ANALYZING PBX SYSTEM FOR NIOSH

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DEDICATION

To my beloved parents, Alias B. Abu and Aminah Bt Hj. Omar

To my sisters, Siti Rahayu, Siti Roziati, Siti Roziaton and Siti Roziani

To Adam Budiman, for his steadfast support

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ABSTRACT

When Alexander Graham Bell created the first telephone, never would imagine how far the technology would go and how irreplaceable his invention would become about 100 years later. Telephone technology has evolved so rapidly that today we have cell phones the size of your palm which can do multitasking from a single call to paying bills. Following this trend also is the method of transporting voice, which over the years has evolved from providing voice quality that is very-blur to crystal-clear. This allows people from any part of the world to communicate with each other without having to be face to face with each other. On top of that, we have the Internet, which is bridging the whole world together. PBX System is a private telephone switch that provides switching including a full set of switching features for an office or campus that widely use on companies or organizations to handle internal and external calls. This thesis intends to analyze the PBX system on NIOSH network. It explains about the network performance, bandwidth utilization and packet management analysis that will be done using simulation software. A few simulation software differentiations will be used to choose the best software to design the prototype and produce the analysis result. National Institute of Safety and Health had been choosing to be part a place of case study for these projects. Prototype design on the simulation with the analysis result could illustrate the benefits of the technology to be proposed and implement in the future.

ABSTRAK

Apabila Alexander Graham Bell mencipta telefon yang pertama, tidak mungkin beliau menjangkakan betapa penting ciptaannya akan menjadi dalam masa 100 tahun. Teknologi telefon telah berkembang begitu pesat sekali hingga kini terdapat telefon sebesar tapak tangan yang mampu melakukan pelbagai fungsi dari sekadar panggilan hingga boleh melakukan pembayaran bil. Turut dimajukan ialah cara suara dihantar ke satu tempat ke satu tempat yang lain. Ini membolehkan manusia berbual diantara satu sama lain tanpa perlu bersemuka. Disamping itu juga, terdapat kemudahan Internet yang memudahkan lagi cara perhubungan dan dapat menyambungkan seluruh dunia bersama.Sistem PBX ialah rangkaian telefon berpusat yang menyediakan sistem telefon untuk pejabat atau kampus dan banyak digunakan oleh pejabat atau organisasi untuk mengawal panggilan dalaman ataupun luaran. Tesis ini bertujuan untuk menganalisa Sistem PBX di rangkaian NIOSH. Ia menerangkan tentang pengurusan rangkaian, penggunaan jalur lebar dan pengurusan paket apabila menggunakan Sistem PBX.Beberapa perisian simulasi akan dibandingkan untuk memilih simulasi yang sesuai bagi melukis prototaip dan menghasilkan keputusan analisa. Institut Keselamatan dan Pekerjaan Negara telah pun dipilih sebagai tempat kajian kes untuk projek ini. Melalui prototaip yang dihasilkan melalui simulasi, ia akan dapat menggambarkan faedah penggunaan teknologi ini untuk dimajukan dan dilaksanakan di masa hadapan.

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ABBREVIATIONS	FULL TERMS
AAA	Authentication, Authorization and Accounting
ACD	Automatic Call Distribution
CME	Cisco CallManager Express
CMM	Cisco Call Manager
CO	Central Office
DSP	Digital Signal Processor
FTMK	Faculty of Information Communication Technology
FXO	Foreign Exchange Office
FXS	Foreign Exchange Station
GSM	Groupe Speciale Mobile
HWIC	High Speed Wan Interface Card
IP	Internet Protocol
KUTKM	Kolej Universiti Teknikal Kebangsaan Malaysia
LAN	Local Area Network
MGCP	Media Gateway Control Protocol
NAT	Network Address Translator
NIOSH	National Institute of Occupation Security Health
PBX	Private Branch Exchange

C	Personal Computer
OTS	Plain Old Telephone System
SM	Projek Sarjana Muda
STN	Public Switch Telephone Network
oS	Quality of Service
0	Serial 0
CCP	Skinny Client Control Protocol
MB	Small and medium-sized business
DM	Time Division Multiplex
elco	Telephone Company
TP	Unshielded Twisted Pair
LAN	Virtual Local Area Network
PN	Virtual Private Network
AN	Wide Area Network
ML	Extensible Markup Language

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CHAPTER 1

INTRODUCTION

1.1 Project Background

The evolution from a circuit switched to packet switched communication system platform has been one of the most widely discussed and analyzed events within the enterprise communications system market for the past few years.

Today's enterprise communications market is in a considerable flux caused by major ongoing changes in the technology of core products and the network infrastructure. Notably, voice communications systems are migrating from a time to a packet-based switching and transmission design.

Customers are beginning to realize that communication systems based on an IP control signaling and communications transmission platform are not a new product type but merely another category of PBX systems.

Private Branch Exchange which known as PBX, support calls processing and switching functions to enable telephone calls between two or more station users. It was design for more robust functionality, greater growth capacities for ports, traffic and call processing, and more levels of redundancy.

This thesis intends to analyze the technology that can be considered to be still in its infant in Malaysia. It explains about technology before further illustrating the benefits of the technology with a prototype. In this project, the states of art for PBX system will be analyzed. In particular, the Legacy PBX Traffic, Legacy PBX Switch Network Design, PBX Requirements and Architecture, and technologies, which support PBX System such as IP Telephony, will be considered. Particular simulation software, like OPNET Modeler, cNet, REAL, ns-2, AdventNet and others also will be considered in this project.

