TESIS^ APPROVAL STATUS FORM

JUDUL: ANALYSIS AND DESIGN WIRELESS NETWORK FOR PSC-SHIPREPAIR CDN. BHD

SESI PENGAJIAN: 2005

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(HURUF BESAR)

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Tarikh : 24/11/05

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^ Tesis dimaksudkan sebagai Laporan Projek Sarjana Muda (PSM)

ANALYSIS AND DESIGN WIRELESS NETWORK FOR PSC-SHIPREPAIR SDN.BHD

MOHD SHAHRIL BIN KAMARUDDIN

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

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

DECLARATION

I hereby declare that this project report entitled

ANALYSIS AND DESIGN WIRELESS NETWORK FOR

PSC-SHIPREPAIR SDN.BHD

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

STUDENT : _____ Date : 24/11/05
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SUPERVISOR : _____ Date : 24/11/05
(MR ZULKIFLEE BIN MUSLIM)

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Sincerely,

Mohd. Shahril Kamaruddin.

ABSTRACT

This document describes the requirements for Projek Sarjana Muda 2(PSM) and project description about Analysis and Design Wireless Network for PSC-Shiprepair Sdn.Bhd. The purpose of the PSM 2 is to expose students to actual research environment and to enhance the student knowledge and skills. The PSM 2 is very important to each student to learn how to create a good thesis in the future. The purpose of this thesis is to make an analysis on wireless LAN technology such as environment, equipment, network topology and make comparison between the current wireless network designs and enhance wireless network design using the OPNET Modeler simulation to get the result which design are suitable to be used. Using the OPNET Modeler simulation software we will be get the best solution which design are good to reduce the company monthly payment and improve the productivity of work in PSC-Shiprepair Sdn.Bhd.

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CHAPTER 1

INTRODUCTION

1.1 Project Background

This thesis intends to analyze the wireless technology and design a new wireless network for PSC-Shiprepair Sdn.Bhd. It explains about the wireless technology before further illustrating the new wireless design using OPNET Modeler Simulation. In this project, the states of art for wireless technology will be analyze. In particular, the Legacy Wireless Technology, Wireless Network Requirements and Architecture, and design.

1.2 Problem Statement

PSC-Shiprepair is using wireless network just for access the Internet. To access the company application such as email and database staff must connect to the wired network connection. As Heavy Industry Company usage of wireless technology just for Internet purpose is not practically because not fully used the wireless technology.

The company also facing with increasing payment bills when using streamyx connection to access the Internet. It is because five department of this company are using their own streamyx connection. In other case, some of the staff did not know how to connect to the wired connection after used the wireless network. To solve the simple problem IT technician were called to help them, this is wasting the time and also make the work productivity become low.

1.3 Objective

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

i) To analyze the wireless technology such as design, topology and architecture

The analysis will be done on the wireless technology itself. It will provide easy and simple way of understanding the wireless concept including the architecture and structure based on current design.

ii) To compare the new wireless network design with current design.

To make comparison the wireless network in term of performance such as Response Time. Access Delay and Throughput.

iii) Help the organization to implement the new technology (wireless) to increase the productivity.

1.4 Scopes

The scope of this project is makes an analysis for wireless technology and develop the wireless network design PSC-Shiprepair Sdn. Bhd. This project will only be providing to manufacturing organization. This analysis will be used when the organization want to make the improvement for their network connection.

This project will describe all issues about wireless technology and the wireless networking capability. Example of the issues is standard, coverage and design of wireless networking.

The organization can makes this project as reference to build their wireless networking in the future.

1.5 Expected Output

Even though the project was not done yet, but wireless technology analysis will have some diagrams and design based on the understanding on the functions of the scenario implementation.

The information on analysis will be used for simulation part where setting and configuring are implemented on the prototype for this project.

The diagram for wireless network on the organization will be design and data on system and station review will be collect such as access delay and response time. 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.

