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FIXED WIRELESS TELEPHONY USING CDMA TECHNOLOGY

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FIXED WIRELESS TELEPHONY USING CDMA TECHNOLOGY

MOHD SYUMAIMI BIN RAMELI

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

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY
KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA
2006

DECLARATION

I hereby declare that this project report entitled

FIXED WIRELESS TELEPHONY USING CDMA TECHNOLOGY

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

STUDENT :  Date : 27/11/06
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DEDICATION

Especially dedicated to my beloved parents, Mr. Rameli and Mrs. Azan Haizan for
invoke and giving impulse everyday without bored.

For my supervisor, Mrs Aslinda Binti Hassan at Kolej Universiti Teknikal Kebangsaan
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ABSTRACT

This project application identify optimality properties for scheduling downlink transmissions to data users in CDMA networks. For arbitrary-topology networks, This Project show that under certain idealizing assumptions it is optimal for a base station to transmit to only one data user at a time. Moreover, for data-only networks, prove that a base station, when on, should transmit at maximum power for optimality. The optimality conditions imply that there exist (i) To setup facilities for browsing an Internet from road show area using CDMA Phone technology; (ii) Facilitate online registration for E-Melaka participant from the road show area,(iii) To develop a small network connection through CDMA Phone from road show area. Numerical experiments illustrate that scheduling achieves significant capacity gains over conventional CDMA. Fixed Wireless Telephony using CDMA technology is a new telephone service, where customers can enjoy voice, fax and internet / data applications with a better quality of service. CDMA or Code Division Multiple Access is based on digital radio technology using the CDMA system, which provides high quality telecommunication services. It provides an alternative service to normal fixed line telephony

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CHAPTER I

INTRODUCTION

1.1 Project Background

This project application defines the ability of different wireless technologies to co-exist within a single geographic area, owned and operated by different service providers with relatively simple sharing arrangements for common infrastructure is one of the key aspects which makes wireless technology a valuable addition to the universal service concept in fact it can change the fundamental assumptions embodied within traditional approaches to universal service. This paper examines the challenge operators and regulators have in providing telecommunications services, especially to smaller communities, and the role Wireline Equivalent Fixed Wireless Access systems can play. Fixed Wireless Telephony using CDMA technology is a new telephone service, where customers can enjoy voice, fax and internet / data applications with a better quality of service. CDMA or Code Division Multiple Access is based on digital radio technology using the CDMA system, which provides high quality telecommunication services. It provides an alternative service to normal fixed line telephony. Customers will be supplied with a Fixed Wireless Terminal (FWT) for communication purposes.

1.2 Problem Statement

Facilities to access Internet is a very important if we want to do the online road show. Sometimes, K-Economy Staff have to setup an online road show from the village that does not have the facilities to access the Internet. This project is doing research about how to solve the problem to make the real online promotion about E-Melaka program through surfing internet from the road show area using Fixed Wireless Phone using CDMA technology and setup the local area network (LAN) at road show area that can access to Internet.

1.3 Objectives

Achievement on the objective is:

1. To setup facilities for browsing an Internet from road show area using CDMA Phone technology.
2. Facilitate online registration for E-Melaka participant from the road show area.
3. To develop a small network connection through CDMA Phone from road show area.

1.4 Scopes

Scope of this project module is:

1. This application will access the Internet from every place of road show area by setup an internet connection using the CDMA Phone
2. Small network connection will be setup for the sharing Internet access.

1.5 Project Significance

For all above, this application is enable users and administration staff to use the Internet facilities from the road show area where there are no facilities to access to Internet. In addition, this application can be used in K-Economy Division for another program if needed to have an online program by using the internet at the place that not have an internet connection .

1.6 Conclusion

This project application will be implemented at K-Economy Division to solve the problem to setup an online road show by using the CDMA Phone Technology.

Next chapter which is on literature review defines of a collection of published researches that are relevant to the problem statement. All good research and writing is guided by a review of the relevant literature. Regardless of the research methodology used, the purpose of the literature review remains the same. It is an essential test of the research question against that which is already known about the subject.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

Literature review is the review of a collection of published research relevant to the research question. All good research and writing is guided by a review of the relevant literature. An integral component of the scientific process, a literature review is the mechanism by which research is viewed as a cumulative process. The literature review has two components which is the actual literature search and the writing of the review. Regardless of the research methodology used, the purpose of the literature review remains the same. It is an essential test of the research question against that which is already known about the subject.

Project methodology is a guideline to help agencies establish a project management competency within their organizations and roadmap to implementing a successful project. In addition, process that includes phases, activities, tasks and key templates or deliverables.

