

**THE UNIFIED MESSAGING SERVICE:
A FEASIBILITY STUDY FOR IMPLEMENTATION
IN THAILAND**

by

Ms. Wittada Hongsiriruk

**A Final Report of the Three - Credit Course
CE 6998 Project**

**Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Science
in Computer and Engineering Management
Assumption University**

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Project Title The Unified Messaging Service:
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Academic Year November 2000

The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 PROJECT, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.

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November 2000

ABSTRACT

The Unified Messaging represents the next leap forward in user convenience and a powerful leveraging of different types of the communication. It is a consolidation and integration of various messaging technologies in a single location to allow users with the ability to access messages information from a single interface. On the business side, the Unified Messaging represents an opportunity for Internet Service Providers and Telephone Companies including Wireless Network Operators to add value to their services. With the increasing competitive pressures in the mobile network market, the introduction of sophisticated value added services is seen as a prime alternative revenue source and a key factor in winning and retaining customer loyalty.

This project document is proposed to conduct the feasibility study for the wireless network operator regarding the introduction of the Unified Messaging Service into Thai market. The feasibility study for its implementation is address in this paper to explore the possibility in delivering this type of technology, which includes the analysis in technical, operational, marketing, and financial aspects. The result of the study indicates that the implementation of the Unified Messaging Service in the wireless network environment is feasible in term of technical and operational given that the project is well managed and the budget is well prepared. But it is not feasible once consider the project in term of financial and marketing, because the payback period is too long and the Thai market is not ready for such advanced service.

However, the decision for the implementation of the UMS should also combined with other factors such as the positive image of the company, the leadership as the position of the company in the business, and the opportunity for company to create other new services in the future.

ACKNOWLEDGEMENTS

The author would like to take this opportunity to express her gratitude to Dr. Chamnong Jungthirapanich, her supervisor, for his valuable assistance and support during the course of the project. The author would also like to thank all of her friends and staff in CEM, Assumption University, for their helpful information and supporting ideas.

Finally, the author would like to express her deepest gratitude and appreciation for her beloved family who have continually given the encouragement and support throughout her Master Degree course at the Assumption University.



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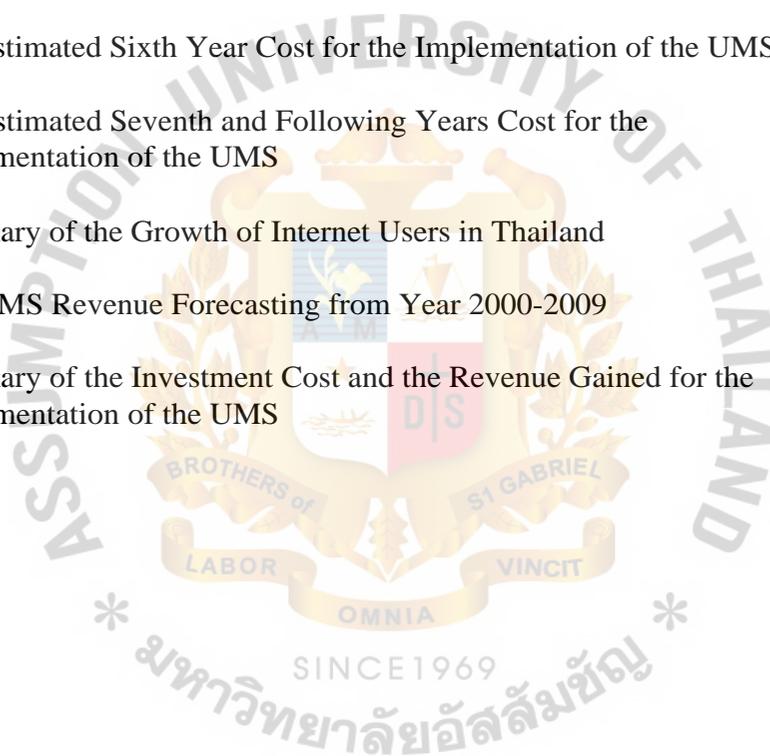
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I. INTRODUCTION

Communication is becoming more and more important on both personal and business daily basis. To survive in the information age, people are seeking for multi methods of communication in order to achieve just on time information. Today, people have telephones, facsimiles, electronic mail accounts, pagers, cellular phones, answering machines, and voice mails to maintain communications. Unfortunately, rather than lessening the need for one communication medium and simplifying the way of communication, people have created superimposition ways of information exchange. As the number of communication channels increase, people have various places, which is not convenient somehow, to check for messages.

Today, telephone numbers are associated with a physical location. People may place extension phones on the same line so that one does not have to run from room to room in order to answer the telephone. Facsimiles sit in one location, so in order to retrieve a fax, one must walk to its location; it would be cumbersome if the fax machine is across the country from where one might be during the time of message arrival. E-mail may be convenient with the use of a notebook computer, so people can usually obtain information as long as a phone jack or a strong enough wireless connection are available.

Today's technologies have somehow created a complicated situation. As for each geographical location, there is a separated address. In order to reach a person while they are working, a caller must dial the office phone number, not the home phone. It seems that when addressing messages or calls, people call to a physical location, not the actual person.

The Unified Messaging Services (UMS) is introduced to eliminate the existing inconvenience in communication. As it is mentioned by a research firm, Ovum, that

"Unified Messaging brings together diverse types of message into a single user interface accessed through the communication devices of your choice." Generally, the UMS is a collection of products and services that aid the conveyance of information in a natural way. It gives people intelligent control over the sending and receiving of messages. Instead of addressing messages to a physical location, the UMS assign an address to a person and permits the recipient of the message to receive all messages (from any sources) into one logical location. Therefore, people can obtain messages anywhere and anytime by accessing through a single path of communication channel.

This project is purposed mainly to conduct the feasibility study for the implementation of the Unified Messaging Services in Thailand.

1.1 Background of Study

As the need for the communication increases, the consequences are various types of separate communication medium. The essence of the communication is to break down the barrier. Toward the future, the trend for communication is going to be an integrated type, which will provide a simple but effective means for information exchange. The tele-communication and data-communication worlds are converging and the communication products need to address the needs from both worlds. The Unified Messaging Service involves breaking down the barriers between both worlds so that people using different technologies, different media, and different terminals can still communicate to anyone, anywhere, at any time.

Accordingly, several companies have developed platforms for the Unified Messaging Services. The UMS represents an opportunity for the Internet Service Providers (ISPs) and Telephone Companies (TELCOs) or others to add value to their services. It is built on an assumption of demand from business people, corporate

customers and consumers who are in need of speed and convenience of messaging technology.

Since the UMS can be beneficial to both potential consumers and the service providers, it is interesting to forecast the demand for the UMS in Thailand and then to conduct the feasibility study in term of economic.

1.2 Purpose and Scope of Study

The purpose of this project is to study the feasibility of implementing new type of technology product, The Unified Messaging Service, in Thailand. Specifically, the scope of this project covers only for implementing as value-added services in a mobile network in Thailand.

By employing useful methods for the systematic development of feasibility business case, it is intended to offer structured frameworks for product implementation both in marketing and investment aspects. The final aim for this project, however, is to derive at the conclusion and recommendation of the decision on the implementation of The Unified Messaging Service based on current information in a mobile network operator.

1.3 The Project Statement of Problem

The USA Today said on December, 1998 that "The next big thing in the telecommunications market is going to be unified messaging". Ovum which is an independent research firm with a URL address at <http://www.ovum.com>, predicted in January 1998 that there would be 110 million subscribers of unified messaging services worldwide by 2003 creating a \$9 billion industry. In December 1998, Ovum expanded their projection saying the unified messaging industry would grow to \$31 billion by 2006.

implementation is not limited only on the result of the feasibility but other factors as well. The recommendation will cover other important aspects that must be taken into account by management in making decision.



II. LITERATURE REVIEW

2.1 The Unified Messaging Service

2.1.1 Description of the Unified Messaging Service

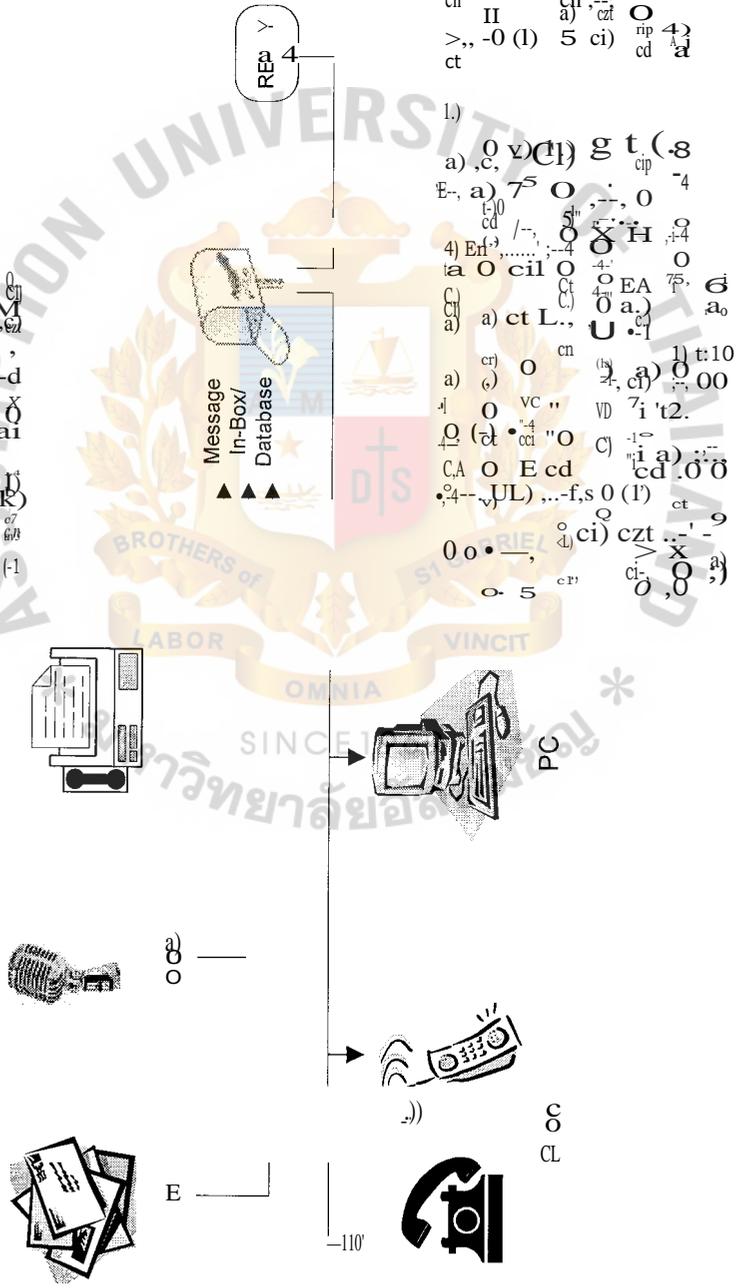
The Unified Messaging is the integration of several different communication medium, such that users will be able to retrieve and send voice, fax, and e-mail messages from a single interface, whether it be a landline phone, wireless phone, or Internet-enabled PC. With the Unified Messaging, people can reduce the number of places to check for incoming voice, fax, and e-mail messages.

