NETWORK ANALYSIS AND DESIGN AT TERUNTUM COMPLEX

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NETWORK ANALYSIS AND DESIGN AT TERUNTUM COMPLEX

AFIQ BIN LAMAZNUN

A thesis submitted in fulfillment of the requirements for the award of the degree of
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(Computer system and Networking)

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SUPERVISOR'S DECLARATION

"I hereby declare that, I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of the degree of Bachelor of Computer Science (Computer Systems & Networking)"

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STUDENT'S DECLARATION

"I declare that this thesis entitled called 'Network analysis and design at Teruntum Complex' is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree"

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ABSTRACT

As a networking student, it is important and compulsory to have some basic knowledge of networking knowledge about the network design, know how to make an analysis of network design and know how to implement or apply the network. Network architecture is a design of a communications network; it is a framework for the specifications of a network's physical components and their functional organization and configuration, its operational principles and procedures as well as data formats used in its operation. Meanwhile a computer network, often simply referred to as a network, is a collection of hardware components and computers interconnected by communications channels that allow sharing of resources and information. Networks may be classified according to a wide variety of characteristics such as the medium used to transport the data, communications protocol used, scale, topology, and organizational scope. The rules and data formats for exchanging information in a computer network are defined by communications protocols. For my project which is Network analysis and design at Teruntum complex. Overall of this project is based on analysis on network performance in increasing the network performance at the selected area itself by referring to graph and what we can interpret from the graph that being produced. This analysis using Opnet IT Guru simulation tools that will be explained more throughout this report.

ABSTRAK

Sebagai pelajar dalam bidang komputer dan sistem rangkaian, ia adalah penting dan wajib untuk mempunyai pengetahuan asas rangkaian iaitu mengenai reka bentuk rangkaian, tahu bagaimana untuk membuat analisis reka bentuk rangkaian dan tahu bagaimana untuk melaksanakan atau menggunakan rangkaian. Senibina rangkaian adalah reka bentuk rangkaian komunikasi, ia adalah satu rangka kerja bagi spesifikasi komponen fizikal rangkaian dan organisasi fungsian dan konfigurasi, prinsip operasi dan prosedur serta format data yang digunakan dalam operasi. Sementara itu, rangkaian komputer, sering hanya disebut sebagai rangkaian, a dalah satu koleksi komponen perkakasan dan komputer yang saling oleh saluran komunikasi yang membolehkan perkongsian sumber dan maklumat. Rangkaian boleh dikelaskan mengikut pelbagai ciri-ciri sebagai medium yang digunakan untuk mengangkut data, komunikasi protokol yang digunakan, skala, topologi, dan skop organisasi. Kaedah-kaedah dan format data untuk bertukar-tukar maklumat dalam rangkaian komputer yang ditakrifkan oleh protokol komunikasi. Untuk projek saya yang merupakan analisis dan reka bentuk rangkaian di kompleks teruntum. Keseluruhan projek ini adalah berdasarkan kepada analisis mengenai prestasi rangkaian dalam meningkatkan prestasi rangkaian di kawasan yang dipilih itu sendiri dengan merujuk kepada graf dan apa yang kita boleh tafsir daripada graf yang dihasilkan. Analisis yang dijalankan ini menggunakan Opnet alat simulasi Guru yang akan diterangkan sepanjang laporan ini.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter briefly explain on the main objective of this research and explain on the usage of Opnet It Guru simulation modeler. As a networking student, it is important and compulsory to have some basic knowledge of networking knowledge about the network design, know how to make an analysis of network design and know how to implement or apply the network. Network architecture is a design of a communications network; it is a framework for the specifications of a network's physical components and their functional organization and configuration, its operational principles and procedures as well as data formats used in its operation. Meanwhile a computer network, often simply referred to as a network, is a collection of hardware components and computers interconnected by communications channels that allow sharing of resources and information. Networks may be classified according to a wide variety of characteristics such as the medium used to transport the data, communications protocol used, scale, topology, and organizational scope. The rules and data formats for exchanging information in a computer network are defined by communications protocols. Well-known communications protocols are Ethernet, hardware and Link Layer standard that is ubiquitous in local area networks,

and the Internet Protocol Suite, which defines a set of protocols for internetworking, i.e. for data communication between multiple networks, as well as host-to-host data transfer, and application-specific data transmission formats. Computer networking is sometimes considered a sub-discipline of electrical engineering, telecommunications, computer science, information technology or computer engineering, since it relies upon the theoretical and practical application of these disciplines. The properties of computer networks is Facilitate communications which is using a network, people can communicate efficiently and easily via email, instant messaging, chat rooms, telephone, video telephone calls, and video conferencing. Permit sharing of files, data, and other types of information which are in a network environment, authorized users may access data and information stored on other computers on the network. The capability of providing access to data and information on shared storage devices is an important feature of many networks. Then share network and computing resources which are in a networked environment, each computer on a network may access and use resources provided by devices on the network, such as printing a document on a shared network printer. Distributed computing uses computing resources across a network to accomplish tasks. Then the network may be insecure which the network may be used by computer hackers to deploy computer viruses or computer worms on devices connected to the network, or to prevent these devices from normally accessing the network (denial of service). Lastly the network may interfere with other technologies; power line communication strongly disturbs certain forms of radio communication, e.g., amateur radio. It may also interfere with last mile access technologies such as ADSL and VDSL.

1.2 Problem Statement

One of the problems encountered leading to this project is sometime in the network have some intruders want to sabotage any file or computer in the network. So the network must be secure from any intrusions that will make the network connection unsecure place for the data transferring. Then another problem is there is no proper design of network in the selected area which will cause trouble or make it hard when network engineer want to troubleshoot the network.

1.3 Objectives

The objectives of the project are to:

- To implement the network design using IT Guru Software and make an analysis towards the network ability and performance including reducing packet loss in transmission data.
- To implement a network that has the ability to recover itself when a network problem occurs.
- To apply security for firewall network in Wireless and wired connection in the network that has been designed for 1st floor of Teruntum complex

1.4 Scopes

The scopes of the project are:

i. The network design is being implemented in 1st floor of Teruntum Complex.
ii. The connection that will be implemented is consists of wire line and wireless.
iii. The target user of this project is all the people that use the network either the shop owner that use wired network connection in the shop and wireless network for the customer.

1.5 Thesis Organization

In chapter 1, it is to introduce the idea about the project that will develop. This chapter will discuss about the problem statement, objective, and scope of work in the project.

Chapter 2 is about to explain the literature review of the project. It will discuss about the security of the network and the several integrated security method.

Chapter 3 will discuss the approach and the method for the project in designing, implementing and developing the project.

Chapter 4 is to explain about the development and all the process that involve in the project. It is explaining how the method, techniques or tools implement in the developing project.

In chapter 5 will discuss about the result and the discussion. This chapter will show and explain the results and data analysis that have been done in this project. This chapter also will discuss about the project suggestion and project enhancement.

Chapter 6 is discuss about the conclusion of the developing the project and summarization.

CHAPTER 2

LITERATURE REVIEW

This chapter briefly discusses about the literature review of the network analysis, design and security in public places such as shopping complex. There are seven main sections in this chapter. The first main section is introduction of this chapter. Then, the next main section describes the concept. After that, the manual system of the project will be discussed. Next, there are two main sections which discuss several technologies and techniques separately. The next main section discusses the existing system while the last main section reviews the methodologies used to develop and discuss the network analysis and design it.

2.1 Introduction

Literature review surveys on scholarly articles, books, journal and other literature sources relevant to the area of research for this project. The aim for literature review is to gain a clearer perceptive in developing this project. So, this chapter will explain on all information gathered from previous researches for this project. Firstly, it will include a description of the concepts for this project. The main concepts of this system are wireless network analysis and design or also known as Wi-Fi by the public. This chapter will also include the description of wireless network analysis, design, and the method to develop

better wireless system in scope of security and range. The technology section explains the devices and plan that being used in implementing the wireless network and how to design and make an analysis of the wireless network itself.

2.2 The Concept of the Project

There are several concepts that need to be clearly defined for this project. First of all is the Wireless Network. Then, the concept of its design and the concept of security technique will be depicted in this section. The concept of implementation and planning wireless network will also be described in detail in this section too.

2.2.1 The Concept of Wireless Network

According to Oxford English-English Dictionary in, wireless is using radio, microwaves, etc. (as opposed to wires or cables) to transmit signals. Wireless also is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or the entire communication path. Some monitoring devices, such as intrusion alarms, employ acoustic waves at frequencies above the range of human hearing; these are also sometimes classified as wireless. The first wireless transmitters went on the air in the early 20th century using radiotelegraphy (Morse code). Later, as modulation made it possible to transmit voices and music via wireless, the medium came to be called "radio." With the advent of television, fax, data communication, and the effective use of a larger portion of the spectrum, the term "wireless" has been resurrected.

While network is an arrangement of intersecting horizontal and vertical lines or a group or system of interconnected people or things. Then wireless network is communication or bond that interconnected people or things using radio, microwaves, etc. (as opposed to wires or cables) to transmit information or data between them. Although wireless networking began to penetrate the market in the 1990s, the technology has actually been around since the 1800s. A musician and astronomer, Sir William Herschel (1738 to 1822) made a discovery that infrared light existed and was beyond the visibility of the human eye. The discovery of infrared light led the way to the electromagnetic wave theory, which was explored in-depth by a man named James Maxwell (1831 to 1879). Much of his discoveries related to

electromagnetism were based on research done by Michael Faraday (1791 to 1867) and Andre-Marie Ampere (1775 to 1836), who were researchers that came before him. Heinrich Hertz (1857 to 1894) built on the discoveries of Maxwell by proving that electromagnetic waves travel at the speed of light and that electricity can be carried on these waves.

Although these discoveries are interesting, you might be asking yourself how they relate to wireless local-area networks (WLANs). Here is the tie-in: In standard LANs, data is propagated over wires such as an Ethernet cable, in the form of electrical signals. The discovery that Hertz made opens the airways to transfer the same data, as electrical signals, without wires. Therefore, the simple answer to the relationship between WLANs and the other discoveries previously mentioned is that a WLAN is a LAN that does not need cables to transfer data between devices, and this technology exists because of the research and discoveries that Herschel, Maxwell, Ampere, and Hertz made. This is accomplished by way of Radio Frequencies (RF).

With RF, the goal is to send as much data as far as possible and as fast as possible. The problem is the numerous influences on radio frequencies that need to be either overcome or dealt with. One of these problems is interference. For now, just understand that the concept of wireless LANs is doable, but it is not always going to be easy. To begin to understand how to overcome the issues, and for that matter what the issues are, you need to understand how RF is used.

2.3 The Other System Of Internet Network

The other system of communication in a network instead of wireless network is the wired network that involves many cabling parts. It is also known as Wired LANs that use Ethernet cables and network adapters. Although two computers can be directly wired to each other using an Ethernet crossover cable, wired LANs generally also require central devices like hubs, switches, or routers to accommodate more computers.

For dial-up connections to the Internet, the computer hosting the modem must run Internet Connection Sharing or similar software to share the connection with all other

computers on the LAN. Broadband routers allow easier sharing of cable modem or DSL Internet connections, plus they often include built-in firewall support.

Installation of wired LAN (local area network)

Ethernet cables must be run from each computer to another computer or to the central device. It can be time-consuming and difficult to run cables under the floor or through walls, especially when computers sit in different rooms. Some newer homes are pre-wired with CAT5 cable, greatly simplifying the cabling process and minimizing unsightly cable runs.

The correct cabling configuration for a wired LAN varies depending on the mix of devices, the type of Internet connection, and whether internal or external modems are used. However, none of these options pose any more difficulty than, for example, wiring a home theater system.

After hardware installation, the remaining steps in configuring either wired or wireless LANs do not differ much. Both rely on standard Internet Protocol and network operating system configuration options. Laptops and other portable devices often enjoy greater **mobility** in wireless home network installations (at least for as long as their batteries allow).

Cost

Ethernet cables, hubs and switches are very inexpensive. Some connection sharing software packages, like ICS, are free; some cost a nominal fee. Broadband routers cost more, but these are optional components of a wired LAN, and their higher cost is offset by the benefit of easier installation and built-in security features.

Reliability

Ethernet cables, hubs and switches are extremely reliable, mainly because manufacturers have been continually improving Ethernet technology over several decades. Loose cables likely remain the single most common and annoying source of failure in a wired network. When installing a wired LAN or moving any of the components later, be sure to carefully check the cable connections.

Broadband routers have also suffered from some reliability problems in the past. Unlike other Ethernet gear, these products are relatively new, multi-function devices. Broadband routers have matured over the past several years and their reliability has improved greatly.