2.2 Fact and Finding

For fact and finding, there are few researches that are related to this project. The first fact describes the CDMA Phone technology can be implemented to setup an internet connection and the second fact is for the connection to the internet can be using the 3G technology. Both facts and finding will be used as reference in this project. In

addition, this project will look into the definitions and the difference between CDMA Phone Technology and 3G Technology concept.

2.3 CDMA Technology

Code Division Multiple Access (CDMA) technology is a driving force behind wireless networks around the globe. CDMA solution offers a robust wireless portfolio that allows network operators to compete successfully with the most advanced technology available today that gracefully evolves to the technology of tomorrow. With CDMA technology powering for user network, This technology provide the next generation of communication technologies. As Always On wireless data services evolve and the number of subscribers continues to increase, CDMA portfolio is complete with a comprehensive range of wireless options that expand subscriber services, optimize network performance, lower capital costs, and reduce the overall cost of ownership.

The unique features of CDMA technology make it a formidable alternative for fixed wireless telephone applications. The W-CDMA technology used by this WLL system is selected to provide primarily ISDN-like services and data rates to subscribers. This technology also provides a smooth transition into the third generation wireless technology. The air interface used in this WLL system is an interim TTA standard, which specifies a CDMA-based protocol operating in the 2.30–2.40 GHz band. The standard allows two types of bandwidth (5 and 10 MHz). The WLL system described in this article includes the WLL gateway switch, the radio port controller and the radio interface unit. The gateway switch connects the radio system to the PSTN and ISDN. The RPC provides concentration and control functions to a number of base stations called RPs. The RIU is comprised of the fixed units attached to the residential or commercial buildings. Also included are the radio port operation and maintenance (RPOM) unit, which is responsible for maintaining and managing the radio network

elements, and the inter-working function unit, which is used as a gateway to data services such as the Internet and PSPDN.

2.3.1 A Wireless Local Loop System Based on Wideband CDMA Technology

The telephone is a convenient medium people can use to communicate. However, even the most basic phone services are not available everywhere. Rural and isolated areas, as well as regions subject to severe conditions such as earthquakes and floods, introduce greater challenges. A wireless local loop (WLL) system provides solutions to alleviate these difficulties better than the solutions based on wired loop access technologies. In areas isolated from land, the WLL network can be installed rapidly. An additional benefit of the WLL system is that it reduces the cost of operation and maintenance since there is no wire to maintain. In general, WLL refers to the use of radio and wireless technologies in the local loop instead of copper wire technologies to provide access to the public telephone network. To be feasible, any wireless local loop application must provide at least the same functionality of the wired network, if not more, with the same or greater quality of service (QoS). In many cases, WLL performs better than the wireline network in terms of economics and as such provides a direct substitute for today's wireline local loop. In addition, wireless technology provides a platform for offering additional mobility-related services that may bring additional revenue to network operator. There are many applications using WLL radio technology in urban and suburban areas. Typically, in anticipation of future traffic demand, wired equipment must be over-engineered to minimize frequent and costly deployment. For a wireline system, it takes a minimum of 36 months to fully deploy a network, and the typical period is five to seven years. Yet the practical fill rate for such a network is less than 70 percent. In contrast, a wireless network can be deployed in one to six months with a practical fill rate of greater than 90 percent. The type of wireless technology to be deployed depends on the answers to the following basic questions: Is the technology under consideration based on a standard? Is it based on a low-power or a high-power technology? How can this specific technology-based system be connected to the public switched telephone network (PSTN)? Depending on the answers, the technology under

consideration may have different planning, economic, and engineering implications. Technology alternatives for WLL include: point-to-point systems, cellular systems modified for WLL applications, satellite-based systems, and systems designed especially for WLL applications. There are a number of systems designed especially for WLL applications, some of which are based on standards, while others are proprietary solutions. There are three low-powered technologies based on standards that are designed to be included in wireless local loop applications:

- The digital enhanced cordless telecommunications (DECT) system designed in Europe.
- The personal handyphone system (PHS) designed in Japan.
- The personal access communication system (PACS) designed in the United States.

The air interface used in this WLL system is an interim standard published by the Telecommunications Technology Association (TTA) of Korea. CDMA is a form of *spread-spectrum*, a family of digital communication techniques that have been used in military applications in the past. CDMA has gained significant international acceptance by cellular radio system operators as an upgrade to increase both their system capacity and service quality. The unique features and benefits of CDMA make it an excellent technology choice for fixed wireless telephone systems. In a fixed telephony environment, CDMA is estimated to provide up to 15–20 times more capacity than its competitors (e.g., AMPS-based technology) for wireless local loop applications. CDMA has single cell frequency re-use capability and requires no contiguous bandwidth. This allows an operator to plan and deploy the system quickly and more cost effectively (fewer cells). To provide increased quality, CDMA also allows variable rate vocoders, robust error correction, and diversity in frequency, space, and time. The W-CDMA technology used by the WLL system has been selected to provide primarily ISDN-like services and data rates to subscribers while providing a smooth transition into the third generation wireless technology that is the basis for ITU's international mobile telephone (IMT)-2000 activities. Currently, W-CDMA has been

selected by many organizations around the world as the choice for IMT-2000 applications. The next section provides details of the air interface protocol implemented. The system architecture is the topic of the following section. The primary components of the WLL system are also discussed in this section. The following two sections describe the network management features and interworking functions. Finally, a brief conclusion section is provided.