Technologies exist that enhance the integration of voice mail and e-mail, are such as text-to-speech software that converts e-mail into spoken words. Other technologies, such as speech recognition, are becoming more reliable (in the near the future). The basic concepts of how the Unified Messaging work is as appeared in Figure 2.1.

In fact, the Unified Messaging Service goes beyond the integration of message mediums within the message box. The UMS also provides the recipient with control over message receipt, information gathering, and messaging routing. The Unified Messaging is not an end product, but it can be used as a base platform for other applications. The real definition of the Unified Messaging is quite broad, it is often focused on the customer experience within the various segments in the marketplace. The Unified Messaging is a portfolio of applications that allow the service providers to utilize the capabilities of the UM to best meet the need of subscribers. Its application may include several features as the following examples: (<http://cgi.hellodirect.net> 1999)

- (a) Telephone answering: The Unified Messaging may include the unify phone calls feature (or Single Number Reach feature), which will forward phone calls to subscriber's number. The subscriber would then need only one number for all phone-based messaging needs. In case the subscriber cannot

1 incoming messages of the Uni
 in the form of E-mails, Voice mail
 message box. The UMS provides
 to control over all messages in



The Operating Procedure of the Unified Messaging Service.

CNI
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be reached, the message is forwarded into user's mailbox. If the call contains a fax, the call is placed in the user's mailbox.

- (b) **PC access for storing and retrieving of messages:** All voice/fax/e-mail messages can be accessed via the internet based PC. The user can listen to a voice message via the PC's multimedia capabilities. The user can also view fax directly on the PC screen.
- (c) **Telephone access for storing and retrieving of messages:** The Unified Messaging converts e-mail messages to speech through a text-to-speech feature for telephone access. Faxes can be directed to any fax machine for printing. E-mail messages and attachment may also be converted to faxes for remote printing.
- (d) **Notification of incoming fax/voice/email messages:** To eliminate the need to check for messages in the unified mailbox, the notification feature is available. There are many ways to receive notifications, such as by pager, wireless phone (via SMS email), or by PC screen (sound event, blinking cursor), so that users know immediately that new messages have been received.
- (e) **Unified E-mail messaging:** With POP, the UMS is capable of retrieving e-mail messages from other POP accounts of the user into one location. This is so that the user need not check for all e-mail accounts and that all messages can be accessed via the telephone.
- (f) **Personalized greeting:** The introduction message is important to one's image, the Unified Messaging may also offer the ability to personalize greetings.

(g) Voice mail integration: To eliminate the need to check for more than one voice mailbox (in case people have many voice mailboxes, i.e. in large corporation), the UMS can be integrated with other voice mail system. This is a good selling point to the business world.

There are still many other features that the UMS can offer. Technologies for future development such as speech-to-text translation (speech recognition) and enhanced message management tools are expected to increase the Unified Messaging Service popularity.

2.1.2 Typical Unified Messaging Scenarios

The Unified Messaging addresses the needs of savvy customers who want to merge voice, fax, and e-mail according to what they find convenient. Here are some typical uses of the UMS:

The problem 1: An entrepreneur uses the same phone line for her fax machine and her modem. If she's on the Internet for important works, she can neither send nor receive faxes.

The Solution 1: Faxes are sent to her unified mailbox, where she can view them online without stopping her Internet work, and then respond via e-mail, forward the fax to a colleague, or print a hard copy.

The problem 2: A mother doesn't have a PC and misses e-mail information passed amongst her friends who have e-mail accounts.

The Solution 2: Friends send e-mail to her unified mailbox, and she calls her access number, listens to her e-mail read to her by a synthesized voice, and then replies to it.

- (b) Able to increase messaging availability with maximum penetration in existing and new global segments.
- (c) Able to generate new source of revenue and the opportunity to streamline product and service offerings as well as the operations.

(2) Benefits for Users

With a single Unified Messaging System, it can deliver important benefits to both individual and corporate users as following (Lucent Technology Octel Messaging Division 1999):

(a) Less time managing messages, more time on important business

- (1) Access all messages from a telephone or PC.
- (2) Reply to e-mail with voice or reply to voice mail with e-mail.
- (3) Convert e-mail messages and attachments to faxes.

(b) Freedom from the Office

- (1) Listen to e-mail messages over the telephone using text-to-speech conversion.
- (2) Access voice, fax and e-mail from your PC using dial-in service.

(c) Ability to track, organize and store voice, fax and e-mail messages together

- (1) Access voice, fax , and e-mail messages from a single inbox.
- (2) Use personal folders for management of voice, fax and e-mail messages.

(d) Fax message privacy

- (1) There is more privacy that the incoming faxes are not read by someone else.

- (2) Faxes are stored in the users' mailbox and can be displayed on the users' computer screen at their convenience.

2.1.4 The Unified Messaging Service Targeted Subscribers

Essential to the success of deploying unified messaging to a market is understanding the needs of the diverse market segments. By mixing and matching various unified messaging applications, service providers can increase market penetration, maximize revenues, and stimulate interest for more unified messaging functionality. The targeted market segments of the unified messaging are the following various groups of subscribers: (<http://www.lec.org> 1999)

- (1) The messaging-savvy subscriber: The premium-class subscriber will be one of the first to adopt fully enhanced unified messaging. Whether these subscribers are heavy messaging users at home or small office home office (SOHO) business entrepreneurs, with unified messaging they have a means of saving time and increasing productivity by having access to all their messages.
- (2) The casual e-mail subscriber: More and more people are subscribing to e-mail at home. Many of those subscribers may only be casual e-mail users. They check e-mail infrequently and do not depend on it for communication. This presents another market segment that can take advantage of unified messaging.
- (3) The single-line home: Households with a single phone line and are the Internet subscribers would normally lose their calls during Internet sessions. However, for a household subscribing to unified messaging, the calls can still be picked up. With unified messaging, subscribers do not have to

disconnect to know if a phonecall has come in. They can access their voice mailboxes while on-line.

- (4) Disparate messaging preferences: People using different types of communication devices should be able to communicate to each other. For instance, people who prefer using e-mail should be allowed to communicate with people who prefer voice mail, and vice versa. Unified messaging can be applied here to bridge e-mail and voice-mail communities, expanding the messaging network.
- (5) Wireless phone subscribers: Subscribers of digital wireless phones can also take advantage of unified messaging to access their messages. Through the handset display, they can access their mailbox and see a listing of their voice, fax, and e-mail messages. They can then use the softkeys of the handset to select the message to which they wish to listen.
- (6) Fax subscribers: For subscribers who like to use a fax machine, having a unified mailbox will provide them with added fax functionality. With unified messaging, they are able to print faxes to the destination of their choice, and they can also view their faxes directly from their PC. They can treat the fax as they would like a voice message, with reply, forward, and save capabilities.

2.1.5 The Unified Messaging System Overview

The term unified messaging describes the nature of the resulting services, where different message types are combined into a single virtual mailbox, which can be accessed with multiple types of methods. Virtual mailbox can be achieved by collecting messages from various sources into a central location. Multiple access methods can then be obtained by connecting this central mailbox into different kinds of access

networks like Internet or telephony network. A simple picture of the Unified Messaging system connectivity to other components is as shown in Figure 2.2.

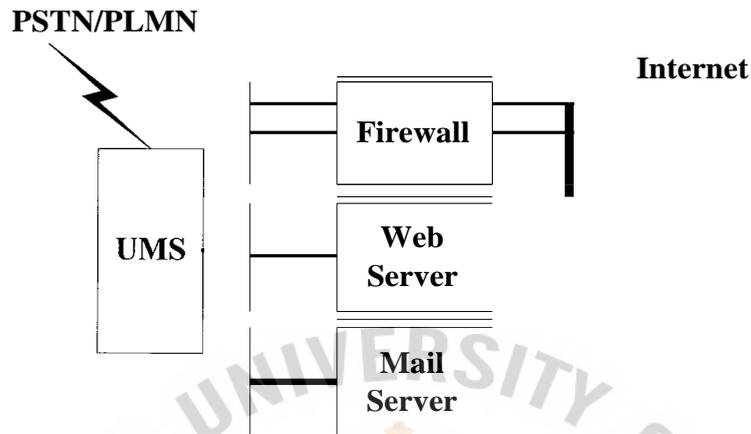


Figure 2.2. Simple Connectivity Picture of the Unified Messaging System.

When there is a way to access many types of messages, messaging can be made more intelligent. This means that UM solution should provide, for example, ways to convert messages from one type to another and ways to notify people who do not have temporarily email client available.

In order for the UM solution to support the integrated services, the UMS must interface with various PSTN, PLMN and Internet components, which are needed to receive and deliver messages from and to other messaging system. Some of these interfaces conform to international standards but others are proprietary systems. The following figure (Figure 2.3) details some of the important components with which the UMS must interface (Timo and Esa 1999).

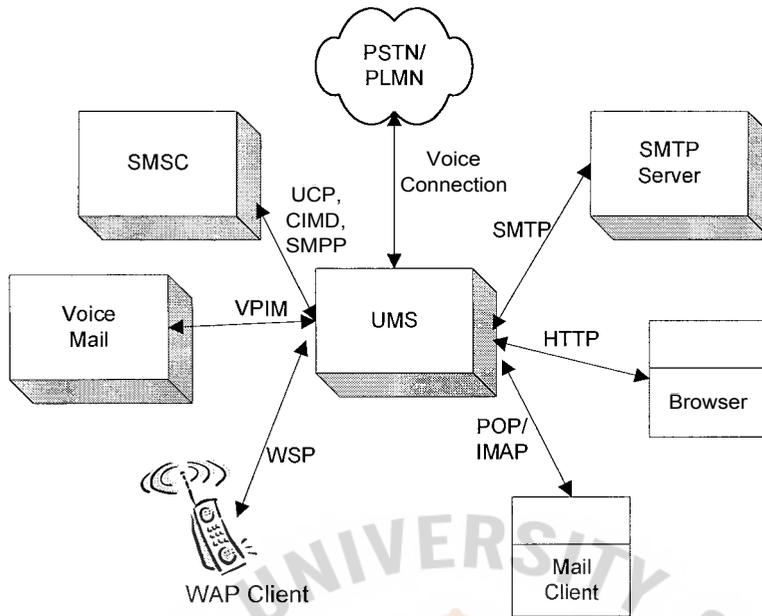


Figure 2.3. Interfacing with Other Systems.

The most common messaging systems today are e-mail and voicemail. In order to receive e-mail messages the UMS must support Simple Mail Transfer Protocol (SMTP) protocol, which is used between Internet mail servers to deliver mail messages, and therefore act like a normal SMTP server. The UMS must also interface with other e-mail servers which employ POP or IMAP protocol, and thus behave like a normal e-mail client, enabling message retrieval from other possible mailboxes of a user to a central place.