CHAPTER II

LITERATURE REVIEW & PROJECT METHODOLOGY

2.1 Introduction

Wireless communications is one of the most active areas of technology development of our time. This development is being driven primarily by the transformation of what has been largely a medium for supporting voice telephony into a medium for supporting other services, such as the transmission of video, images, text, and data. Thus, similar to the developments in wireline capacity in the 1990s, the demand for new wireless capacity is growing at a very rapid pace.

WLAN connectivity enables companies to deliver new services over their networks. For example, instant messaging can be used to communicate and make time-critical business decisions anytime, anywhere. Existing network services can also be used more productively, for instance, IT administrators equipped with laptops are able to provide desktop support to users from any place in the company. A laptop or PDA with WLAN capability can even allow mobile employees to work from public "hot spots" at airports and hotel.

2.2 Fact and Finding

2.2.1 Wireless Local Area Network (WLAN)

LAN stands for local area network, so a wireless LAN is simply a network linking two or more computers without wires (cables). In many offices today, computers communicate with each other and with printers and other devices by sending information along wires. Using newer technology, computers can be linked by the same method as your cordless telephone operates in your home - by transmitting the signal through air. Just as your cordless telephone frees you to make a phone call from anywhere in your home, the wireless LAN permits workers to use their computers anywhere in the network area, such as an office building or corporate campus. As with the wired network, the computer can access information stored in other computers in the office. Some wireless networks are designed to cover a broader area and are called wide area networks or WANS.

WLAN configurations vary from simple, independent, peer-to-peer connections between a set of PCs, to more complex, intra-building infrastructure networks. There are also point-to-point and point-to-multipoint wireless solutions. A point-to-point solution is used to bridge between two local area networks, and to provide an alternative to cable between two geographically distant locations (up to 30 miles). Point-to-multi-point solutions connect several, separate locations to one single location or building. Both point-to-point and point-to-multipoint can be based on the 802.11b standard or on more costly infrared-based solutions that can provide throughput rates up to 622 Mbps (OC-12 speed). (wireless.utk.edu)

In 1997, when the Institute of Electrical and Electronics Engineers (IEEE) created the first WLAN standard they called it 802.11. Because it could only support a maximum bandwidth of 2Mbps - far too slow for most of today's applications - ordinary 802.11 wireless products are no longer being manufactured. The next wireless incarnation was 802.11b, which supports bandwidths of up to

11Mbps, followed by the creation of 802.11g, which supports bandwidth up to 125 Mbps and signals in a regulated 5 GHz range.Synopsis of the three primary 802.11 standards:

802.11b - This technology supports bandwidth up to 11MBps, which is comparable to the speeds of traditional Ethernets. 802.11b uses the same 2.4GHz radio signaling as the original 802.11 standard. Because it is an unregulated frequency, 802.11b devices run the risk of incurring interference from appliances that use the same 2.4 GHz range, such as microwaves and cordless phones. However, if you install 802.11b devices out of range of other appliances, you can avoid the interference. Some manufacturers prefer using unregulated frequencies, such as 802.11b to lower their production costs. On the negative side, 802.11b is relatively slow and supports fewer simultaneous users.

802.11a (not recommended for most wireless users) - IEEE created 802.11a at the same time it made 802.11b. 802.11a supports bandwidth up to 54 Mbps and signals in a regulated 5 GHz range. This higher frequency limits the range of 802.11a in comparison to 802.11b, and due to its higher cost it's used primarily in the business sector rather than in homes. 802.11a's higher frequency also causes its signals to have difficulty penetrating walls and other obstructions. Because they utilize different frequencies, 802.11a and 802.11b devices are incompatible with each other.

802.11g - This technology supports of up to 125 Mbps, uses the 2.4 GHz frequency and is backwards compatible with 802.11b devices. 802.11g supports more simultaneous users, offers the best signal range and is not easily obstructed. The disadvantages of 802.11g is higher cost and possible interference with appliances on the unregulated signal frequency.

