DESING AND IMPLEMENTATION OF SERVICE MANAGEMENT SYSTEM

by

Mr. Chirasak Luiang-urai

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

November, 2000

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Project Title	Design and Implementation of Service Management System
Name	Mr. Chirasak Luang-urai
Project Advisor	Asst.Prof.Dr. Vichit Avatchanakorn
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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.

Approval Committee:

(Asst.Prof.Dr. Vichit Avatchanakorn)
Advisor

(Prof.Dr. Srisakdi Charmonman)
Chairman

(Dr. Chamnong Jungthirapanich)
Dean and Co-advisor

(Asst.Prof.Dr. Boonmark Sirinaovakul)
Member

(Dr. Prapon Phasukyud)
Member

(Assoc.Prof. Somchai Thayarnyong)
MUA Representative

November 2000

ABSTRACT

This project is to design, develop, and implement application software ttiat will provide improved performance of services and quality of services in a computer company. The existing service system is based on manual operation and paper documents passing among units in the organization. The problems of the existing system are information scattering, lacking of performance measures, outdated data, and slow communication. The proposed system, which relies on a centralized database will maintain all necessary data in the service processes. It will keep data related to performance and quality of service and provide tools for analyzing those data as well as generating managerial reports.

Two key concepts are kept in mind during system design and implementation. The new system must be consistent to customers' behaviors and the costs of development must be kept into minimum. The existing resources are utilized as efficiently as it's possible. A PC-based server and Microsoft SQL are used due to their cost effectiveness. Borland Delphi is the main development tool because the development team familiar with it.

After implementation, the new system shows its value of information center. Services are delivered to customers faster, more efficient, and more effective with reasonable costs. Managements can monitor status of services and can find points of improvement quickly. The company can also save much money by better resources utilization.

ACKNOWLEDGEMENTS

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I. INTRODUCTION

1.1 Background

Customer satisfaction is a key measure of success or failure of a company. Many companies explicitly include the concept of customer satisfaction in their corporate mission or core value statements. Further, they incorporate customer satisfaction management in both strategic and operational plans. Customer satisfaction management usually links to quality-related processes.

Service or customer support is a must in today's business. In fact it can be said that the service itself is the business of many organizations. Service has direct impact on customer satisfaction. In one way a good service can create good customer perception of the service. In another way a lower-than-expected service will push the existing customer out and prohibit new customers. A quality service can establish loya(lty and competitiveness. Business, in contrast, may collapse by a bad service. A quality process and system is not only built with a good plan, but it also requires continuous improvement by analyzing pass performance and feedback data. Good communication among participants is a key factor of quality system too.

Service management requires accurate information about customer (finding out who your customer and what they want) as well as fast and effective response. Several data must be continuously collected and measured in order to improve performance of the service. Information technology is an appropriate tool for doing such things. There are many ways to apply information technology with service management. It can be used in financial function, customer assistance function, communication, and so On. The company in this case sells and implements computer systems for its customer, and provides both technical support and on-site service. It wants an information system that maintains customer data, equipment data, and customer calls. The system would

automate day-to-day operation such as job assignment/scheduling, problem/solution search, and generates several reports.

1.2 Problem Statement

The existing service system of the company in this study is a manual system which mainly uses paper documents. The current system faces many problems as stated below:

(1) It is difficult to retrieve some information from scattered data.

(2) Management cannot monitor the service processes. Sometimes customer's problems are solved too late and it affects satisfaction in services.

(3) Management lacks quantitative data. They don't have data of number of calls, service time, costs of service, etc. so service performance evaluation is subjective. It 's also a tedious work because information comes from many paper documents.

(4) Resources are not utilized properly. Some staffs are burdened with workload when others have too much free time.

(5) Service staffs don't have tools and sources of information that will help them solve customer's problems. They lack knowledge base of past problems and solving so quality (efficiency and effectiveness) of services depends on staffs' ability.

1.3 Objectives

Service Management System would be developed for these objectives.

(1) Collect necessary data related to service processes, rearrange it, and keep it in the centralized database so that information can easily be retrieved and analyzed.

(2) Change from paper documents into electronic forms.

(3) Generate up to date reports for management. The reports give information about status of service processes such as workload, efficiency, costs, etc.

(4) Build knowledge base to help service staffs solve customer's problems.

1.4 Scopes

The service management system covers the following functions:

(1) Customer Information Management — All essential information related to customer (name, location, user, equipment, etc.) will be recorded as a master data and will be referenced by other transactions.

(2) Call Management — All incoming calls will be kept into the database. Call status can be monitored so that appropriate action can be taken at the right time.

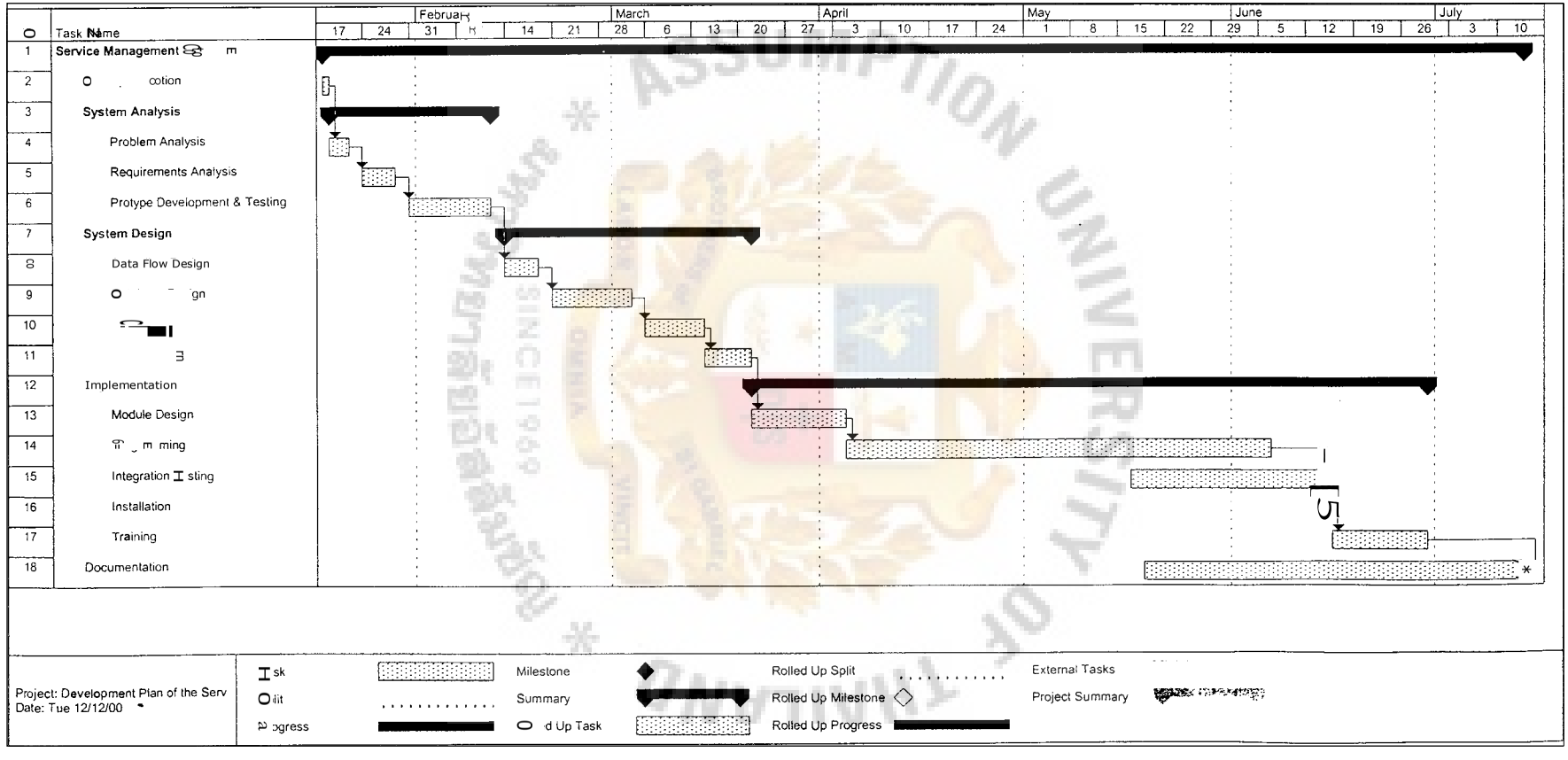
(3) Service Operation Management — Service requests and work orders 'will be submitted to agencies through the information system. Management can monitor and evaluate performance of individual agency as well as the cost of service.

(4) Help Desk Assistant — The past problems and proved solution will be categorized and be kept into the database with searching tools.

(5) Messaging System — Electronic mail is a major tool for transferring information between individuals and groups of people.

(6) Reporting — The service management system will generate both operational reports and reports for management. Operational reports include work order, service summary report, and so on. The other type of report is for management. It will show information about workload, performance, or cost of service by which management can evaluate the service.

1.5 Project Plan



Project Plan

II. LITERATURE REVIEW

2.1 Prerequisites for Service Management

Most businesses or maybe all will relate to an aspect of service either service provider or customer or both. Good service will help stimulate the customer to consume goods and services as well as accredit the quality of goods and services so that re-buying is generated. Moreover, the good services could help the businesses to grow and gain more customers. In other words, the service provider could create their customer by their own servicing.

Service management is a technique that could be used to create customers who will need the service. This will help the business to reach the customer's satisfaction which affect directly its income and profit. Service management covers every part, which relates to the customer from a physical infrastructure management to the management of how each staff has been working.

Before any improvement or change is made, reviewing of current situation must be done first. This will indicate where we are at present include our strength and weakness. Below are the details of what has to be reviewed:

(1) Review of Current Service

The first step is review of current service in order to answer questions as follows:

(a) Who is the customer or the service user?

(b) What does the customer use service for?

(c) What is the pointer of the efficiency of service?

(d) What is the efficiency of service needed?

(e) What is the principle process in service management?

(f) Who is the main group related to the service?

(2) Review of Service Specification

This step is to review what is the service providing to the customer, what is the specification. These are necessary because it will be difficult to know the cause of either success or failure of the service if the service is not specified. Service management must not only provide compatible service to make the customer satisfies but also specify definition and creation of the service.

(3) Review of Users' Service Expectations

The expectation of service is changeable. It is specified by various factors from present experience in using service sold to new information gained by customer. Users' expectation will determine the level of satisfaction in service. How to provide some which is higher than users' expectation must be awarded to increase users' satisfaction at any real level of the service.

(4) Review of User Perception of the Service

To know how the service is, user perception is the best indicator because it holds both the measurement of the service efficiency and the users expectation. Understanding users' perception will provide a clear picture of elements of the service that is the most important to the users. So, the review of users' perception is the most significant to indicate the users' perception.

The objective of a service management implementation is to manage all the elements of the service, from the setting and ongoing management of the customers' expectation to the delivery of service on a day-to-day basis to ensure that the gap between users' expectation and users' perception is narrowed to a point where the customer satisfaction with the service is at an acceptable level. (Hallows 1995)

2.2 Defining and Understanding Customer Requirements

Defining customer requirement is the kicking off on the setting up all service management system. If the customer requirement have been clearly defined and understood, service provider will reach the right and effective goal over the user's perception. However, there will be three huge problems in defining requirement of service (which all organizations must face) as follows:

The first and the most remarkable problem is that most customers could not clarify the picture of service; they have not expected to understand what users really need from service, not only what needs but also why they need it, must be found.

The second, which greatly affects the definite customer requirement on service basing on technology, is closed information between the need of system and working method the need of service. Both parts affect customers' perception but in Service Management the difference between the need of working method and the need of service have to be separated in order to understand that which part is value added to the ability of the system.

The third is there are a number of different communities, each of which has different objectives and different angles from which they perceive. The diverse nature of these objectives will almost inevitably lead to conflicts of interest regarding the service. The other part of service management is to manage the relationship among the groups of users to help them understand and accept the different needs and objectives.

Requirements for service provision must be understood in terms of whether they are what user wants, what the user needs, or what the user expects. What the user wants may not be articulated in terms of a technical capability or service. It is more likely to be related to the business objectives being supported by the service. The needs of the user are also likely to be expressed in business terms, but probably with a greater

emphasis on the capabilities required rather than objectives to be met. Both wants and needs must be understood and reconciled. What the user expects is the main area in which the service provider can exert influence, as expectation is a result of definition of needs and specification of how the service can meet those needs.

In order to understand user wants, needs, and expectations, it is necessary to understand the users themselves.

2.3 Measuring Customer Satisfaction

A successful service must respond to user needs and expectations otherwise it will fail. So accurate and punctual measuring is needed to measure customer satisfaction. There are many things that can be used to measure customer satisfaction such as service availability, response time, number of faults, length of time the telephone rings at the help desk, length of time used to fix the problem, and so on. While all are very worthwhile, they are measurements of items that determine customer perception of service quality and not direct measurements of the customer's perception of the service or the customer's satisfaction. Customer satisfaction is more than the sum of the parts. While good performance by each individual element may be indicative of successful service provision it is not a measure of the real test of customer satisfaction.

For example, a service could be operating at 99.99% availability, but if that 0.01% unavailability was when a particular user wanted to access the service, it is unlikely that user is 99.99% satisfied. They are probably extremely dissatisfied with service performance. All they saw was 100% unavailability.

Only one method to measure customer satisfaction is asking them what they need, Direct contact with customers help the service provider knows any real problems and identify the potential of the satisfaction in advance before other alternatives will be

considered. However using indirect measuring is still needed because it can be used to measure the quality of the service in a quantitative way.

Measuring customer satisfaction is a process of systematical plan and study. Although there is no practical rule, from the study (Wargo 1996) it is found that what impede the success of measuring customer satisfaction are as follows;

(1) Inadequate study definition

Analysis will be inaccurate if the definition of the study is too narrow. On the other hand if the definition is too wide it will be time wasting high cost and information gained will not correspond to the needs. So the definition must be clear and be accepted by all parts involved in the study.

(2) Failure to take process orientation

Measuring customer satisfaction is not just a figuring and comparing the outcome of customer satisfaction which for example maybe level of 4.2 from 5. This does not suggest how to improve the quality of the service. Working process and it's problem, how to make a good example including how to improve the process to increase customer satisfaction must be studied. The satisfaction at 100% is not always suitable. Each organization has to find the balance point for itself and it's customer.

(3) Inability to define appropriate performance measures

Performance measures for customer satisfaction are kind of tricky. A look at basic measures of overall performance such as profitability may not make the best of indicators since the financial impact of customer satisfaction is often a long-term effect. Likewise, other measures such as customer retention quickly lose their appeal as one begins to realize the inability to compare retention rates across industries. And, as mentioned

earlier, customer satisfaction scores themselves may not lead you to the best company.

A more complete answer lies in breaking down the process of customer satisfaction management and picking measures that indicate "best" in that particular sub-process. For example, commitment to customer satisfaction improvement May best be indicated by whether or not an organization specifically mentions customer satisfaction goals in its mission/vision statements or corporate objectives. Still, issues of prioritizing customer satisfaction data may be best addressed by questions that ask for information on if or how the organization prioritizes the customer data it receives. And other areas that you wish to emphasize in particular will have their own indicators.

2.4 Customer Assistance and Help Desks

In some organizations the customer assistance function is seen as merely providing a capability to receive calls from uses and pass them on, or serving as a gatekeeper between the users and those who can help them. The key to resolving customer calls is to get the right information to the right person in the right time frame.

Other organizations have implemented highly skilled help desk functions for a specific user groups that are able to resolve almost all problems without further reference.

The requirements for customer assistance differ depending upon the kind of services being offered and also upon the relationship between the service provider and the service recipient. The decision of what kind of customer assistance function to implement is key to ongoing customer satisfaction and perception of customer service as well as the cost effectiveness of the service provider organization. Some of the basic determining parameters are as follows:

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(1) Number of Users - With a large number of users, there is normally a high volume of customer assistance calls. The requirement for the quick pick-up of calls and the need to handle a high volume frequently determine the introduction of a call dispatch function.

(2) Number of Services - When a number of services are being offered by an organization with a single customer assistance point, it is unlikely that a customer assistance function can provide support for all services without referring the call to a specialist function elsewhere in the service provider organization.

(3) Service Recipient Interface - Many organizations have their own internal help desk to interface to the service provider. This results in two major changes in the relationship. First, the number of calls is filtered and reduced, and second, the caller to the service provider is at a higher skill level than average end user. In this case a call dispatch function is not appropriate.

(4) Skill Levels - A high skill level within the service recipient also determines the type of response expected from the service provider. When the skill level of the service recipient is higher than that of the service provider, this causes frustration and dissatisfaction in the service recipient. In the long term the development of the skill level within the service provider's help desk is essential to improve the service provided. As the skill levels increase, customer assistance functions are more likely to make an immediate response to users with problems.

The goal of customer assistance is to resolve customer's problems quickly and cost effectively, and to change the customer's poor perception of service into a

perception of quality service. A good help desk today will be able to close about 80% of all telephone calls with the customer first call.

A benchmarking study by the American Productivity & Quality Center (APQC) shows call centers to be valuable tools for improving and maintaining customer satisfaction. The 57 percent of best-practice companies that use call centers do so as tools for comprehensive data mining. Long gone are the days of using call centers to herd incoming inquiries; they have since become real-time customer feedback systems.

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III. SYSTEM ANALYSIS

3.1 Background of the Organization

(1) Business

The company in this project runs business about selling computer, software and network system. It also provides maintenance service for other organizations. The company's products and services are in the following areas:

(a) Computer - Company sells computer sets with pre-installed operating systems. It provides after-sales services of hardware maintenance and fixing.

(b) Network Equipment - Customers can purchase the network device and setup it by themselves or they can have the company setups for them. The company also provides advisory service in designing network, installation, and solving problems.

(c) Application Software - The company has its own developed software for freight forwarder and securities company that need technicians for installation and technical supports.

(d) System Integration - Not only the specific products are sold, but also total solutions consisting of products from many sources are often required. System integration needs higher skills and knowledge because problems of interoperation between products are commons.

(e) System Maintenance - System maintenance and administration are provided for other organizations that do not want to concern about technical issues and concentrate to the core business. Technicians will visit customer's sites on schedule or in need.

(2) Customer

Customers can be divided into two major groups. The first group is personal customer and the second is corporate customer. The latter is the bigger group and uses service frequently. Customers are spread over several industries and none of them take majority of stake than others. Customer may be defined by their requirements on the service.

(a) End User - The first and most obvious is the end user, who has requirements for the functions and performance of the service and the level of help and support available.

(b) User Management - The user management has requirements on the service for the management of the user population, the control of costs, and the ability of the service to support the organization in meeting specific business goals.

(c) Service Provider Staff - People involved in the day-to-day provision of the service are also requiring the service. Their needs determine their ability to provide a level of service that will meet the requirements of the end use and use management.