2.3.2 User Requirements

As discussed earlier, any WLL system must provide at least the same functionality as the wired network, if not more, with the same or greater quality of service. The following is a list of features that reflect several key end-user requirements as seen in residential and small business markets today.

- Voice service.
- Voice band data service (access to the Internet via modem).
- Facsimile service.
- Data service (e.g., Internet access).
- ISDN service.

A service provider trying to meet these end-user requirements would demand greater flexibility from the WLL system. A primary design input to the WLL system was to incorporate the user requirements listed above to allow the carrier to offer a variety of services. Following is a list of services that can be offered by using the WLL system described here:

- Voice service: 64 kb/s PCM, 32 kb/s ADPCM
- Voice band data service: ~ 56 kb/s (facsimile, modem)
- Data service: ~ 115 kb/s (Internet service, PC communication)
- ISDN service: ~ 144 kb/s (2B+D)

It should be noted that there are many other user requirements suitable for WLL systems. An example of this is the high-speed link (up to 100 Mb/s) between the end user and the service providers' network. This type of service is more suitable for large business customers and future residential services directed toward voice, data, and video integration. These types of services are outside the scope of the WLL system described here.

2.3.3 Air Interface

The radio interface of the WLL system conforms to the air interface standard specified by the TTA of Korea. This standard, called "Wideband CDMA Air Interface Compatibility Interim Standard for 2.3 GHz Band WLL System," was first published in October 1996 and was updated in December 1997 [4]. The interface provides a basis for the implementation of WLL radio system equipment including the customer premises, base station, and controller systems as explained in the following sections. It specifies a CDMA-based protocol operating in the 2.30–2.40 GHz band. The standard supports telephone, facsimile, and ISDN services. In particular, it specifies a wireless packet transmission mode to support high-speed data services efficiently through the WLL. The standard allows two types of bandwidth (5 and 10 MHz).

2.3.4 Basic Model of Radio Interface

The terminal consists of the existing fixed PSTN, ISDN terminals, and the terminal interface module, which connects the existing fixed terminals with the base station through the radio interface. In general, the base station refers to the network, which typically includes base stations, controllers, and switching systems. The base station provides the function of network radio interface termination and the function of wired interface with the switching system. The switching system provides local switching or toll switching functions, and is also connected to a fixed communication network such as a PSTN or an ISDN. The basic model of the protocol applied to the radio interface is

defined in The wireless protocol architecture consists of the WLL radio resource control (WRR) plane, which is responsible for the radio resource management (RM); the WLL communication control (WCC) plane, which is responsible for the bearer connection and call control (CC) and mobility management (MM) functions; and the WLL packet control (WPKT) plane, which supports radio packet data transmission. Each signaling plane has a general hierarchical structure pursuant to the OSI reference model.

2.3.5 Physical Layer Aspects

The wideband CDMA-based multiple access mode supports the overall functions of the physical layer for modulation/demodulation to provide telephone, facsimile, high-speed data, and packet communication services for current PSTN users. The physical layer includes the functions of modulation/demodulation, channel encoding and decoding. These functions of the physical layer are applied to both the WRR plane and the WCC plane. In the physical layer, there are two categories of channels: the *forward channel* from the base station to the terminal, and the *reverse channel* from the terminal to the base station. The types of forward channels are: pilot, sync, paging, forward traffic, and forward power control and signaling (PCS). Also, a forward packet traffic channel can be included in the forward channel types according to user requests. The reverse channel includes an access channel and a reverse traffic channel. In addition, a packet access channel and a reverse packet traffic channel can be included according to user requests.

2.3.6 Data Link Layer Aspects

The data link layer is responsible for reliable delivery of messages from the network. Its main functions include connectionless mode operation, data resending, and point-to-point data transfer between originating and terminating terminals, error control, and sequence control. The basic functions of this layer are available equally to both the WRR and WCC planes, but the former supports only connectionless access mode which does not set up a data link for the synchronization channel (SYCH), the access channel (AXCH), and the paging channel (PGCH). Logical channels used in the data