Performance

Wired LANs offer superior performance. Traditional Ethernet connections offer only 10 Mbps bandwidth, but 100 Mbps Fast Ethernet technology costs little more and is readily available. Although 100 Mbps represents a theoretical maximum performance never really achieved in practice, Fast Ethernet should be sufficient for home file sharing, gaming, and high-speed Internet access for many years into the future.

Wired LANs utilizing hubs can suffer performance slowdown if computers heavily utilize the network simultaneously. Use Ethernet switches instead of hubs to avoid this problem; a switch costs little more than a hub.

Security

For any wired LAN connected to the Internet, firewalls are the primary security consideration. Wired Ethernet hubs and switches do not support firewalls. However, firewall software products like Zone Alarm can be installed on the computers themselves. Broadband routers offer equivalent firewall capability built into the device, configurable through its own software.

2.4 The Technology Of Wireless Network

The technology is the application of scientific knowledge for practical purposes, especially in industry. The technology used in this project is the Wireless Network Internet connection that can connect wireless router and the end user which is public people that using internet in more efficient way than before.

2.4.1 The Wireless Router

A Wireless router is a device that performs the functions of a router but also includes the functions of a wireless access point and a network switch. They are commonly used to allow access to the Internet or a computer network without the need for a cabled connection. It can function in a wired LAN (local area network), a wireless only LAN (WLAN), or a mixed wired/wireless network. Most current wireless routers have the following characteristics:

- LAN ports which function in the same manner as the ports of a network switch.
- A WAN port to connect to a wide area network, typically one with Internet access. External destinations are accessed using this port. If it is not used, many functions of the router will be bypassed.
- A wireless antenna allows connections from other wireless devices (NICs (network interface cards), wireless repeaters, wireless access points, and wireless bridges, for example), usually using the Wi-Fi standard.

Some wireless routers also include a DSL or cable modem in addition to their other components.

Figure 2.1 Sample of wireless router nowadays

2.4.2 The Network Cabling

Structured cabling is building or campus telecommunications cabling infrastructure that consists of a number of standardized smaller elements (hence structured)

called subsystems.

Structured cabling falls into six subsystems:[1][2]

Demarcation Point is the point at which the telephone company network ends and connects with the wiring at the customer premises.

Equipment or Telecommunications Rooms house equipment and wiring consolidation points which serve the users inside the building or campus.

Vertical or Riser Cabling connects between the equipment/telecommunications rooms, so named because the rooms are typically on different floors.

Horizontal wiring can be IW (inside wiring) or Plenum Cabling connects telecommunications rooms to individual outlets or work areas on the floor, usually through the wireways, conduits or ceiling spaces of each floor.

Work-Area Components connect end-user equipment to outlets of the horizontal cabling system.

Structured cabling design and installation is governed by a set of standards that specify wiring data centers, offices, and apartment buildings for data or voice communications using various kinds of cable, most commonly category 5e (CAT-5e), category 6 (CAT-6), and fiber optic cabling and modular connectors. These standards define how to lay the cabling in various topologies in order to meet the needs of the customer, typically using a central patch panel (which is normally 19 inch rack-mounted), from where each modular connection can be used as needed. Each outlet is then patched into a network switch (normally also rack-mounted) for network use or into an IP or PBX (private branch exchange) telephone system patch panel.

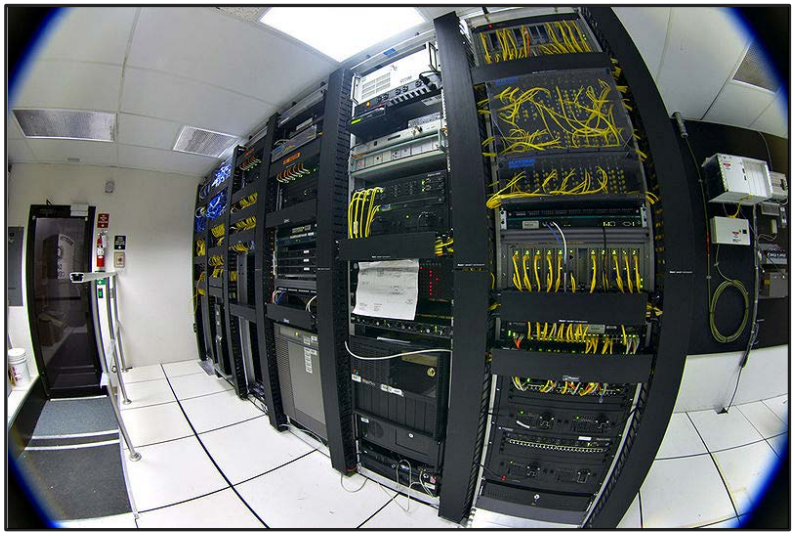

Figure 2.2 Network Cabling

Lines patched as data ports into a network switch require simple straight-through patch cables at the each end to connect a computer. Voice patches to PBXs in most countries require an adapter at the remote end to translate the configuration on 8P8C modular connectors into the local standard telephone wall socket. No adapter is needed in the U.S. as the 6P2C and 6P4C plugs most commomly used with RJ11 and RJ14 telephone connections are physically and electrically compatible with the larger 8P8C socket. RJ25 and RJ61 connections are physically but not electrically compatible, and cannot be used. In the UK, an adapter must be present at the remote end as the 6-pin BT socket is physically incompatible with 8P8C.

It is common to color code patch panel cables to identify the type of connection, though structured cabling standards do not require it, except in the demarcation wall field. Cabling standards demand that all eight conductors in Cat5/5e/6 cable are connected, resisting the temptation to 'double-up' or use one cable for both voice and data. IP phone systems, however, can run the telephone and the computer on the same single cable.

2.4.3 The End user

The final or ultimate user of a computer system. The end user is the individual who uses the product after it has been fully developed and marketed. The term is useful because it distinguishes two classes of users, users who require a bug -free and finished product (end users), and users who may use the same product for development purposes. The term end user usually implies an individual with a relatively low level of computer expertise. Unless you are a programmer or engineer,

you are almost certainly an end user.

Figure 2.3: The End user

2.5 Advantages and Disadvantages of WLAN

ADVANTAGES	DISADVANTAGES
The WLAN Internet connectivity is a brilliant and great idea for those companies whose site is not conducive to LAN wiring because of older building or budget limitations. For example, older buildings, leased spaces or temporary sites.	This technology of LAN also facing obvious potentials in customer mobility and configuration changes significantly worse than wired in the risk of jamming, in the potential of interference, and in the detection of customer location.
Ensures the Internet customer, web-served mobile communication and field service productivity, which leads to dollars savings quicker from any other commercial equipment available recently. WLAN can provide network hardware for in-building and building-to-building data networks, as well as mobile communication equipment for information capture and display.	Most office environment and modern homes are constructed of materials that are relatively “translucent” to radio waves at 2.4 GHz so the range will not be greatly limited, however they do tend to present very reflective environments and the ultimate limitations will probably be caused by severe “multipath” consequences.

WLAN hardware can be higher than the cost of traditional wired LAN hardware while the initial required for, overall installation expenses and life-cycle costs can be significantly lower. The long-term cost benefits are greatest in dynamic environments requiring frequent moves and changes.	If there are too many people or businesses in the same area have WLAN, then the band of air that they transmit signals on can become overloaded. Problems with signal interference are already happening and there are no doubts that the airwaves will become overloaded (Dunne, 2001).
Trade show and branch office workers minimize setup requirements with central database thereby increasing productivity.	The WLAN is significantly worse than wired in the risk of jamming, potential for interference, and in the detection of RF signal.
WLAN mobility, i.e., student attending class on a campus accesses the Internet, accessing information, information exchanges and learning.	The lack of interoperability among WLAN products from different manufacturers. The classic Ethernet 802.11 standard was ignored in developing current WLAN products (Seymour 2000).
The WLAN was clearly better then wired in setup/teardown time and effort.	The WLAN equipment is not capable of sending and receiving data successfully during field exercises in case of heavy fog or dust storm.
Senior executive officers, managers can present their briefings using WLAN without carrying the data files, charts, and any storage equipment.	WLAN is not able to download and upload large-sized data files.
Most WLAN equipment is plug-and-play. This will help in reducing the total cost to include vendor technical installation, equipment redundancy in	Susceptibility too many forms of external interface and the cost of transmitting stations. Furthermore, United States, international authorities and treaties

case of system crash.	strictly regulate most of the bands that can support high-speed communication. The uses of these bands require an expensive license (Burd, 1998).
WLAN technology allows the network to be where the wired connection cannot be.	Interference from friendly network will likely effect WLAN operation as the popularity of this industry increases.

Table 2.1 Advantage and disadvantages of Wireless LAN

2.6 The Methodology

There are several methodologies often used in the wireless network and security nowadays. The famous design in networking scope is the OSI model

2.6.1 The OSI Model

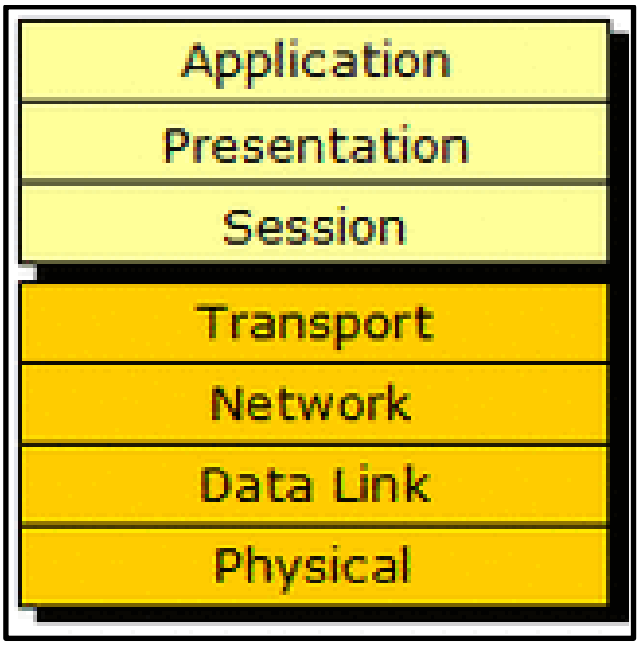

Figure 2.4 OSI Model - Upper and Lower Layers

Bradley Mitchell

The Open Systems Interconnection (OSI) reference model has been an essential element of computer network design since its ratification in 1984. The OSI is an

abstract model of how network protocols and equipment should communicate and work together (interoperate).

The OSI model is a technology standard maintained by the International Standards Organization (ISO). Although today's technologies do not fully conform to the standard, it remains a useful introduction to the study of network architecture.

The OSI Model Stack

The OSI model divides the complex task of computer-to-computer communications, traditionally called *internetworking*, into a series of stages known as *layers*. Layers in the OSI model are ordered from lowest level to highest. Together, these layers comprise the OSI stack. The stack contains seven layers in two groups:

Upper layers -

7. application
6. presentation
5. session

Lower layers -

4. transport
3. network
2. data link
1. physical

Upper Layers of the OSI Model

OSI designates the application, presentation, and session stages of the stack as the *upper layers*. Generally speaking, software in these layers performs application-specific functions like data formatting, encryption, and connection management.

Examples of upper layer technologies in the OSI model are HTTP, SSL and NFS.

Lower Layers of the OSI Model

The remaining *lower layers* of the OSI model provide more primitive network-specific functions like routing, addressing, and flow control. Examples of lower layer technologies in the OSI model are TCP, IP, and Ethernet.

Benefits of the OSI Model

By separating the network communications into logical smaller pieces, the OSI model simplifies how network protocols are designed. The OSI model was designed to ensure different types of equipment (such as network adapters, hubs, and routers) would all be compatible even if built by different manufacturers. A product from one network equipment vendor that implements OSI Layer 2 functionality, for example, will be much more likely to interoperate with another vendor's OSI Layer 3 product because both vendors are following the same model.

The OSI model also makes network designs more extensible as new protocols and other network services are generally easier to add to a layered architecture than to a monolithic one.

CHAPTER 3

METHODOLOGY

This chapter briefly discusses about the methodology and the procedures of wireless network analysis, methods and techniques used in implementation of the wireless network system, hardware and software specification of the wireless network system itself.

3.1 Introduction

This section will explain on several analysis of wireless network that widely used nowadays including their advantage and disadvantages. The overall development process for my wireless network system is done by using waterfall methodology model. The justification of the chosen methodology will be discussed in detail in the next section while the stages of the waterfall methodology will be discussed in detail in Section 3.3. Besides that, this chapter depicts all the requirements of the wireless network system.