(d) Service Provider Management - The management have requirements to be able to know the effectiveness of the service being provided in meeting the objectives of the organization itself.

(3) Organization Chart

The company is a small organization. It has around 55 employees in the following departments:

(a) Sales and Marketing - It's responsible for achieving sales target using marketing tools and strategies. There are two sections in sales and

marketing department. The channel sales section establishes and manages distribution channels through dealers, and corporate sales section takes care of corporate customers.

(b) Finance and Accounting - It's responsible for accounting and financial functions in the company.

(c) Human Resources and General Affairs - It's duties are office support, facilities and utilities managements, and all functions of human resources management.

(d) Purchasing - Other units can send purchasing requests to this department. Purchasing department will find the sources and bargain the prices. It also manages the stock of goods.

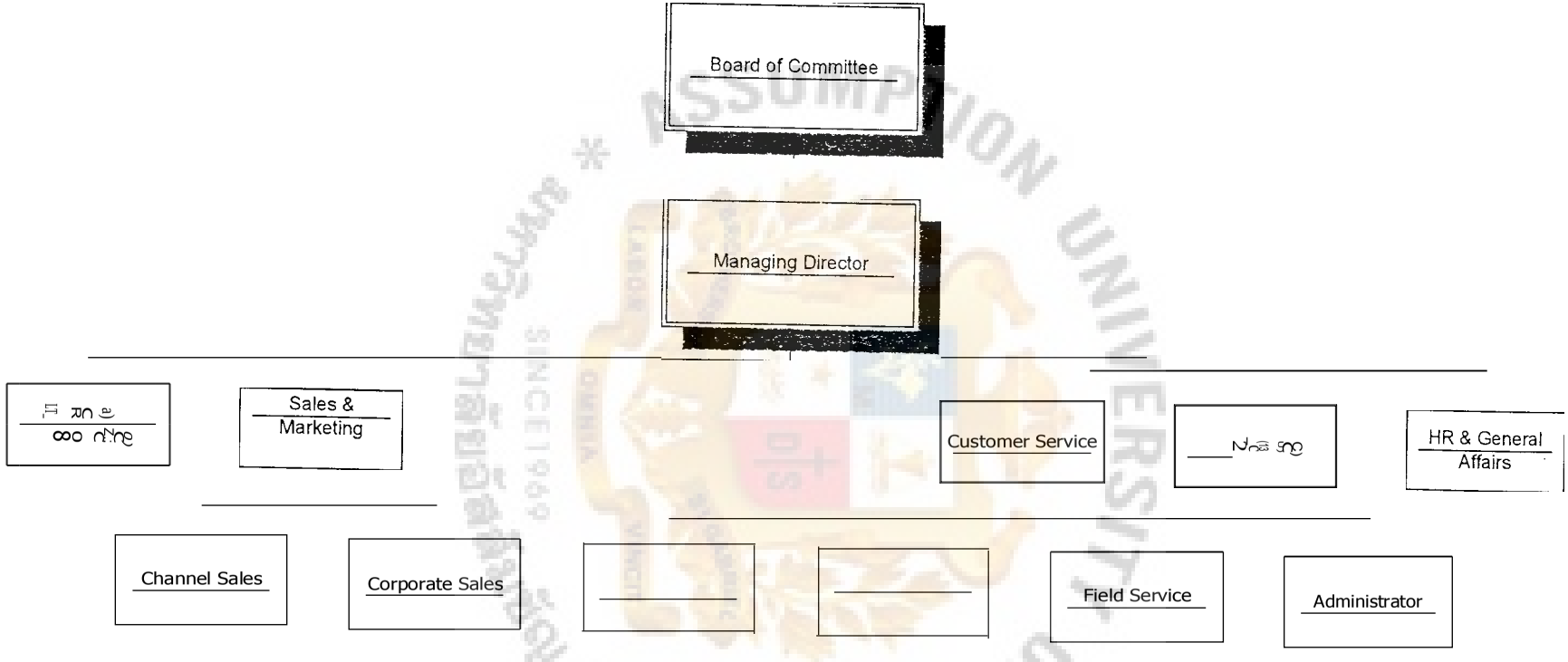
(e) Customer Service - The customer service department runs all of technical supports and service functions. It's divided into four teams:

(1) Help desk team receives calls from customers and solve their problems online. The unsolved problems are forwarded to field service team or product specialist team but the help desk team still monitors succeeding processes and keeps contacts with customers.

(2) Product specialist team is a group of people who are expert in products sold by the company and provide technical consultancy and solutions in depth.

(3) Field service team provides on-site services at customers' sites.

(4) Administrator team helps document work and control stock of spare parts and equipment.



Organization Chart.

3.2 Service Process

The current service process begins when customer calls for help. Help desks receive the calls, get information about customer problems, and try to solve them at once. If the problems are too complex, they will transfer the cases to field services or product specialists. If nobody is available at that time, customer will be asked to wait for call back within two hours. Field services or product specialist then take further actions.

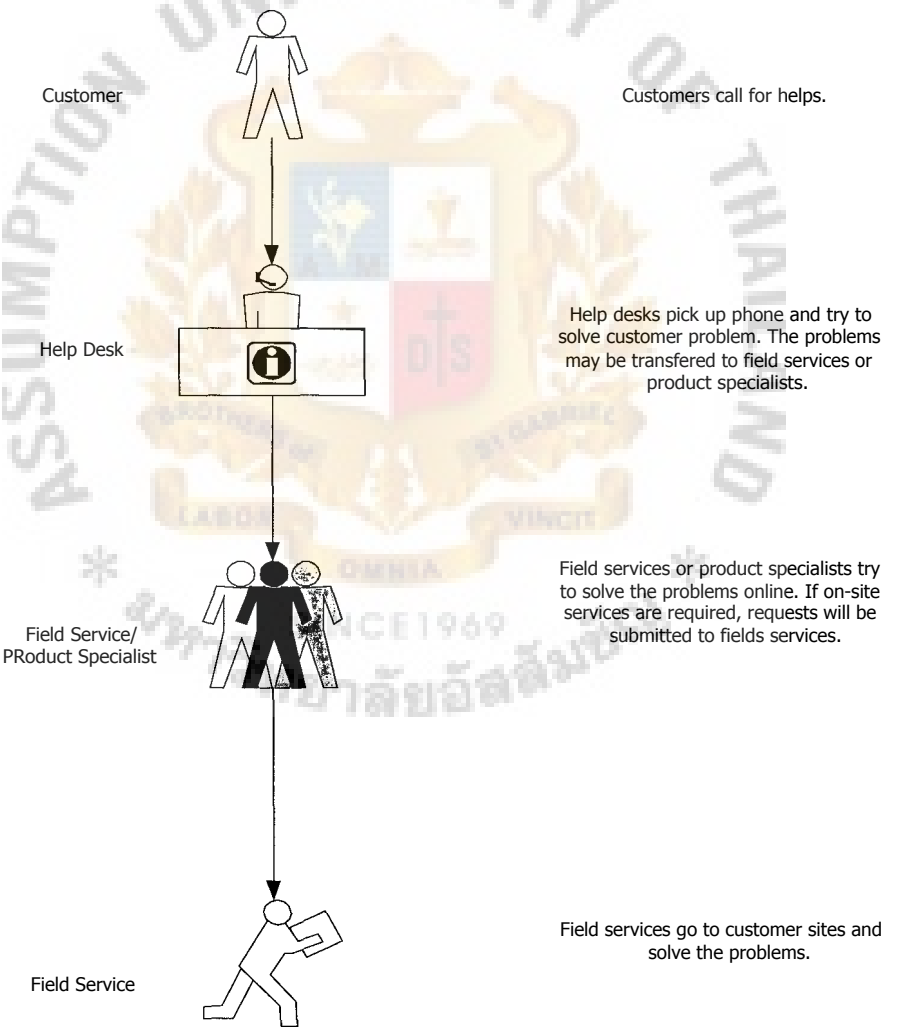


Figure 3.2. Work Flow of Service Processes.

If the problems cannot be solved by telephone, requests for field service will be sent to appropriate staffs by help desks. Customers will be appointed for on-site service and field services will reach the customers' sites within next business day. The field services have to submit service reports to their supervisors after they finish jobs. Otherwise they won't get service wage.

From the beginning to the end, it is the responsibility of help desks to monitor status of the cases, to keep communication with customer, and to coordinate with other units so the problems will be solved as soon as possible.

3.3 Current Problems and Areas of Improvement

Problems in the existing system can be divided into two groups, problems in service delivery and problems in service management.

(1) Problems in Service Delivery

Problems found in service delivery usually involve quality of service and performance of service.

(a) Problem solving depends much on ability of individual staff and his familiarity with the problem. It is difficult to control quality of service consistently. It usually takes more time to solve customer's problems when a highly skilled staff is not available.

(b) A higher skilled staff normally has more workload than others. He is so busy that he has a little free time to transfer his knowledge to others. The eventual result is he is burdened by more and more work and quality of service is dropped.

(c) Most documents are paper documents kept in files and binders. It is difficult to retrieve pieces of important information from a pile of paper.

(d) There is no record of customer's call so nobody except the one who receive the call can check follow-up actions.

(e) Schedule of service is written on limited space of a whiteboard. Rearranging schedule is not easy. It's also hard to check which staffs are available at any time.

(f) Many reports are created from scattered data so it 's likely to be time consuming and to be full of errors.

(g) Internal communication between each staff is in the form of memo or informal notes. It cannot guaranty that a recipient gets the message or a sender has sent the message.

(2) Problems in Service Management

Service management involves monitoring status of service tasks and taking proper actions to prevent any causes of customer's dissatisfaction. The company in this project has problems in service management as below:

(a) Management has outdated information because of delay in collecting data from scattered sources.

(b) Managements don't have quantitative data related to performance of service. They cannot accurately evaluate performance of service. It's often subjective up to who evaluates. Managements want to improve performance of service but they lack accurate measures.

(c) Information of service usage such as frequency and costs cannot be retrieved fast and easily. The information can be used to determine appropriate level of service that increase customer's satisfaction by spending minimum money.

3.4 Existing Computer Information System

Currently, almost all of the staffs in customer service department have their own PCs. They normally use PCs for documentation, Internet access, software testing, problem simulation, and so on. All computers are connected together through local area network and there also is one server for file and print service and for the inventory management software.

Table 3.1. Inventory of the Existing Computer Information System.

Computer Hardware and Software	Quantity	Functions
Server - Pentium II 350MHz - 256MB RAM - 16GB Harddisk Space - Windows NT Server	1	File and print services
PCs - 32MB RAM or more - Varieties of CPU model - 2GB Harddisk space or more - Windows 98, Windows NT	15	General purposes
Laser Printer	1	Network printer
Fast Ethernet Hub 16 Port	2	LAN equipment ,
Microsoft SQL Server	1	DBMS for inventory management software

Microsoft Windows 98 is the main operating system. There are a few PCs run Microsoft Windows NT and one of them is the server. There is no plan for using Unix or other operating systems in core functions by the next few years, though Linux is being studied as a substitution for Windows NT.

The server runs Microsoft SQL to provide database management service for the inventory management software. There is no performance problem at this time and the server capability is expected to serve more databases.

3.5 Requirements

(1) General

(a) The new system should be easy to understand and to use.

(b) The new system should decrease printed documents as much as possible.

(c) The new system should be implemented on the existing facilities with minimum costs.

(d) Information inquiry should be fast.

(2) Input

(a) Help Desk

(1) Information of customer's calls and following actions

(2) Problems and solutions

(3) Work order

(4) Job schedule

(b) Field Service

(1) Service report for each work order

(2) Problems and solutions

(c) Administrator

(d) General Information of Customer

(1) Equipment of customer

(2) Users at customer's site

(3) Staffs who take care of the customer

(4) Maintenance contract

(5) Costs of service

(3) Output

(a) Help Desk

(1) List of customer calls filtered by customer's name, date, call status, and staff

(2) List of customer equipment

(3) List of problems and solutions filtered by key words

(4) List of available staffs at the specific time

(5) List of jobs filtered by customer's name, date, job type, job status, and staffs.

(6) List of work orders filtered by customer's name, date, and staffs

(7) Printed work order

(b) Field Service

(1) List of problems and solutions filtered by key words

(2) List of work orders filtered by customer's name, date, and staffs

(3) Printed problems and solutions

(4) Printed work order

(5) Report of total work order and service pay for the specific staff

(c) Administrator

(1) List of customers

(2) List of customer equipment

(3) Report of schedule of preventive maintenance

(4) Report of total customer call grouped by call types

(5) Report of total customer call grouped by customers

(6) Report of total work order and cost of services grouped by customers

(7) Report of total work order and cost of services grouped by staffs

(d) Management

(1) Report of performance of service

(2) Report of performance of staffs

(4) Security

(a) Each user should have a unique account and he requires a password to access the system.

(b) Private data should be prevented from unauthorized access.

(c) Manager and supervisor must have authority to access and control information created by their subordinates.

(d) There is no need for data encryption because it takes too much processor load and data is not much secret.

IV. SYSTEM DESIGN

4.1 Data Flow Diagram

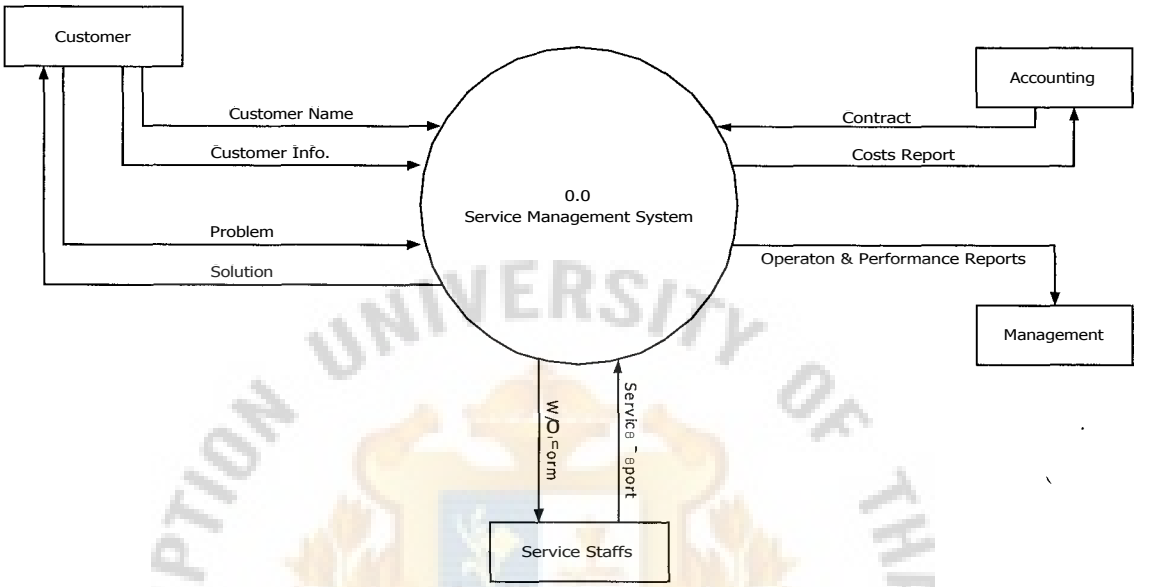


Figure 4.1. Context Diagram.

The new system has been designed in order to collect all related information in the service processes. The information is processed and used as a tool for service delivery. Computers are brought into almost steps of the designed system so that following up the status of service could be done fast and the information could be analyzed to improve the efficiency of the service.

From Figure 4.1 it is seen that external entities in the system are customer, field service staff, management and accounting. All staffs in customer service department are in the system. What the customer gives to the system is customer name, customer information and his problem and what the customer will gain from the system is the

solution. The field service staff will take orders from the system and return the service reports. The management and accounting receive the reports as need.

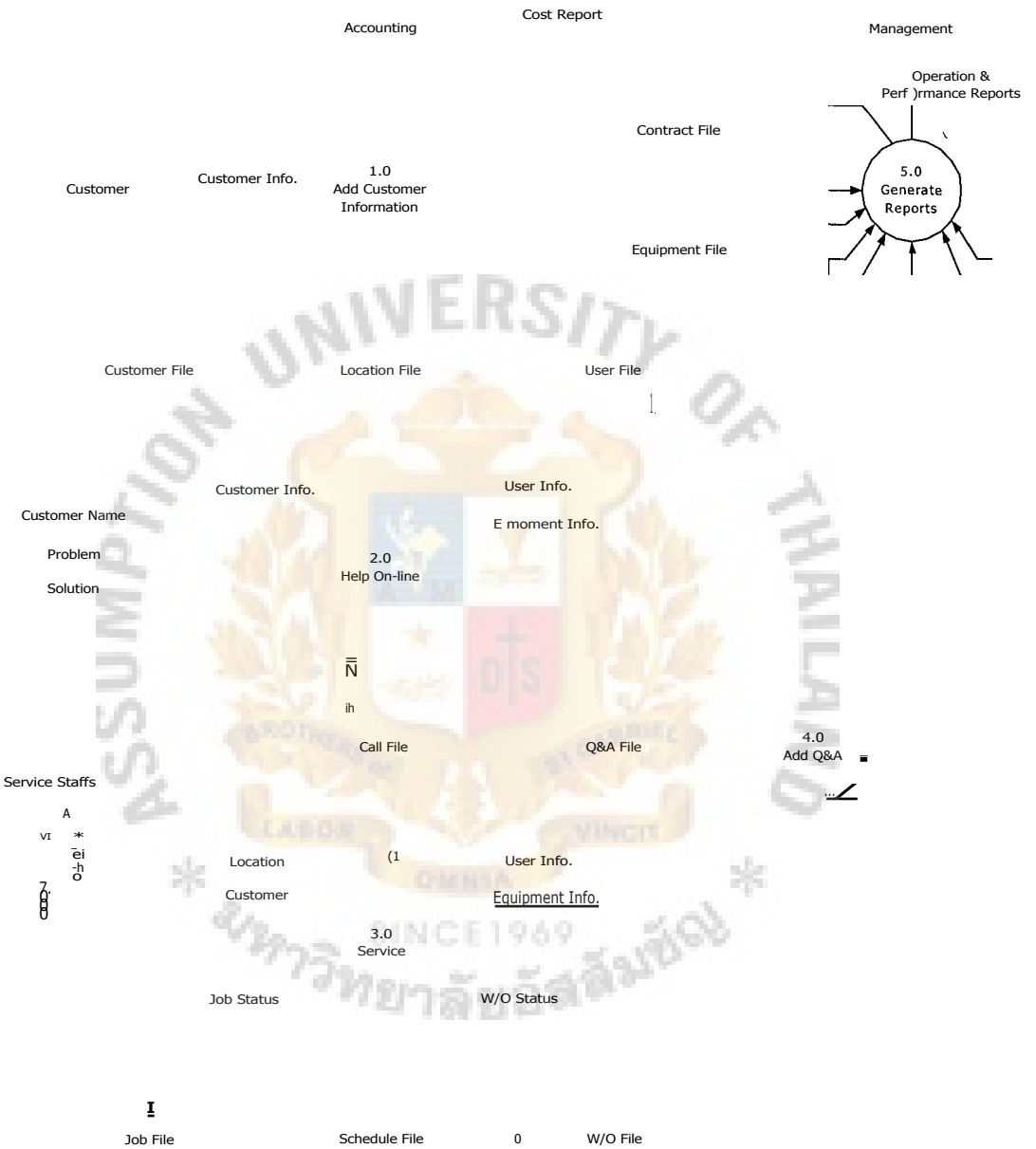


Figure 4.2. DFD Level 0.