Retrieval of voicemail is much more complex issue because voicemail systems do not normally provide external interfaces. This issue will be resolved with the introduction of VPIM (Voice Profile over Internet Mail) standards, which define how to transport voice and fax messages over SMTP protocol. An alternative solution is to build voice mail capabilities into the UMS.

Message notification is a critical feature for any messaging system. In the GSM environment the short messaging feature provides a convenient method to deliver

notification and it can also be used to send the actual messages and to carry mailbox management information. Short message systems interfaces are often proprietary, the most common of which are UCP, CIMD, GPI and SMPP.

The most common way of accessing messages is an e-mail client. Web browsers can also be used to access messages and access methods such as Wireless Application Protocol (WAP) can be used to run a micro web browser on mobile phones providing the necessary mailbox access. Besides accessing messages, web browsers can be used to manage UMS configuration. Configuration management with web browser is useful especially for users to modify their private configuration information, like passwords since browser is commonly accepted and is a commonly available information access tool.

2.1.6 The Unified Messaging Framework and Environment

In order to be able to implement the Unified Messaging system, one must first understand its framework. The Unified Messaging Framework (UMF) is a collection of components that simplify the messaging service application development. The UM service applications together with UM framework provide the functionality which is visible to the users and also offers fast time to market for new messaging services through utilization of existing resources. (Timo and Esa 1999)

Figure 2.4 outlines the architecture and environment of the UM framework. This logical architecture is not, however, limited to unified messaging but can be applied to many kinds of network service platforms.

The UM framework environment comprises UM applications and network resources. UM applications access and manipulate different kinds of messages and they can be built by harnessing the components provided by the framework. It is the UM applications which implement the unified messaging functionality.

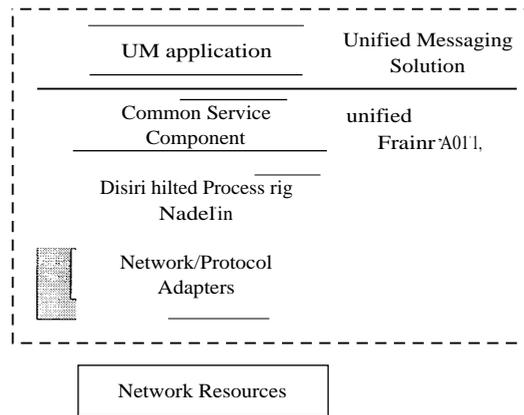


Figure 2.4. Architecture of the UM Framework.

Network resources represent different kinds of networks, which can be used to access the UM applications. These resources are employed by the application since their functionality is network communication. And because the unified messaging in general gives a unified view into a message box containing different types of messages from various kinds of clients, different kinds of networks and protocols must be adapted to the framework.

The UM framework have been categorized into various layers according to their functionality. These layers include the **Distributed processing platform**, **Network/Protocol adapters**, and the **Common service component**.

The **Distributed Processing Platform (DPP)** enables communication between the components of UMF. The UMF and UM application consist of components which interact with each other. The distributed processing platform provides support for their execution and interaction in the distributed environment. The DPP also provides features, which support run time operations such as load balancing. Load balancing shares the load of the framework and the applications between several computer nodes. By using the distributed platform it is possible to integrate and still distribute the

various components of the UMF over several network nodes. Figure 2.5. Illustrates the distribution of the UMF.

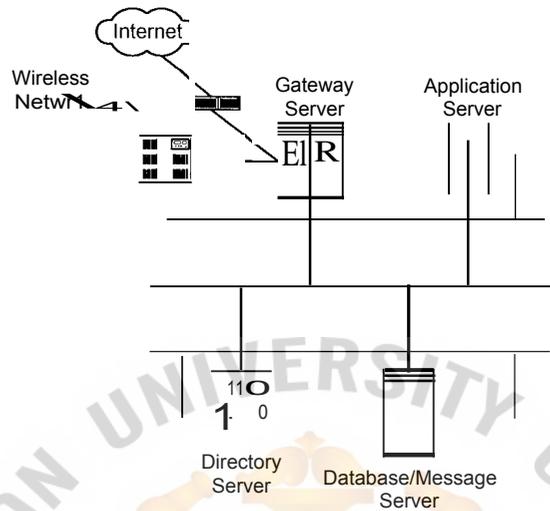


Figure 2.5. Distribution of UMF.

The Network/Protocol Adapters have two main functions. They enable different kinds of terminals to access UMF applications and they also provide communications resources to the applications. A framework can contain one or more network adapters depending on the environment and the needs of the service provider. The number of the adapters can also vary over time. Figure 2.6 below shows example of Network/Protocol adapter services.

In Figure 2.6, the SMTP adapter is used to access the UM application. This application uses the SMS adapter to send a short message notification to the mobile phone of the receiver of the email.

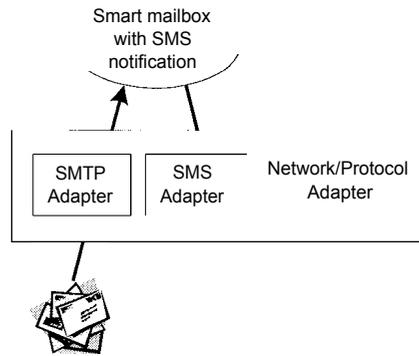


Figure 2.6. Network/Protocol Adapter Services.

A UM application developer can freely combine the services of the adapters and create any type of sophisticated and advanced services, which may be required. Because new adapters can be easily plugged to the framework, the framework does not limit the imagination of the developer.

The common service components are reusable functional blocks which are being utilized by the UM applications. The main trust behind the framework is that there are common needs among the components of the environment. For example, most of the UM applications need a place for messages and therefore there should be a common message store for the use of all the applications. This kind of general requirement can be solved once as a common UM service component which provide interfaces to the client components. Most of the common services are involved in management since the same management needs apply to all the applications and the UM framework itself. By providing a suitable set of common service components to the use of the UM applications and other component, the framework can be managed as a whole. Figure 2.7 provides the example of the use of some common service components.

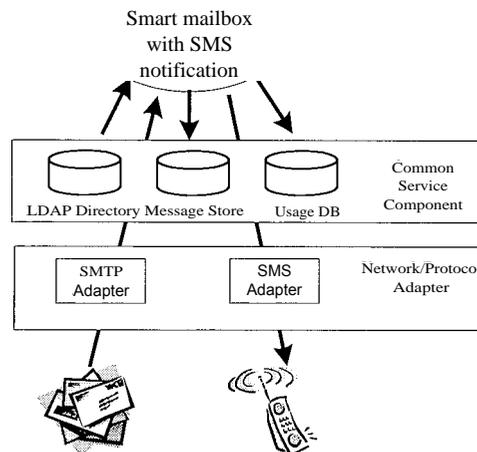


Figure 2.7. Example of Using Some Common Service Components.

In the example presented in Figure 2.7 the common services used are the LDAP directory for user information, a common message store for the messages and a billing database for accounting. As a minimum the following common components are required in the UMF:

- (a) Message conversion utilities for converting messages from one format to another (e.g. text-to-speech).
- (b) A message store as a central repository for the messages.
- (c) A directory which is used to centralize the configuration information.
- (d) A set of management tools.

2.2 Design for Feasibility Study

2.2.1 Life-Cycle Costing

The recent combination of economic trends, rising inflation, cost growth experienced for many systems and products, the continuing reduction in buying power budget limitations, increased competition, and so on, has created an awareness and interest in total system and product cost. Not only are the acquisition costs associated with new systems rising, but the costs of operating and maintaining systems already in

Life-cycle cost is determined by identifying the applicable functions in each phase of the life-cycle, costing these functions, applying the appropriate costs by function on a year-to-year schedule, and ultimately accumulating the costs for the entire span of the life cycle. Life-cycle cost includes all producer and consumer costs.

In developing cost data for a life-cycle cost analysis, the cost analyst should initially investigate all possible data sources to determine what is available for direct application in support of analysis objectives. If the required data are not available, the use of parametric cost estimating techniques may be appropriate. However, one should first determine what can be derived from existing data banks, initial system planning data, supplier documentation, reliability and maintainability predictions, logistic support analyses, test data, field data, and so on.

2.2.2 New Product Forecasting

Forecasting the future and profitability of new products or services is one of the most difficult and challenging management functions. The actual performance of new products or services depends on a large number of factors, which include not only consumer acceptance of the new product or service, but also economic and technological conditions, competitive forces, easiness by which the product can be imitated by competitors, cost considerations, and so on. Assessing the importance of these factors and using them to forecast the product or service revenues and profits is not an easy task. At the same time, it cannot be avoided because it is difficult.

New product or service forecasting requires information that might be found from one of the following sources: (Spyros and Steven 1989)

- (1) Management and expert judgments: Management's or experts' subjective estimates are used to forecast a new product's likely performance.

- (2) Analogous products: A product with characteristics similar to those of the new product under consideration is used to forecast its likely performance.
- (3) Consumers: Based on consumer responses, the likely performance of a new product is derived by estimating people's awareness of the product as well as information about trial sales and subsequent repeat purchasing.

These three types of information sources are used at the different stages of the new product development process for which they are most appropriate. Management's subjective estimates and analogy-type information are usually used at the idea or concept screening stage, prior to the undertaking of a consumer-based evaluation study. If the initial forecast of management gives the "go ahead" signal, a study among consumers is conducted. The next stage involves forecasts based on data generated by consumers. These forecasts are evaluated by management in order to decide whether or not to continue with pretesting the new product or service. If a "go" decision is reached again, a test market is undertaken, and the data from the test market are used in a test-market-based forecasting model. Finally, if the product is introduced, the early sales results are monitored carefully and used in an early-sales-based forecasting model.

Despite their close association with the different stages of the new product development, the forecasting procedures used are not purely statistical. Past experience of marketing managers and their subjective estimates are being incorporated with those of the various forecasting models in order to arrive at predictions for each stage of the process. The task is never easy or free of uncertainty.

2.2.3 The Use of Discounted Payback Period

The payback period for an asset or project is the number of years it must be retained or be economically useful to recover the initial investment with a stated return. It should never be used as a method equivalent to PW, EUAW, or rate of return to select

between alternatives, but merely as supplemental information about an alternative. Payback analysis may be performed using before-tax or after-tax cash flows. To find the payback period n at a stated return, determine the n value in years using:

$$0 = -P + \sum_{t=1}^n CF_t (P/F, i\%, t)$$

where CF_t is the net cash flow at the end of year t . After n years (not necessarily an integer), the cash flows will recover the investment and a return of $i\%$. If the asset or project is active for more than n years, a larger return will result; but if the expected retention period is known to be less than n years, there is not enough time to recover the investment and the required return. It should be pointed out that in payback-period analysis, any cash flows occurring after n years are neglected in the computation.