3.2 The Justification of the Chosen Methodology

The main reason to choose waterfall methodology for wireless network analysis development is because the simple system and it will be easy to understand. Therefore, even it is a simple wireless network analysis system it still requires detailed analysis to make sure the result will be the best medium for anyone to understand and apply what is all about wireless network.

3.3 The Stages of Chosen Methodology

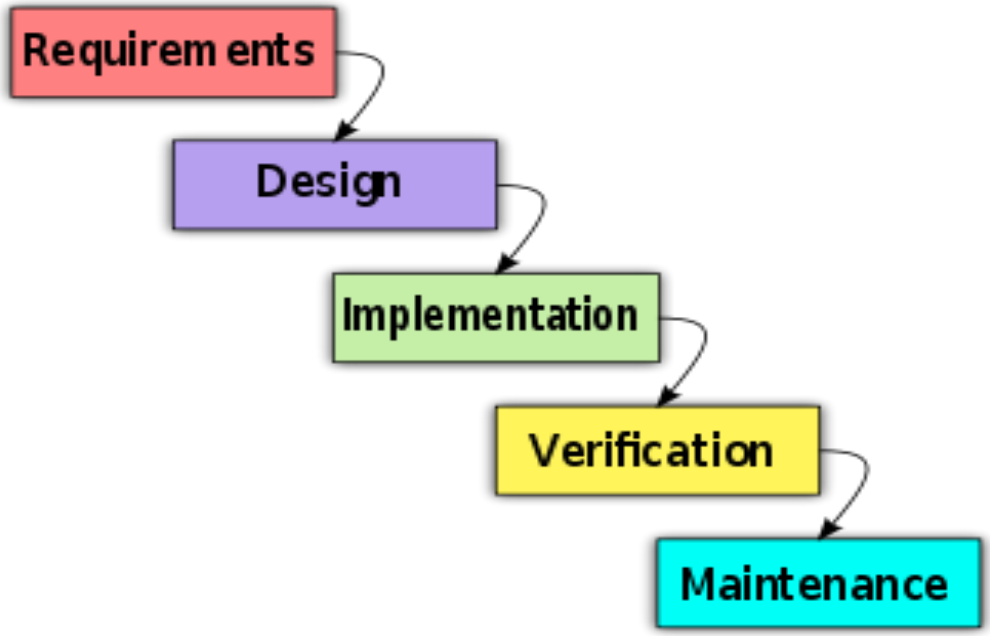

Figure 3.1 – SDLC waterfall model

The chosen methodology is waterfall methodology. The justification of the chosen methodology is discussed in Section 3.2. The development starts at the core of the waterfall and will continue until the client can understand and easily use the network design and topology. During the first interaction, there might be only a paper work or just a sample of old system that has been use before. The increase of the interaction also increases of the complete system. The waterfall methodology contains five main phases:

(i) Customer Requirements
(ii) Design/Planning
(iii) Implementation
(iv) Verification/Validation
(v) Maintenance/Troubleshooting
(vi) Calculating the power of transmission and reception

Customer Requirements is a phase in which the network engineer knows the demand of the customer by communicated between each other. In developing wireless network it is a must to fulfil the customer requirements such as higher data transfer rate and the cable system is organized and well structured.

Design or Planning is the phase to define resource, schedule planning, and collection of related information the wireless network to make sure the correct analysis can be make for the system. Sampling of existing documentation has been done in this phase.

Implementation sis is a critical phase that all of the design and planning being implemented in the wireless network system. The detailed about implementation phase will be discussed in details later.

Verification or validation is the process of checking that a product, service, or system meets specifications and that it fulfils its intended purpose. These are critical components of a quality management system such as ISO 9000. Sometimes preceded with "Independent" (or IV&V) to ensure the verification and validation is performed by a disinterested third party.

Maintenance is the name given to keeping your software up to date with the latest version (in my project case maintenance refer to how the network engineer do the maintenance for the wireless network that under his supervisory) - maintenance includes full releases, interim releases and hotfixes. Usually maintenance contracts is being done annually or twice a year.

3.3.1 Flow Chart

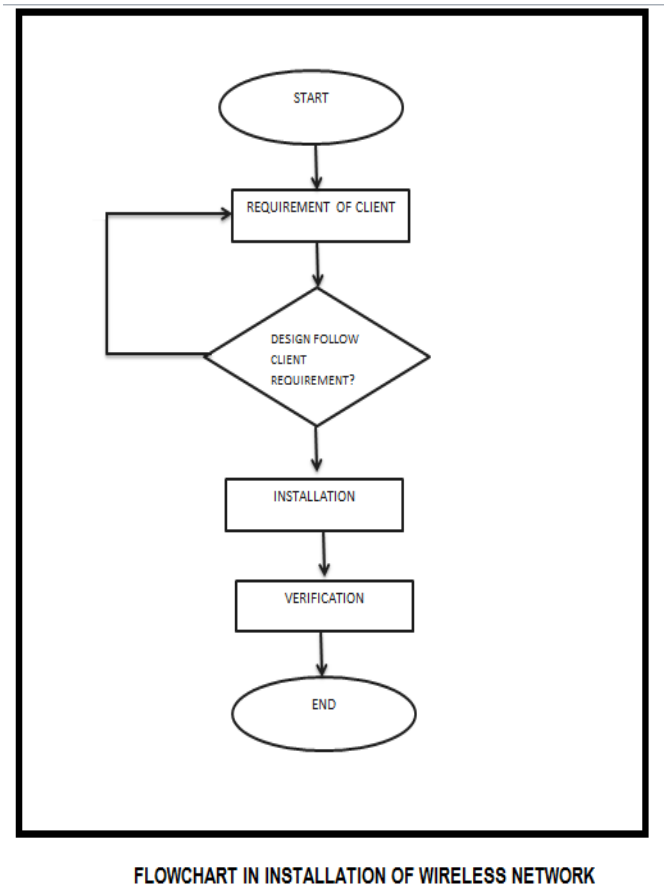

Figure 3.2: Flowchart in installation of wireless network

The figure 3.2 is about the flow chart of the installation of wireless network as I proposed. Firstly The wireless network need a discussion between the network engineer or contractor and the client about type and design of wireless network that the client want. After they agree on a design the installation phase will occur. After all the installation phase is finish it needs to be verified by a networking engineer to make sure the network fulfill the requirements.

3.3.2 Level-0 Diagram

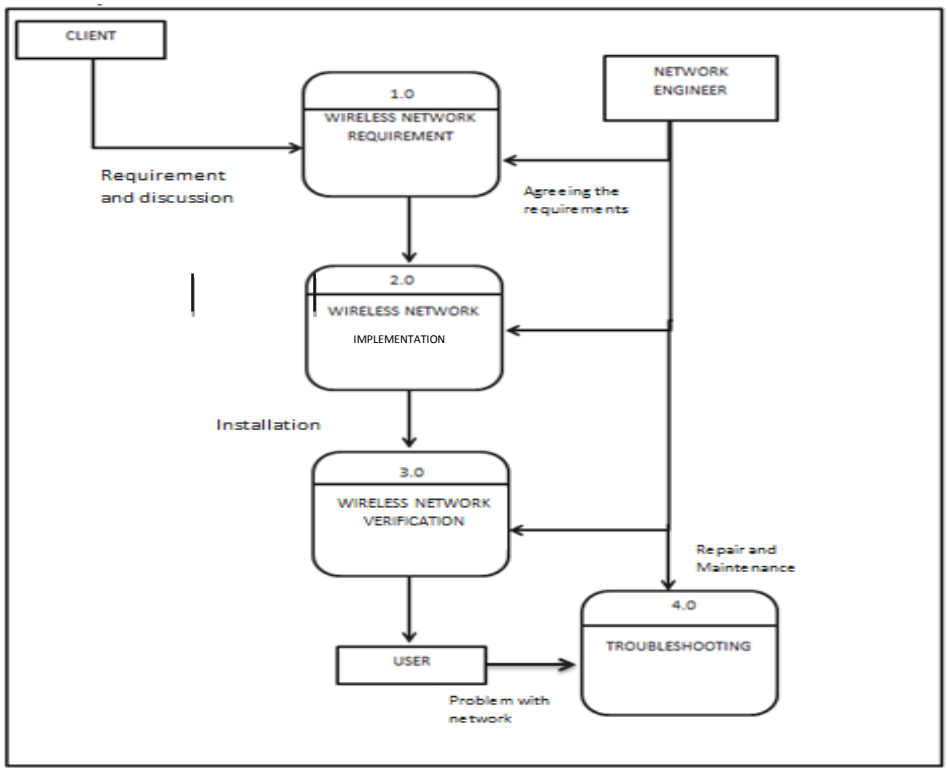

Figure 3.3: level-0 diagram

Based on level-0 diagram shown above, the first entity is the client. The client needs to have a discussion or networking engineer in charge for the requirement of the new wireless network design which the client wants. After booth party agree on the design of the new network the wireless network implementation or also known as installation phase will occur. In this phase there are so many important work and job that need to be done and require high skill to make sure that the network will achieve the three important goals which is Performance, Security and Availability. After all the installation has finish and take place the network must be verified to make sure it can be used and fulfill client requirements which are the 1st step. Then the network is ready to be used by the end user and if there is a problem with the network, it will be a job for the networking engineer to do the troubleshooting and the networking engineer also have a task which he need to do a maintenance for the network at least once in a year.

3.3.3 The Customer Requirements

Prior to planning phase, the customer communication which is communication between customer and networking engineer has been conducted to gather user requirements and to increase developer's comprehension on research area which is what actually the customer want in their wireless network area including performance, security and coverage. Firstly we must know who is customer? What are the customer requirements? And how do we ensure that the requirements can be met?

Who is the Customer?

Customers for an information system are many and varied. They include, of course, those individuals who directly use the system to perform their work tasks. These are the "users," and are normally easy to identify. For example, clerks in the Personnel and Accounting departments are users of a Payroll System. For TQM purposes, all users are customers.

What Are The Customer's Requirements?

This is the area which often presents an insurmountable hurdle to implementing wireless network Systems. Defining customer requirements is usually the most difficult task usually face.

How can the networking engineer be expected to meet customer requirements, first time and every time, when no one, including the customers, knows exactly what these requirements are? They never develop exactly the same system twice. They believe that "Zero Defects" is totally unrealistic.

I once had a sincere Programmer/Analyst tell me: "You never know what the user's requirements are until you get into the testing phase, so the thing to do is code something and see what happens."

Fortunately, wireless network is a system that can be easily modded because it involve more physical devices and it is easy to track the error from server room.

How Do We Ensure That Requirements, Once Known, Can Be Met?

The only method which produces quality information systems on a consistent basis is a "Life Cycle" approach. In our last column we discussed those stable, measurable, repeatable processes which must be in place to ensure quality in systems development and maintenance. Lacking these processes, meeting customer requirements is a pure crap shoot. Sometimes we will win, but more often we will fail. Worse, there is no way to predict what the result will be on our next project.

3.3.4 The Design and Planning

There are phase which is called the design and planning before the implementation phase:

Enterprise Wireless LAN Design

Designing an enterprise class WLAN is not a trivial task. If designed incorrectly the WLAN will have coverage gaps and capacity issues. Outlined below are steps that should be followed when designing an enterprise class WLAN.

Requirements Gathering

One of the biggest mistakes made by IT professionals is to focus on WLAN signal coverage instead of WLAN capacity. Many WLAN projects start with a wireless site survey without any information about why the WLAN is being deployed.

The first step in any WLAN design should be to sit down with the future users/owners of the WLAN and determine where WLAN coverage is needed and what applications will be used. Focusing on WLAN capacity requirements of applications first will usually result in a WLAN design with proper coverage too.

Also, this is a good time to start discussing the security requirements of the organization and any special compliance requirements or integration issues related to wireless LAN security that may need special attention.

Physical Site Survey

Request electronic copy of building drawings and conduct a physical site survey to verify that the information in the drawings is correct. Note any changes not reflected in the drawings, such as new additions or construction material that would significantly attenuate or reflect wireless signals.

Another goal of a physical site survey is to determine the locations where access points should not be installed such as bathrooms, lobby areas, or elevator shafts.

During the physical site survey start thinking about cable paths in relationship to telecom closets and possible mounting locations for access points. Note any special requirements that would impact deployment phase such as high ceilings, outdoor coverage requirements, or historical building regulations.

If allowed, take digital photos of facilities to help with predictive RF WLAN Design step and deployment phase.

3.3.5 The Implementation / Deployment

Today, many businesses are moving beyond wires and deploying a modern wireless network backbone to do much of their network's heavy lifting. In a recent conversation with Carousel's wireless specialist Chris Williams, we discussed the steps that businesses should take to properly plan for the deployment of a robust Wi-Fi network that will meet their mobility needs for years to come.