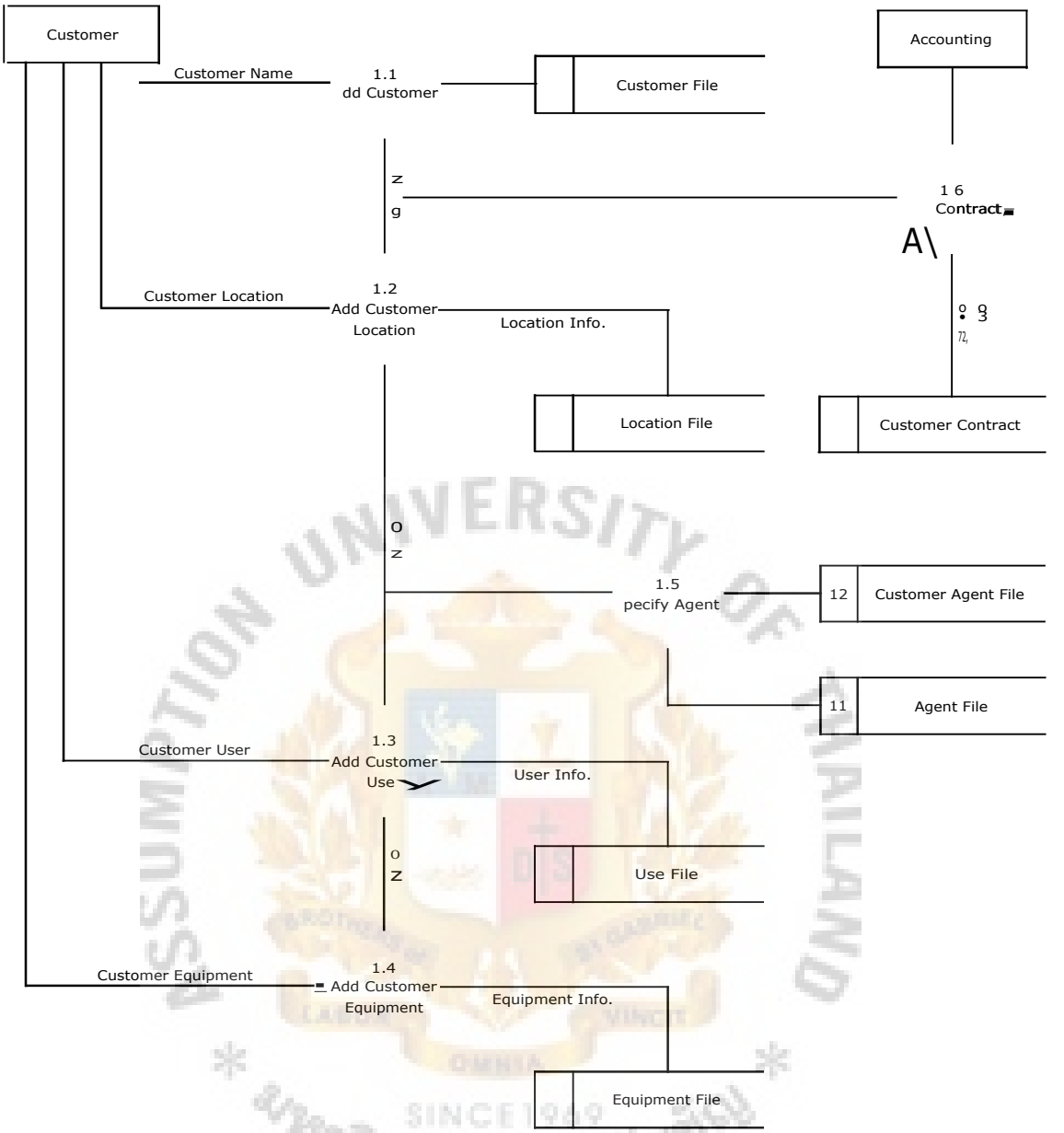


Figure 4.3. DFD Level 1 of Process 1.

DFD level 0 illustrates relationships among service processes. Starting from customer information is added into database in the process 1. When the customer informs the problem by telephone, his problem is recorded and is compared with problems in the past in order to find the match solution (process 1). The helpdesk staff uses his skill combined with the knowledge base to solve the customer problem. If the

problem cannot be solved online, the field service staff will be sent to the customer site by the process 3.

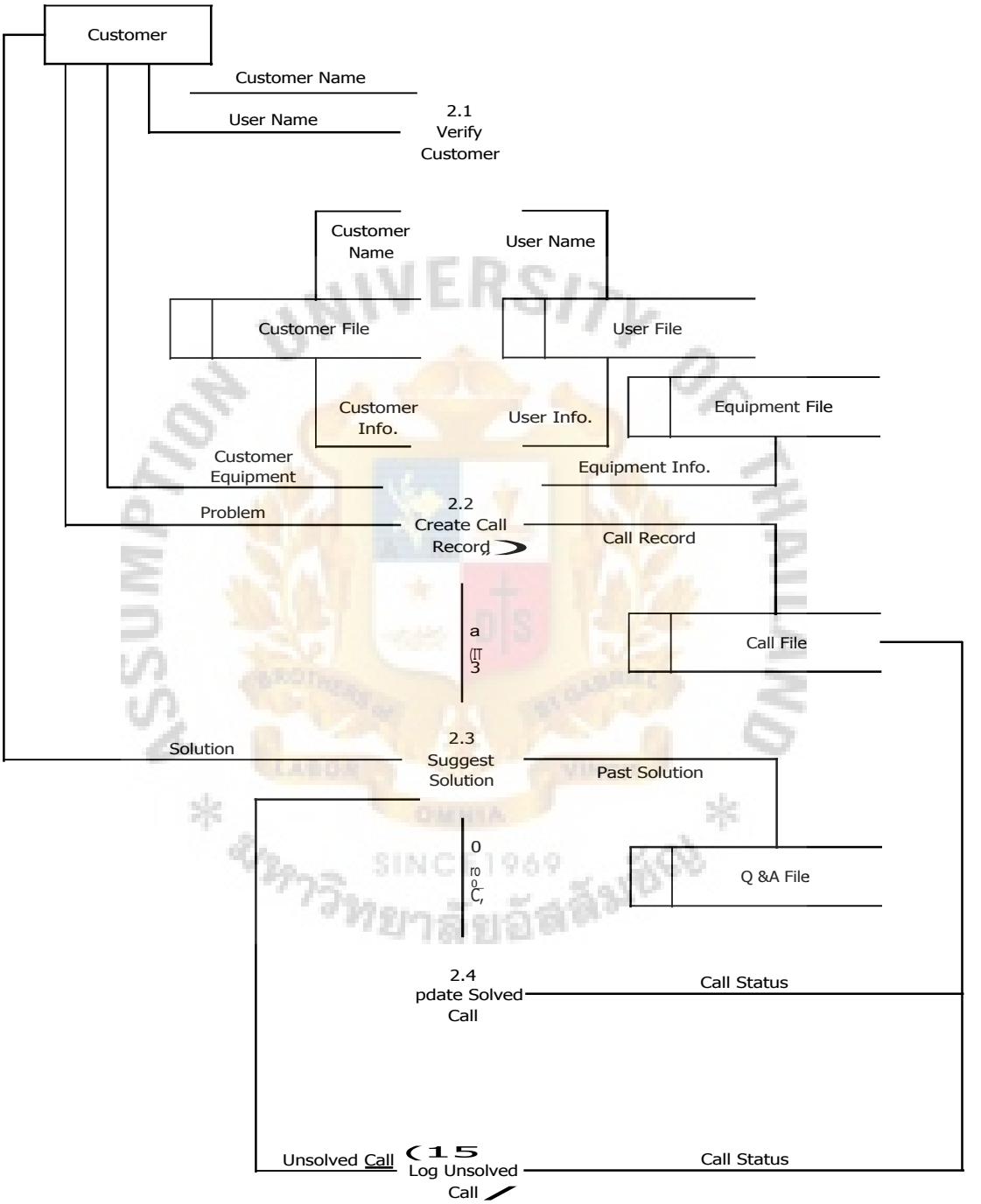


Figure 4.4. DFD Level 1 of Process 2.

DFD level 1 of process 1 shows the sub-processes of adding information related to the customer. Customer name, locations, users, equipment are added into the database consequently as well as the service provider's agents. The information helps service staffs know background of the customer.

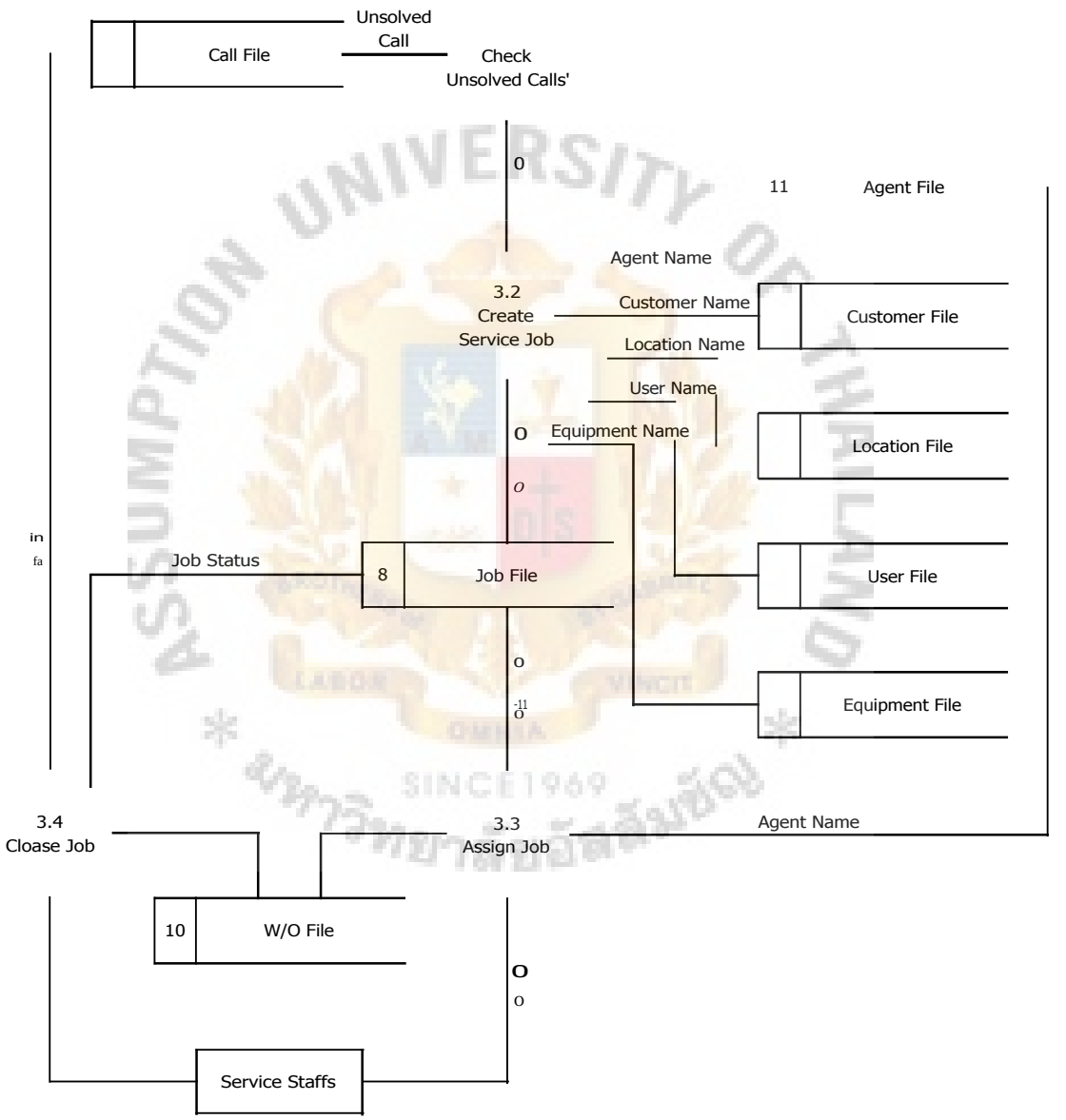


Figure 4.5. DFD Level 1 of Process 3.

DFD level 1 of process 2 illustrates the sub-processes of receiving call from the customer, the customer name and user name are verified (process 2.1). The customer problem is added into the call database (process 2.2) and then the solution for his problem is retrieved from the past records (process 2.3). The solution is suggested to the customer and the call status is updated to Close (process 2.4). If the customer problem cannot be solved at this time or the problem needs on-site service, the call status will be changed to Waiting for Solution or Waiting for Site Visit (process 2.5).

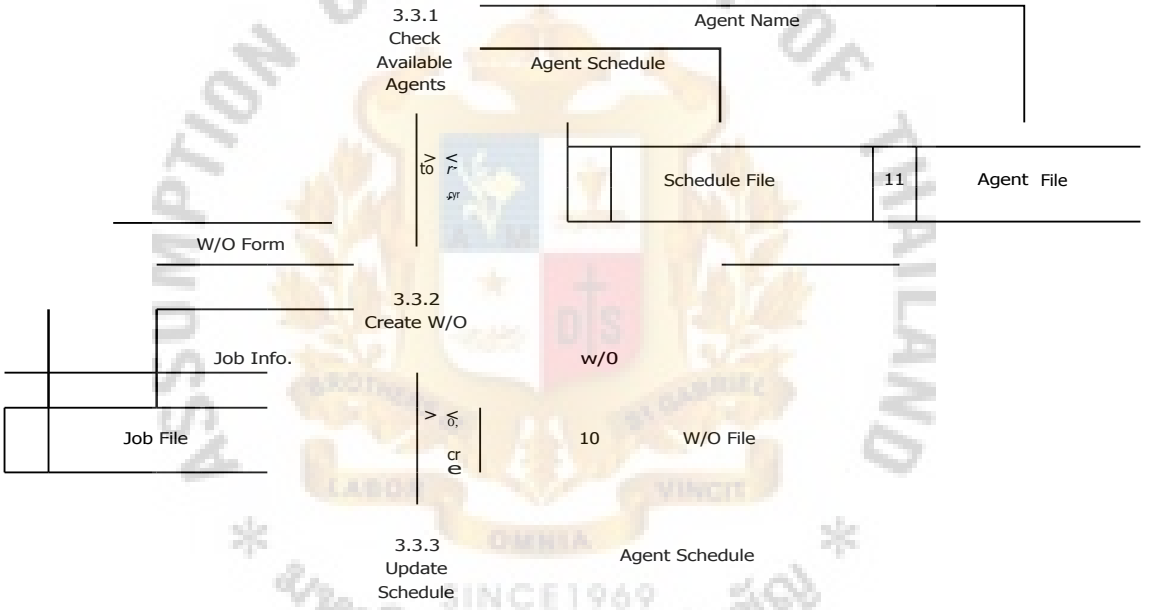


Figure 4.6. DFD Level 2 of Process 3.3.

DFD level 1 of process 3 shows sub-processes of on-site service for the customer problem that cannot be solved on-line. The service job will be created for unsolved call (process 3.2) and the job will be assigned to an available field service staff (process 3.3) through the W/O form. After the job is completed the field service staff records his operation into the database and close the job (process 3.4).

DFD Level 2 of process 3.3 shows more details of assigning job. Available staff is determined by checking schedule of each staffs in the database (process 3.3.1) and the W/O is created for the staff (process 3.3.2). Schedule of the staff is updated according to service time specified in the W/O (process 3.3.3).

4.2 Database Design

Relational database is the method selected to design the database of the new system because it requires none of extra investment for DBMS and development tools. Database, additionally, is compatible with the existing system. The database comprises of main table as below:

(1) Customer Table - To store records of general information of customers such as name, type, group, etc.

(2) Customer Agent Table - To store the list of agents who support the customer.

(3) Customer Equipment Table - To store records of equipment used by customers.

(4) Customer Contract Table - To store service contracts.

(5) Agents Table - To store profile of the company's staffs and their abilities.

(6) Call Table - To store records of customer calls.

(7) Job Table - To store records of service jobs created by agents.

(8) Work Order Table - To store records of work order for site visiting issued to field service agents.

(9) Service Schedule Table - To store records of service schedule of individual agent.

(10) Q&A Table - To store records of problems and proved solutions.

There are also many other tables beside the above tables. Some store data related to the main tables. Others are linking tables that create relationship between data in the tables. The details of tables and data structures are in Appendix A.

4.3 Screen Design

User interface of the proposed system is designed based on Geographical User Interface (GUI), windows and menu driven interface for ease of use and understand. Please see Appendix C for more details of screen design.

4.4 Report Design

(1) Report of Call Summary - This report shows overall information about total number of calls, total number of pending calls and total number of closed calls comparing with number of customer. It also shows relationship among product groups, type of problems, frequency of problems, and average respond time.

(2) Report of Call Workload & Performance - This report shows performance of individual agent in term of ability to solve the coming calls.

(3) Report of All Calls - This report shows all transactions occur during the specified period.

(4) Report of Pending Calls - This report shows the calls that require special attention due to their long response time and having not been solved.

(5) Report of Service Workload & Performance - This report shows performance of individual agent in term of ability to serve customers on-site. It also shows efficiency metrics such as lead/lag time and service time in average.

(6) Report of Service Job Summary - This report shows relationship between product groups and number of service jobs.

(7) Report of All Jobs - This report shows all service jobs occur during the specified period. It also shows number of W/O of each job.

(8) Report of Cost of Service - This report summarizes costs due to on-site service job classified by service agents and departments.

(9) Service Request Form - Other departments submitted the form to service staffs when they need service from the customer service department.

(10) W/O Form -This form is submitted to service agents as a work order and service agents use it to write down what they actually do.

(11) Agent Schedule - This report shows service schedule of all agents in specified period.

(12) Report of Customer List - This report shows the list of customers' name and addresses.

(13) Report of Most Active Customer - This report shows top ten of customers who have the most activities (call or service) during the specified period.