The discount payback provide an indication of both the risk and the liquidity of a project, a long payback means that the investment money will be locked up for many years, hence the project is relatively illiquid, and since the project's cash flows must be forecast far out into the future, the project is probably quite risky.

2.2.4 The Use of Present-Worth (PW) Method

The Present-Worth (PW) or the Discount Cash-Flow (DCF) calculation, which may be called as Present Value (PV) or Net Present Value (NPV), is routinely used for making economic-related decisions. Generally, the Present Value of the cash flow due n years in the future is the amount which, if it were on hand today, would grow to equal the future amount. This method is very popular because future expenditures or receipts are transformed into equivalent dollars (Bahts) now. The formula for calculating the Present Value is as this equation:

$$P = F[1/(1+i)^n]$$

III. INVESTMENT COSTS

This chapter emphasizes on the investment aspect of the Unified Messaging system, which involves the development of a Cost Breakdown Structure (CBS) for the total cost in its life cycle.

The Unified Messaging System is a collection of components necessary for making unified services visible to customers. Therefore, before getting into the stage in designing of the system and the components to integrate into one system to make a unified services, it is important to define first all the service applications that the system will do to serve the requirement of potential customers. The next section describes the scope of services and features for this study.

3.1 Services and Features Description

Because the Unified Messaging system can offer a variety of services, therefore it is necessary to define first the scope of service and feature for this particular study. Defining the service applications and features which UM vendors can offer are described below:

- (1) **Single Number Reach:** A service that enables the subscriber to be reached in different locations (such as at home, office or on the mobile phone) depending on the time of the day, activity, etc. If the subscriber is not able to answer the call, the calling party is always given the opportunity to leave a message.
- (2) **Message Storing:** Messages can be stored to a subscriber's unified mailbox in the system using either a fixed phone or a mobile phone via the Telephony User Interface (TUI). Messages can also be stored using a handheld terminal, a PC or a laptop using a Graphical User Interface (GUI)

such as Web page or an e-mail client. Faxes can be stored using a fax machine connected via the PSTN.

- (a) Voice messages storing: Voice messages are stored using the Telephony User Interface where the calling party is presented with a number of guiding prompts to assist him. The calling party uses DTMF to navigate through menus and to initiate commands to the system. The subscriber can choose to have one greeting active for all calls or to set up the service so that the system will play different greetings depending on the situation. The most common way for a calling party to leave a message is to listen to the personal greeting or the system greeting, in case no personal greeting has been activated, leave the message, and then terminate the call by hanging up.
- (b) Fax messages storing: The subscriber is given a personal fax number used by the calling party to store fax messages. The system supports an auto detection feature, giving the possibility for subscribers to use a common number for both voice and fax mail stored. The system will detect the fax tone from the connecting fax, generate fax answer tone back and initiate the fax transmission. Incoming fax mail messages are placed in the subscriber's unified mailbox.
- (c) E-mail messages storing: The subscriber is given a personal e-mail address that is used to send e-mail to the subscriber's unified mailbox. Incoming e-mail messages are placed in the subscriber's unified mailbox. It is also possible for the system to retrieve e-mails from subscriber existing e-mail accounts and store it in the unified mailbox.

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messages are identified in the subject field as "Voice" messages, and can be retrieved as wave (.wav) or RealAudio format sound files attached to the e-mail. Fax mail messages are identified in the subject field as "Fax" messages, and can be retrieved as .tif format image files attached to the e-mail. E-mail messages are presented in the e-mail client as ordinary incoming e-mails.

(c) Text to speech media conversion: The Unified Messaging System offers text-to-speech media conversion enabling e-mail message retrieval over the Telephony User Interface. The text-to-speech feature gives the subscriber the freedom to listen to e-mail message details using, for example, his mobile phone while in the car. The subscriber can listen to parts of the e-mail message or to the full message. An e-mail message read out using text to speech technology is treated as a voice mail.

(4) Notification Services: The Unified Messaging System includes notification capabilities. Once a new message has been stored into the subscriber's mailbox, a notification message is initiated to inform the subscriber of the change in his mailbox. The notification is sent to the subscriber's mobile terminal using a Short Message (via a Short Message Service Centre, SMS-C) or as an e-mail to the subscriber's specified e-mail address. There are two different types of notification services available to the subscriber: detailed message notification and message count notification. The notification service used is determined by the subscriber through the subscriber profile.

- (a) Detailed message notification: This type of notification provides details about a specific message such as "Urgent", Message type, Date and time, etc. A short message is sent each time a new message is received in the unified mailbox.
 - (b) Message count notification: This notification uses a short message indicating the number of new messages waiting by type i.e. "Voice mail-3 Fax mail-1 e-mail-2".
- (5) Personal mailbox administration by the subscriber: The subscribers can perform much of the mailbox administration themselves. The administration of the mailbox parameters can be done in two different ways:
- (a) Via the Telephony User Interface using DTMF tones to navigate through the system and to initiate commands.
 - (b) Via a WEB based interface using a compliant WEB browser.
- Example of the administration functions that the subscriber can administer are:
- (a) Distribution list management: Add, delete, rename distribution lists, manage the content of existing distribution lists.
 - (b) Message playback: Administer the message playback options.
 - (c) Personal identification number management: Change the PIN code for authentication.
 - (d) Personal greeting management: Listen, activate, de-activate, delete and re-record all of the greetings.
 - (e) Default fax number: Define the default fax number for re-directing faxes.

- (f) Notification management: Choose to use the detailed message notification or the message count notification.
 - (g) Single number reach management: Choose to activate and de-activate the single number reach service. This includes the option to change the time/days used to control the call sequence for the single number reach, etc.
- (6) System Administration: The UM system can be managed and administrated through the Web interface using any compliant Web browser. This includes features for service provisioning to subscriber such as Individual subscriber management (Add, modify, and delete individual subscribers), Bulk addition of subscribers (Add a large number of subscribers at the same time), Class Of Service management (Define templates for class of service that will be assigned to individual subscriber's profiles for determining their service level), etc.
- (7) Operation and Maintenance: The UM system must also include the operation and maintenance function that provides the capability for the system to deliver traps for serious conditions and even for normal maintenance. This O&M function includes, for example, Logging (for logging of system events segregated into event logs, software logs and resource logs), SNMP management (provides a comprehensive SNMP interface for the operation, logging, performance, configuration, and fault management functions for the software application objects), Real time monitor (fort viewing real time operations in the system), etc.
- (8) Charging function: The Unified Messaging system includes also subscriber event logging that is used for charging. The Call Detail Records (CDRs)

which provide service provider with information of activities performed during each call which should cover all necessary details that can be used to feed billing systems and create innovative charging schemes.

3.2 The Cost of Investment

The total system cost of investment can be estimated once the services and features of the Unified Messaging System are determined. This section, the concept of Cost Breakdown Structure and Life-cycle Cost Analysis are employed to determine the total cost of investment.

The historical information on existing systems similar in configuration and function to the Unified Messaging System are used where applicable. Appear in Figure 3.1, the cost breakdown structure of each category in the Life-Cycle Cost is the standard cost which is derived from historical experience that can be applied to specific functions or activities for the implementation of the Unified Messaging System.

Resulting from the cost breakdown structure in Figure 3.1, the summary of each cost contributes to the total investment cost is listed in a year by year basis. These costs are derived by taken from historical information of other projects similar in nature of technology.

Year 0 (Initial Investment): Year 0 is time for the starting of the requirement to implement the service, therefore all the cost involving research and development of new services are the expense of this stage, which basically is the cost for feasibility study and planning in term of marketing, technical, and operational aspects. And once the decision to implement the Unified Messaging Service is placed, the major cost of the implementation would be the initial investment cost of the entire system, which covers the system acquisition cost for any hardware (system hardware, network hardware, test equipment, etc.) and software (system software, UMS application software license,

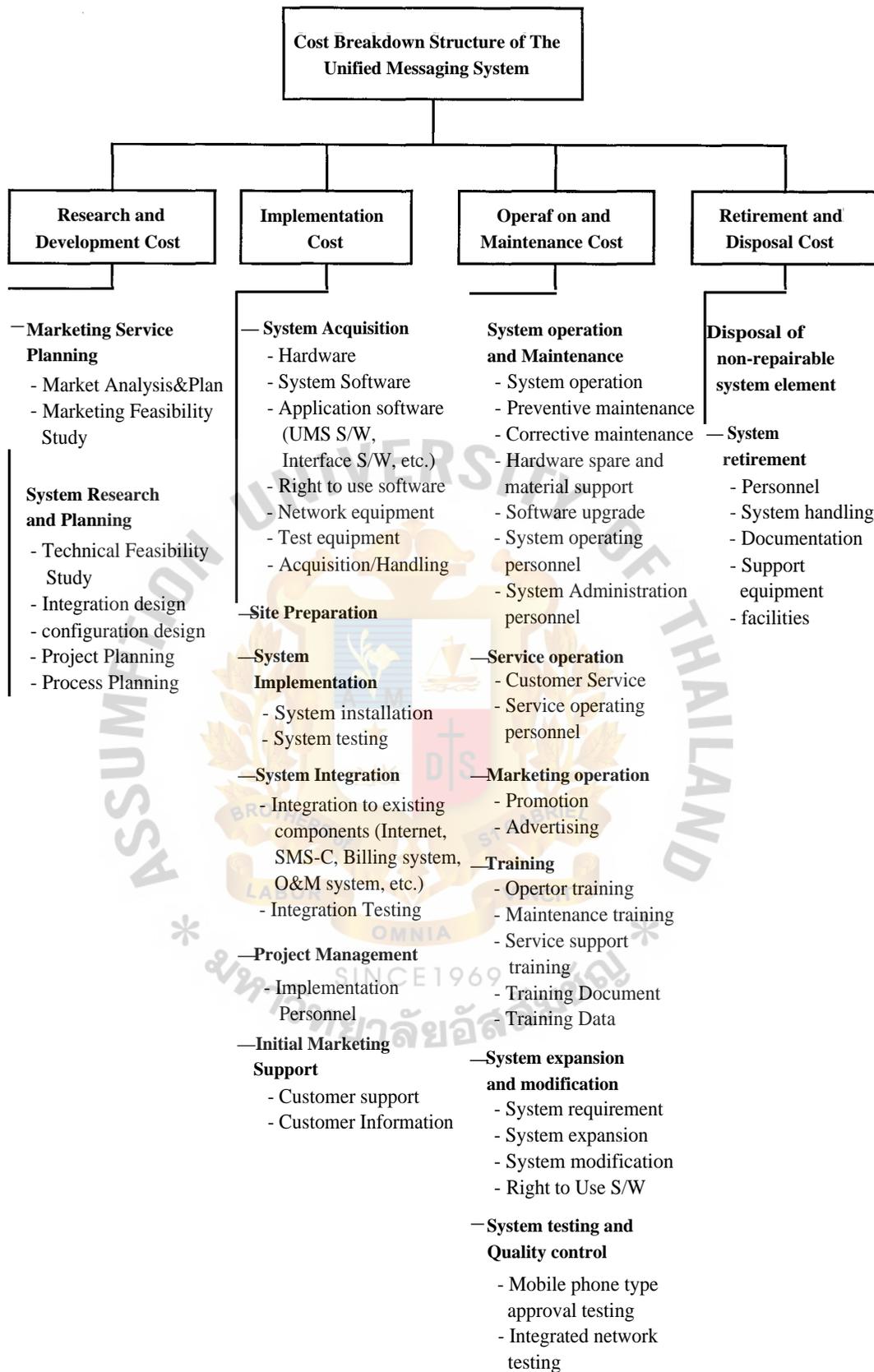


Figure 3.1. Cost Breakdown Structure of the Unified Messaging System.

etc.). The License of the software is normally offered as the Right To Use (RTU) per subscribers. In addition to the application software cost, the Right To Use must also be purchased based on number of the UMS users. The cost for site preparation, system implementation, system integration and testing, and project management, are part of the cost during the implementation stage. The cost for the system implementation and integration will be quite high because it needs experts or specialists who have been specifically trained and worked for this particular system, and because the integration of the UM system into other components will take efforts in order to customize the system to integrate into specific environment. The initial cost for marketing support and advertisement of the new service are also the expenses during the first year of implementation. The estimated total cost of the initial investment is as summarized in Table 3.1.