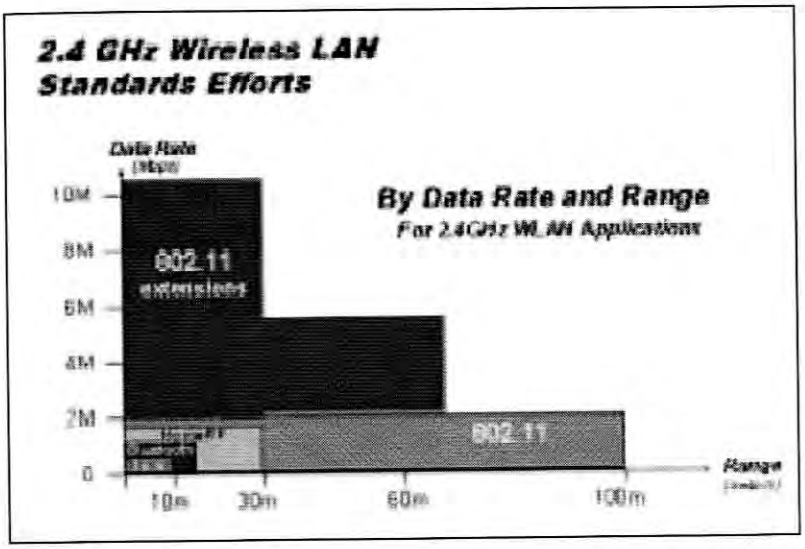

Figure 2.0:- 2.4 Ghz Wireless LAN Standards (new IEEE 802.11 tandard for 2.4Ghz wireless LANS)

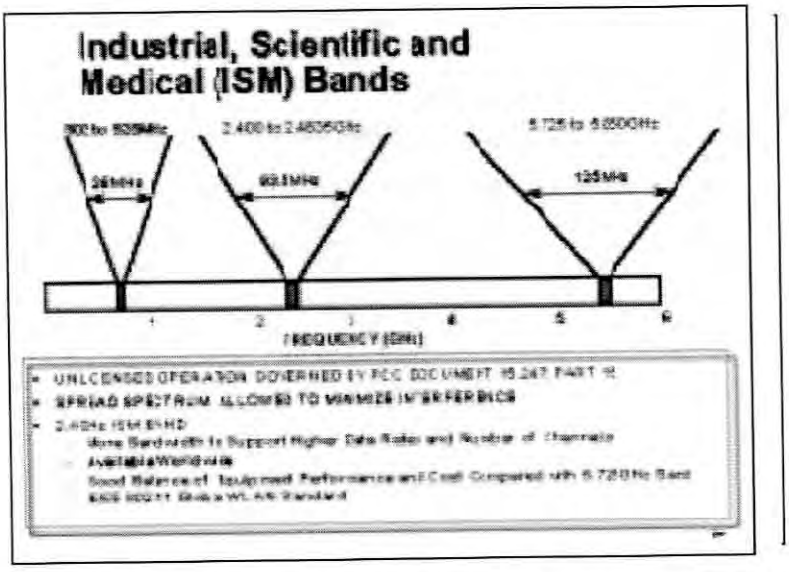

Figure 2.1:- ISM bands (new IEEE 802.11 standard for 2.4Ghz wireless LANS)

2.2.2 WIRELESS LAN ARCHITECTURE

The architecture of a network defines the protocols and components necessary to satisfy application requirements. One popular standard for illustrating the architecture is the seven-layer Open System Interconnect (OSI) Reference Model, developed by the International Standards Organization (ISO). OSI specifies a complete set of network functions, grouped into layers, which reside within each network component. The OSI Reference Model is also a handy model for representing the various standards and interoperability of a wireless network.(Jim Geier.2004)

2.2.3 IEEE 802.11 Wireless Standard

The IEEE 802.11 specifications are wireless standards that specify an "over-the-air" interface between a wireless client and a base station or access point, as well as among wireless clients. The 802.11 standards can be compared to the IEEE 802.3™ standard for Ethernet for wired LANs. The IEEE 802.11 specifications address both the Physical (PHY) and Media Access Control (MAC) layers and are tailored to resolve compatibility issues between manufacturers of Wireless LAN equipment.