4.5 Module Design

Designs of system and database will be studied by programmers and then be broken into pieces of program modules. The system consists of a hierarchy of modules and they are designed following these principles (Senn 1989).

(1) Modularity and Partitioning - Lower-level modules are generally smaller in scope and sized compared to higher-level modules and serve to partition processes into separate functions.

(2) Coupling - Modules should have little dependence on other modules in a system.

(3) Cohesion - Modules should carry out a single processing function.

(3) Application users are separated by their functions and they can access only menus and tables related to their work.

(4) Application users cannot delete master data and protected transactions in order to maintain data integrity. However database administrator can do.

(5) A logon name is used if some transactions require the user name so that users cannot create faked records.

(6) Program and database is backed up from Monday to Friday. The full backup method is done on every Friday, and the differential backup method Is used on the others. Tape backup is used for its inexpensive price.

(7) Virus scanner is installed in the server and every workstation. A new virus data files are set to be automatically downloaded and updated monthly from the Internet.

(8) Input data is validated by the program and DBMS.

4.7 Hardware and Software

Almost all of the existing hardware has enough capability to run the new service management software without upgrading. The server, however, requires more memory and harddisk space. Extra 256MB RAM and 10GB harddisk space will be added.

There is no need for new software acquisition too because the new system can operates with the current software.

4.8 Cost/Benefit Analysis

(1) System Costs

The system costs of the Service Management System are divided into three main categories, which are investment cost, development cost, and operating and maintenance cost.

(4) Span of Control - Modules should interact with and manage the functions of a limited number of lower-level modules.

(5) Size - The number of instructions contained in a module should be limited so that module size is generally small.

(6) Shared Use - Functions should not be duplicated in separate modules, but established in a single module that can be invoked by any other module when needed.

Top-down methods are used throughout the design process. Starting at he general levels to gain an understanding of the system and gradually moving down to levels of greater detail. During the discussion of input and menu design, a top-down approach was emphasized. The main menu contains several choices. Making one choice produces another menu in which more detailed options are presented to the user. This capability provides users with an easy-to-understand method for using the system and selecting options.

The top-down method is also widely used in software design. Each function the system will perform is first identified and then developed in greater detail. The procedures and processes are developed a step at a time, from general to specific.

4.6 Security and Control

The following security policies are established and enforced in order to ensure that the system is safe from exposures at appropriate level.

(1) Users are separated into two groups, database administrator and application user, and only database administrator can access the structure of data tables. Application users can create, read, and write data through the application software.

(2) Each user has a unique logon name and password.

Table 4.1. Costs of the Service Management System.

Cost	Amount (Baht)
Investment Cost	
- Hardware Upgrading	50,000
- Software	0
Development Cost	
- Programmer Salary	60,000
Total Fixed Cost	90,000
Operating and Maintenance Cost	
- Operating Cost	0
- Maintenance Cost	24,000/yr
Total Variable Cost	24,000/yr

Investment cost is a fixed cost, which occurs once the implementation phase begins. The existing computer system needs some upgrading but there is no need for the new database software, so the investment cost includes only hardware upgrading costs.

Development cost is also a fixed cost but it can vary upon development time. The longer the development time is, the more the development cost is. Most of development cost is the staffs salary.

It can be thought that there is no operating cost because the new,system requires no more people. The maintenance cost, however, is included because the new software needs a programmer for bug fixing and creating more reports. The maintenance tasks do not need full-time support, so its

cost takes only a fraction (10 percent for this project) of a programmer's salary.

(2) System Benefits

Table 4.2. Benefits of the Service Management System.

Benefits	**Amount (Baht)**
Tangible Benefits	
- Saving for Operating Cost	240,000/yr
Total Tangible Benefits	240,000/yr
Intangible Benefits	
- Better Customer Support	
- Service Quality Improvement	
- Better Decision Making	
- Faster report generating	

The Service Management System gives both tangible and intangible benefits. The tangible benefits include cost reduction due to performance improvement and better resources utilization and control. It is expected that the company can save by keeping number of employees at the current level for the next two years. Without any improvement the company would spend 20 percent more for new staffs in order to support business growth in the next two years.

Customer satisfaction is an intangible benefit that is difficult to see, but it is the heart of service business. If only the new system could increase

customer satisfaction and the existing customers continue using services of the company, it should be benefit enough.

(3) Payback Period Analysis

Table 4.3. Costs and Benefits Comparison.

Month	Cost	Cumulative Costs	Benefits	Cumulative Benefits	Returns	Cumulative Returns
0	90,000	90,000	0	0	-90,000	-90,000
1	2,000	92,000	20,000	20,000	18,000	-72,000
2	2,000	94,000	20,000	40,000	18,000	-54,000
3	2,000	96,000	20,000	60,000	18,000	-36,000
4	2,000	98,000	20,000	80,000	18,000	-18,000
5	2,000	100,000	20,000	100,000	18,000	0
6	2,000	102,000	20,000	120,000	18,000	18,000
7	2,000	104,000	20,000	140,000	18,000	18,000
8	2,000	106,000	20,000	160,000	18,000	18,000
9	2,000	108,000	20,000	180,000	18,000	18,000
10	2,000	110,000	20,000	200,000	18,000	18,000

From Table 4.3, it shows that the project has break even at fifth month. Another way to calculate payback period is using the formula:

$P = I/R$

Where P = Payback period

I = Initial investment or capital expenditure

R = Return on investment

The payback period of this system can be calculated as the following:

P = 90,000/18,000 = 5 months

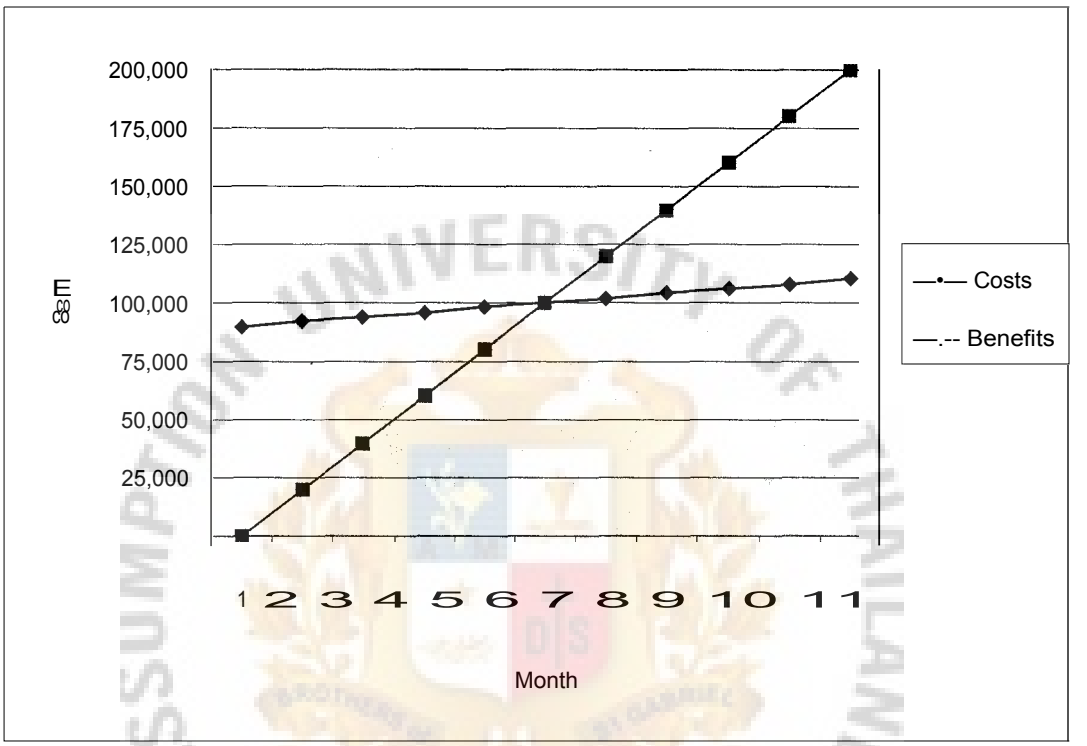


Figure 4.7. Costs and Benefits Comparison.

If time-value of money is counted, the present value must be used instead of actual money. If the cost of money is assumed at 1 percent monthly, the payback period of this system can be calculated as below:

0 = -90,000 + 18,000(P/A, 1%, P)

5 = (P/A, 1%,P)

P = 5.16 months

V. IMPLEMENTATION

Implementation is the process of assuring that the system is operational and then allows users to take over the operation for use and evaluation. The implementation of this project begins after the design is investigated thoroughly by management, users, and programmers. The implementation phase often takes longer time then expected at the design phase because users usually change their requirements after they try using the real system. All possible causes of delay must be kept in mind of the development team at the beginning.

5.1 Coding

The software is developed using Borland Delphi, which is a visual development tools. The development tool is chosen because of its easy to use and low cost. It provides a graphical development environment that helps a programmer reduces the development time and better controls structure of software.

5.2 Testing

The philosophy behind testing is to find errors. Test cases or sets of data are put into the system to determine whether the system will process them correctly. Testing is done in two levels, unit test and system test.

In unit testing the software units making up the system are tested. Unit testing focuses on finding errors in each program module. This enables the tester to detect errors in coding and logic that are contained within that module alone. Those resulting from the interaction between modules are initially avoided. Unit testing occurs, during the coding process.

System testing does not test the software per se but rather the integration of each module in the system. It also tests to find discrepancies between the system and its original objective, current specifications, and system documentation.

5.3 Training

The quality of training received by the personnel involved with the system in various capacity helps or hinders, and may even prevent, the successful implementation of an information system. Those who will be associated with or affected by the system must know in detail what their roles will be, how they can use the system, and what the system will or will not do.

(1) Training System Operators

The computer-center personnel, who are responsible for keeping the equipment running as well as for providing the necessary support service, needs training to ensure that they are able to handle all possible operations, both routine and extraordinary. Operator training involves installation of equipment, software configuration, database backup and restore, and also troubleshooting possible problems

(2) User Training

Users must be instructed first in how to use the new system. Most user training deals with the operation of the system. Training in data coding emphasizes the method to be followed in capturing data from transactions or preparing data needed for decision support activities. Users must also be instructed in how to manipulate data such as adding, editing and deleting.

5.4 Conversion

Parallel system method is used for converting from the old system to the new one. Users continue to operate the manual system in the accustomed manner but they also begin using the new system. This method is the safest conversion approach, since it guarantees that, should problems such as errors in processing or inability to handle

certain types of transactions arise in using the new system, the organization can still fall back to the old system without loss of time, revenue, or service.

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VI. CONCLUSIONS

6.1 Project Summary

The company in this case suffers from several customer service problems. It is found that the service process is usually delayed and management doesn't receive accurate reports in time. Lacking of quantitative data of service performance obstructs service quality and service performance improvement.

The company has seen opportunities to reduce the problems by implementing an information system which gathers all information related to service processes and customers. The Service Management System is developed based on operational and managerial requirements. The new system collects data from service operators, provides information about customer and past service record as needed, and also produces timely reports for management. With information provided by the new system the company better utilize its resources so that it can save a lot of money for salary of additional staffs. Normally the company has to increase number of staffs as its business grows. It can support more customers with the existing staffs because the new system helps it manage resources better. The customer support staffs also gets benefits from the new system. They use less service time because they have almost information about the customers and their problems.

Information at fingertips cut off many printed documents. Sending document back and forth between persons is not required anymore. All information can be accessed from every computer. And if documents are required, they will be sent electronically via e-mail.

The company achieves several tangible and intangible benefits. It can save money, improve performance, reduce paper, and the most importance is increasing in customer satisfaction.

6.2 Future Development

There are many areas that can be developed further as follows:

(1) Integrating the Service Management System with sales and accounting information. This system would reduce data redundancy and data inconsistency. It would provide more analysis information that can help better marketing plan and financial control.

(2) Integrating with WWW. With World Wide Web integration information can be published easily to customers. Users don't need special software to access data. They can use a standard Web browser from virtually anywhere in the world and get benefits from the company's information.

(3) Adding more data into the system. The output of the system must be evaluated and the system should be changed accordingly in order to make it's always suitable to the situation.

APPENDIX A

DATABASE

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Table A.1. Agent.

Field	Type	Length	Status
AgentId	Int	4	H*
DepartmentId	Int	4	[Null]
AgentStatusId	Int	4	[Null]
AgentName	Char	50	H
AgentS ex	Char	1	[Null]
AgentBirthDate	Datetime	8	[Null]
AgentPosition	Char	30	[Null]
AgentEmployDate	Datetime	8	[Null]
AgentPhoneNo	Char	30	[Null]
AgentMobileNo	Char	30	[Null]
AgentPagerNo	Char	30	[Null]
AgentEmail	Char	50	[Null]

Table A.2. Department.

Field	Type	Length	Status
DepartmentId	Int	4	H
DepartmentName	Char	50	H*

Table A.3. AgentSkill.

Field	Type	Length	Status
AgentId	Int	4	[1*
Ski11Id	Int	4	[]*
LevelId	Int	4	[]*

Table A.4. Skill.

Field	Type	Length	Status
Ski11Id	Int	4	H
Skill	Char	30	[]*

Table A.5. SkillLevel.

Field	Type	Length	Status
LevelId	Int	4	[]
SkillLevel	Char	30	[]*

Table A.6. AgentStatus.

Field	Type	Length	Status
AgentStatusld	Int	4	H
AgentStatus	Char	30	[]*

Table A.7. Call.

Field	Type	Length	Status
CallNo	Int	4	[]*
CustomerId	Int	4	[]
LocationId	Int	4	[]
CallTypeId	Int	4	[]
CallGroupId	Int	4	[]
EquipmentId	Int	4	[Null]
UserId	Int	4	[]
CallPriorityId	Int	4	[]
CallStatusId	Int	4	[]
AgentId	Int	4	[]
CallSubject	Char	300	[]
CallProblem	Text	16	[Null]
CallSolution	Text	16	[Null]
CallStart	Datetime	8	[Null]
CallEnd	Datetime	8	[Null]

Table A.8. CallGroup.

Field	Type	Length	Status
CallGroupId	Int	4	[]
CallGroup	Char	30	[]*

Table A.9. CallPriority.

Field	Type	Length	Status
CallPriorityId	Int	4	[]
CallPriority	Char	30	[1*

Table A.10. CallStatus.

Field	Type	Length	Status
CallStatusId	Int	4	[]
CallStatus	Char	30	[]*

Table A.11. CallType.

Field	Type	Length	Status
CallTypeId	Int	4	[]
CallType	Char	30	[]*

Table A.12. Contract.

Field	Type	Length	Status
ContractNo	Int	4	[]*
Customerld	Int	4	[]
LocationId	Int	4	n
ContractTypeId	Int	4	[Null]
AgentId	Int	4	[]
ContractStart	Datetime	8	[Null]
ContractEnd	Datetime	8	[Null]
ContractRespondTime	Int	4	[Null]
ContractPeriodTime	Int	4	[Null]
ContractValue	Float	8	[Null]
ContractPayment	Char	50	[Null]
ContractNote	Text	16	[Null]

Table A.13. ContractlType.

Field	Type	Length	Status
ContractTypeld	Int	4	[]
ContractType	Char	30	[i*

Table A.14. CustomerPriority.

Field	Type	Length	Status
CustomerPrioritylD	Int	4	H
CustomerPriority	Char	30	[]*

Table A.15. CustomerType.

Field	Type	Length	Status
CustomerTypeID	Int	4	H
CustomerType	Char	30	H*

Table A.16. Customer.

Field	Type	Length	Status
CustomerID	Int	4	H
CustomerTypeId	Int	4	H
CustomerGroupID	Int	4	H
CustomerPrioritylD	Int	4	[]
CustomerName	Char	100	[]*
CustomerNote	Text	16	[Null]

Table A.17. EquipmentGroup.

Field	Type	Length	Status
EquipmentGroupld	Int	4	[]
EquipmentGroup	Char	30	[]*

Table A.18. Equipment.

Field	Type	Length	Status
EquipmentId	Int	4	[]
Customerld	Int	4	[]
LocationId	Int	4	[]
EquipmentTypeld	Int	4	[]
EquipmentGroupld	Int	4	[]
EquipmentSupplier	Char	100	[Null]
Userld	Int	4	[Null]
EquipmentName	Char	50	[]*
EquipmentSerial	Char	30	[]*
EquipmentWarranty	Char	20	[Null]
EquipmentBrand	Char	30	[Null]
EquipmentModel	Char	30	[Null]
EquipmentDetail	Text	16	[Null]

Table A.19. EquipmentType.

Field	Type	Length	Status
EquipmentTypeld	Int	4	H
EquipmentType	Char	30	[]*

Table A.20. Job.

Field	Type	Length	Status
JobNo	Int	4	[]*
Ca11No	Int	4	[Null]
Customerld	Int	4	H
LocationId	Int	4	H
UserId	Int	4	H
EquipmentId	Int	4	[Null]
JobTypeld	Int	4	H
JobGroupId	Int	4	H
JobPrioritylD	Int	4	[]
JobStatusId	Int	4	H
JobToAgent	Int	4	[]
JobFromAgent	Int	4	H
JobDetail	Text	16	H
JobStart	Datetime	8	[Null]
JobClose	Datetime	8	[Null]

Table A.21. JobGroup.

Field	Type	Length	Status
JobGroupld	Int	4	H
JobGroup	Char	30	[]*

Table A.22. JobStatus.

Field	Type	Length	Status
JobStatusld	Int	4	H
JobStatus	Char	30	[]*

Table A.23. JobType

Field	Type	Length	Status
JobTypeld	Int	4	H
JobType	Char	30	[]*

Table A.24. Location.

Field	Type	Length	Status
LocationId	Int	4	[]
Customerld	Int	4	[]*
LocationName	Char	100	[]*
LocationAddress	Char	300	[Null]
LocationSubdistrict	Char	50	[Null]
LocationDistrict	Char	50	[Null]
LocationProvince	Char	50	[Null]
LocationCountry	Char	50	[Null]
LocationZip	Char	30	[Null]
LocationPhoneNo	Char	100	[Null]
LocationFaxNo	Char	50	[Null]
LocationNote	Text	16	[Null]

Table A.25. Q&A.

Field	Type	Length	Status
QANo	Int	4	H*
QATypeID	Int	4	H
QAProductGroupID	Int	4	H
QASubject	Char	300	H
QAProblem	Text	16	H
QAS olution	Text	16	H
QAKeywordl	Char	50	[Null]
QAKeyword2	Char	50	[Null]
QAKeyword3	Char	50	[Null]
QAKeyword4	Char	50	[Null]
QAKeyword5	Char	50	[Null]

Table A.26. Schedule.

Field	Type	Length	Status
ScheduleId	Int	4	H
ScheduleDates	Datetime	8	0*
AgentId	Int	4	H*
ScheduleNote	Text	16	[Null]
ScheduleStart	Datetime	8	H*
ScheduleEnd	Datetime	8	H
Customerld	Int	4	0

Table A.27. User.