Year 1 to Year 5: The cost of the first to the fifth year mainly falls in the operation and maintenance category, which includes both hardware and software, preventive and corrective maintenance. The personnel for operating and maintenance of the system is part of the total cost during the life of the system, which also covers the training of the personnel the necessary knowledge in order to operate and maintain the system. The training cost will be higher in the first year and will be reduced in the second, and is not necessary once all courses are finished during the first and second year. The cost for service operation support which is necessary to build up the satisfaction for customers regarding services offered is another area that must be considered and put in the cost planning, this type of cost covers any activities essential to the serving of customers. The advertisement and promotion for services are nolinally a heavy expense during the first and second year, but will be reduced to nothing the following year once the service is well known. And since the quality of the service is

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the direct result of the reliable network, therefore the quality control of the network must be carried out consistently, which incurred some cost for this purpose. The estimated total cost of the first, second, and third-fifth year are as summarized in Table 3.2, Table 3.3, and Table 3.4, respectively.

Table 3.1. The Estimated Initial Investment Cost for the Implementation of the Unified Messaging Service.

Initial Investment Cost Category (From CBS)	Costs (Bahts)
Research and Development Cost	
Marketing Service Planning	500,000
System Research and Planning	500,000
Implementation Cost	
System Acquisition	
Hardware including system software	12,000,000
UMS Application software License	3,000,000
Right To Use software (0-20,000 subscribers)	3,000,000
Network and test equipment	7,500,000
Site Preparation	1,000,000
System Implementation & Testing	3,000,000
System Integration & Testing	3,000,000
Project Management	1,000,000
Initial Marketing Support	8,000,000
Total Initial Investment Cost	42,500,000

Table 3.2. The Estimated First Year Cost for the Implementation of the UMS.

The First Cost Category (From CBS)	Costs (Bahts)
Operation and Maintenance Cost	
Advertisement and promotion	10,000,000
Service operation supporting	1,000,000
Training	2,500,000
System operation and administration personnel	1,500,000
Network quality control and testing	500,000
11/W and STW Operation & Maintenance	5,000,000
Total First Year Cost	20,500,000

Table 3.3. The Estimated Second Year Cost for the Implementation of the UMS.

The Second Year Cost Category (From CBS)	Costs (Bahts)
Operation and Maintenance Cost	
Advertisement and promotion	5,000,000
Service operation supporting	1,000,000
Training	500,000
System operation and administration personnel	1,500,000
Network quality control and testing	*500,000
11/W and S/VV Operation & Maintenance	5,000,000
Total Second Year Cost	13,500,000

Year 6 to Year 10: Besides the operation and maintenance cost that must be paid in year sixth, the system expansion and modification is also another area of cost that must be put into account. The forecasted number of the UMS users in year 2005 will exceed the maximum capacity of the Right To Use purchased from the beginning of the investment, therefore the RTU or the license must be granted more in order to support all users as forecasted (see next chapter). For the seventh and the following

Table 3.4. The Estimated Third-Fifth Years Cost for the Implementation of the UMS.

The Third and Following Years Cost Category (From CBS)	Costs (Bahts)
Operation and Maintenance Cost	
Service operation supporting	1,000,000
System operation and administration personnel	1,500,000
Network quality control and testing	500,000
11/W and S/W Operation & Maintenance	5,000,000
Total Third and Following Years Cost	8,000,000

years, the operation and maintenance cost will be higher since hardware and software will have been used for already more than 5 years. It is normal that hardware which have been operated for a long time will have higher possibility to be out of order and must be fixed or replaced. However, the cost of service operation support should be lower since the service has already been introduced for quite a long period and it should be more familiar to customers. The estimated cost of the sixth year is as appeared in Table 3.5, and the estimated cost the seventh and the following years is as summarized in Table 3.6.

Table 3.5. The Estimated Sixth Year Cost for the Implementation of the UMS.

The Sixth Year Cost Category (From CBS)	Costs (Bahts)
Operation and Maintenance Cost	
Service operation supporting	1,000,000
System operation and administration personnel	1,500,000
Network quality control and testing	500,000
11/W and S/W Operation & Maintenance	5,000,000
System Expansion (RTU 20,000-100,000 Subscribers)	12,000,000
Total Sixth Year Cost	20,000,000

Table 3.6. The Estimated Seventh and Following Years Cost for the Implementation of the UMS.

The Seventh and Following Years Cost Category (From CBS)	Costs (Bahts)
Operation and Maintenance Cost	
Service operation supporting	500,000
System operation and administration personnel	1,500,000
Network quality control and testing	500,000
H/W and S/W Operation & Maintenance	6,000,000
Total Seventh and Following Year Cost	8,500,000



IV. DEMAND FORECASTING

The major task of this chapter is to forecast the revenue obtained from the usage of The Unified Messaging Services in GSM mobile network. The concept of this forecast is to predict long-term trend and the need of the UMS, considered as new services, by given the assumption that the established patterns or relationships do not change. The Analogous Products is used as the source of information for initial forecasting in this case.

4.1 The Unified Messaging Revenue Channel for Mobile Operator

As described in previous chapter regarding services and features of the Unified Messaging Services, the implementation of the UMS can benefit both the subscribers and the wireless network operator. For the operator point, various business models offering such services can be proposed. Generally, by considering the features that the UMS can offer, it can be expected that the revenue increased from implementing the UMS is the result of increasing in the usage of certain existing value-added services. Those particular services are Call forwarding, Voice Mail, and Short Message Service. Based on features and services of the UMS, this is true according to the following reasons:

- (1) The usage of the Call forwarding would be increased through the Single Number Reach and fax redirecting features. If the subscribers have activated the Single Number Reach feature, whenever the call comes in, it will automatically be forwarded to a certain number from which the subscribers can be reached. The same for fax redirecting feature, if the subscribers make a fax redirecting call, the fax will be automatically forwarded to a certain destination fax machine. These features are actually

two services are similar in the nature of services. Short Mail service offers customers the capability of sending and receiving e-mail messages through the mobile handsets. This is the same as the UMS that offers customers the capability of sending and receiving messages, not only limited to e-mail but the combined form of messages.

(2) The users of the UMS for the second and following year should be proportionally increased according to the percentage of the growth of Internet users in Thailand. This assumption should be true due to the following reasons:

- (a) The nature of technology is similar: Just like the Internet which is a network based where the capability of several important systems and services are integrated together, such as the E-mail, E-commerce, WWW, USENET, FTP, etc, the UMS is also a based system where many components are integrated to offer a wide variety of services.
- (b) The Microsoft has stated in the Microsoft's Vision on the Unified Messaging document that "The market for unified messaging system will be sizable and global — related so directly as it is to the Internet, the Public Switch Telephone Network and wireless". For this study, the target group for the UMS is those people who own the mobile phone and the Internet. And with the strong benefit of the UMS that the operator can offer, other GSM subscriber is another potential segment for using the unified messaging services.

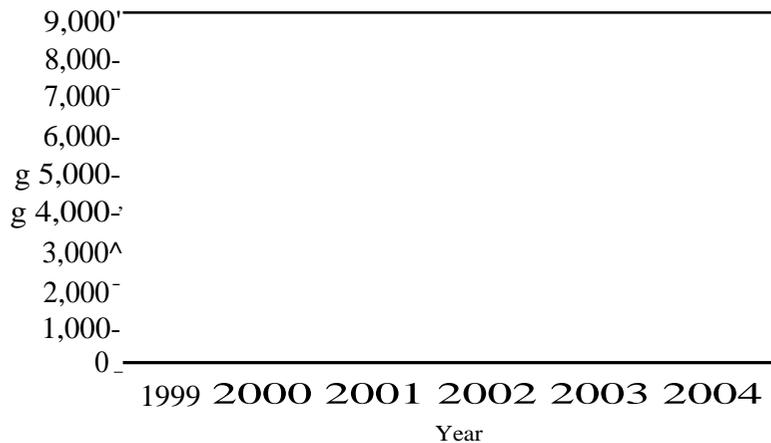
(3) The revenue increased due to the implementation of the UMS should be approximately the same percentage as the increasing of the global messaging volume. The UMS is a service that provides the information

delivery mechanism for customers, which is directly related to the messaging that people use to communicate to each other. Therefore, the revenue would increase according to the increasing in the messaging volume.

Considering the statistic information from the past when Short Mail service was first introduced into GSM network, the average number of subscribers who used Short Mail service was about 2,000 persons during the first year, with only about 40 Bahts/person/month of usage. This numbers was quite low due to the fact that the service was just introduced to the perception of customers and the adoption process of service was in place. During the first year of service introduction, customers go through all stages in the adoption process; awareness, interest, evaluation, trial, and finally adoption of the service. Because the market is not generally ready for service refinements at this time, the company must spend quite a high expense for advertising and promotion to create awareness and distribute information in order to build up the acceptance of the service among the mobile users.

Regarding number of the Internet users in Thailand, Figure 4.1 is a graph showing the forecasted number of Internet users from year 1999 to year 2004.

It is possible to do further estimation of the number of Internet users in Thailand by considering the characteristic of the graph together with the trend of the Internet growth globally. The Internet, like other products or services, will follow the traditional life cycle (Wood 1996). Most experts agree that the Internet is experiencing high growth and the other characteristics associated with the Growth phase. In fact, the Internet technology is determined as a new product when it was first introduced into Thai market. It has already been through the introduction phase, and is adopted, and it is going to grow high in the next five years as predicted by The Nation.