Step 1 – Define Your Use Case

According to Williams, all business must start with the use case for each facility.

Figure 3.4 – Illustration on data transfer to user

"You need Firstly ask yourself, where is your wireless network at today, what do you need to accomplish to support requirements for this next phase, and most importantly, where will it need to be in the future? It is critical that as you go through this process, you build for future use so as not to be penny wise and pound foolish." Questions you will want to ask and data you will need to collect include:

- What apps are currently running over Wifi?
- Are you planning migrating VoIP and data intensive apps like Video Conferencing to wireless?
- Are you going completely wireless or instituting a hybrid approach?
- What is the density of user population in each area of the floorplan?
- How mobile will your workforce be in the facility? What % will be mobile?
- What types of devices will be supported? Desktops, laptops, tablets, smartphones?
- What is the job function in each area of the facility? (marketing may use more media and large files than accounting for example)
- How many devices need to be supported in each location?
- Do your conference rooms have video capability, where are they located and will they impact other users when in use?
- What apps might you look to have on wireless in 3 years, 5 years?

Step 2 – Match your priorities with the right Manufacturer

Once you have a good feeling for your use case, it is important to bring the right technology to bear. For example, says Williams, “If security is your number one concern, Aruba Networks has a very robust security suite. If your largest priority is coverage area, Meru Networks with their single channel architecture may be the right solution for you.”

There are a vast array of wireless networking options in the marketplace, so be sure to understand which features the technology from each manufacturer supports, what Controller Functionality each supplies and how long they have been around and where they are in the marketplace.

Step 3 – Model Your Deployment

Successfully aligning your use case with the placement of the correct types of Access Points throughout your facility can make the difference between project success and some very unhappy end users. As a rule, most manufactures offer a low density, less expensive Access Point for areas with lower traffic, less population density and less intensive application usage, and more expensive high-density Access Points for higher throughput, stronger signal strength, support of applications like VoIP and Video and greater redundancy/self-healing capability.

Prior to deploying a solution, Carousel strongly recommends that you test your plan to make sure it will support your use case. There are two methods for testing.

A. Active RF Survey. This approach consists of literally bringing Access Points on site and setting them up in the preferred locations. Engineers will come on site, walk around with laptops, RF frequency testing units and floorplans to test and record the radio frequency strength at each location in the building. This is then compared against the use case for insight into whether the network will support all users in all instances.

The benefit of an Active RF Survey is that it is 95% accurate (meaning that you will not need to extend the network after deployment due to unforseen requirements) and provides you with real-world analysis of a deployment at your location. Generally there is a cost for this approach as it requires significant manpower and effort.

B. Predictive Planning Tool Assessment. This is a software based approach in which data such as floor plans, building materials, population density, application usage, video conference facilities, megabytes of throughput per user and a bunch of other variables can be added. The software will then provide a suggested AP deployment schema to ensure your company gets the coverage and throughput it needs.

3.3.6 The Verification

Verification or validation is the process of checking that a product, service, or system meets specifications and that it fulfils its intended purpose. These are critical components of a quality management system such as ISO 9000. Sometimes preceded with "Independent" (or IV&V) to ensure the verification and validation is performed by a disinterested third party. In this case the networking engineer need to make sure the wireless network is ready to use by customer and fulfil the customer requirement.

3.3.7 The Maintenance & Troubleshooting

When you have trouble connecting a wireless client (a desktop, laptop, PDA, or phone) to an office network, these step-by-step debugging tips can help with your wireless network connectivity problems.

Start by rechecking your physical connections -- a common culprit that is often overlooked. Check your wireless router's WAN port link to your cable/DSL modem and LAN port links to Ethernet clients. Make sure that WAN and LAN cables are inserted tightly and the status lights are on at both ends. If not:

- Try swapping Ethernet cables to isolate a damaged cable.
- Check your router's manual to make sure that you're using the right type of cable -- some WAN uplinks require cross-over cables.
- If status lights are still off, connect another device like a laptop to the affected WAN or LAN port. If status changes, to device you just replaced may be failing link auto-negotiation. Check port configurations at both ends and reconfigure as needed to match speed and duplex mode.

3.4 The Software Requirements

OPNET solutions model communications devices, protocols, technologies, and architectures, and simulate their performance in a dynamic virtual network environment. Integrated code debugging and data analysis features facilitate the design process. OPNET Network R&D solutions enable a broad range of academic research including:

- Evaluating and enhancing wireless protocols i.e., WiMAX, WiFi, UMTS, etc.
- Designing MANET routing protocols
- Studying new power management schemes for sensor networks
- Researching new enhancements to core network technologies i.e., IPv6, MPLS, etc.
- Analyzing optical network designs

The Design of network

Sample:

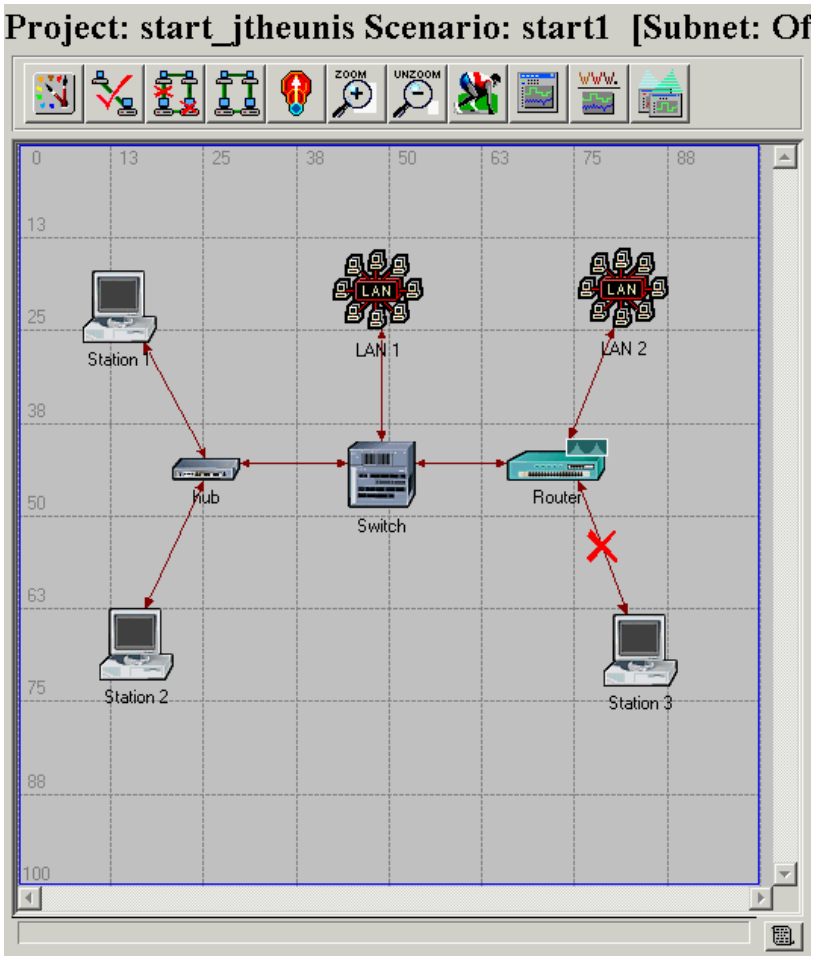

Figure 3.5 – Network design using Opnet ITguru

The Result and Graph for discussion

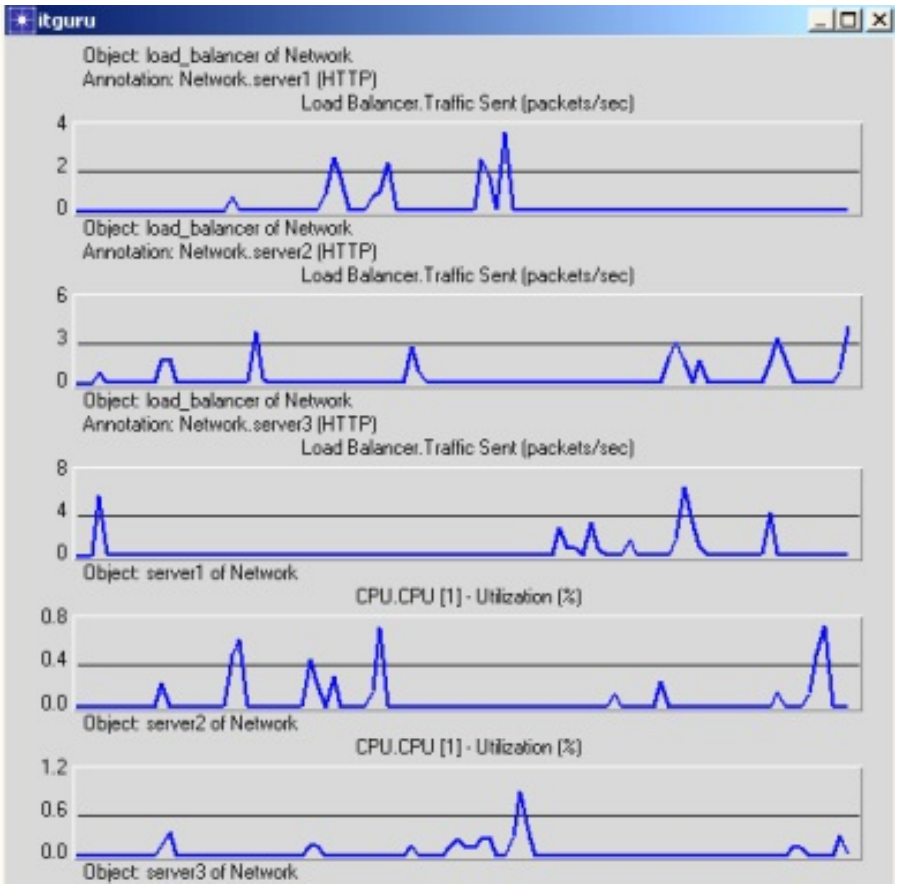

Figure 3.7 – Graph for discussion network design using Opnet ITguru

CHAPTER 4

IMPLEMENTATION

This chapter briefly discusses the results of my proposed project which is the wireless network analysis and design at Teruntum complex. From the previous chapter, it can be seen that Wireless network implementation and analysis is not a big deal for everyone especially for a network engineer but to make it more secure, stable and the performance is always the top is the most difficult task which only several group of people can do. I'm making the analysis on purpose to make people who go through my project will really understand what is wireless network and they even can do troubleshooting on their network by own selves. There is no specified technique during the implementation process rather than we have to know the range, hardware specifications and the type of network which we are set up. Most of the technique is use during securing the wireless network as an example the WPA2, WPA and the WEP key. All of them are the security level of wireless network which most of people use nowadays.

By applying all the required and important thing from the analysis that I've done(refer to previous chapter) readers and evaluators can build a network which are more stable in performance, more secure and more access point without affecting the speed of network.

For my proposed projects which are wireless network analysis, i will use the famous software from Opnet which is ITGURU. This software is widely being used in education for network learning purpose and in UMP it is used in Network Analysis and Design subject.

4.1 INTERFACE DESIGN AND ANALYSIS OF NETWORK EXPLANATION

In this phase the interface design will be explained. In this implementation phase, the current network design in selected area and application will be map using OPNET ITGURU simulation tools. After that, the current network design will be enhance and the simulation will be run again to collect new result.