Field	Type	Length	Status
Userld	Int	4	[]
Customerld	Int	4	[]*
Locationld	Int	4	[]
UserName	Char	50	[]*
UserNickName	Char	20	[Null]
UserSex	Char	1	[Null]
UserPosition	Char	30	[Null]
UserDepartment	Char	50	[Null]
UserPhoneNo	Char	30	[Null]
UserMobileNo	Char	30	[Null]
UserFaxNo	Char	30	[Null]
UserEmail	Char	50	[Null]

Table A.28. WOStatus.

Field	Type	Length	Status
WOStatusId	Int	4	[]
WOStatus	Char	30	[]*

Table A.29. WO.

Field	Type	Length	Status
WONo	Int	4	[]*
JobNo	Int	4	[]
Customerld	Int	4	[]
Locationld	Int	4	[]
EquipmentId	Int	4	[Null]
Userld	Int	4	[]
WOStatusId	Int	4	[]
WOToAgent	Int	4	[]
WOFromAgent	Int	4	[]
WOOrders	Text	16	[]
WOOperation	Text	16	[Null]
WOAppointment	Datetime	8	[]
WOEstimateTime	Int	4	[Null]
WOStart	Datetime	8	[Null]
WOEnd	Datetime	8	[Null]
WOCharge	Float	8	[Null]
WOTransportationCost	Float	8	[Null]
WOExtraCharge	Float	8	[Null]
WOOtherCost	Float	8	[Null]

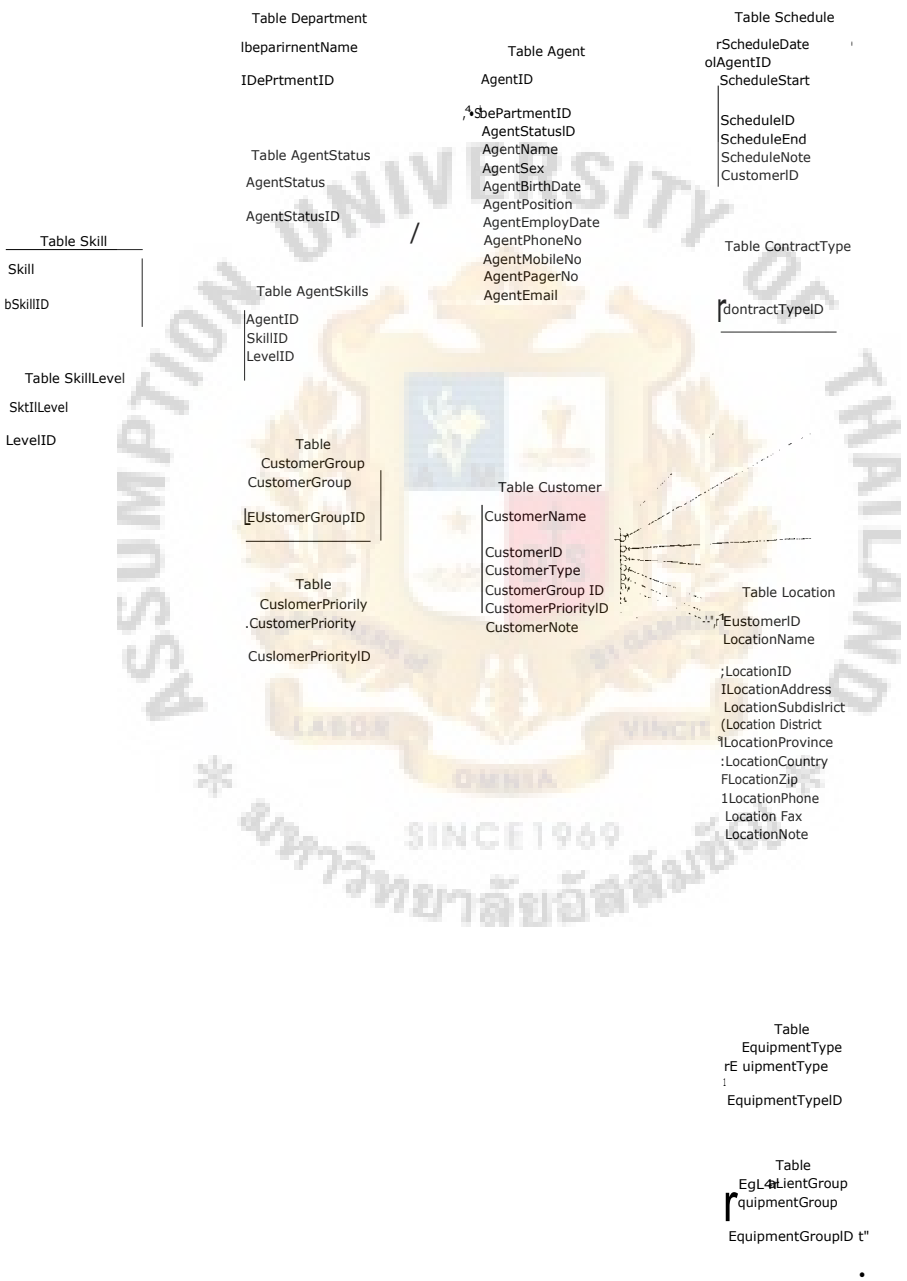

Figure A.1. Relationship Diagram.

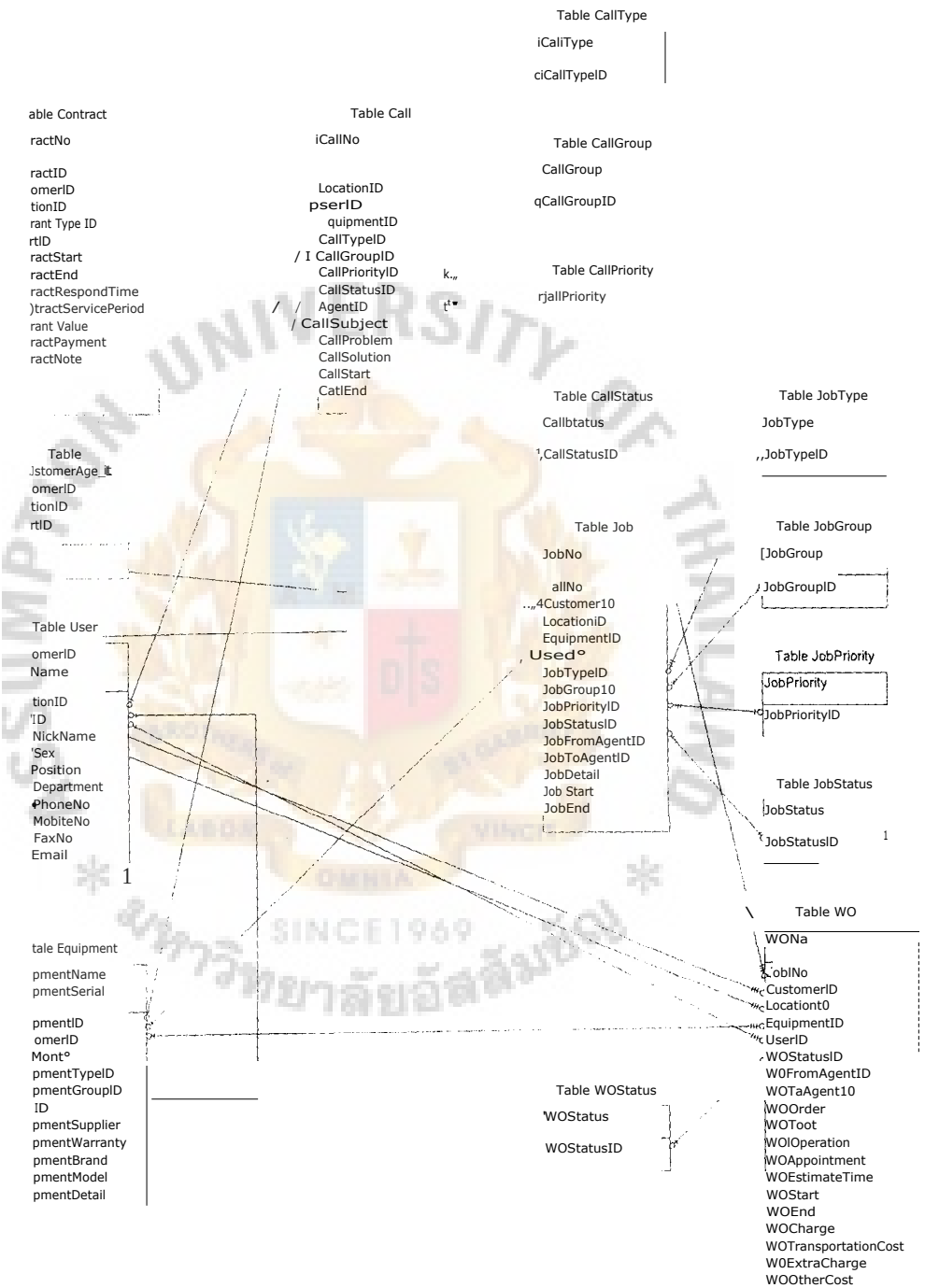

Figure A.1. Relationship Diagram. (Continued)

APPENDIX B

DATA FLOW DICTIONARY

ASSUMPTION UNIVERSITY OF THAILAND
BROTHERHOOD OF ST GABRIEL
LABOR OMNIA VINCIT
SINCE 1969
มหาวิทยาลัยอัสสัมชัญ

Agent Info.	= Agent Name + Sex + Position + Telephone No. + Mobile No. + Pager No. + Email Address + Agent Skills
Agent Name	= Name of service agent
Agent Schedule	= Date and time of site visit of each agent
Agent Skills	= Knowledge or skills of the service agent
Call Closed Date	= Date and time that the call is closed (the problem, is solved).
Call Group	= Group of product to which the customer problem is related.
Call Opened Date	= Date and time that the call is created.
Call Record	= Call No. + Customer Name + Location Name + User Name + Equipment Name + Call Type + Call Group + Problem + Solution + Call Status + Agent Name + Call Opened Date + Call Closed Date
Call Status	= Status of the call record which is [Close I Wait for solution I Wait for Site Visit]
Call Type	= Category of customer problem
Contract	= Maintenance agreement contract of the customer and the service provider
Cost Reports	= Reports of costs of service
Customer Agent	= An agent who supports the customer.
Customer Group	= Industrial group in which the customer business is.
Customer Info.	= Customer Name + Customer Type + Customer Group + Customer Priority

Customer Name	= Name of [Customer Customer Company]
Customer Priority	= [Very Important I Important I Ordinary I Unimportant]
Customer Type	= [Personal I Corporate]
Email Address	= Email address of [Agent I User]
Equipment Brand	= Brand of the equipment
Equipment Expired Date	= Last date by which the warranty is effective
Equipment Features	= Detailed information of the equipment
Equipment Info.	= Equipment Name + Equipment Serial No. + Equipment Expired Date + Equipment Brand + Equipment Model + Equipment Features
Equipment Model	= Model of the equipment
Equipment Name	= Name of customer's equipment
Equipment Serial No.	= Serial No. of the equipment
Fax No.	= Fax no. of [User I Customer]
Job Detail	= Details of service job
Job Group	= Group of product that the job is related to.
Job Info.	= Job No. + Call No. + Customer Name + Location + User Name + Equipment Name + Job Detail + Job Type + Job Group + Job Status + Job Date
Job Type	= Category of service job
Job Status	= Status of the service job which is [Open I Close].
Location Address	= Address of the customer site
Location Info.	= Location Name + Location Address + Telephone No. + Fax No.
Location Name	= Location of the customer.

Mobile No.	= Mobile phone no. of [Agent I User]
Operation	= What is done by a service agent for the customer
Operational Reports	= Reports of service operation
Order	= Description of work or problem to be solved by a service agent.
Pager No.	= Pager no. of the service agent
Past Solution	= The proved solution that is retrieved from the database.
Performance Reports	= Reports of service performance
Position	= Job position of [Agent I User]
Problem	= Statement describes the customer's problem.
Service Date	= Date and time of service work
Service Report	= Report of service which is approved by customer after the service job is finished.
Sex	= [Male I Female]
Solution	= Suggestion or solution is proposed to the customer.
Solved Call	= Call that is completely solved
Telephone No.	= Telephone no. of [User I Customer]
Unsolved Call	= Call that is waiting for solution
User Info.	= User Name + Location Name + Sex + Telephone No. + Mobile No. + Fax No. + Email Address + Job Position
User Name	= Name of user at the customer site
Work Start	= Time that a service agent arrive the customer site.
Work Finish	= Time that a service agent leave from the customer site.
W/O	= W/O No. + Job No. + Agent Name + Service Date + Work Start + Work Finish + W/O Status + Order +

Operation

W/O Form = The document is submitted to an service agent in'case of site visit is required. Information of W/O form is equivalent to data in W/O record.

W/O Status = Status of service which is [Open I Completed]

APPENDIX C

SCREEN LAYOUT

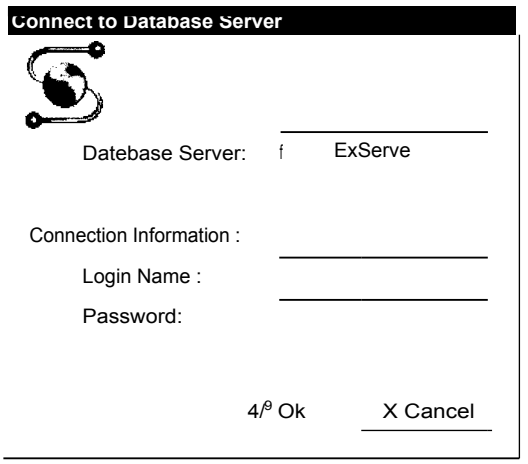

Figure C.1. Logon Screen.

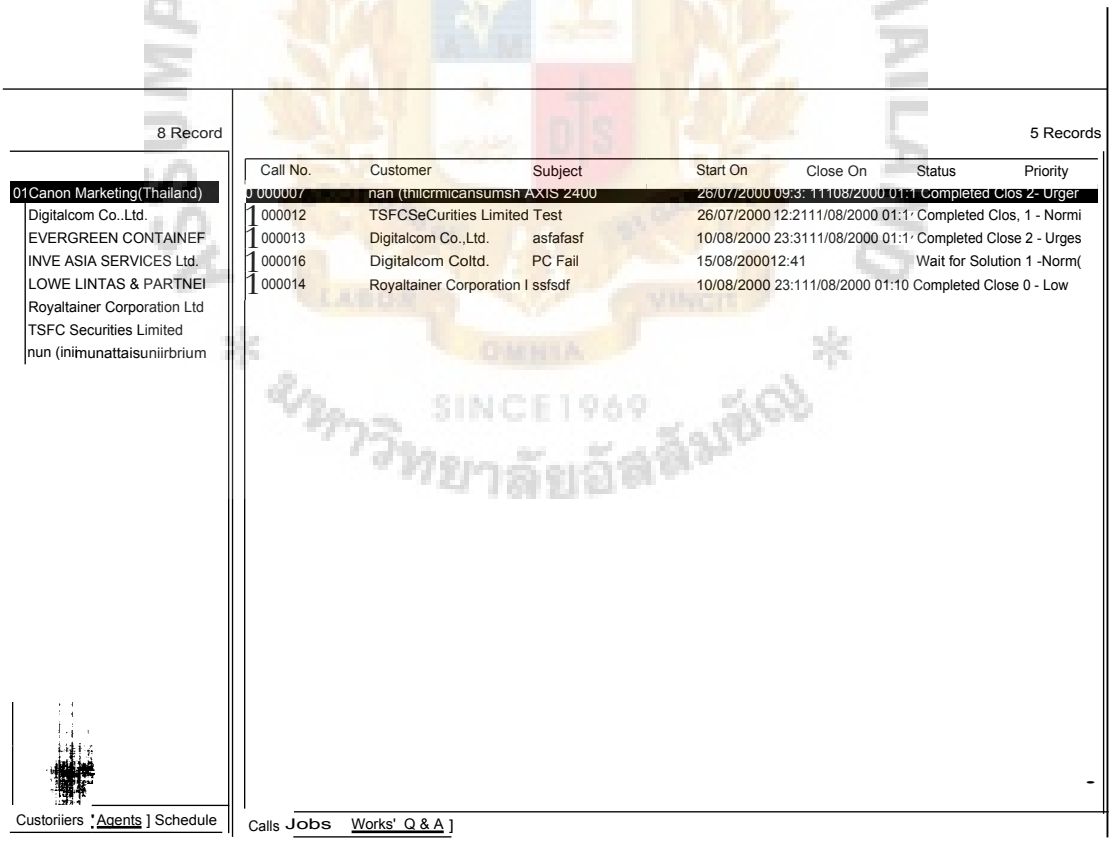

Figure C.2. Main Screen.

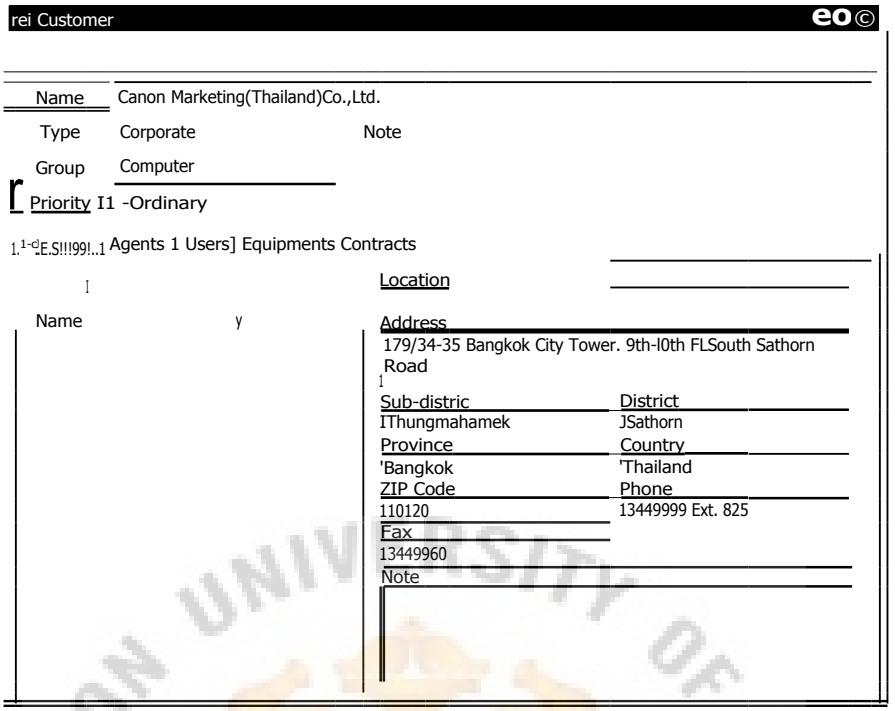

Figure C.3. Customer Screen.