(standards.ieee.org)

MAC Layer	**Management**
Physical Layer Convergence Procedure (PLCP)	

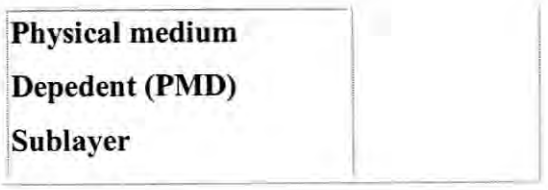

Figure 2.2:- IEEE 802.11 Architecture

2.2.4 Physical Layer

The physical layer provides for the transmission of bits through a communication channel by defining electrical, mechanical, and procedural specifications(N.T Charles,Jr, 2002).

Modulation, which is Physical layer function, is a process in which the radio transceiver prepares the digital signal within the network interface card (NIC) for transmission over the airwaves. *Spread spectrum* "spreads" a signal power over a wider band of frequencies, sacrificing bandwidth in order to gain signal-to-noise performance.

This contradicts the desire to conserve frequency bandwidth, but the spreading process makes the data signal much less susceptible to electrical noise than conventional radio modulation techniques. Other transmission and electrical noise, typically narrow in bandwidth, will interface with only a small portion of the spread spectrum signal, resulting in much less interference and fewer errors when the receiver demodulates the signal.

2.2.5 MAC Layer

Medium access control, which is Data Link layer function in a radio-based wireless LAN, enables multiple appliances to share a common transmission medium via a carrier sense protocol similar to Ethernet (N.T Charles,Jr, 2002). This

protocol enables a group of wireless computers to share the same frequency and space. A wireless LAN MAC provides reliable delivery of data over somewhat error-prone wireless media.

Wireless networks handle error control by having each station check incoming data for altered bits. If the destination station does not detect errors, it sends an acknowledgement back to the source station. If the station detects errors, the data link protocol ensures that the source station resends the packet.

Because of propagation delays, it is possible for two wireless stations to sense that the medium is not busy, and both begin transmitting. This is similar to two people starting to talk at the same time. In that case, each person will generally stop talking, wait, and than start talking again with hopes of avoiding another collision. Wireless LANs follow a similar process for mediating transmission collisions.

2.2.6 Wireless LAN Connection

2.2.6.1 Radio Frequency Based Connections

The architecture of a radio frequency LAN can be simple or complex. The simplest is two PCs equipped with wireless adapter cards that can set up an independent network whenever they are within range of one another. This type of network is called a peer-to-peer or ad hoc network and is defined in the IEEE 802.11 standard. One of the advantages of this type of network is that is requires no administration or pre-configuration. In this configuration the client would only have access to the resources of the other client and not those of a central server. Each station must observe some form of etiquette so that all stations have fair access to the wireless media .(B. Neran, D. Steve,1998).

Figure 2.3:- Wireless Peer-to-Peer Network

This network is very simple and is limited to a very short range. Installing an access point can extend the range of an ad hoc network, effectively doubling the range at which the devices can communicate. An access point is connected to the wired network and each client has access to server resources as well as to other clients. The coverage area depends upon the strength of the propagated radio signal and the type and construction of walls, partitions and other physical characteristics of the indoor environment. Access points have a finite range, on the order of 500 feet indoor and 1000 feet outdoors. A single access point can handle 15-20 client devices.

Figure 2.4: - Clients and Access Points

In a very large facility or campus, it may be necessary to install more than one access point. In order to determine where to position access points, a site survey needs to be performed. The goal is to blanket the coverage cells so that client might move throughout the area without every losing network contact. The site should not have "dead spots" where the radio frequency is not present. Clients can move seamlessly among a cluster of access points, which is called roaming. Access points hand off the client of from one to another in a way that is invisible to the client,

ensuring unbroken connectivity. Stations inside the coverage area automatically choose to associate with the access point that provides the best reception.

