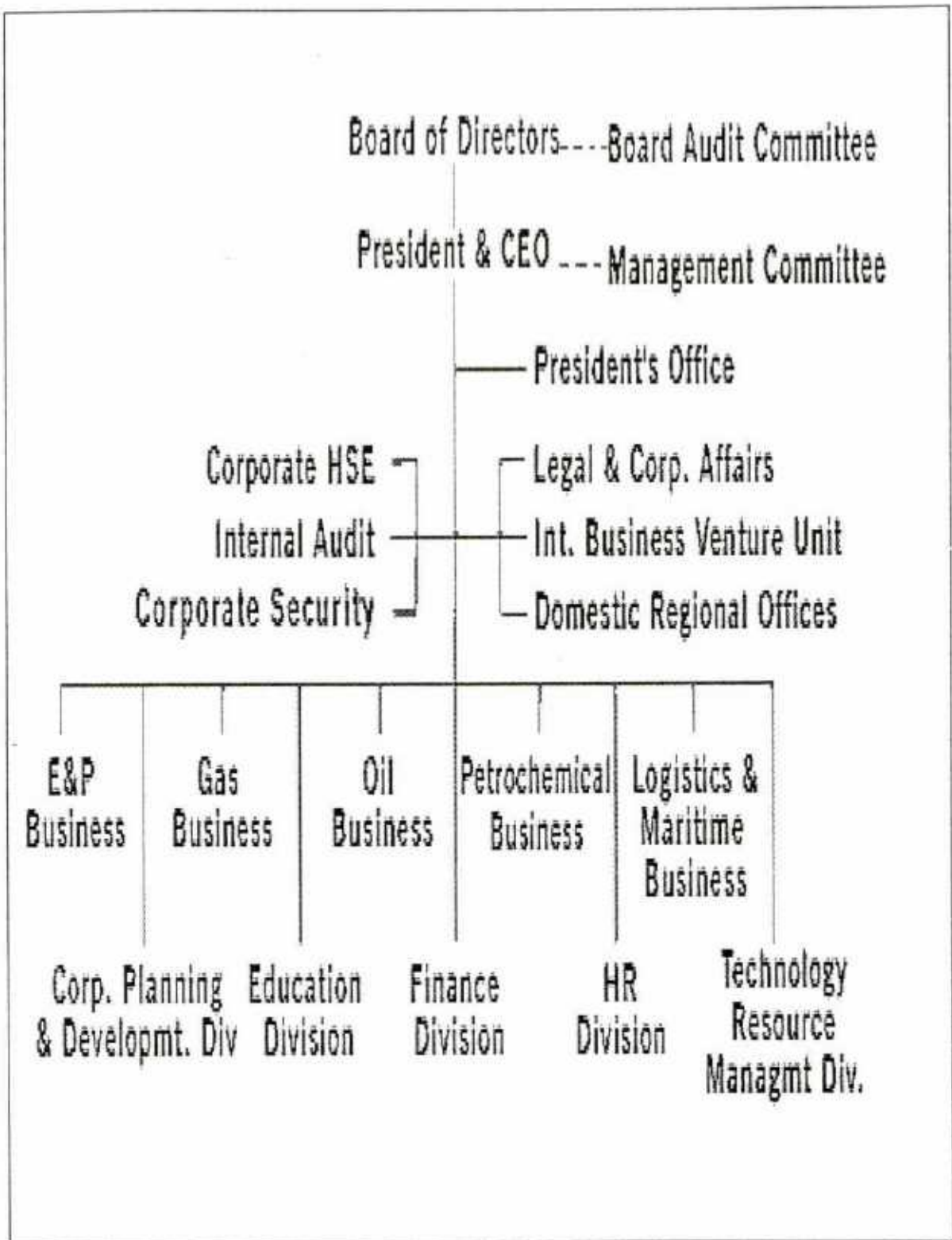
Board of Directors

The Articles of Association of PETRONAS provide that the Board of Directors shall consist of not less than two and not more than 15 directors. The Board of Directors of PETRONAS currently comprises eight members, namely the Chairman, three executive members (the President and two senior Vice Presidents) and four non-executive members. The Prime Minister appoints the Chairman while the Board appoints the other members.

Management Committee

The President is the Chief Executive of PETRONAS. To assist him, the President has formed a Management Committee comprising the Senior Vice-Presidents, the Vice Presidents and the Managing Directors/Chief Executive Officers of main subsidiaries in the PETRONAS Group of Companies.