1.2 Problem Statements

Legacy voice communications systems have achieved a very high level of reliability and support on an extremely robust set of features and functions. For most customers, incremental evolution is preferable to wholesale revolution when it comes to their real-time communications requirement. Unless a customer can balance the risk of new technology against potential cost savings and/or productivity environment, the natural tendency is to minimize risk and proceed slowly into the future.

An organization also facing with increasing call bills when doing an international calls which mostly of them using POTS service from Telecommunication Company. International calls billing also one of the factors on increasing of payment in some organizations.

Besides that, many of manufacturers came with their PBX system product that customer/user didn't expose on their architecture, design, performance, features and requirement. Although this technology was popular and was on demand by many organizations or company at Europe but it still slow in Malaysia and not much know bout it.

Telecommunication Company also was not responsible to provide management and control over off-net and on-net calls which the duty must handle by administration department. So it becomes their additional jobs on monitoring who is using the phone line.

1.3 Objectives

There are several objectives that will be achieved throughout this project. They are:

i) To analyze the concept of PBX system in the LAN/WAN IP network and justify its implementation in the network

The analysis will be done on the concept beneath the PBX system itself. It will provide easy and simple way of understanding the PBX system concept including the architecture and structure based on LAN/WAN based on customer requirement.

ii) To compare the simulation sotware such as OPNET Modeler with others simulation features from suppliers.

As the technology arising, manufacturers also not miss the chance to offer their applications which mostly of product comes with unique features to differentiate the products from others.

iii) To generate hypothesis and IP telephony prototype based on analysis that will be done on PSM 11.

The hypotheses generate from the analysis, will be the propose solution for NIOSH organization.

1.4 Scopes

A scope is the boundary of the system resources created that can be used. For example, what the PBX system can do or to whom it can be used. The scopes for this project are as below:

i) The project will be implemented using a simulation for its prototype modeling. An IP Telephony approach like voice application will be used to stimulate scenario results. The implementation depends on project requirement.

ii) The analysis could be benchmark for future implementation at NIOSH. Some aspect that had been listed could be considered before using this new technology inside NIOSH networks.

iii) This project will begin with analysis on PSM 1 and further implementation on PSM 2. Comparison between the new simulation software on different supplier will be distinguishing what the product they offering for customer.

iv) The constraint from this project that needs to deal with is security issue. The PSTN is extremely secure because the signaling network is closed to the outside world. The potential of signaling and media traversing the same links as the modus operandi of the new network is bound to meet with some skepticism from many of those who put the present PSTN together.

1.5 Project Significance

The promise of VoIP has been to allow carriers to decompose the class systems to manageable and modular components, which is expected to reduce costs (per port and total) and allow for expedient service creation and delivery to

customers. For the beginning, customer will get basic telephone service done differently, but it is also bundled up front with Internet access and data capabilities, depending on the recurring cost.

The advantages on packet switching over circuit switching have to be highlight for customer attention. The Public Switched Telephone Network (PSTN), which preferable by customer is a circuit-switched network. When a telephone call is initiated, a circuit is established between the calling party and the called party that reserves a path, bandwidth, and processing time for the call. Today's circuit-switched networks are Time Division Multiplex (TDM) based networks. TDM sends data at a constant rate, even when there is no data to send. While this provides an inefficient use of resources, it nevertheless accounts for the non-bursty, low latency, and reliable nature of today's PSTN network.

The packet-switched network stuffs data into individual packets to be routed across the network. A packet-switched network can be highly efficient and flexible. Packets are not sent until they are filled and bandwidth is only consumed when packets are sent. Voice over IP, utilizing compression techniques, silence detection, and Quality of Service (QoS) features, attempts to share the advantages of both.

When customers have their LAN wiring in place, there is no longer a need to maintain two separate networks, two separate sets of wire, or separate staff--one to do the phone system and another to do the LAN administration. It's commonly called the *integration* or *convergence* of voice, data, and video on one network--and there is cost savings associated with this approach. Toll-bypass allows for savings. For instance, one school district in Kuala Lumpur could call another district in Selangor, toll-free as it rides the data network between the two.

There are also savings related to reducing the number of lines or not having to purchase additional lines from the local telephone company (Telco), as more of the voice traffic can be shifted to the data network. Other cost savings can include:

the bulk purchase of CO (Central Office, i.e., the phone company) lines, volume discounts on long distance (because it can be aggregated), a single call processor can service multiple locations (rather than one per location), and/or a single voicemail system, etc. on top of the benefits to having a single system to administer, maintain, and upgrade

1.6 Expected Output

PBX system analysis will have some diagrams, tables and graph based on the understanding on the functions of the scenario implementation. The information on analysis and hypothesis will be used for simulation part where setting and configuring are implemented on the prototype for this project.

The diagram for IP Telephony service on the organization will be design and data on system and station review will be collect such as delay and clarity measurement. Data will be captured from the beginning of implementation.

Hopefully, the organization could give cooperation and full support for the analysis phase. Using their information will help student to understand the concept and implementation on the real world.

1.7 Conclusion

As wrote before, the project will be focused on PBX system analysis for NIOSH network. Then one of network simulation tools from any product will be choose to be used for simulation as project prototype.

PBX system analysis can be used as a platform for students and lecturers to study about the new technology that provide by Internet Protocol like Voice Conferencing, Media Conferencing or IP Telephony using the simulation software.