Figure 2.5: - Multiple Access Points and Roaming

In order to expand the topology of the network, a designer might choose to use extension points to augment the network of access points. Extension points look and function like access points, but they are not tethered to the wired network, as are access points. Extension points extend the range of the network by relaying signals from a client to an access point or another extension point. Extension points may be strung together in order to pass along messaging from an access points to far-flung clients.

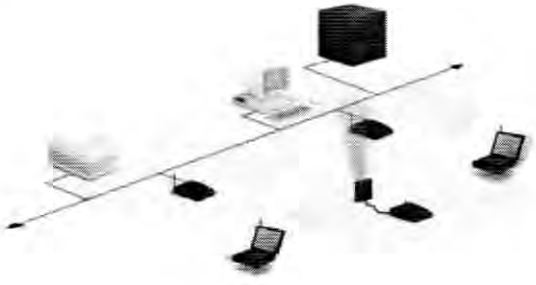

Figure 2.6: - Extension Point

One additional component can be used to expand a wireless network. If you want to connect two wireless building LANs you can install a directional antenna on each building, each antenna targeting the other. The antenna on A is connected to your wired network via an access point. The antenna on B is similarly connected

to a different access point in that building, which enables wireless LAN connectivity in that facility. The directional antennas provide high transmission rates from building to building. This is achieved by concentrating the radio signal from one antenna to the other antenna.

Figure 2.7: - Directional Antennas

2.2.6.2 Infrared Connections

One of the advantages of using infrared is that it can not penetrate walls. This makes it easy to build a cell-based network. In an office building, each room may be a cell and there is no interference between two cells. The second advantage of using infrared is the ability to carry high bandwidth. A disadvantage of using infrared is that it is easily obstructed and cannot pass through solid objects. This problem can be fixed by using a point-to-point configuration or a sun-and-moon configuration where the signals are diffused by reflecting them off of some type of surface(B. Neran, D. Steve ,1998).

An infrared link can be configured in different ways, depending on orientation, and beam angle of the transmitter and receiver. Figure 3.8 shows the possible infrared link configurations. The transmitter (T) and receiver (R) can be positioned to transmit in line-of-sight (LOS) such as (a), (c) and (e) in Figure 3.8. In this configuration, the beam can travel directly from the transmitter to the receiver, without reflection. Another method of connecting a transmitter and receiver is by receiving a signal that is reflected by the ceiling or ceiling and walls (diffuse reflection). This is shown in (b), (d) and (f) in Figure 3.8. An office environment

has good reflection properties (40%-90%) due to light colored walls and ceilings, which allow communication to occur even if the infrared beam is not in line of sight.

The directed, line-of-sight configuration is not capable of supporting one-to-many or many-to-one connections. This may be fixed by adjusting the infrared frequencies in the transmitter and receiver. However, it is impractical to adjust transmitter and receiver before transmitting data. This would not be a major drawback in a cell where there are a fixed number of pre-adjusted docking stations incorporating one transmitter and one receiver.