ORGANIZATION CHART



NETWORK IN PETRONAS

Overview

The network connects national and international subsidiaries of the company as portrayed by the followings :

LAN network system

Data Network:

- Data Center at Bangi
- 99.5% ability
- CISCO router
- Ethernet use

Direct Line:

- Twin Tower to Ho Chin Min (Vietnam)
- MISC (using British Telecom)
- Dayabumi to Twin Tower (using British Telecom)
- Filtering software using Firewall (only for business use)
- Each floor has connection-using ATM but not fully utilize yet
- Nortell features
- Workstations have three connectivities (5000 PC's users):
 - Data
 - Voice

- Multimedia

- International sites via network using public router (50-60 public network)
- Celcom and Telekom are the operator for the voice network system
- Using multiplexer
- Bandwidth between voice and data
- 20 concurrent users that can use the line
- Redundant topology
- Alternate topology when a topology is down

PSTN :

- Public Switch Network
- Using the extension only
- Using microwave and satellite system at certain area

Protocols

- TCP/IP and IPX
- No token ring
- No FDDI
- Workstation and hub (Fast Ethernet)
- 155 mega bytes
- ATM all the way

Future

- Will fully utilize the bandwidth
- 1 network = Data + Voice + Video
- Videoconference to do meeting (for the time being only the top management will do the video conference)

Petronet Infrastructure

- Authorization person only
- Extranet and intranet
- Vietnam to Malaysia and Malaysia to Vietnam calls as local calling charge
- Electronic payment system:
 - Up-dating after pick-hour
 - On-Line MESRA payment

Quality of Service

The system (overall) quality is good

Advantages & Disadvantages

Advantages:

- Already has the ATM cable in the building
- Using the direct line to contact branch in oversea
- Has back- up if something happen in the router
- Software filtering is good for company so that the employees will concentrate to their work
- The radiated media (microwave and satellite) usage is important so that the data transfer difficult to be interfered

Disadvantages:

- The ATM cable should be fully utilized
- The direct line should be wider to every branches of PETRONAS at oversea
- E-mail within the company itself including branches at oversea would not be an accurate method to get the latest news or information about the company immediately
- Protocols should be improved in order to maintain the safety of data stored and transferred

NETWORK IN PETRONAS - EXPLANATION

Petronas is a company that operate within the international scale. It has many branches and joint ventures with companies all over the world. Their company activities are not only restricted on oil based products but also span across maritime and petrochemical.

The Twin Tower is where Petronas' headquarters is placed. All business activities are controlled from this tower. Thus, it also handled the network connection between the national and international subsidiaries.

They use ATM (Asynchronous Transfer Mode) as their network backbone, which means Local Area Network system is implemented in their organization. Within Malaysia, they use Wide Area Network system to integrate connection between different divisions in various locations. Communication is facilitated by Petronet (Petronas Network) which rely on three main sources:

- Data
- Voice
- Multimedia

Public Switch Network with Nortell features has been implemented by Petronas for their network infrastructure.

For data network, they have a data center at Bangi, which controlled and stored all the data operations from inside and outside the country. The data

centre is controlled using robotic technology and has 99.5% ability of storing data with support from Cisco router and Ethernet .

Interestingly, the connection with MISC is not established by using their normal telephone lines, but instead they leased the lines from other carrier, British Telecom. The same goes for connection between Dayabumi and Twin Tower.

For international network and communication, Petronas use variety of networks and infrastructures. Petronet is their main network to connecting Twin Tower with their subsidiary at Ho Chin Min in Vietnam. For other international subsidiaries Petronas make use of the Internet and normal telephone line, which is provided by Telekom to communicate. Furthermore, they also leased lines from Celcom to support their voice communication system. The international subsidiaries are interconnected by a public router (50-60 public networks). In certain areas, Petronas use the microwave satellite system, which provides different bandwidth between voice and data.

Security features

For the security reasons, Petronas has many data storage backup. Within Petronas Tower, they have 7 backups, as well as at other places . They also made redundant topology as an alternate topology in case a topology is breaks - down. Firewall is widely used for filtering software in their daily business operations.

Petronas Infrastructure

Petronas has developed its own networking called PETRONET. The network span across all Petronas subsidiaries in this country. At International level, Ho Chin Minh in Vietnam is the only subsidiary that implements Petronet. The best part of this network facility is that charges are imposed as local calling charge, thus enable Petronas' staffs at Vietnam to communicate with the headquarters and their families cheaper. However, only authorised staffs are allowed to use Petronet to make calls or perform any network activities.

Extranet and intranet facilities are also well equipped within the infrastructure. As for the electronic payment system, Petronet use batch processing where all accounts will be up-date after the peak-hour. Payment can also be made through MESRA on-line , an electronic payment system within the network infrastructure.

PETRONAS COMMUNICATIONS NETWORK

(NETRONAS) – A PROPOSAL OF

MEDIA SELECTION

There are several factors that need to be considered in media selection. They are:

The types of network:

There are many types of networks. Some media only used for wide area networks (microwaves and satellite), while others typically are not (twisted pair, coaxial cable, radio, and infrared). Fiber optic is the most unique, for it can be used for virtually any type of network.

Cost :

Cost always changing in computer related technology. Thus, I could only give estimation about the cost. Among guided media, twisted pair wire is the cheapest, followed by coaxial cable and the most expensive, fiber optic cable. On the other hand, cost of radiated media will varies based on distance. For short distances (several hundred meters), radio and infrared are the cheapest, for moderate distances (several hundred miles), microwave is cheapest, and for long distances, satellite is cheapest.

Transmission distance :

Twisted pair and radio can transmit from 100 to 300 meters, coaxial cable and infrared from 200 to 500 meters and fiber optic cable can transmit up to 75 miles. In addition, new types of fiber optic may reach more than 600 miles. For longer distance connection, transmissions need to be repeated.