Source: *The Nation*

Figure 4.1. Estimated Numbers of Internet Users in Thailand from Year 2000-2004.

The global Internet growth trend has been investigated and predicted by many research firms worldwide, and most of these sources are predicted and agreed in the same way that the global Internet growth during the next decade will be very superior. Computer Industry Almanac reports an expected of 259 million online users worldwide by year-end 1999, by 2000 the number is expected to reach 349 million, 490 million Internet users by year-end 2002, and over 765 million by year-end 2005. Newsbytes Asia reports that there will be a 422% increase in the number of online users in Asia over the next six years and the number is expected to reach 228 million by 2005. There are currently 43.6 million online users in Asia and a 62% increase is expected by 2006. From these projections, we can ensure that the demand for the Internet in Thai market will grow in a high rate during the next decade.

When considering the graph of the estimated Internet users in Thailand forecasted by *The Nation* (see Figure 4.1) together with the global trend of Internet usage as mentioned above, it is reasonable to forecast the number of Internet users in Thailand during year 2005 to 2009 in the increasing direction. The curve fitting method is used here to analyze the forecasted data from year 2000 to 2004, together with the analyzing

of the mathematics model related to the curve of the graph. The result of the analyzing is a polynomial in the form of quadratic equation $y=469643x^2-2000000x+3000000$ that can fit the curve of the Internet users graph in Figure 4.1. The estimation of the Internet users in Thailand from year 1999 to 2009 should be like in Figure 4.2.

From the information appears in Figure 4.2, it is possible to calculate the growth in percentage of Internet users in yearly basis. By finding the different number of users in each year, then do the interpolations to receive the percentage of growth in each year, for example, the percentage of growth in year 2000 could be calculated as the following:

The difference in number of users from year 1999-2000

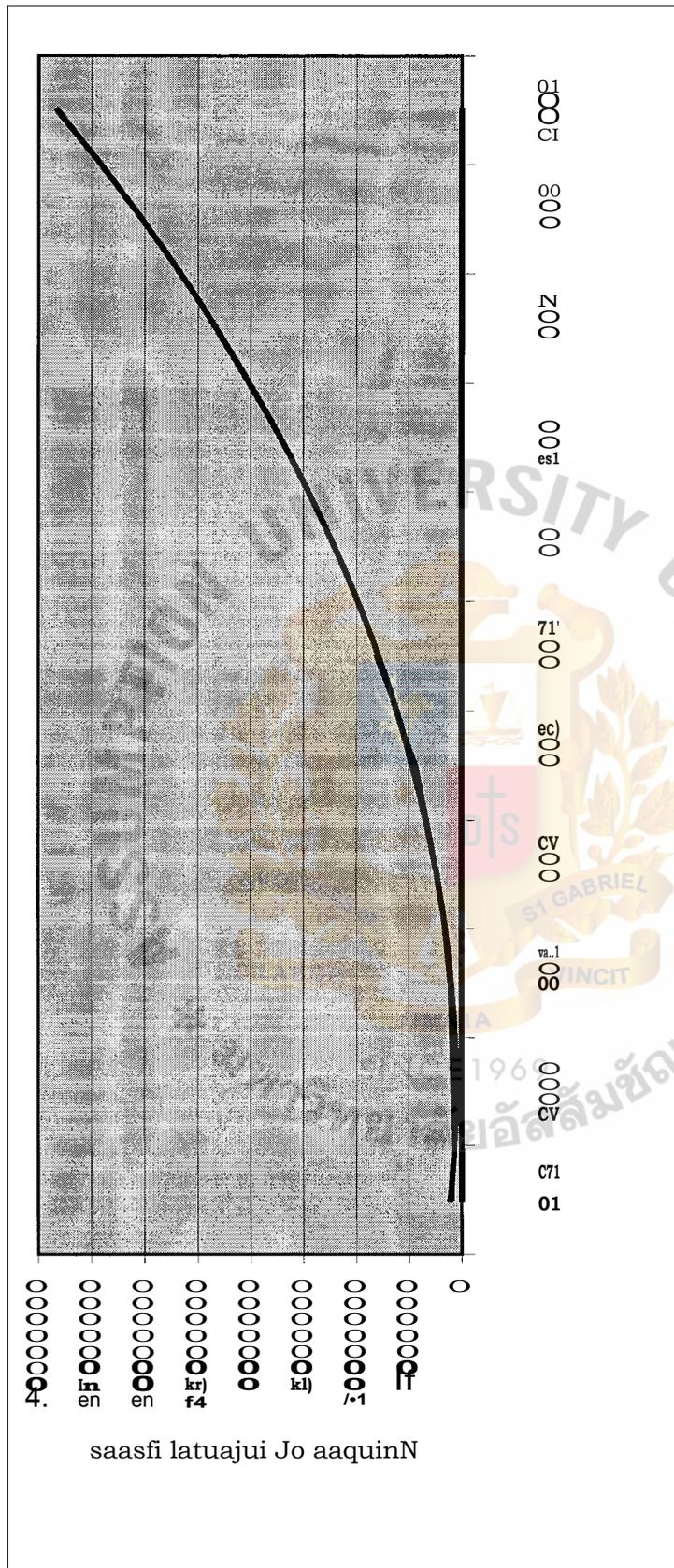
$$= 900,000 - 800,000 = 100,000$$

Therefore, the percentage of Internet users growth of year 2000

$$= 100,000 * 100 / 800,000 = 12.5\%$$

Table 4.1 shows the percentage of Internet users growth of each year based on the information in Figure 4.2.

In essence, not only the number of Internet users will increase as predicted, but the volume of messages sending and receiving will also be expected to increase over years. Today, the communication and the transfer of information is the most important task in person's day. Pitney Bowes, an independent global messaging system provider which a URL address at <http://www.pb.com>, conducted a world wide user survey in 1999 regarding the global messaging practices and found that message volume is growing approximately 6% per year. This includes all kinds of messaging altogether, e.g. e-mail, telephone, voicemail, postal mail, fax, etc.



Estimated Number of Internet Users in Thailand from Year 2000-2009.

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Summary of the Growth of Internet Users in Thailand.

ปี	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number of Users	80,000	1,000,000	2,000,000	3,000,000	4,000,000	5,000,000	6,000,000	7,000,000	8,000,000	9,000,000	10,000,000
Percentage of Growth	-	1,200%	200%	33%	25%	20%	17%	14%	11%	9%	7%

Table 4.2 shows the forecasting amount of the revenue increased from the implementation of the Unified Messaging Services from year 2000 to 2009. The result from the table is obtained from the calculation as explained above.

From the table, it is obvious that the revenue of the UMS implementation during the beginning years of the operation is quite low. The reason may be because the introduction of new service into the market normally consumes a period of time to reach the acceptance from customers. However, the revenue is predicted to increase every year according to the increasing in number of UM subscribers and the amount of usage as appeared in the table.



V. THE FEASIBILITY STUDY

This chapter presents feasibility studies for the implementation of the Unified Messaging Service in GSM wireless network operator, which consists of four main parts. The first part deals with the technical feasibility, followed by the second part which is about operational feasibility, then the marketing analysis, and the last part is financial feasibility study of the project.

The detail of features and services description in Chapter 3 is used here to analyze the possibility of technical and operational aspect, while the number from forecasting result in Chapter 4 is used as a based figure to analyze the acceptance of the market and the demand from the target group toward the new service. Lastly, the amount of investment cost from Cost Breakdown Structure in Chapter 3 and the amount of revenue forecasting in Chapter 4 are inputs for conducting the feasibility in term of financial. The key concept for financial feasibility study is to determine whether the project is feasible based on period of time required to cover the investment cost together with the amount of money gained from implementing the project based on the present value basis. The discounted payback and the present-worth methods are utilized here as a tool for financial feasibility study.

5.1 Technical Feasibility Study

The technical feasibility is the available hardware/software capable of meeting the requirements. When the need for a system is established, the technical-oriented study must be conducted to identify the possible technologies that can be applied in resolving the specified system requirements.

To implement the UMS in wireless network operator environment, there are two technical areas that should be focused on; one is regarding the UM core system

configuration and the other is the integration aspect. The detail regarding these two issues are as following:

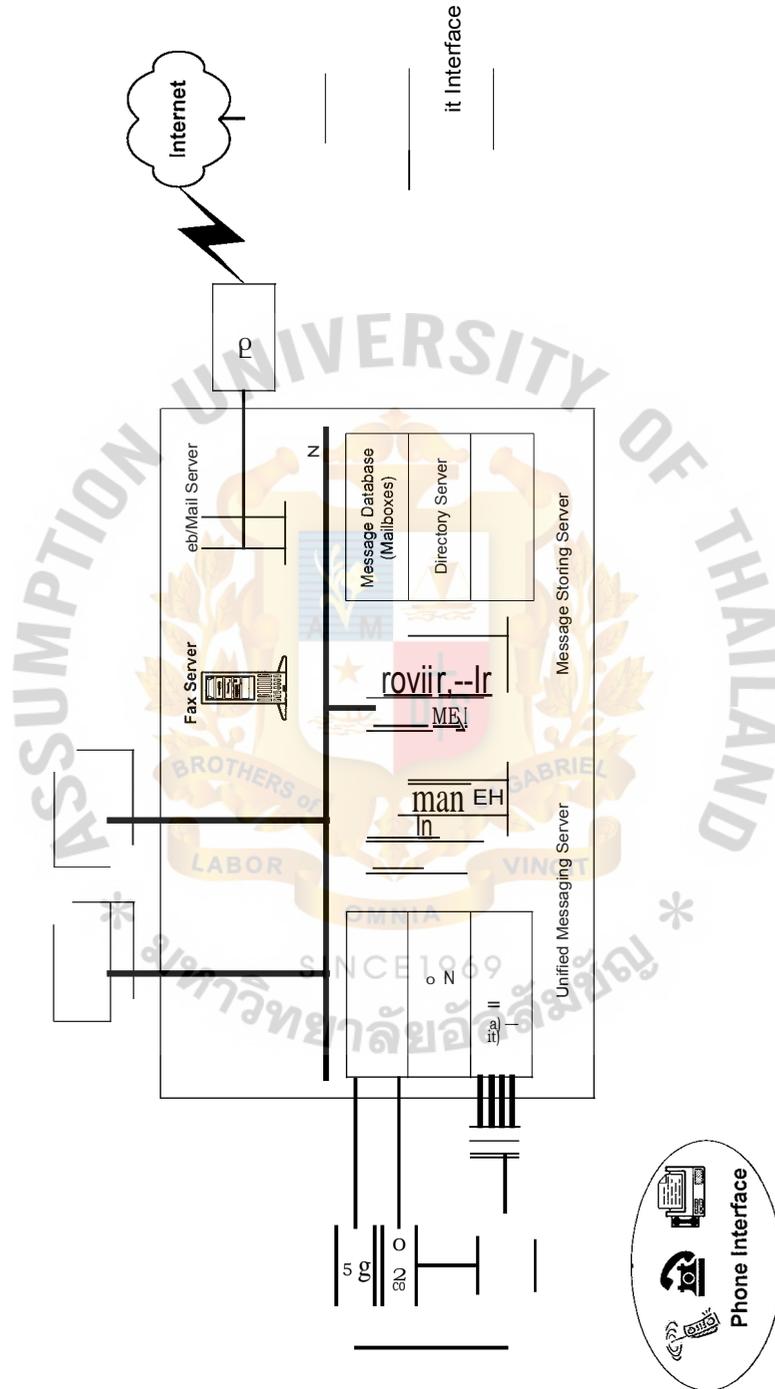
5.1.1 The Unified Messaging Core System Components and Configuration

The features and services description in Chapter 3 is used here to investigate and determine system components and configuration involved in the implementation. Based on the existing network infrastructure and environment together with the common UM framework necessary to build up the system, the picture of the Unified Messaging System should be as shown in Figure 5.1.