Figure C.4. Customer Location Screen.

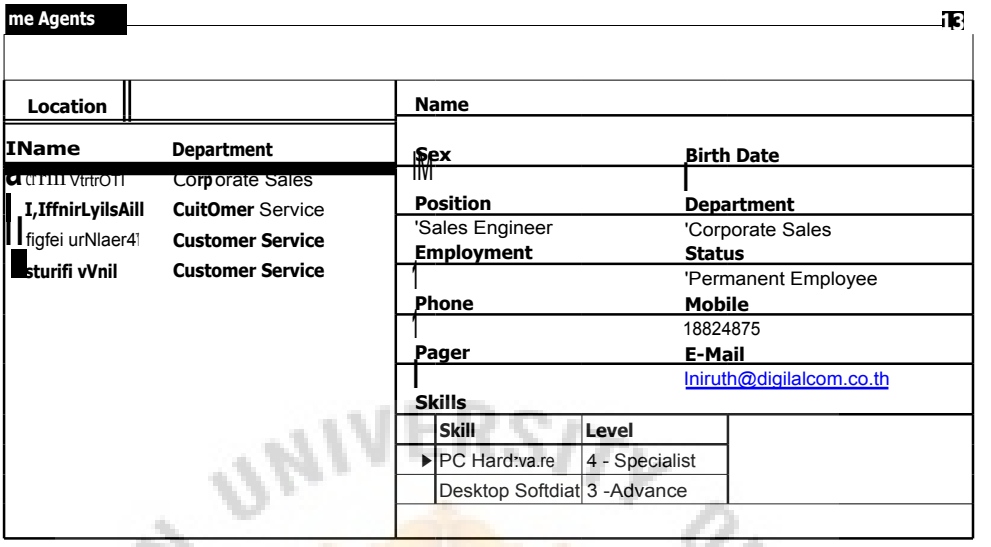

Figure C.5. Customer Agents Screen.

Figure C.6. Customer Users Screen.

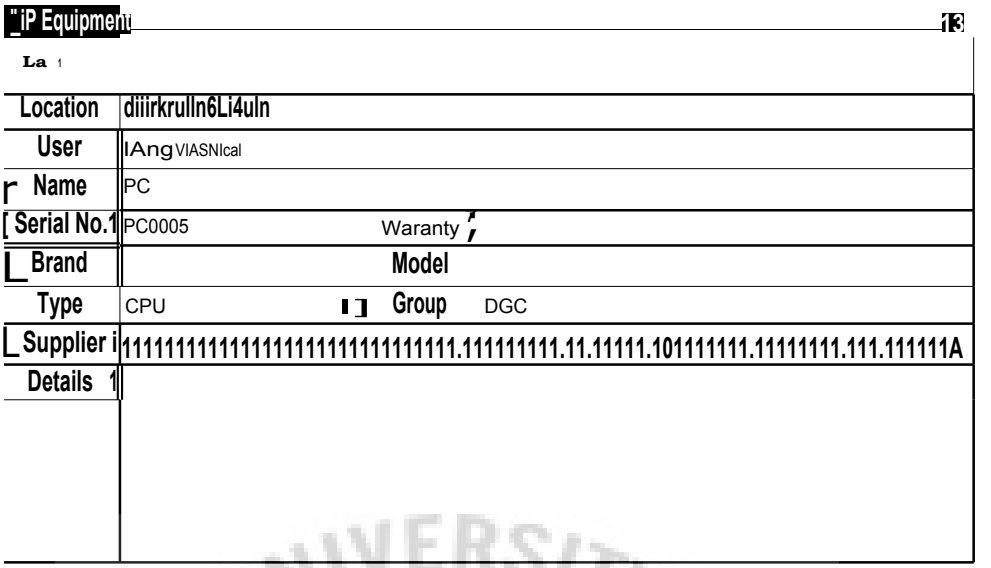

Figure C.7. Customer Equipment Screen.

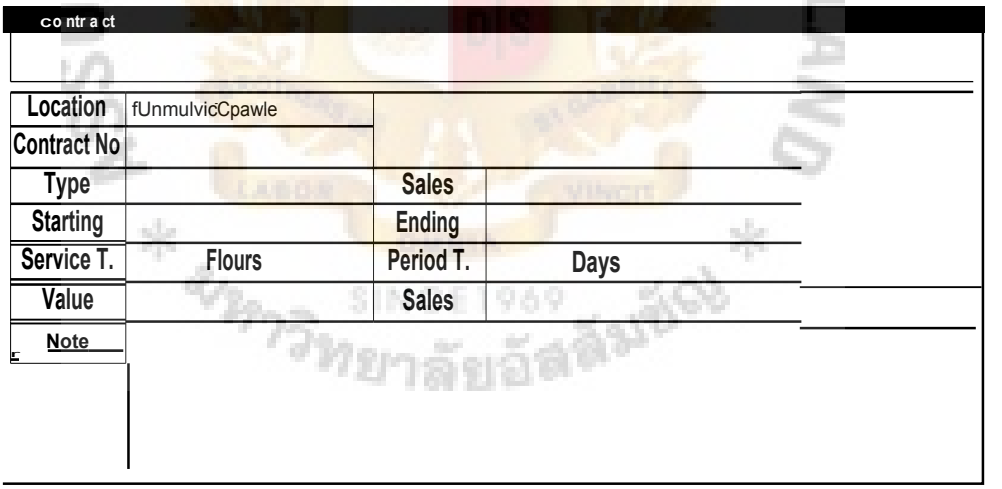

Figure C.8. Customer Contract Screen.

rail,'

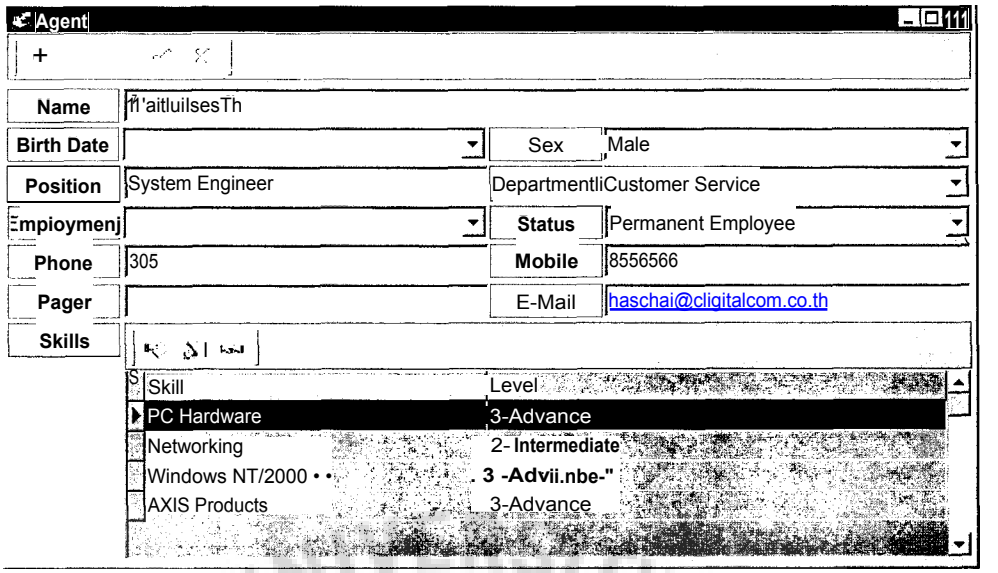

Figure C.9. Agent Data Screen.

Figure C.10. Schedule Screen.

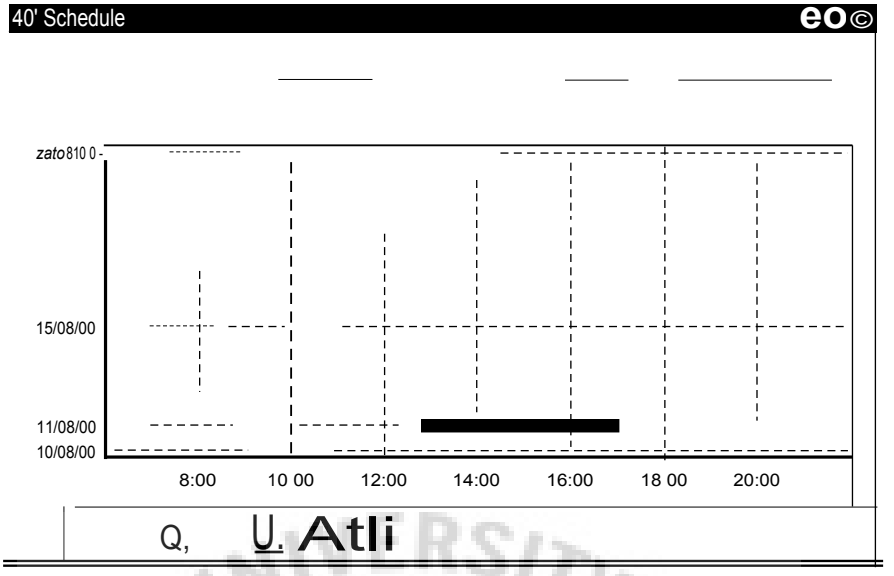

Figure C.11. Schedule View Screen.

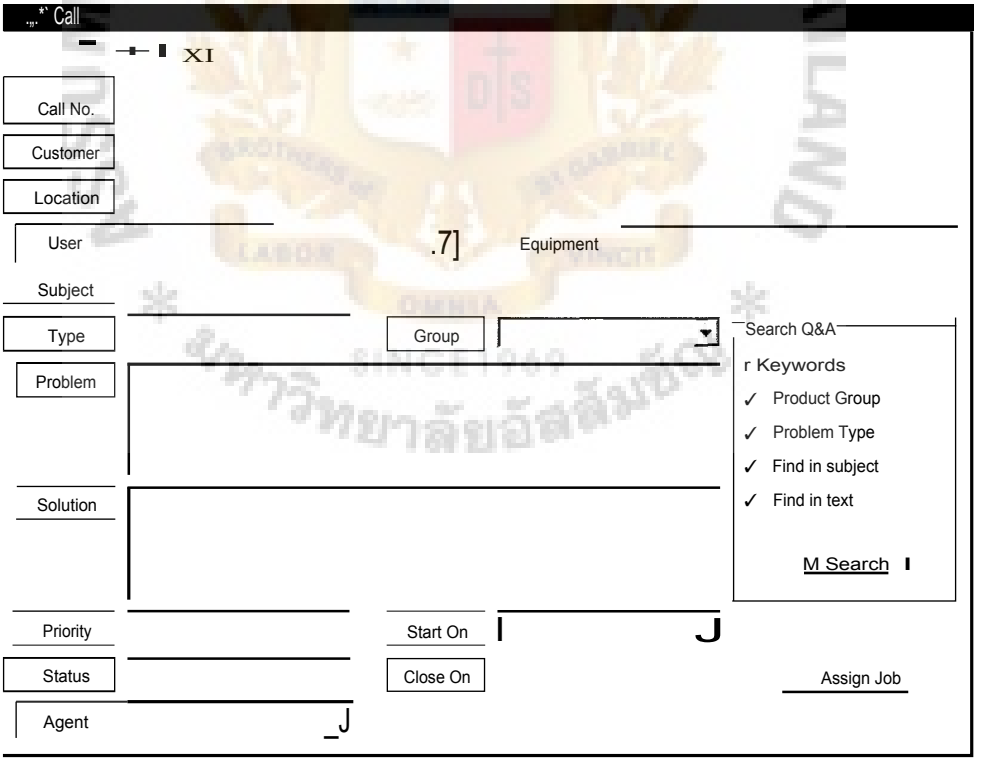

Figure C.12. Call Screen.

Job

Job No. | Call Ref.1

Customer: non OTaikriunaznlill£115fitivm'anyiNtitiatcalananylNgi)

Location: สำนักงานใหญ่

User: 17351114 nnara.a | Type: Configuration

Equipment: | Group: AXIS

Status: Close | Priority: 2-Urgent

Detail: Check/WIG 2400.

Start on: 26/07/2000 09:53 | Close on: 26/07/2000 00:00

To: 1 elitifi gnu | From:

Work Order

Work N	CuStOme	sais	T	From
000002	non (iiiinnsrmentrarrail Open			ทัสชัย แก้วลอยฟ้า
000012		pleledC.19,s	แก้วลอยฟ้า	อภิชาติ วิชาน
090013	non tillik1.11•044tnmirn$112,01gp:		ciafauK2aairili	อภิชาติ วิชาน

Figure C.13. Job Screen.

Work Order | IMO

W/0 No.	00001::	Job Ref.	zi
Customer	non (alifirmuerate TIMM illir1111411TIVviiittateainiearreNti)		±.l
Location	kriirmlutxri)		L]
User	:11151+34 nsis.qa	Equipment!'	2]
Order	Check AXIS 2400.		-11
			L'd
Tools	sgsdfg		...*-1
			L...j
roperationi	asfafafasfas		
itppointmen	14/08/200015:20	Est. Time	4
Arrival	14/08/2000 1 5:20	Departure I 14/08/2000 16:00	2.-.I
W/O Exp.	30	Tran. Exp.'	30
Wage Exp.	30 1 OtherExpi I		30
To	ii:ara, urnaaegl	From I laTanfl g	
Status	1111111121211E111111111111111111111111111111111z_l		

Figure C.14. W/O Screen.

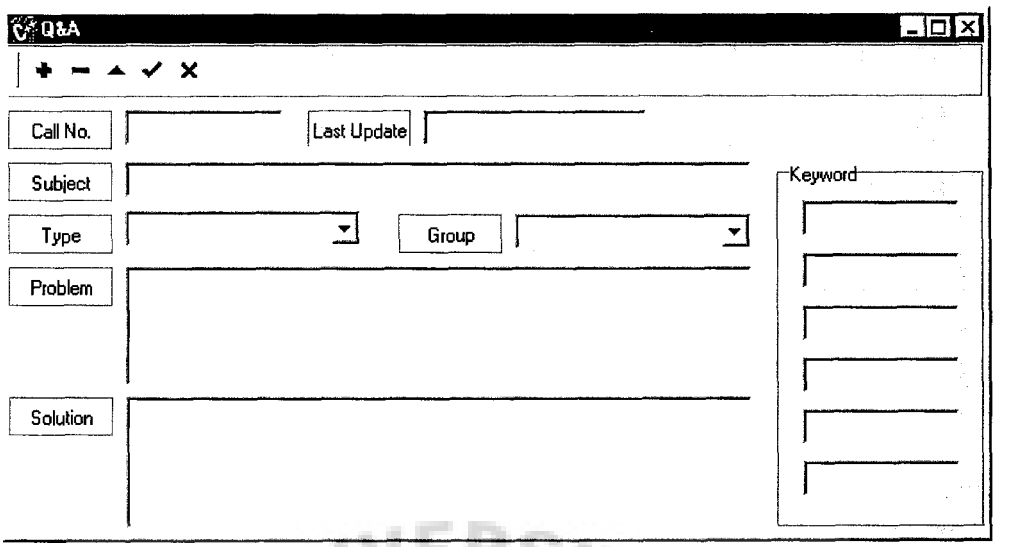

Figure C.15. Q&A Screen.

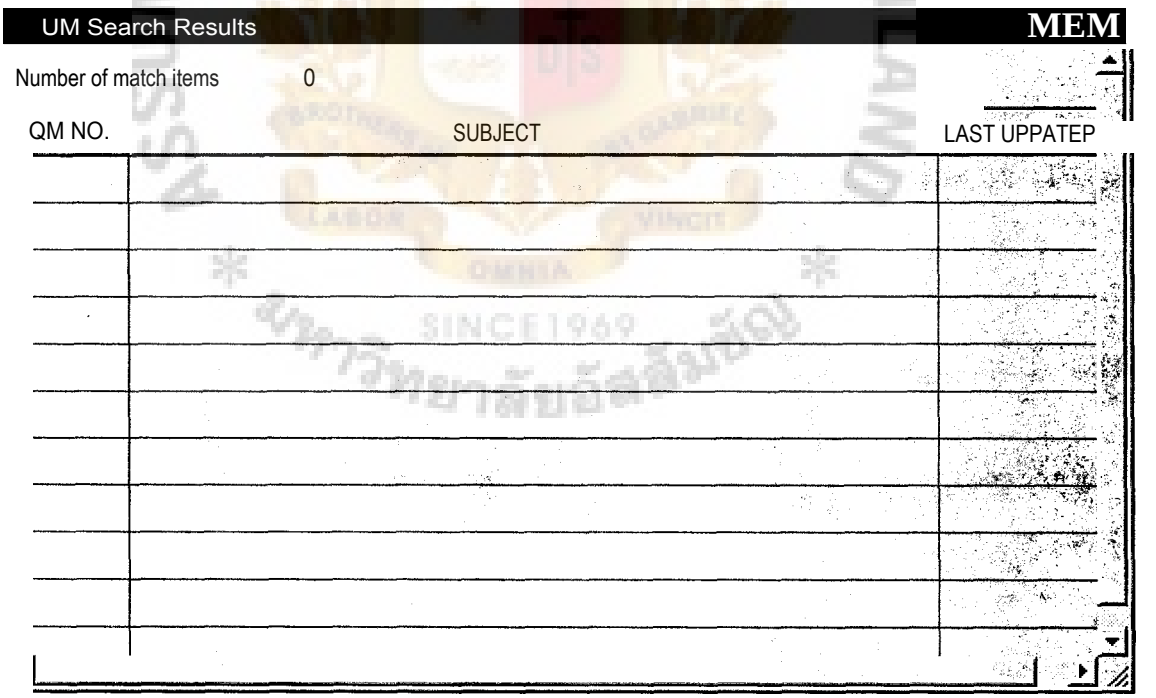

Figure C.16. Q&A Search Results.

APPENDIX D

REPORT LAYOUT

Printed Date DD/MM/YYYY Page 9999

DIGITALCOM SERVICE CENTER
Report of Call Summary
DD/MM/YYYY — DD/MM/YYYY

Overall Calls Distribution

Number of Calls		9999999	from	9999999 customers
Closed Calls	:	9999999	from	9999999 customers
Pending Calls	:	9999999	from	9999999 customers

Calls Distribution by Product Group

Product Group 1

Type	No. of Calls	Closed Calls	Pending Calls	Resp. Time
Bugs Report	999999	999999	999999	999999
Communication	999999	999999	999999	999999
Complaints	999999	999999	999999	999999
Configuration	999999	999999	999999	999999
Data Errors	999999	999999	999999	999999
Installation	999999	999999	999999	999999
System Fails	999999	999999	999999	999999
Operation	999999	999999	999999	999999
Virus Infection	999999	999999	999999	999999
Total	9999999	9999999	9999999	999999

Product Group 2

Type	No. of Calls	Closed Calls	Pending Calls	Resp. Time
Bugs Report	999999	999999	999999	999999
Communication	999999	999999	999999	999999
Complaints	999999	999999	999999	999999
Configuration	999999	999999	999999	999999
Data Errors	999999	999999	999999	999999
Installation	999999	999999	999999	999999
System Fails	999999	999999	999999	999999
Operation	999999	999999	999999	999999
Virus Infection	999999	999999	999999	999999'
Total	9999999	9999999	9999999	999999

Figure D.1. Report of Call Suumary.