Security :

Security depends on types of media used. Guided media is more secured as compared to radiated media. Fiber optic is the most secure media.

Error rates :

Radiated media almost widely open to highest error rates, while guided media is better with fiber optic provides lowest error rates. Even twisted pair offer a better usage in error rates.

Transmission speeds :

Twisted pair and coaxial cable provide data rates from 1 to 100 Mbps (Mega bytes per second). On the other hand, fiber optic cable ranges from 100 Mbps to 10 Gbps. Radio and infrared provide speed of 1 to 4 Mbps. Meanwhile satellite and microwave range from 20 to 50 Mbps.

PETRONAS COMMUNICATIONS NETWORK

(NETRONAS)

GROUND COMMUNICATIONS NETWORK LAYOUT

– A PROPOSAL

(Please refer PETRONAS NETWORK on previous page.)

PETRONAS communications network (**NETRONAS**) is extensive since its operations are through out quite a wide region around the world.

There are three main places operated as a big center in their region specifically. The big centers are:

- ⊕ PETRONAS Tower in Kuala Lumpur

This center covers Peninsular Malaysia regions as well as East Malaysia regions including off shore stations. The smaller centers that is linked directly from this center are MISC, Melaka, Bangi, Bangunan Daya Bumi, Kerteh, East Malaysia and off shore stations.

- ⊕ Ho Chi Minh Center in Vietnam

This center covers Vietnam and North of Asia Regions. It is possible to be linked into China, Mongolia, Taiwan as well as Korea on a future date.

⊕ Khartoum Center in Sudan.

This center covers Sudan as well as other African countries. The center is possible to be linked into North, South, West and East African countries in the future.

Types of networks:

In NETRONAS, there are two types of network layouts. The networks are Wide Area Network (WAN) and Local Area Network (LAN). WAN needs unguided media (to be efficient), while LAN needs guided media.

WAN configuration is used in linking PETRONAS Tower with Sudan Center, Ho Chi Minh Center, in Vietnam and local off shore stations as well as east of Malaysia. To link PETRONAS Tower with Sudan Center, I suggest that Petronas make use of the satellite. This is due to its distance, transmission speed and its cost. The same goes to the linkage between Sudan Areas with other regions in Africa.

Meanwhile at Ho Chi Minh Center, in Vietnam, we can use ATM backbone with fiber optics to link it to PETRONAS Tower. Fiber optics is used instead of unguided media since it is not too far and more reliable.

To link between PETRONAS Tower and off shore petroleum stations, the use of microwave is enough. The distance is relatively not too far and it is less costly to implement this method. Furthermore the stations are off the ground.

On the other hand, LAN is used to set up configuration between all local regional centers. In PETRONAS Tower itself, we should implement ATM function at the utmost. The linkages between all local regional centers with the Tower use the same types of backbones – ATM.

The Uses of Multiplexer

Multiplexer is needed when we want to put two or more simultaneous transmissions on a single communication circuit. Multiplexing a voice telephone calls means that two or more separate conversations are sent simultaneously over one communication circuit. Multiplexing is done in multiple of four – e.g. 4, 8, 16 and 32.

The primary benefit of multiplexing is saving money in terms of reducing the amount of cable or the number of circuits.

There are many types of multiplexers. For example, frequency division multiplexers (FDM), time division multiplexers (TDM) and statistical time division multiplexers (STDM). In NETRONAS, I think it is best to use wavelength division multiplexers (WDM). It is one version of FDM used in fiber optic cables. WDM works by using laser to transmit different frequencies of light (color) through the same cable. Each channel is assigned a different frequency so that the light generated by one laser does not interfere with the light produced by another.

WDM permits up to 40 simultaneous circuits, each transmitting up to 10 Gbps, giving total network capacity in one fiber optic cable of 400 Gbps. One WDM cable running at 400 Gbps could transmit almost entire daily volume of telephone calls made in North America.

WDM is relatively new technique, so it will continue to improve over the next few years. Experts predict that WDM transmission speeds should reach 25 terabits per second within five years – all without laying new fiber optic cable.

ASYNCHRONOUS TRANSFER MODE (ATM) IN

PETRONAS

A synchronous Transfer Mode (ATM) or sometimes-called cell relay is a form of packet switching in which fixed size cells of 53 octets are used. There is no network layer and many of the basic functions have been streamlined or eliminated to provide for greater throughput. There are three possible types of ATM network:

- Gateway to ATM WAN – An ATM switch acts as a router and traffic concentrator for linking a premises network complex to an ATM WAN.
- Backbone ATM switch – Either a single ATM switch or a local network of ATM switches interconnect other LANs.
- Workgroup ATM – High performance multimedia workstations and other end systems connect directly to an ATM switch.

Talking about ATM in PETRONAS, the Twin Towers is currently using the Backbone ATM switch as its network backbone. ATM backbone switches typically provide point-to-point full duplex circuits at 155 Mbps. In practice, a mixture of two or all three of these types of networks is used to create an ATM