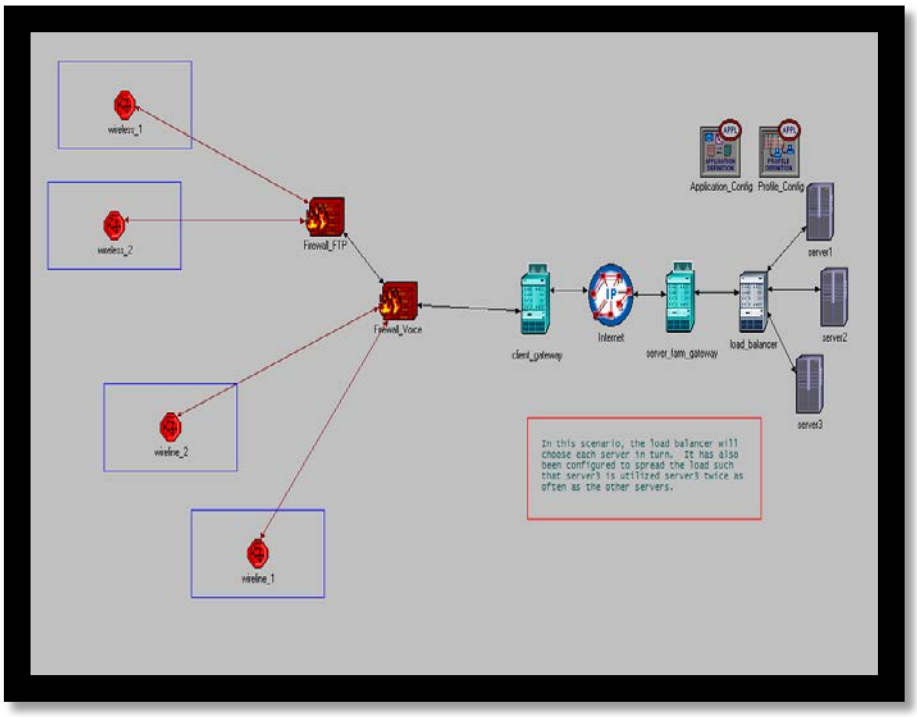

FIGURE 4. 1 Current network of all department in 1st floor Teruntum Complex Design

On figure 4.1 is the interface of my proposed network design for the teruntum complex, Kuantan. I'll use branded server like Cisco to make sure I'll get the

maximum network performance in the network scenario. I'll use the common server in the design.

My design and network analysis for the Teruntum complex has 3 main objectives which are:

- To implement the network design using IT Guru Software and make an analysis towards the network ability and performance including reducing packet loss in transmission data.
- To implement a network that has the ability to recover itself when a network problem occurs.
- To apply security for firewall network in Wireless and wired connection in the network that has been designed for 1st floor of Teruntum complex.

For the first objectives which are to implement the network design using IT Guru Software and make an analysis towards the network ability and performance including reducing packet loss in transmission data. I have chosen to explain the round robin load balancer to make sure there is zero downtime of network and I'll also explain the usage of switch rather than hub in the network to reduce packet loss during data transmission to explain why switch is always a better option in network design.

For the second objective which is to implement a network that has the ability to recover itself when a network problem occurs I'll explain on the usage of recovery failure in network design which is very important to prevent zero downtime of network and show how server reboot to recover itself and start operating in managing the network.

For the third and last objectives which are to apply security for firewall network in Wireless and wired connection in the network that has been designed for 1st floor of Teruntum complex. I choose to apply firewall for both Wireless and wireline network. For the wireless network I'll blocking the access of ftp connection and

voice connection while the 2nd firewall will only block voice connection from the wire line nodes. All the nodes are prohibited and block from accessing the remote login to the server.

4.1.1 The Floor Plan

I have go to collect a floor plan for the places that I want to make the design and conduct the analysis on network there. From the information that I got from the Teruntum building keeper which is Mr. Daud Bin Kaswi. The complex never had a proper network design before this. The administration there once ask contractor from TM(Telekom Malaysia) to equip the floor with few wireless router and I think that that is not the best and proper way for a building network design. Below is the floor plan that I get :

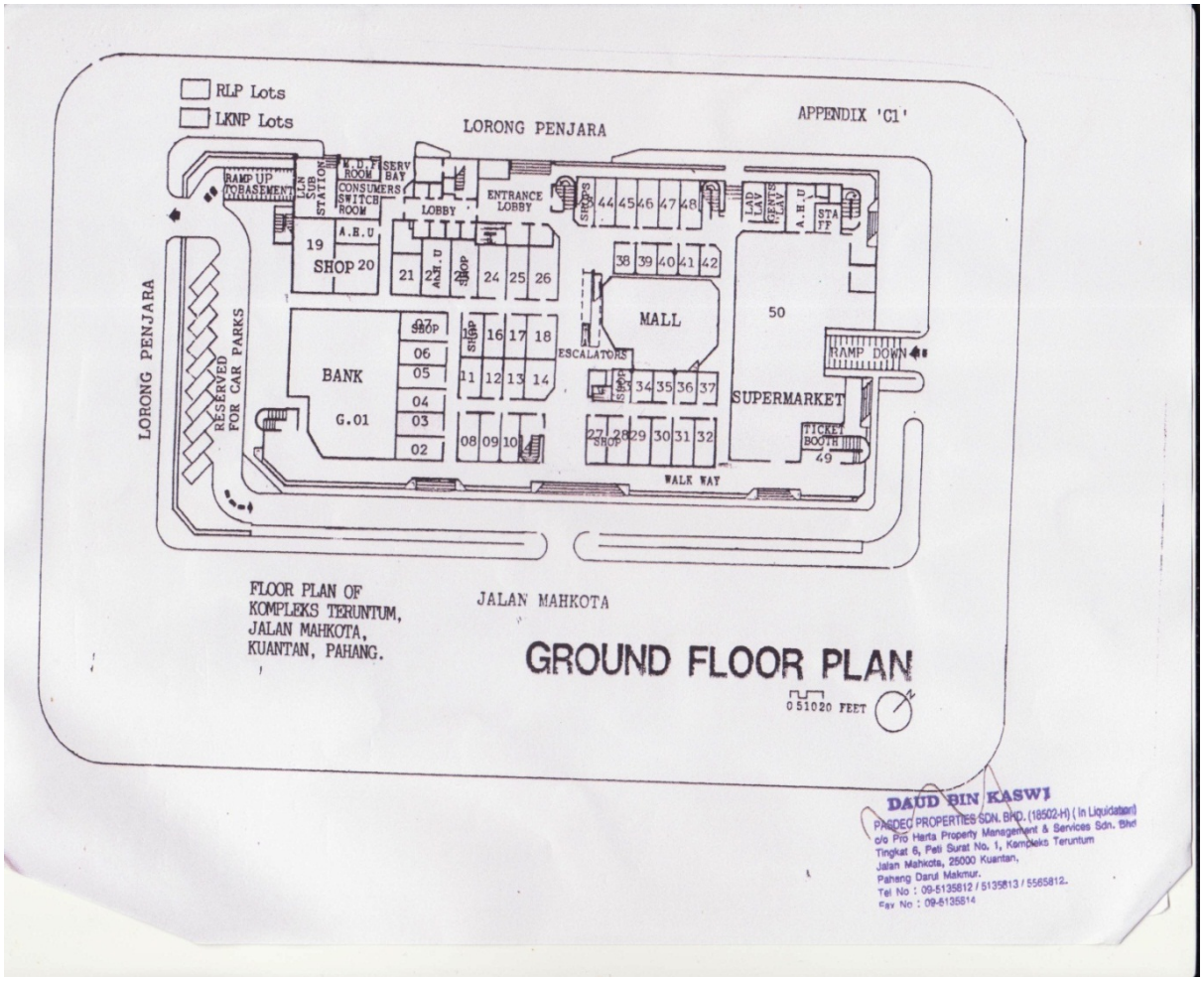

FIGURE 4. 2 FLOOR PLAN OF 1ST FLOOR TERUNTUM COMPLEX

From the floor plan that I get. We can see that there is about 48 premises or shop excluding the Bank that they already have their own internet network which we

know that is private and the Supermarket in Lot 50 which are empty now. So they are only about 48 premises that require the LAN network and I will put about 4 wireless network router and few server to enhanced the network there.

4.1.2 Star Topology Design

I would prefer to choose the star topology design for my design in this project because in Star topology, all the components of network are connected to the central device called “hub” which may be a hub, a router or a switch. Unlike *Bus topology* , where nodes were connected to central cable, here all the workstations are connected to central device with a point-to-point connection. So it can be said that every computer is indirectly connected to every other node by the help of “hub”.

All the data on the star topology passes through the central device before reaching the intended destination. Hub acts as a junction to connect different nodes present in Star Network, and at the same time it manages and controls whole of the network. Depending on which central device is used, “hub” can act as repeater or signal booster. Central device can also communicate with other hubs of different network. Unshielded Twisted Pair (UTP) Ethernet cable is used to connect workstations to central node.

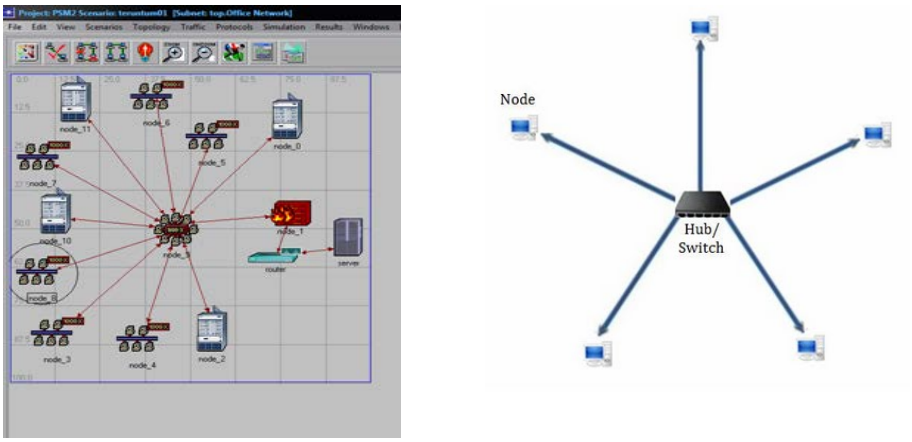

FIGURE 4. 3 Star topology Example

Advantages of Star Topology

1) As compared to Bus topology it gives far much better performance, signals don't necessarily get transmitted to all the workstations. A sent signal reaches the intended destination after passing through no more than 3-4 devices and 2-3 links. Performance of the network is dependent on the capacity of central hub.
2) Easy to connect new nodes or devices. In star topology new nodes can be added easily without affecting rest of the network. Similarly components can also be removed easily.
3) Centralized management. It helps in monitoring the network.
4) Failure of one node or link doesn't affect the rest of network. At the same time its easy to detect the failure and troubleshoot it.

Disadvantages of Star Topology

1) Too much dependency on central device has its own drawbacks. If it fails whole network goes down.

2) The use of hub, a router or a switch as central device increases the overall cost of the network.

3) Performance and as well number of nodes which can be added in such topology is depended on capacity of central device.

4.2 The Implementation

4.2.1 Load Balancer Test for Server

1) No Load Balancer Configuration is applied

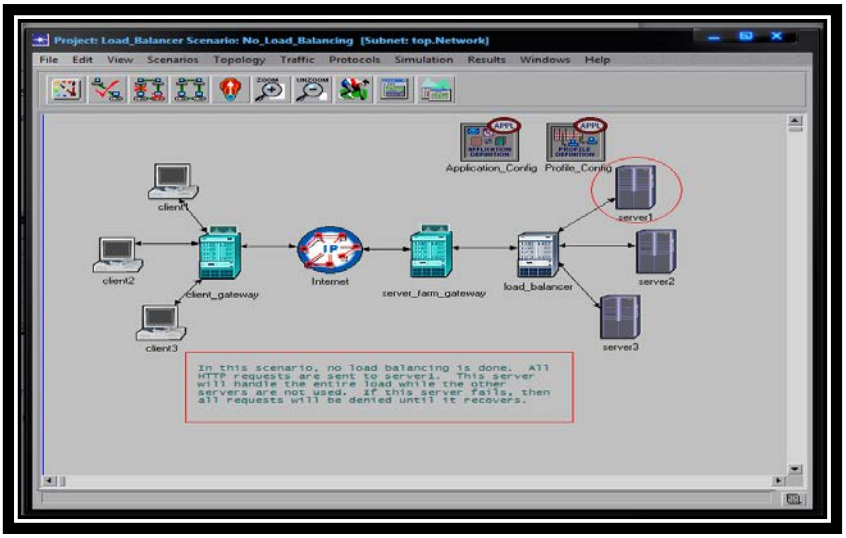

FIGURE 4. 4 No Load Balancer

In figure 4.4 there is no load balancer applied in the network design. All HTTP requests are sent directly to server 1. This server will handle the entire load while the other servers are not used. If this server fails, then all requests will be denied until it recovers.