The architecture components of The Unified Messaging System based on services and features defined and the existing environment should include the Unified Messaging server, Message Storing server, Web/Mail server, Fax server, and Access Gateway(s) to outside network.

- (1) The Unified Messaging Server is the integral link between the LAN and telephone network. Its role is to:
 - (a) Play and record voice messages.
 - (b) Provide telephone answering for single number reach service of individual subscribers.
 - (c) Compress voice messages in realtime for storage on the Message Storing server.
 - (d) Retrieve voice messages from the Message Storing server, decompress and play them in realtime.
 - (e) Interpret DTMF for mailbox manipulation and control.
 - (f) Perform text-to-speech conversion for voice playback of text such as e-mail.
 - (g) Forward inbound fax calls to the fax server.

- (h) Forward faxes and e-mail messages to the fax server for printing.
 - (i) Interact with the SMS-C for notification of new incoming messages to the subscribers.
- (2) The Message Storing server is the system that acts as the repository for all subscriber messages in any forms (voice, fax, e-mail). It contains:
- (a) All user mailboxes.
 - (b) All mailbox contents: voice messages, e-mail messages, faxes and other documents are all stored in the server. It stores messages as objects, as file attachments or as simple text messages. Compressed voice and fax messages are stored in the mailboxes for playback, retrieval and transport.
 - (c) Directory: a list of all users and subscribers are stored in the LDAP database, including information regarding type of subscriptions and services for each subscriber.
- (3) Web/Mail server is the interface to the Internet world. Its functions are to:
- (a) Provide Web-based interface for service provisioning function.
 - (b) Offer a basic set of e-mail features: send and retrieve e-mail, retrieve e-mail from other POP account, etc.
- (4) Fax server is the interface for retrieving and delivering of the faxes from/to subscribers. When a fax is detected by the Unified Messaging server, it will be forwarded to the fax server along with fax routing information so that the fax can be received and placed into the subscriber's unified mailbox. The system also uses fax server to deliver faxes to subscribers.
- (5) Access gateway is the point for any telephony access, it is also the component that executes the requested service on the telephony access.



The Configuration of the Unified Messaging System.

5.1.2 The Unified Messaging System Integration to Other Systems

The Unified Messaging System must also be integrated into other existing system to enable combined components into one unified environment. For this particular studied system, as shown in Figure 5.1, the Unified Messaging System should be integrated into components as following in order to fully support the offered services.

- (1) The Internet: The Unified Messaging System must be connected to one of the Internet Service Provider in order to provide subscribers the connection to the Internet world, provide the Web-based interface for subscribers to manage their own profile through the Web and also the ability to send and receive mail to/from other account. This connection can be a trunk of leased line connected directly from the Web/Mail server to an Internet server with a certain speed, e.g. 1 MB, 2 MB, etc. Note that the connection to the Internet must be put through the firewall for protection of the internal network security.
- (2) The PSTN/PLMN: The Unified Messaging System must have a connection to the Mobile Switching network so that subscribers are able to make voice call for storing and retrieving of messages. The call will access at the voice gateway where the requested services are routed to the correct application within the system. This connection can be a 2 MB trunk connect directly to the mobile switching. And since the routing from the mobile switching network to the PSTN has already existed, therefore, there is no need to make new connection to the PSTN again for this purpose.
- (3) The SMS-C: The Unified Messaging System must be connected to the Short Message Service Centre for notification of incoming messages service. When new messages arrive in the unified mailbox, the application will

inform the SMS-C to send the notification to subscribers mobile phone. This connection can simply be an Ethernet connection or a leased line dedicated.

- (4) **The Voicemail System:** The Unified Messaging System should be connected to existing Voice Mail System to allow the transportation of voice and fax messages. The Ethernet connection can be used for the connection between the voicemail and the UMS.
- (5) **The Central Billing System:** The Billing is the component handling the charging function for all the services used by the subscribers. The connection to the billing system can be a direct Ethernet connection from the Unified Messaging System.
- (6) **The Central Operation and Maintenance System:** Operation and Maintenance is the component that facilitates the operation and maintenance management. This includes the fault management of the overall system. The connection to the operation and maintenance system can be a direct Ethernet connection from the Unified Messaging System.

5.1.3 Summary of the Technical Feasibility Study

- (1) **The Unified Messaging Core System:** The UM core system should consist of components such as the Unified Messaging Server, Message Storing Server, Web/Mail server, fax server, etc., altogether with technologies like text-to-speech, network adapter protocols, etc., to form a single system that fulfills all service requirements. This type of system has already been implemented in other countries in both ISP and Telco environments and is successfully operated especially in the US. Therefore, it should be possible

to implement the same type of system in the wireless network environment in Thailand as well.

(2) The Unified Messaging Integration Components: The UM system must be integrated into many network components in order to provide a complete service solution for mobile subscribers. As mentioned, the UM system must mainly be connected to the PLMN to provide an access channel for mobile handsets, which includes also other components such as SMSC and Voicemail system. On the other side, a connection to the Internet Service Node such as the ISP must be connected to provide the UM system the access to other mail server for sending and receiving e-mails. With the based infrastructure of the wireless network, the integration can be done as long as the UM core system support the correct type of protocols in order to inter-work with such components.

In general, the technical issue of the Unified Messaging System is not the problem in the implementation since the technology exists and has already been implemented. However, the budget for the implementation should be carefully prepared.

5.2 Operational Feasibility Study

In addition to the technical analysis, the operational aspect in implementing the UMS must also be put into account. The operational feasibility is the capability that the organization can absorb changes in technologies. When new technologies are introduced and must be implemented, the important thing beside the investment money is the operation personnel comprising the expertise and knowledge in carrying out successful implementation and operation of the system. In addition, the customer service support must also be arranged in a proper way to service all customers for

subscription of this particular service. Basically, the operation aspects that must be concerned for the implementation of this project should consist of the following points:

- (1) The person to carry out successful implementation and operation of the system. Regarding this concerned in the implementation of the project, the company must assign persons who are responsible for the implementation and operation of the system. And during the implementation, a turnkey type of contract can be made between the company and the supplier who supplies the equipment and technology. The expertise and knowledge in technology of the supplier company, together with the experiences of the company's own employee in implementing similar systems, can help the implementation to be successful. However, one of the most important things is the technology transfer. This area is simply the training program for personnel in charge of operating and administering the system, whether formal training or on the job training. The company must ensure that the training programs are carried out sufficiently to support future technical operation of the system.
- (2) The customer service support personnel and process: The persons who are responsible for customer service support can be those who have already supported in other services, who will be assigned more responsibility on this particular service. However, regarding this concern, the company must ensure that the process in distribution of the information about the service is arranged in a proper process and the information given to those personnel are sufficient to support potential customers satisfaction.

Given that the implementation project of the UMS is well managed to include the investment on operation personnel and to organize well the operational process in

customer service supporting function, the implementation of the UMS will be feasible in term of operational aspect.

5.3 Marketing Feasibility Study

The marketing analysis is done to assess the demand for products or services before the decision to introduce particular new product or service into the market. To predict the demand for the Unified Messaging Service, the number of the GSM subscribers and the behavior in using services can be used as a point of consideration together with the information on revenue forecasting result in Chapter 4.

From 1994 when the GSM network was first commercially operated in the market until now, the number of GSM subscriber is growing every year and is expected to continue growing for many years unless there is other network technology that could replace it. And since there are many types of value added services that could be developed and added into this digital network, whether in the form of voice or non-voice services, one of the competitive strategies is the differentiation in the value added services that the wireless network operators could offer to their customers. Therefore, many value-added services have been introduced and offered as part of the service beside the normal voice call. The example of value added services that have been offered are Short Message Service, Voicemail, Call Forwarding, Internet Short Mail, Interactive Voice Response (IVR), etc.

However the percentage of the revenue gained from these value added services is very low when determined from the statistic information on the usage of these value added services. Only approximately five percents of the total amount of revenue are generated from the use of value added services.

The statistics information from the past is definitely supporting the result of the forecasting obtained from previous chapter. That is the number of the Unified

Messaging Service users and its amount of usage will be very small compared to the total subscribers in the network. The reasons that shape this situation would be because of the followings:

- (1) Most of the subscribers utilize their mobile handsets only for normal voice communication purpose. They tend to use just only the handset's basic feature, which is for calling and receiving normal voice calls.
- (2) When introducing new and advanced technology into the market, it normally requires a period of time to distribute the information regarding the service until the customers get familiarity and to finally adopt it. Since the Unified Messaging Service is quite new, therefore, it takes time before the technology is moving into growth stage when high revenue can be generated.

In marketing point of view, the introduction of the Unified Messaging Service into the market will require a period of time before the adoption of this service. From the demand forecasting, the need for this service is not so high compared to total number of customers in the network.

5.4 Financial Feasibility Study

5.4.1 Feasibility Study Using Discounted Payback Method

Before conducting the financial analysis of the UMS project, it is necessary to determine the lifetime of the system. When the company introduces any new services into the market, the operation must be carried out until the end of its life, which in this case, is equal to the life of the GSM network. It is difficult to predict the life of the GSM wireless operating network and that it's life may last for a long period from now. However, the telecommunication business is currently granted under the concession by the Telephone Organization of Thailand (TOT), and the life is about ten years from

now. And because the technologies are moving fast and normally is quite short in its lifetime, therefore, it is reasonable to consider the Unified Messaging Service's project life for ten years.

The amount of project investment cost and the revenue increased from the UMS operation described in Chapter 3 and Chapter 4 are summarized in Table 5.1. And the cash flow diagram, which is a graphical representation of the cash flow drawn on time scale, appears in Figure 5.2 to show the time of UMS implementation from year 0 to year 10 (2000-2009).