Printed Date DD/MM/YYYY

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DIGITALCOM SERVICE CENTER

Report of Call Workload & Performance

DD/MM/YYYY — DD/MM/YYYY

Agent	No. of Calls	Closed Calls	Pending Calls	Resp. Time
XXXXXXXXX	999999	999999	999999	999999
XXXXXXXX	999999	999999	999999	999999
XXX =Oa	999999	999999	999999	999999
XXXXXXXXX XX	999999	999999	999999	999999
XXXXXXXX	999999	999999	999999	999999
XX	999999	999999	999999	999999
XXXXXXXX	999999	999999	999999	999999
X	999999	999999	999999	999999
XX	999999	999999	999999	999999
Total	9999999	9999999	9999999	9999999

Figure D.2. Report of Call Workload and Performance.

Printed Date DD/MM/YYYY
Page 9999

DIGITALCOM SERVICE CENTER

Report of Pending Calls

DD/MM/YYYY – DD/MM/YYYY

C	7	6.	Customer	Subject	Open on	Status	Agent
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX
			XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	XXXXXXXXX	XXXXXXXXXXXXXXX

Total Number of Pending Calls: 9999

Fig. D.3. Report of Pending Calls.

Printed Date DD/MM/YYYY

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DIGITALCOM SERVICE CENTER

Report of Costs of Service

DD/MM/YYYY – DD/MM/YYYY

Costs of Service Grouped by Agent

Agent	No. of Jobs	Normal Charge	Vehicle Charge	Extra Charge	Others	Total
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
Total	9999999	9999999	9999999	9999999	9999999	9999999

Costs of Service Grouped by Department

Agent	No. of Jobs	Normal Charge	Vehicle Charge	Extra Charge	Others	Total
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999	999999
Total	9999999	9999999	9999999	9999999	9999999	9999999

Report of Costs of Service.

Printed Date DD/MM/YYYY Page 9999

DIGITALCOM SERVICE CENTER
Report of Service Workload & Performance
DD/MM/YYYY — DD/MM/YYYY

Agent	No. of Jobs	Closed Jobs	Pending Jobs	Lead Time	Service Time
XXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999.
XXXXXX	999999	999999	999999	999999	999999
~XXXXXXXX	999999	999999	999999	999999	999999
XXXXXXXXXX	999999	999999	999999	999999	999999
XXXXXXXXXX	999999	999999	999999	999999	999999
XXXXXXXXXXXXXXXXXX	999999	999999	999999	999999	999999
~XXXXXXXXXXXX	999999	999999	999999	999999	999999
Total	999999	999999	999999	999999	999999

Figure D.5. Report of Service Workload and Performance.

Printed Date DD/MM/YYYY Page 9999

DIGITALCOM SERVICE CENTER
Report of Service Job Summary
DD/MM/YYYY — DD/MM/YYYY

Overall Jobs Summary

Number of Jobs	:	9999999	from	9999999 customers
Closed Jobs	:	9999999	from	9999999 customers
Pending Jobs	:	9999999	from	9999999 customers

Jobs Distribution by Department

Department	Number of Jobs	Closed Jobs	Pending Jobs
XXXXXX	999999	999999	999999
X	999999	999999	999999
	999999	999999	999999
XXXXXX	999999	999999	999999
	999999	999999	999999
XXXXXXX	999999	999999	999999
Total	**9999999**	**9999999**	**9999999**

Jobs Distribution by Product Group

Product Group	Number of Jobs	Closed Jobs	Pending Jobs
	999999	999999	999999
	999999	999999	999999
	999999	999999	999999
VOCXX	999999	999999	999999
XXXXXX	999999	999999	999999
	999999	999999	999999
Total	**9999999**	**9999999**	**9999999**

Figure D.6. Report of Service Job Summary.

Printed Date DD/MM/YYYY

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DIGITALCOM SERVICE CENTER

Report of All Calls

DD/MM/YYYY – DD/MM/YYYY

Subject	Status	Agent
XXXXXXXXXXXXXXXXXXXXXXXXXX	HHHHHHHH	XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX	HEHEEHEEEEERE	XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXX		XX XXXXXXXXXXXXXX

Hours

0.0

Printed Date DD/MMTYYYY

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DIGITALCOM SERVICE CENTER

Report of All Jobs

DD/MM/YYYY – DD/MM/YYYY

Job No.	Customer	Subject	Open on	Close On	W/O	Agent
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	DD/MM/YYYY	DD/MM/YYYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/MM/YYYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/MM/YYYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXX	/MM/YYYY	/YYY	XXXXXXXXXXXX	XXXXXXXXXXXX	XXXXXXXXXXXX

Total Number of W/O:

Total Number of Jobs:

Total Number of Customers:

Figure D.8. Report of All Jobs.

Printed Date DD/MM/YYYY

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DIGITALCOM SERVICE CENTER

Agent Schedule

DD/MM/YYYY – DD/MM/YYYY

DD/MM/YYYY

Agent	:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										

DD/MM/YYYY

Agent	:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										
XXXXXXXXXXXXXXXXXXXX										

F ฉ ฉD.9. Agent Schedule.

Printed Date DD/MM/YYYY Page 9999

DIGITALCOM SERVICE CENTER
Customer List

Customer Group 1

Customer Name: xxxxxxxxxxxxxxxxxXxxxxxxxxxxxxxxxxxx
Location: **xxxxxxxxxxxxxxxxxxxxx xxxxx**
XXxxxxxxxxxxxx
XXXXXXXXXXXXXXXXXXXX
Telephone: +99(9)9999999
Fax: +99(9)9999999

Customer Name: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Location: XXXXXXXXXXXX XXXXXXXXXXX
XXXXXXXXX XXXXXX XXXXXXX
X~ XXXXXXXX XX XXXXXXXXX
Telephone: +99(9)9999999
Fax: +99(9)9999999

Customer Name: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Location: XXXXXXXXX XXX XXX
XX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Telephone: +99(9)9999999
Fax: +99(9)9999999

Customer Group 2

Customer Name: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Location:XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X XX
XXXXXXXXXXXXXXXXXXXXXX
Telephone: +99(9)9999999
Fax: +99(9)9999999

Figure D.10. Report of Customer List.

Printed Date DD/MM/YYYY Page 9999

DIGITALCOM SERVICE CENTER

Most Active Customer

DD/IVIM/YYYY — DD/IVIM/YYYY

Top 10 Customer Calls

Customer	No. of Calls .
XXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX	999999
XXX ~XXXXXXXXXXXXXXXXXXXXXX XXXXX	999999
XXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXX	999999
XXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX	999999
XXXXXXXXXXXXXXXXXXXXX XX)OO(	999999
XXX ~XXXXXXXXXXXXXX XXXXXXXXXXXXXX	999999
XXX ~XXXXXXXXXXXXXX X)0(XXXX	999999
XXXXXXXXXX XXX XXXXXXXXXXXXXX	999999
~XXXXX XXXXXXXXXXXXXXXXXXXXXXX	999999
XXXXXXXX XX XXXXX	999999

Top 10 Customer Services

Customer	No. of Jobs
XX~ ~XXXXXXXXXXX XXX	999999
XXX XX	999999
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX	999999
XXXXXXXXXXXXXXXXXXXXXXX XXXXX X	999999
XXXXX XX	999999
XXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXX	999999
XXXXXXXXXXXXXXXXXXX XXXX	999999
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	999999
XXXXXXXXXXXXXXXXXXXXXXXXX	999999
XXXXXXXXXX XXXXXXXXX XX	999999

Figure D.11. Report of Most Active Customer.

WORK ORDER & SERVICE REPORT

DIGITALCOM CO.,LTD.
888/205 3rd Fl. Mahatun Plaza Bldg.
Ploenchit Rd.. Palhumwan, Bangkoko 10330
Tel +662-2545525 Fax +662-2545530

W/O No. 000964
Job Ref. 000709 Call No.

Customer ABN AMRO ASIA SliCURITIES PLC.

Branch

Address 313 olim CP.31111.T83 ttel1 21

01111 1111'3)1 MILL 10500

Telephone 255-145

Contact Person 1LD0

Type Repair

Group PC

Equipment

Order

;I8V110111 LAN •INV1 I . AUTO DIAL (15 WS)

Tools

Operation

For Agent Only

SERVICE AGENT ((BM 810tAli APPOINTMENT 13/11/2000 11:00

For Customer

Singnature STARTED TIME

FINISHED TIME

Figure D.12. Work Order & Service Report.

SERVICE REQUEST

DIGITALCOM CO.,LTD.
888/205 3rd Fl. Mahatun Plaza Bldg
Ploonchil Rd Palhumwan, Bangkoko 10330
Tel +662-2545525 Fax +662-2545530

Job No. 000709

Date ¡ 2 1' 20011 15.14

Appointment ! 2ouo :ou

Customer AI1N AMR() ASIA SECURITIES PLC.

Branch 011'1< I. 0 13110i

Address ;13 UI 11111.111'1 '1111 2 I

!111 11 4118. ¦ 0500

Telephone ss

Contact Person 1]II .!

Priority 1 - Normal

Type Others

Group APEX

Equipment

To tTriaci Frifm5olip.1

From Reuters

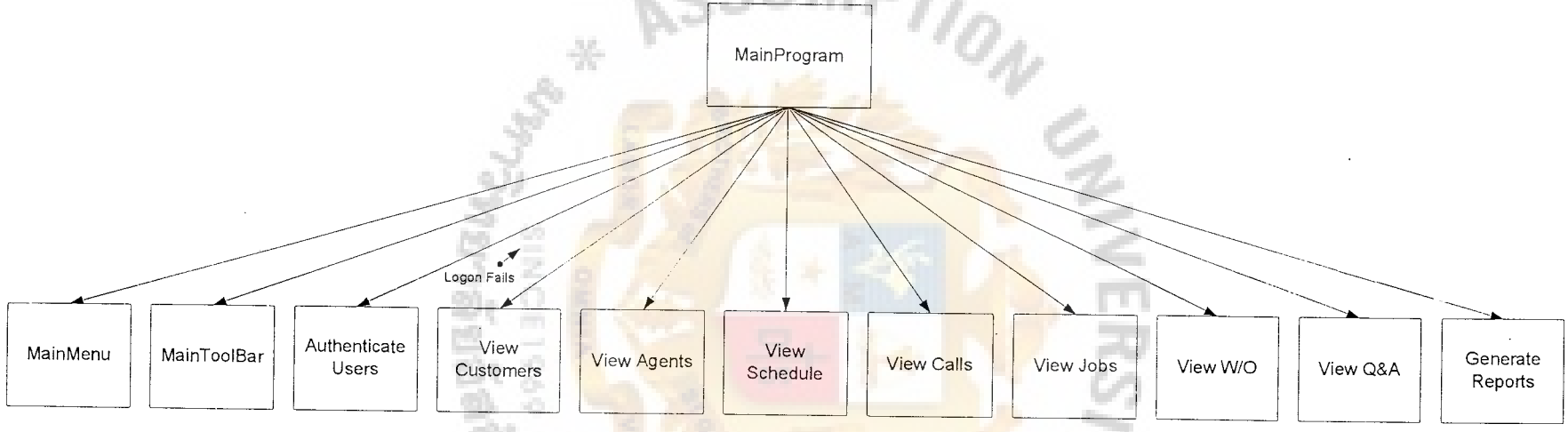
Detail

#4161401711 LAN 13/1 I (LiTitn QtTN1)"1'&S" • AUTO DIAL (15 WS)

Figure D.13. Service Request Form.

APPENDIX E

STRUCTURE CHART



Structure Chart — Main Process.

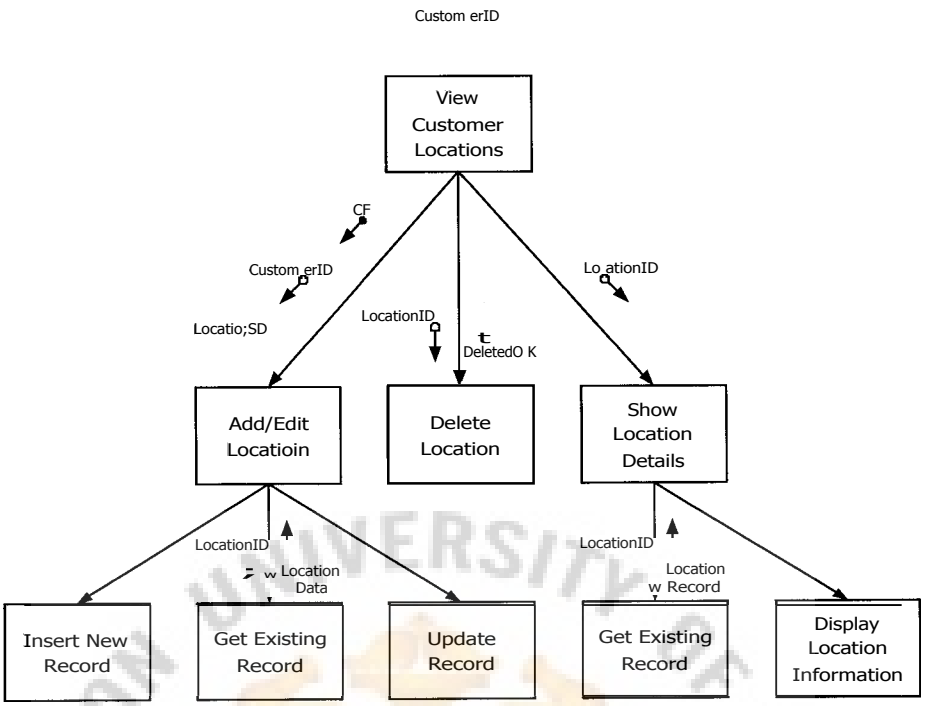


Figure E.2. Structure Chart — Customer Location Process.

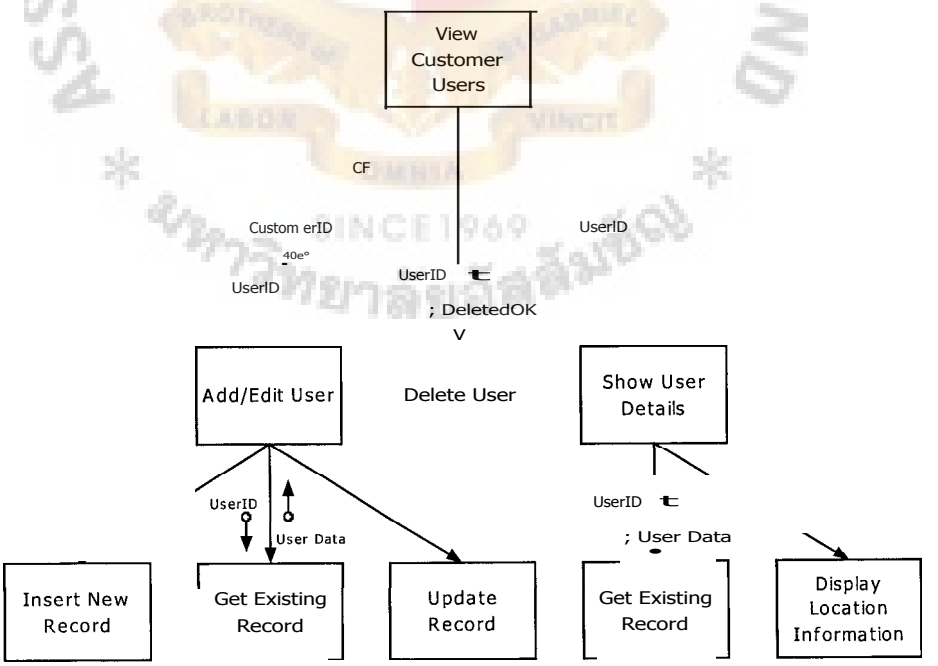


Figure E.3. Structure Chart — Customer User Process.

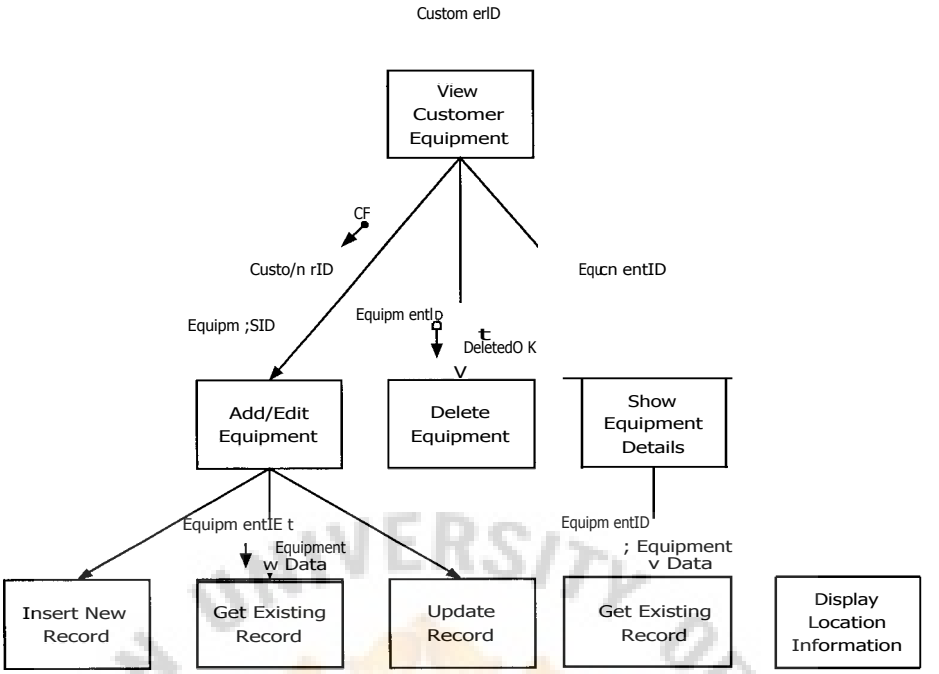


Figure E.4. Structure Chart — Customer Equipment Process.