2) Random load balancer

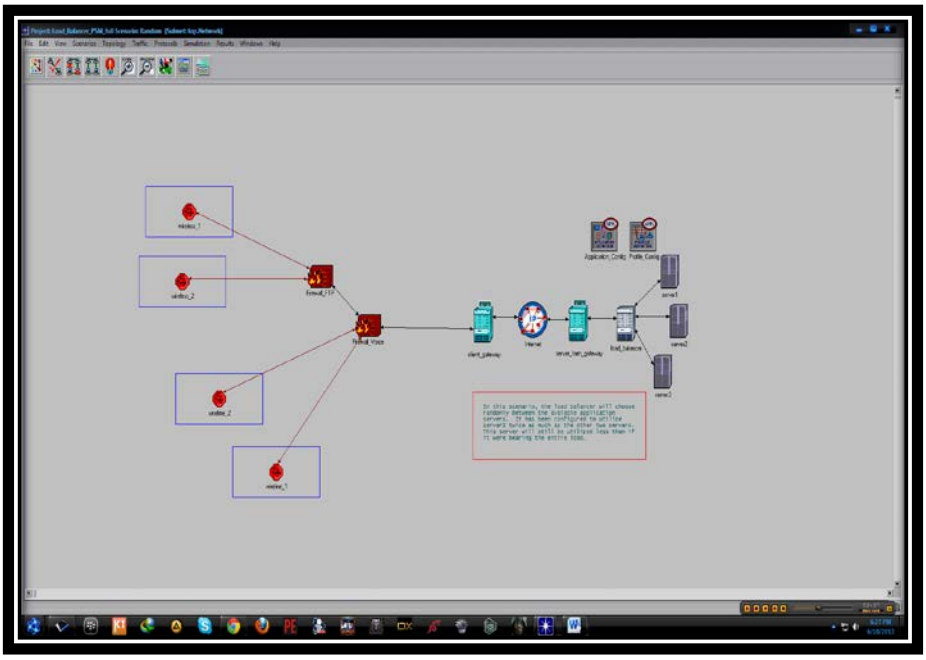

FIGURE 4. 5 Random Load Balancer

In figure 4.5 is the scenario of random load balancer, the load balancer will choose randomly between the avaiable application servers. It has been configured to utilize server3 twice as much as the other two servers. This server will still be utilized less than if it were bearing the entire load.

3) The Round Robin Load Balancer (Recommended)

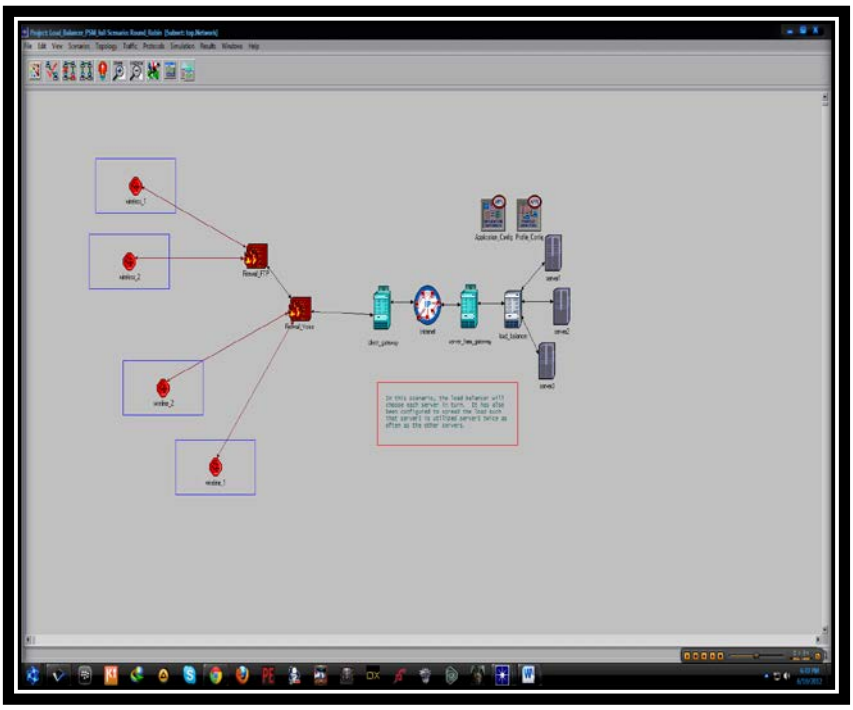

FIGURE 4. 6 Round Robin Load Balancer

In this scenario, the load balancer will choose each server in turn. It has also been configured to spread the load such that server3 is utilized server3 twice as often as the other servers.

4.2.2 Security / Firewall for LAN & WLAN

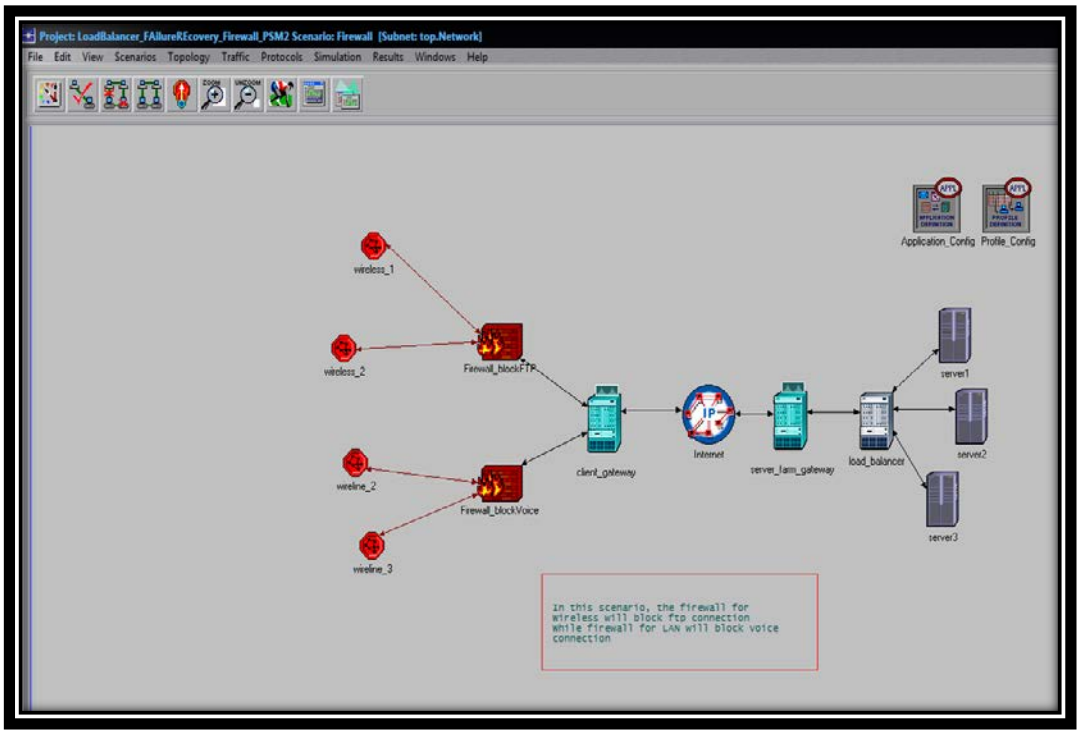

FIGURE 4. 7 Lan & Wlan Firewall

In figure 4.7 is the scenario of firewall that being applied in the network, the firewall will block ftp connection and voice connection while the 2nd firewall will only block voice connection from the wire line nodes. All the nodes is prohibited and block from accessing the remote login to the server.

4.2.3 Recovery Failure Test in the server

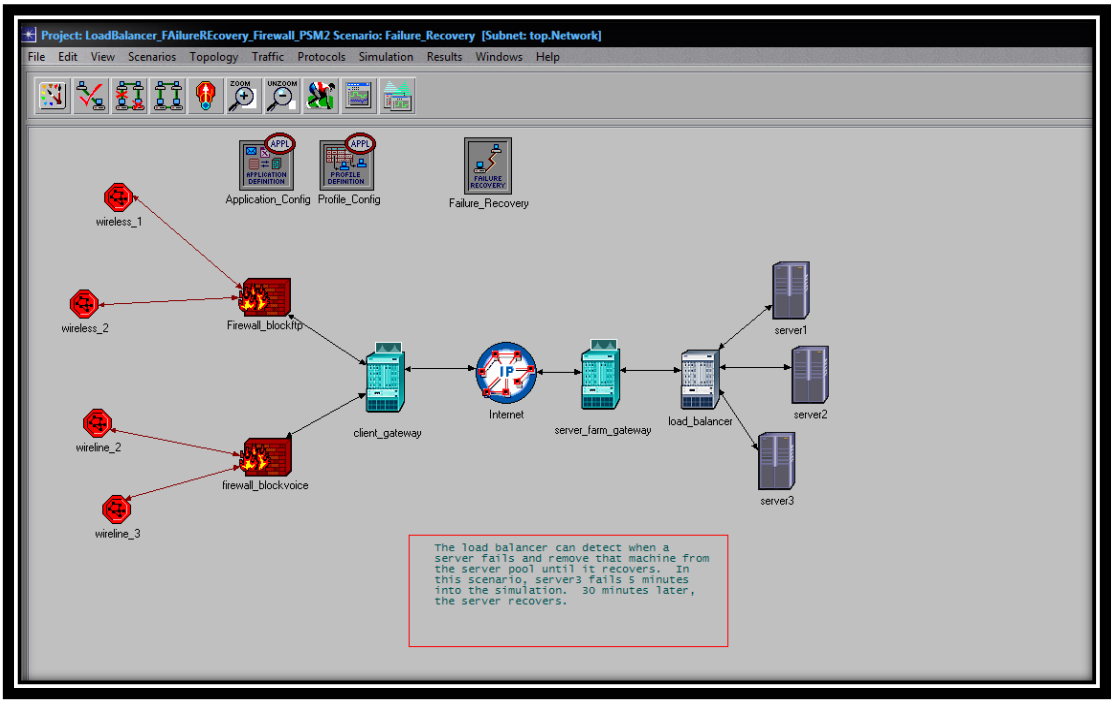

FIGURE 4. 8 Recovery Failure

In figure 4.8 is the scenario of recovery failure of the network. The load balancer can detect when a server fails and remove that machine from the server pool until it recovers. In this scenario, server3 fails 15 minutes into the simulation. 30 minutes later, the server recovers. Then in the 30 minutes after server 3 fails. Servers 1 also fail. Then server 1 is restart in 30 minutes to recover it back in order to make it work as usual.

4.4 Comparison between current and the proposed network.

There is no current network design in Teruntum complex so the one which is proposed is the one which is being referred. Even my proposed is the only one which need to be refer there is the benchmark or level that has been set by the client which is stated in the client requirements.

The proposed design will use branded device from Cisco and Microsoft to make sure we'll get the maximum performance on the network there. Other than that the network also use the leased line to increase the network performance. The proposed network is also connecting the server using server farm and 3 different servers to make sure the performance are improved.

4.4.1 The proposed network used Cisco Router and Switch

The cisco router and switch has many features and benefits. The router has a high performance processor. The high performance processor supports concurrent deployment of high performance, secure data service with headroom for future applications. The cisco switch meanwhile uses industrial grade components, a compact form factor, convection cooling and relay output signaling to extend intelligent services such as enhances security , high availability and advanced quality of service (QOS) to areas that cannot beserved by traditional commercial grade Ethernet switches.

4.4.2 The used of leased line

A leased line is a permanent, always on connection between two locations. It is a dedicated, private line and only carries communications and traffic from your company, resulting in a guaranteed level of service. The line can be used for data, video and voice and is most effective when sharing bandwidth hungry applications between different offices. High speed connections up to 1Gig are available. Leased line require that a fixed line be connected to the building. It is an annual rental fee only and has no connection or any other additional connectivity charges for the use of the service. Leased line has the ability to connect separate offices and the buildings so that they can share data and connections. This in turn allows for better productivity and effectiveness of staff and student.

4.5 Conclusion

As the conclusion the entire network is a complete process of this analysis of network design and its utilization performance. This simulation implementation is been done to analyze the network performance and suggest the best network proposal that could be done to support the total user and fulfill the client requirement.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Introductions

In this chapter, it is describe on the output from the testing result based on the graph that are simulated in the OPNET ITGURU modeler simulation tools of the proposed network. The preparations of this project are taking a few times to fully complete all the proposed the network design and analysis.

To achieve the research objectives, there are main thing that must have been completed in the network design and analysis to make sure the network is in its best for the performance and utilization.

5.2 Result Analysis

This project has met all the objectives of this project, which are:

- To implement the network design using IT Guru Software and make an analysis towards the network ability
    - This project has use the Opnet it guru modeler software to make all the analysis required in completing the analysis of the proposed network including the load balancer to increase performance and utilization of network.
- To implement a network that has the ability to recover itself when a network problem occurs.
    - The proposed network has the ability to recover which is reboot when it fail or tend to face any problem.
- To apply security for firewall network in Wireless and wired connection in the network that has been designed for 1st floor of Teruntum complex

- The proposed network has its own firewall to make sure the network is being protected 24/7 from unauthorized user.