From the amount of the investment cost and the revenue gained in the table, the discounted payback period method is used to determine the period of time required to cover the investment cost, based on the bank interest of 8%. The calculation is done from the following equation:

$$\begin{aligned}
 0 = & -42,500,000 - 19,540,000(P/F,8\%,n) - 12,143,539(P/F,8\%,n) - \\
 & 5,364,424(P/F,8\%,n) - 2,666,806(P/F,8\%,n) + 3,055,018(P/F,8\%,n) - \\
 & 2,872,724(P/F,8\%,n) + 17,279,936(P/F,8\%,n) + 28,425,246(P/F,8\%,n) \\
 & + 42,361,790(P/F,8\%,n) + 59,546,955(P/F,8\%,n)
 \end{aligned}$$

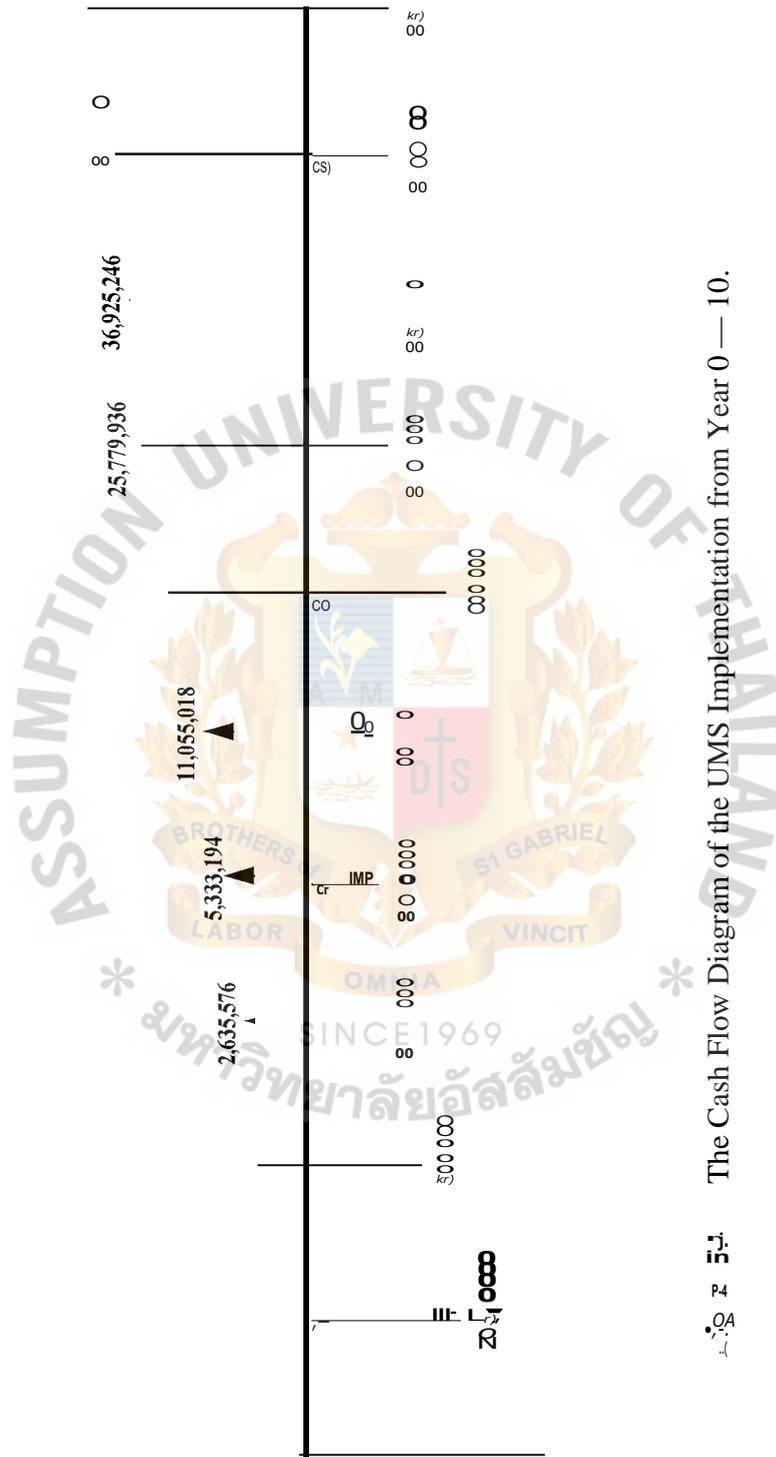
The result of the calculated payback period from this equation is $n = 12.4$ years which is longer than its life. Therefore, using the planning horizon of 10 years, the project will not be feasible.

5.4.2 Feasibility Study Using Present-Worth Method

In order to find out what is the revenue gained or lost by the end of year ten in implementing the UMS, the present value of all investment cost and revenue received during ten years can be calculated or discounted into the equivalent value of money now by using the present-worth method.

Table 2. Summary of the Investment Cost and the Revenue Gained for the Implementation of the UMS.

รายการ	บาท										
	Initial (0)	2000 (1)	2001 (2)	2002 (3)	2003 (4)	2004 (5)	2005 (6)	2006 (7)	2007 (8)	2008 (9)	2009 (10)
Investment Cost (Bahts)	20,500,000	20,500,000	20,500,000	20,500,000	20,500,000	20,500,000	20,500,000	20,500,000	20,500,000	20,500,000	20,500,000
Revenue Gained (Bahts)	960,000	1,920,000	2,880,000	3,840,000	4,800,000	5,760,000	6,720,000	7,680,000	8,640,000	9,600,000	10,560,000



รูปที่ 5.1 The Cash Flow Diagram of the UMS Implementation from Year 0 — 10.

Follow the bank interest, the interest i of 8% compounded yearly can be used to calculate in the present-worth equation. Let the $PW(\text{cost})$ is the present value of the investment cost and $PW(\text{revenue})$ is the present value of the revenue gained, and note that the value of the factor $(P/F, 8\%, 1)$ is 0.9259, $(P/F, 8\%, 2)$ is 0.8573, $(P/F, 8\%, 3)$ is 0.7938, $(P/F, 8\%, 4)$ is 0.7350, $(P/F, 8\%, 5)$ is 0.6806, $(P/F, 8\%, 6)$ is 0.6302, $(P/F, 8\%, 7)$ is 0.5835, $(P/F, 8\%, 8)$ is 0.5403, $(P/F, 8\%, 9)$ is 0.5002, and $(P/F, 8\%, 10)$ is 0.4632. The calculation of the present value of this UMS project is as following:

$$\begin{aligned}
 PW(\text{cost}) &= 42,500,000 + 20,500,000(0.9259) + 13,500,000(0.8573) \\
 &\quad + 8,000,000(0.7938) + 8,000,000(0.7350) + 8,000,000(0.6806) \\
 &\quad + 20,000,000(0.6302) + 8,500,000(0.5835) + 8,500,000(0.5403) \\
 &\quad + 8,500,000(0.5002) + 8,500,000(0.4632) \\
 &= 121,074,900 \text{ Bahts} \\
 PW(\text{revenue}) &= 960,000(0.9259) + 1,356,461(0.8573) + 2,635,576(0.7938) \\
 &\quad + 5,333,194(0.7350) + 11,055,018(0.6806) + 17,127,276(0.6302) \\
 &\quad + 25,779,936(0.5835) + 36,925,246(0.5403) + 50,861,790(0.5002) \\
 &\quad + 68,046,790(0.4632) \\
 &= 118,335,150 \text{ Bahts} \\
 PW &= - PW(\text{cost}) + PW(\text{revenue}) \\
 &= - 121,074,900 + 118,335,150 \\
 &= - 2,739,750 \text{ Bahts}
 \end{aligned}$$

From the present value obtained in the calculation above, it is possible to conclude that by the end of year ten after the implementation of the Unified Messaging Service, the company will still lose approximately 2,739,750 Bahts.

VI. CONCLUSIONS AND RECOMMENDATIONS

This chapter is intended to conclude and to express ideas regarding the investment on the Unified Messaging Service in the wireless network operator environment. The study done in this paper is referred to the current existing situation and is based on the nature of the telecommunication business in Thailand. Although the Unified Messaging System can be a base system for many other services that the company can offered, functions and features of the UMS covered in this study is only a part of services available currently, which is clearly scoped and written in Chapter 3.

6.1 Conclusions

In an attempt to introduce any new services/technologies into operation in the market, operators must have a certain level of confidence that such technologies are feasible or worth to implement. Due to the reason that technologies are moving so fast, the operator must ensure short payback period for the investment, which indicates the level of profit gains in the particular technology implementation. This is because the longer the payback period of the project, the more risky the company will face in term of financial. Therefore, the payback period for such technologies, particularly the Unified Messaging System, should not last longer than five to ten year timeframe.

Based on the result of the feasibility study in previous chapter, the implementation of the UMS is possible in the wireless network in term of technical and operational. But when considering the financial aspects, it is obvious that the project is financially not feasible, since the project cannot payback within ten years and the company will face revenue loss of approximately 3 million Bahts after ten years of the UMS operation. The result also indicates that the project is not feasible in term of marketing, because the demand for the UMS as a value added service for the wireless handsets is quite a small portion of the total network subscribers.

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6.2 Recommendations

Although the implementation of the Unified Messaging Service will not be feasible in term of financial and marketing, however, the decision for the implementation of the Unified Messaging Service should not be limited only to the financial and marketing issues. There are many other factors that should also be taken into account in order to decide whether to continue investing on the project. The following points are factors that the management must consider.

- (1) The implementation of the UMS can have a great indirect benefit to the company, because it may be a cause of the increasing in the number of subscribers in the network. Although there may not be many people who are going to use the UM Service, the new value added service would lead to a positive image of the company and it is the indication of the quality in servicing the customers, which could persuade new customers to subscribe to the GSM network.
- (2) If the leadership is the key concept for the company's market strategy, then to be the first to introduce this advanced technology into the market would be a way of maintaining its position in the telecommunication business. Although the demand for the UMS in Thai market is not high during the beginning of the introduction, however, being the first mover in implementing such service would mean the advantage to the company. This is because while the standard of the Unified Messaging has not yet been standardized in the market, the implementation would mean that the company is capitalizing on the opportunity to create the standard of the messaging services in the market, in order to become the leader in the wireless messaging service.

(³) As mentioned earlier, the Unified Messaging System is not an end product system, but instead a based platform for many kinds of applications or services that the company can provide to its subscribers. Therefore, implementing the UMS would be an opportunity for the company to create another services added on to the same system. The example of the other service that can be further developed in the same platform would be the Speech-to-text using voice recognition technology, which is currently under developing by many vendors and not yet a reliable system but is expected to be available soon.

To be able to further develop new services within the same system as another added on module provides the company the flexibility and a faster time for introduction of new services solution into market in the future. This ability would be an advantage such that it gives the company a highly competitive edge over its competitors, and also provides the company with new revenue channel. In case the company is going to introduce new services in the future by utilizing the same UM platform, the result of the feasibility study may be different from what is studied here and the company may need to do another separate feasibility study case.

In general, the management of the company is required to consider all the possible factors as mentioned above together with the feasibility study result, and leverage all these factors to determine the most important factor for the decision making process in order to come up with the final decision.

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