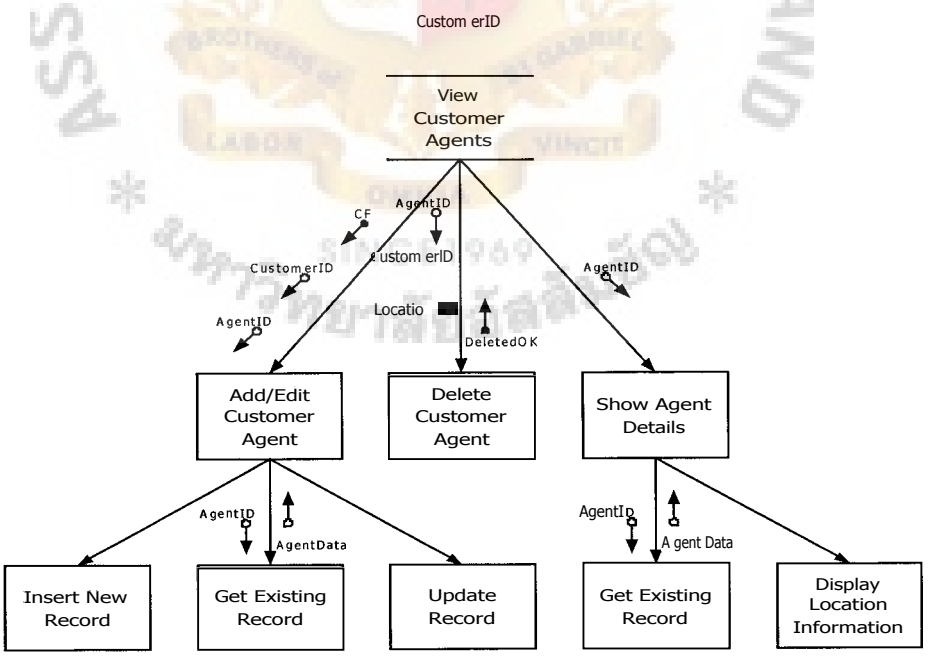


Figure E.5. Structure Chart — Customer Agent Process.

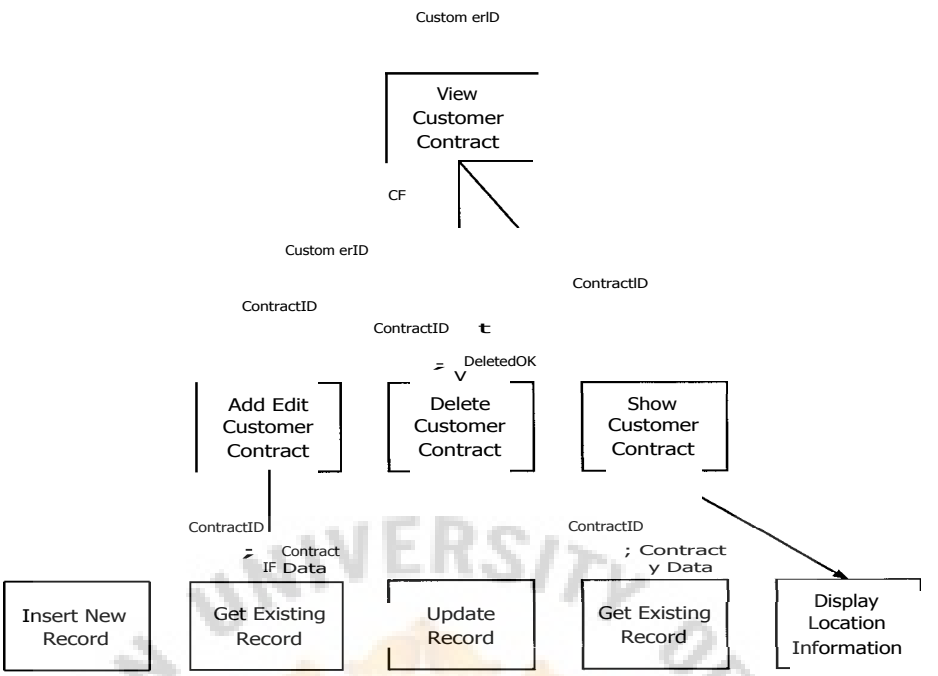


Figure E.6. Structure Chart — Customer Contract Process.

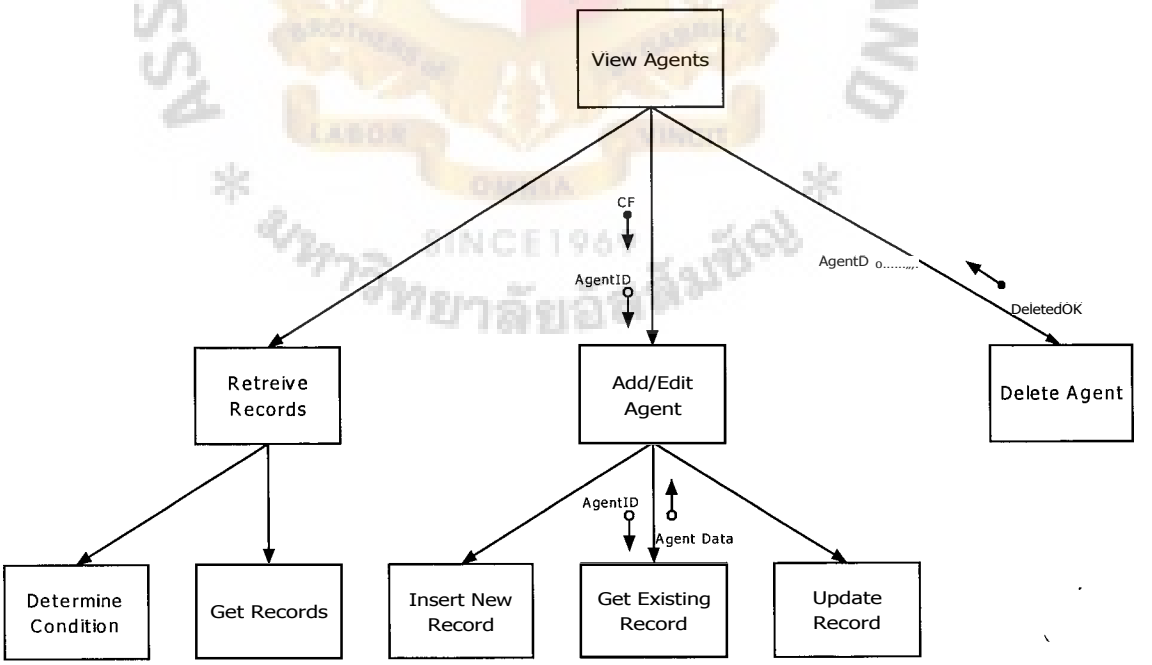


Figure E.7. Structure Chart — Agent Process.

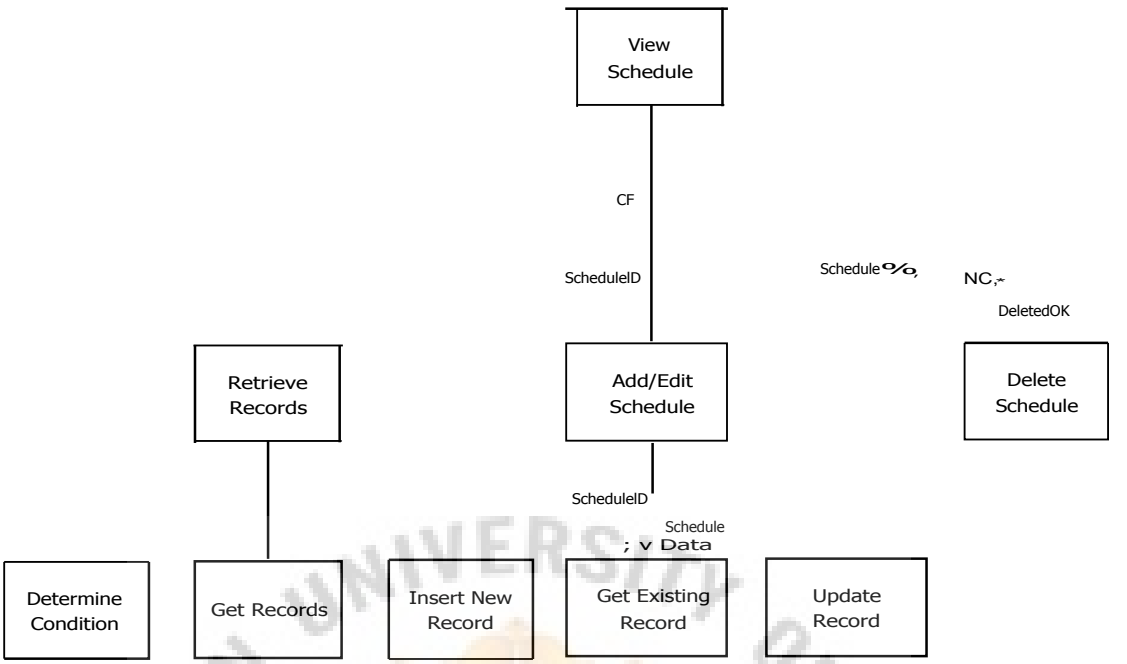


Figure E.8. Structure Chart — Schedule Process.

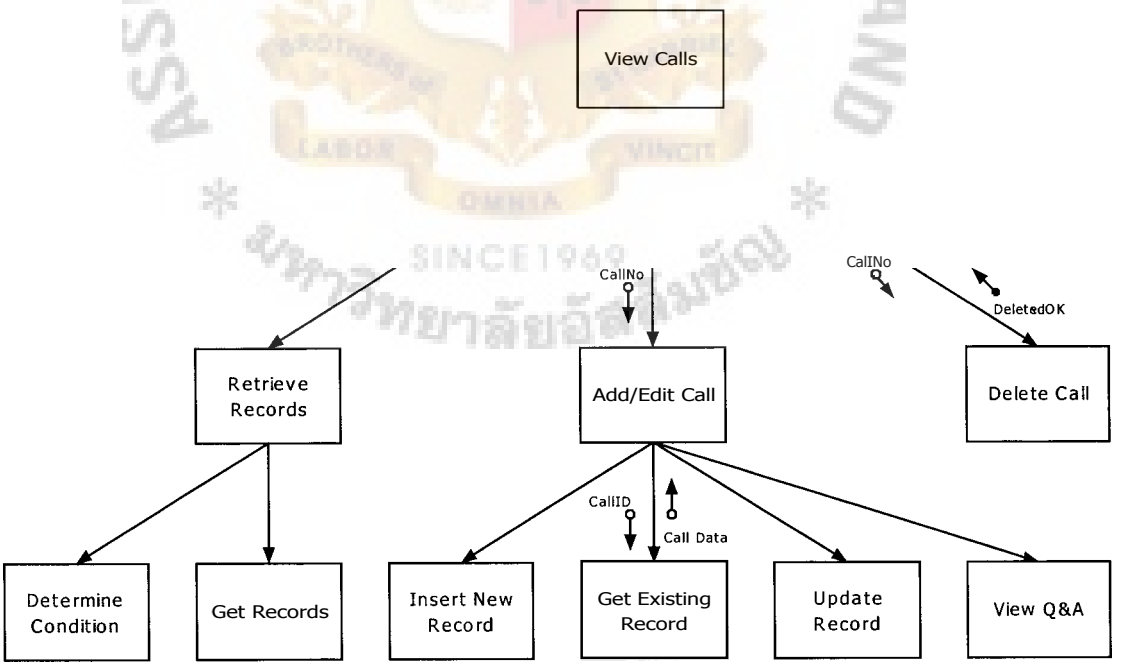


Figure E.9. Structure Chart — Call Process.

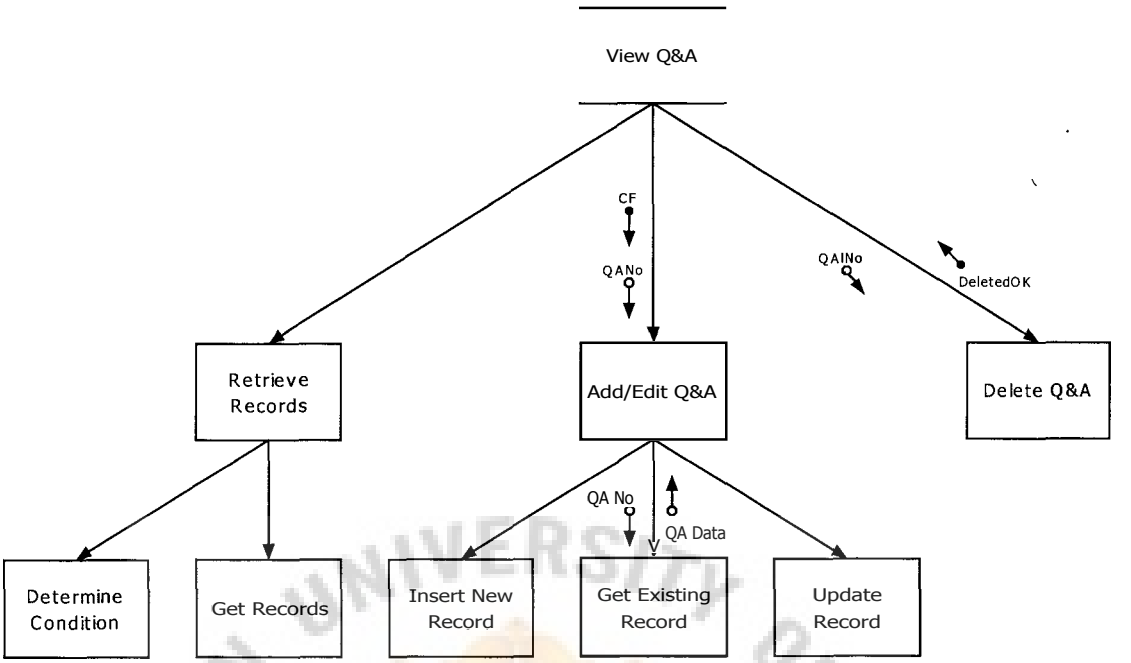


Figure E.10. Structure Chart — Q&A Process.

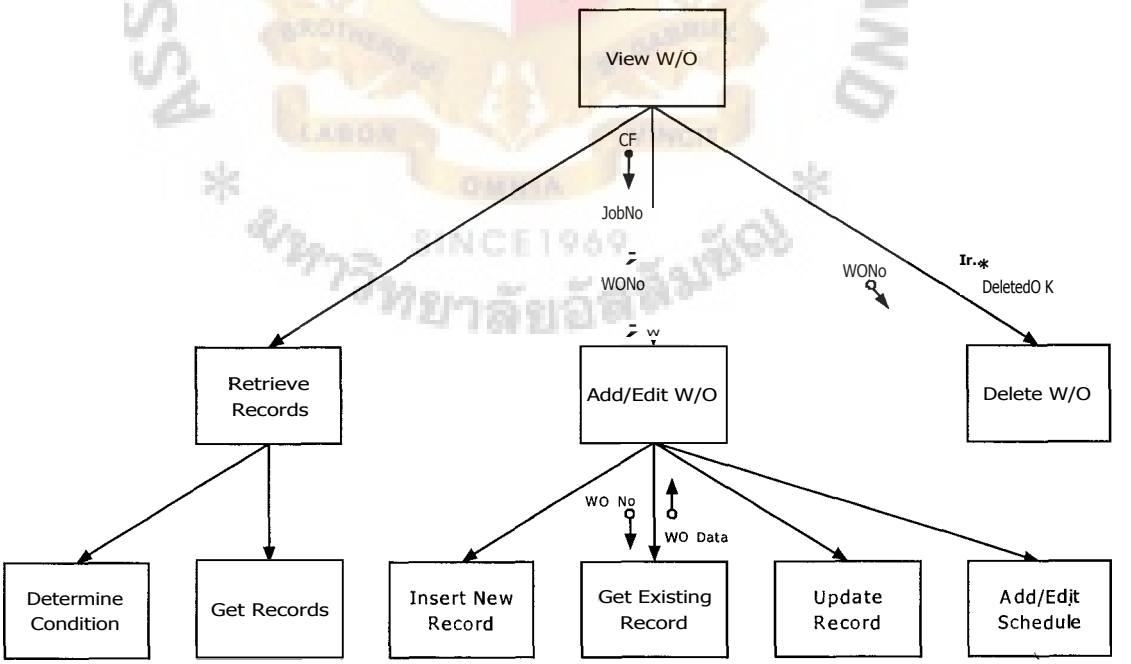


Figure E.11. Structure Chart — W/O Process.

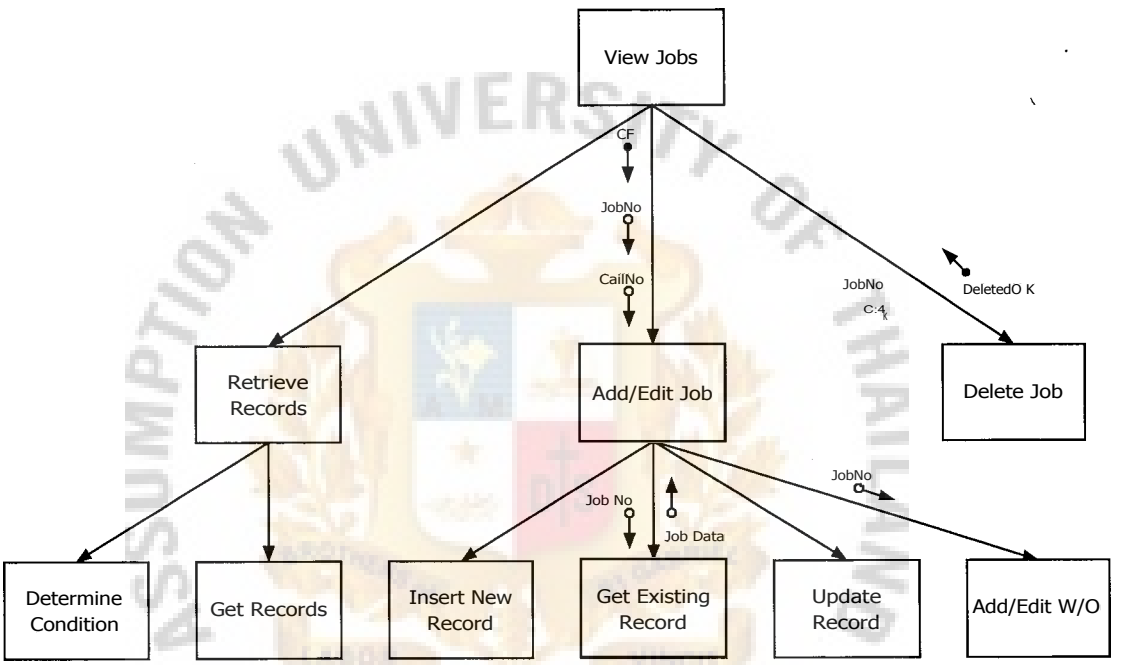


Figure E.12. Structure Chart — Job Process.

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