5.2.1 The simulation sequence graph.

This is the achievement of the objective. The simulation sequence graph is run when its starts the simulation. Then the new window will excises with the progress of the simulation. The computer will beep when the simulation is finished in the computer. The time use for each simulation is different depends on the complexity of network model and the amount of the traffic that are analyzed and the of cause the speed of the computer itself. This is the simulation sequence graph :

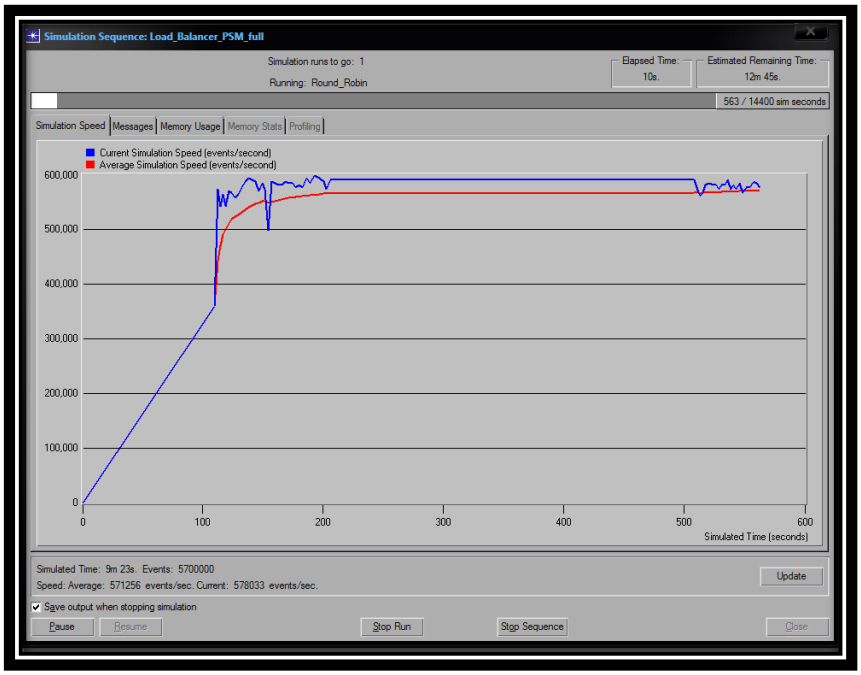

FIGURE 5. 1 Graph of the simulation sequence for each test on the network analysis.

This is how to speed up the simulation for each test in the analysis which are the load balancer, firewall and recovery failure test on the network. All simulation are performed as the graph shown in figure 5.1

5.2.2 Load Balancer

The results: No load Balancer applied

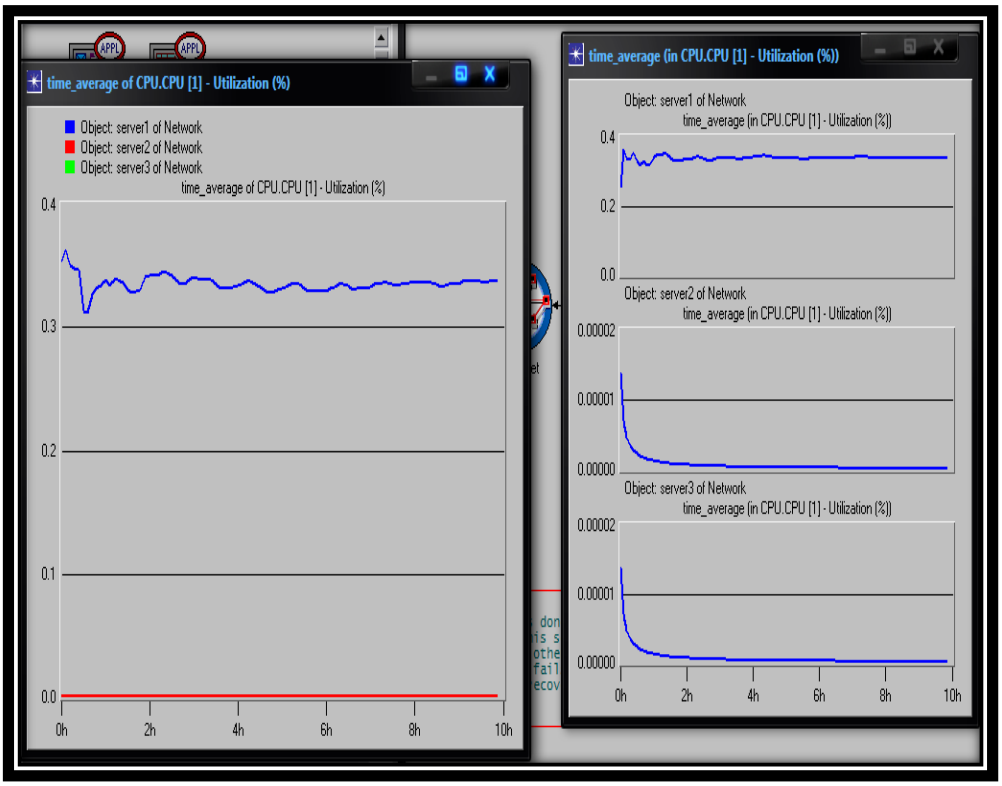

FIGURE 5. 2 No Load balancer

In this scenario, no load balancing is done. All HTTP requests are sent to server1. This server will handle the entire load while the other servers are not used. If this server fails, then all requests will be denied until it recovers.

In figure 5.2 there is no load balancer applied thus we can see the graph only has response of object server in server 1. There is no any interaction in server 2 or 3 in the graph.

The results: Random Load Balancer

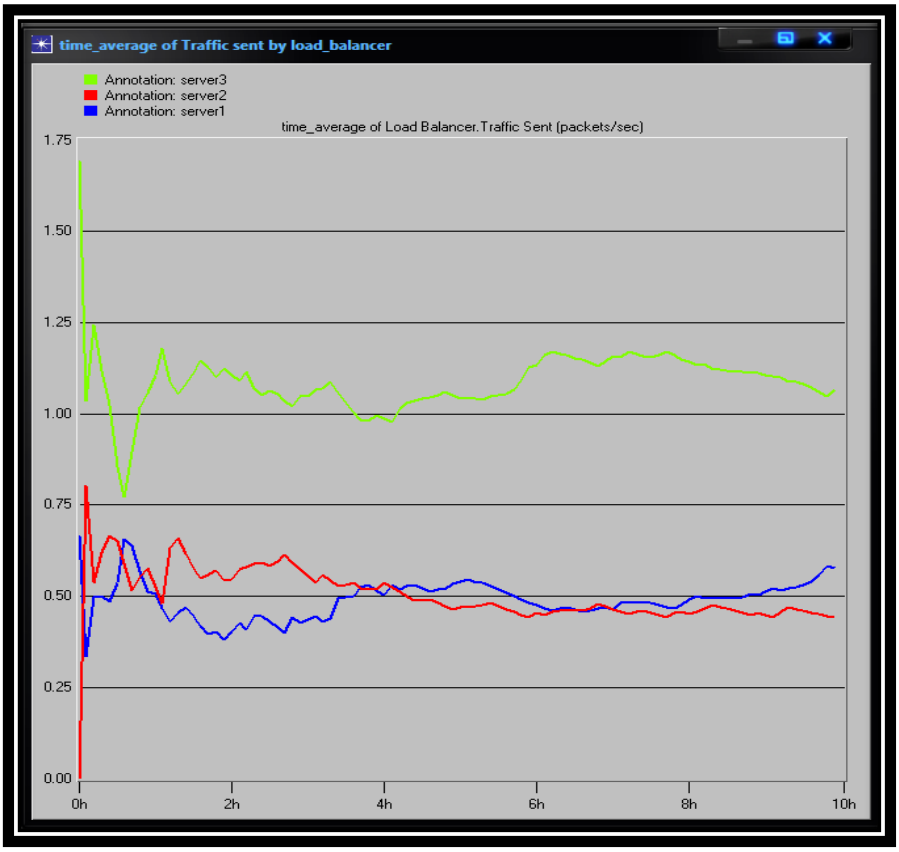

FIGURE 5. 3 Random Load Balancer

In this scenario, the load balancer will choose randomly between the available application servers. It has been configured to utilize server 3 twice as much as the other two servers. This server will still be utilized less than if it were bearing the entire load.

From the graph 5.3 we can see that the data is randomly distributed across the 3 server. The data transmitted also not stable especially in server 1 and server 2. This is because it is randomly distributed by the server.

The results: Round Robin Load Balancer

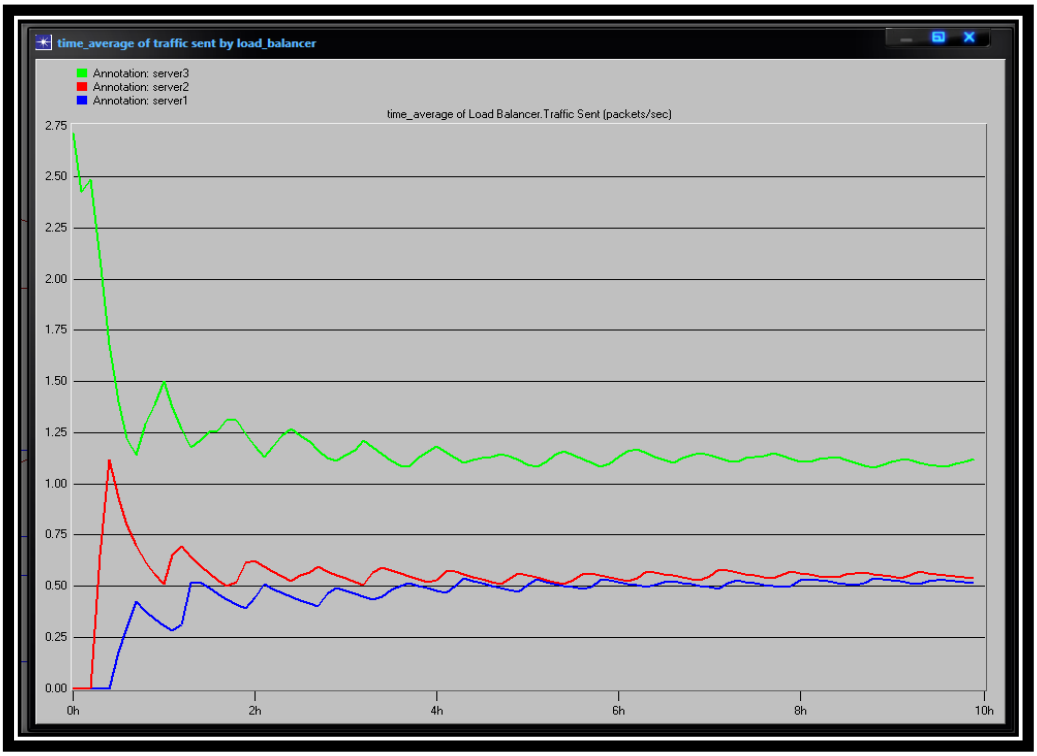

FIGURE 5. 4 Round Robin Load Balancer

In this scenario, the load balancer will choose each server in turn. It has also been configured to spread the load such that server3 is utilized server3 twice as often as the other servers.

Round Robin Load balancing allows you to distribute client requests across multiple servers. Load balancers improve server fault tolerance and end-user response time. Load balancing distributes client requests across multiple servers to optimize resource utilization. In a scenario with a limited number of servers providing service to a large number of clients, a server can become overloaded and degrade server performance. Load balancing is used to prevent bottlenecks by forwarding the client requests to the servers best suited to handle them. Thus, balancing the load.

In a load balancing setup, the load balancers are logically located between the client and the server farm. Load balancing is used to manage traffic flow to the servers in the server farm. The network diagram shows the topology of a basic load balancing configuration. Load Balancing can be performed on HTTP, HTTP, SSL, FTP, TCP,

SSL_TCP, UDP, SSL_BRIDGE, NNTP, DNS, ANY, SIP-UDP, DNS-TCP, and RTSP.

Load balancing uses a number of algorithms, called load balancing methods, to determine how to distribute the load among the servers. When a load balancer is configured to use the round robin method, it rotates incoming requests around to the managed servers, regardless of the load.