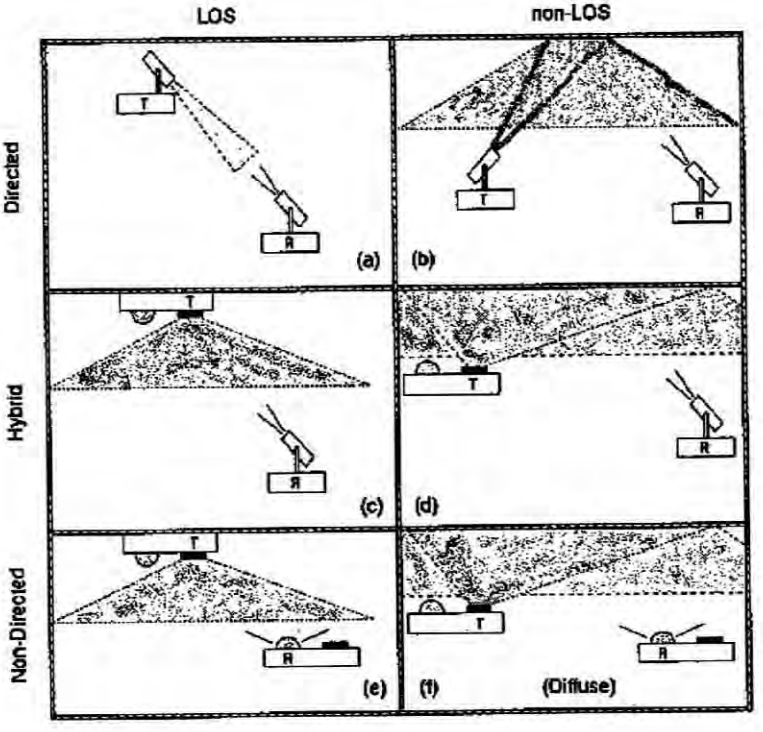

Figure 3.8: - Infrared Optical Links

2.3 Project Methodology

Many types of methodology for development are able in this current environment. Most of the methodologies are used frequently based on the system purpose. The most suitable approach in order to develop this project is the System Development Life Cycle (SDLC) methodology where this SDLC have 5 main components that is Investigation, Analysis, Design, Implementation and Maintenance & review.

At the first stage, there will be studies on requirements analysis and specification. After that, the next stage will be proceed with system analysis and design and followed with design stages. Class implementation stages will be done after the design are finished, and continue with unit testing. On the same time, application implementation will be proceeding. After those stages are finished, the next stages that will be proceed is system testing which in the Maintenance and review.

2.4 Project Requirement

2.4.1 Software Requirement

Software development tools that will be used during the development cycle are Microsoft Visio for design development. OPNET Modeler software are used to simulate the project along the development process.

2.4.2 Hardware Requirement

Hardware tools

- Personal Computer (1 units)
- PSC-Shiprepair Networks Plan

2.4.3 Other Requirements

There are no additional requirements for the first stages. However, during the system flow and development if there is other requirement that maybe needed, it will be recorded and added in the final report.

2.5 Project Schedule and Milestones

Table 1 : Milestones PSMI

No.	Activity	Start Date	Finish Date	Result
1.	• Briefing on the Projek Sarjana Muda. • Find a supervisor.	4.4.2005	4.4.2005	List of students title for PSM and supervisor will be distributes.
2.	• Submit a proposal to the supervisor to be review.	4.4.2005	6.4.2005	Complete Proposal submitted.
3.	• Last check up and submit proposal to AJK.	7.4.2005	8.4.2005	Proposal approved.
4.	• Write chapter one and chapter two with supervisor assessment on project progress.	11.4.2005	22.4.2005	Report for chapter one and two with project flow management report.
5.	• Write chapter three with project developing	25.4.2005	6.5.2005	Report for chapter three.

	progress.			
6.	• Write chapter four with project developing progress.	9.5.2005	13.5.2005	Report for chapter four.
7.	• Performance assessment and project progress.	13.5.2005	13.5.2005	Student status decided.
8.	• Finish up and submit the project one report.	16.5.2005	20.5.2005	Project one report.
9.	• Presentation and project assessment.	23.5.2005	27.5.2005	Report for project one presentation.
10.	Semester break	30.5.2005	28.6.2005	
11.	• System development start.	11.7.2005		System finished and running according to the proposal.

Table 2: Milestone PSM II

No	Activity	Duration	Start	Finish
1	Design Phase	20 days	11/07/05	05/08/05
2	Submit Design Phase to Supervisor	2 days	04/08/05	05/08/05
3	Implement Phase	30 days	08/08/05	16/09/05
4	Introduction	2 days	08/08/05	09/08/05
5	Software Environment	2 days	10/08/05	11/08/05