5.2.3 The Firewall

The Results:

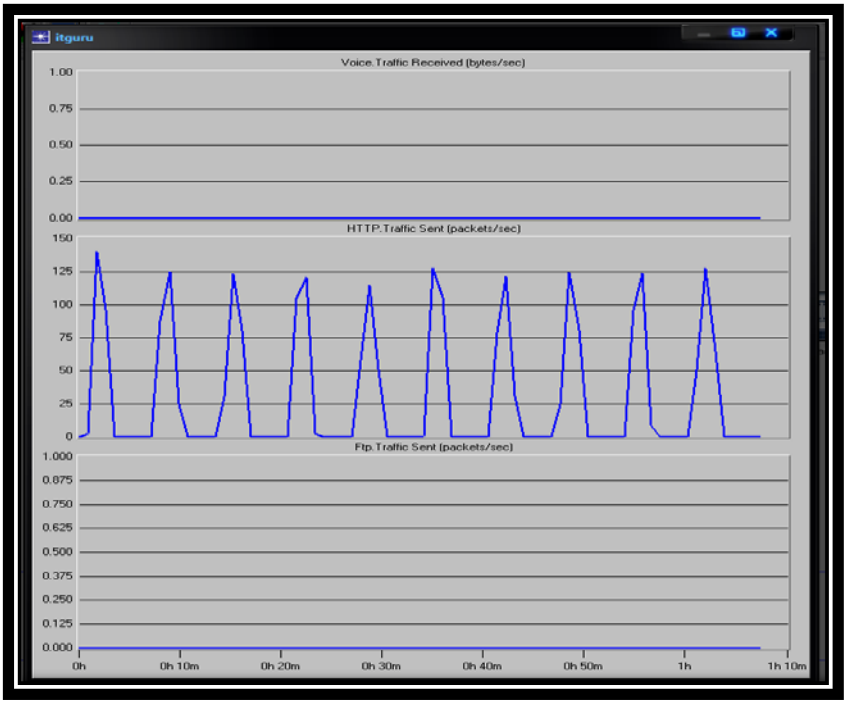

FIGURE 5. 5 Firewall Graph

In this scenario, the firewall will block ftp connection and voice connection while the 2nd firewall will only block voice connection from the wire line nodes. All the nodes is prohibited and block from accessing the remote login to the server. We can see that there is no graph for the voice and FTP in the graph. There is only HTTP connection allowed. This is to ensure there is no overload of usage in network and make it stable for large number of user.

5.2.4 The Recovery Failure

The Results:

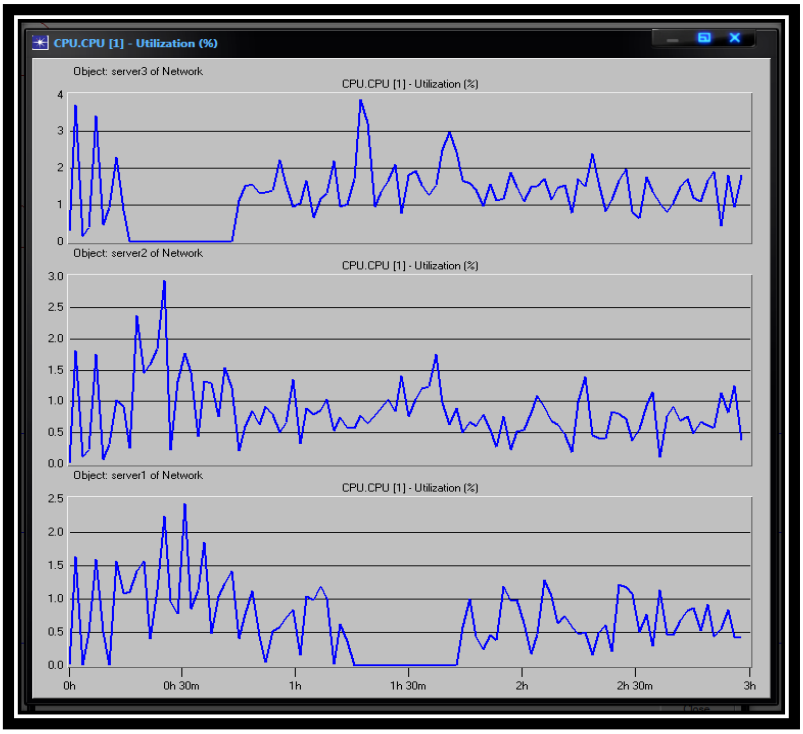

FIGURE 5. 6 Recovery Failure Graph

The load balancer can detect when a server fails and remove that machine from the server pool until it recovers. In this scenario, server3 fails 15 minutes into the simulation. 30 minutes later, the server recovers. Then in the 30 minutes after server 3 fails. Servers 1 also fail. Then server 1 is restart in 30 minutes to recover it back in order to make it work as usual. When a network interface enters the Failed state, the Cluster service triggers the failure of all IP Address resources that use that network interface. When an IP Address resource fails, the Cluster service treats it like the failure of any other resource: All resources that depend on the IP Address resource fail, and the Cluster service uses the failover policy that you have set to determine whether or not to fail over the resource group.

5.3 Constraints

There are several things that were identified as the constraints while developing and finishing this project. The first constraints while developing this project is the time constraint to finish this project. There are lots of things that I need to figure out in finishing this project such as get the valid floor plan for the selected area. Other than that is the physical constraints which is the software being used is OPNET ITGURU academic edition so there is a limit on usage of the software so it's make me difficult in producing graph for the discussion output. Lack of experience and knowledge in using OPNET ITGURU modeler simulation tools also the constraints in this project.

5.4 Conclusion

The analysis of the network performance and utilization in Teruntum Complex are achieved the objective and the aim of the research.

CHAPTER 6

CONCLUSION

6.1 Introduction

The aim of this research is to do some network design and analysis in Teruntum complex and ensure maximum network performance and reduce the obstacle that will slow down the network especially in sending and receiving packet data. The analysis are consist of the newly proposed network design on the selected area which is the 1st floor of the Teruntum Complex.

In this chapter, it will conclude all chapters in details explanation. Each chapter describes the system to develop and the processes in developing the network analysis and design. Each phase in this project are plays its own role so that the project and development will run smoothy.

6.2 Summary of Literature Review

Some research has been done to make an analysis and gather the information in order to develop the best network design as I show in chapter 4 which is my proposed network design which is the best and suits the network. The research are based on journals form the researchers, internet and also form some books. From these resources, the information about developing the network design can be gathered.

6.3 Summary of Methodology

For methodology of this project, the waterfall model form the System Development Life Cycle is chosen. The waterfall model has five phases. Each phase in the model have their own roles for this project so that the project can be developed easily and run smoothly. The design must fulfill its objectives which are being stated earlier and produce a graph as a prove to show the network status using OPNET IT GURU modeler simulation.

6.4 Further Study Recommendations

As a course of action, this research can be more reliable by doing a more systematic. Other than that this research can be a guideline and the OPNET ITGURU simulation modeler can be made to do more type of analysis because it has more functionality and tools. The software analyses the network performance and utilization at he selected location. For example the Teruntum 1st floor, the researcher must do analysis if want to make a network design. And to make sure the design be more accurate the Opnet ITGURU software will make sure the design come with explanation on why and how the device work.

6.5 Lesson Learnt

Time management is really plays a huge role in this project. Besides that, it is having to do research and develop this project. So that, there are other subject for this final year that require a lot of attentions. Assignment and tests of another subjects has become major barrier during finishing this project.

Other barrier in this project is the amount of holiday during development phase of this project. More proper project planning is needed in order to make this project more successful and make more high quality project. Without a good project planning, everything will become a mess. A good project planning and execution ensure the project finish on time and all due date is met.

6.6 Conclusions

As the conclusion, the network design is a must for every building or any size of places that the user is in a large number. This is because it will ensure that the network will achieve the best performance and make sure that user get what they paid for the network in term of stability and performance of the network itself.

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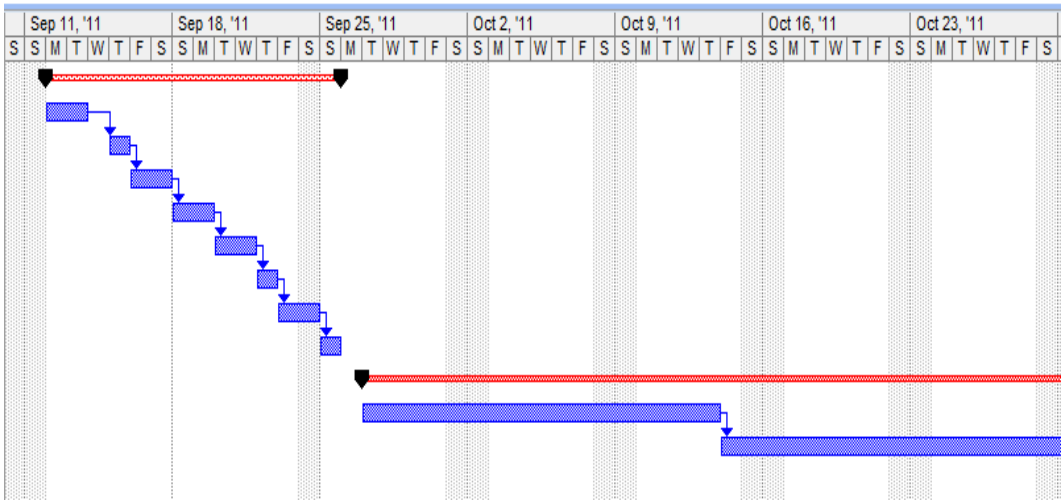
APPENDICES

APPENDIX A

Gant chart PSM I

1		**Project Requirement Planning**	13 days	Mon 9/12/11	Sun 9/25/11	
2		Identify the title of project	2 days	Mon 9/12/11	Tue 9/13/11	
3		Identfy the problem statement of project	1 day	Thu 9/15/11	Thu 9/15/11	2
4		Identify the objective of project	2 days	Fri 9/16/11	Sat 9/17/11	3
5		Identify the scope of project	2 days	Sun 9/18/11	Mon 9/19/11	4
6		Identify task	2 days	Tue 9/20/11	Wed 9/21/11	5
7		Estimate task duration	1 day	Thu 9/22/11	Thu 9/22/11	6
8		Develop analysis flow	1 day	Fri 9/23/11	Sat 9/24/11	7
9		Analysis software and hardware tools	1 day	Sun 9/25/11	Sun 9/25/11	8
10		**User design system**	**60 days**	**Tue 9/27/11**	**Fri 12/16/11**	
11		Chapter 1 : Introduction	13 days	Tue 9/27/11	Thu 10/13/11	
12		Chapter 2: Literature review	26 days	Fri 10/14/11	Fri 11/18/11	11
13		Chapter 3: Methodology	15 days	Sat 11/19/11	Thu 12/8/11	12
14		Chapter 4: Expected Result and Discussion	3 days	Fri 12/9/11	Tue 12/13/11	13
15		Chapter 5: Conclusion	3 days	Wed 12/14/11	Fri 12/16/11	14
16		Submission of draft thesis and PSM report to SV	5 days	Mon 12/26/11	Fri 12/30/11	
17		Submission of overview and log book to coordinat	3 days	Wed 12/28/11	Fri 12/30/11	
18		PSM presentation	5 days	Mon 1/16/12	Fri 1/20/12	
19		Submission of PSM1 report	2 days	Fri 1/20/12	Sun 1/22/12	



APPENDIX B

Gant chart PSM II

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Development Stage**	**74 days**	**Mon 1/2/12**	**Thu 4/12/12**	
2	Define setting	5 days	Mon 1/2/12	Fri 1/6/12	
3	Digitalize interface design	31 days	Mon 1/9/12	Mon 2/20/12	2
4	Design model	29 days	Tue 2/21/12	Fri 3/30/12	3
5	Chapter 4 sbmission	1 day	Fri 3/30/12	Fri 3/30/12	3
6	Technique implementation	10 days	Fri 3/30/12	Thu 4/12/12	3
7	**Testing Stage**	**11 days**	**Fri 4/13/12**	**Fri 4/27/12**	
8	Usability testing	6 days	Fri 4/13/12	Fri 4/20/12	
9	Editing	5 days	Mon 4/23/12	Fri 4/27/12	8
10	**Discussion Stage**	**10 days**	**Mon 4/30/12**	**Fri 5/11/12**	
11	Result analysis	2 days	Mon 4/30/12	Tue 5/1/12	
12	Result discussion	3 days	Wed 5/2/12	Fri 5/4/12	11
13	Future research	4 days	Mon 5/7/12	Thu 5/10/12	12
14	Chapter 5 submission	1 day	Fri 5/11/12	Fri 5/11/12	13
15	**Maintenance Stage**	**4 days**	**Mon 5/14/12**	**Thu 5/17/12**	
16	System touch up	3 days	Mon 5/14/12	Wed 5/16/12	
17	Drafted thesis submission	1 day	Thu 5/17/12	Thu 5/17/12	16
18	**PSM 2 Presentation**	**3 days**	**Wed 5/23/12**	**Fri 5/25/12**	
19	**Final submission**	**4 days**	**Mon 5/28/12**	**Thu 5/31/12**	18