IFIX: NEW INFORMATION EXCHANGE FRAMEWORK FOR FINANCIAL ORGANIZATIONS

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ในปัจจุบันการแลกเปลี่ยนข้อมูลหลายๆ ระบบมีความสำคัญเป็นพื้นฐานเพราะมีการนำระบบมาใช้มากกว่าในอดีต ในขณะที่มาตรฐานการแลกเปลี่ยนข้อมูลทางการงานหรือที่เรียกว่า FIX ถูกนำมาใช้ในธุรกิจหลักทรัพย์ วิทยานิพนธ์ฉบับนี้เสนอสถาปัตยกรรมเพื่อการส่งต่อข้อมูล และข้อมูลการค้าหลักทรัพย์บน FIXML กรอบงานที่นำเสนอใหม่นี้ทำหน้าที่เป็นอินเตอร์เฟซหนึ่งของระบบ FIX มีชื่อว่า IFIX IFIX นี้จะเน้นไปยังการซื้อขายหลักทรัพย์และการส่งต่อข้อมูลที่รองรับการทำงานของนายหน้าค้าหลักทรัพย์เพื่อการเพื่อลดขั้นตอนงานและคนของกรอบงานในปัจจุบัน ในขั้นตอนของการพัฒนา IFIX รายละเอียดของ IFIX จะถูกกำหนดโดยการวิเคราะห์ข้อมูลของผู้ใช้ ข้อมูลถูกเก็บโดยการสัมภาษณ์ การประชุม และการฝึกอบรมผู้ใช้ หลังจากออกแบบและพัฒนา IFIX ขั้นตอนการประเมินจะถูกดำเนินการโดยการใช้แบบสอบถาม โดยมีผู้เชี่ยวชาญ 3 คน และผู้ใช้ 20 คน หลังจากนั้นจะนำไปวิเคราะห์โดยใช้โปรแกรม SPSS เวอร์ชั่น 22 ประมวลผล ผลลัพธ์จากการวิเคราะห์พบว่าค่าเฉลี่ยของความพึงพอใจอยู่ในระดับดีมาก นอกจากนี้ลักษณะของผู้ใช้ส่วนใหญ่ของ IFIX ที่ได้รับจากแบบสอบถามเป็นส่วนใหญ่อายุเฉลี่ยอยู่ในช่วง 30-40 ปี มีประสบการณ์ด้านการทำงานอยู่มากกว่า 10 ปีและวุฒิการศึกษาระดับปริญญาตรี การวิเคราะห์ข้อมูลแบบประเมินความพึงพอใจของผู้ใช้ทั่วไปพบว่า โดยเฉลี่ยส่วนใหญ่อยู่ในระดับมาก

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At present, information exchanges between systems are significantly important since the system is used more than the past. In spite of the fact that there is a standard Financial Information Exchange System, called as FIX, is executed around the securities organizations. This dissertation proposes a new architecture to forward request and the data securities trade design based on the FIXML. This new proposed framework acts as another interface of FIX System, named as IFIX. This IFIX focuses on trading of securities and forwarding information which supports brokers to perform their tasks. As a result, the reduction of the trading and forwarding messages is obtained. In order to develop the IFIX, the specifications of IFIX are defined from analyzing the users' information; this information is gathered from interviewing, meeting, and training users. After designing and developing IFIX, the evaluation process has been performed by questionnaire asking 3 experts and 20 users. Then, statistical analysis using SPSSv22 is executed. The result of data analysis indicates that the average of satisfaction scores on the IFIX from experts is very good. Furthermore, the characteristics of majority users of the IFIX obtained from the questionnaire are people with aging between 30 – 40 years, experienced more than 10 years, and their education level is the bachelor degree. This majority group also agrees that the IFIX can generally serve their needs very good.

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CHAPTER 1

Introduction

Financial industries have many trading transactions and many markets, such as equities (can be called as securities), fixed income, derivatives and Foreign Exchange (FX). The rapid growth of the financial industries according to market conditions and future business, in both volume and value, causes changes in the world's financial services and supports in the multi-currency trading. In order to accommodate these changes, Financial Information eXchange (FIX) was introduced.

Shangguan [1] stated that the consequence of building FIX in various organizations leads to the improvement of the financial services that brings benefits to all financial industries. However, this research focused in the logistic information exchange problem where requirements from customers were analyzed to be the enterprise standard process.

Although computers are used as a part in normal working process currently, traditional information exchange among financial industries is still not prevalent. Thus, traditional information exchange is manually performed using phones, documents, flat files via the web portal, and flat files via emails. However, the popular way to exchange information is to upload using flat files via the web portal because the transfer system can validate the transferred flat files. Unfortunately, manual process causes various problems, such as real time exchange, security, different of platform, and reliability.

Similarly to the logistic problem, the transaction transferred from brokers to Stock Exchange of Thailand (SET) under the problem of real time electronic exchange of securities transaction data is considered as a major function of FIX. The development of the FIX protocol has been improved to work with XML by embedded XML as a part in the FIX pattern, called as FIXML [2].

In Thailand, FIX is implemented with additional application interface, called as FIX system. It supports brokers' activities in transactions of stock data. In addition, the Post Trade Integration system (PTI) is used to send all securities transaction data from brokers to SET every end of the day as an offline transfer process. However, this procedure is going to be replaced with FIX; and real time electronic exchange of securities transaction data will be occurred.

Even though FIX will be implemented to support the real time transaction transfer process of securities transaction data, the order from sub-brokers must be manually processed only by their brokers because sub-brokers do not have the license. Another exchange file between sub-brokers has many formats. Thus, the order transfer mechanism from sub-brokers to their brokers is out of standard.

In order to solve the problem of various order transfer mechanisms from sub-brokers, this thesis proposes a new transfer mechanism of FIX system that will not break the broker's license but the standard transfer mechanism can be maintained. Therefore, the information exchange, in additionally, a depository FIXML messages will be implemented.

This chapter proposes the problem in Section 1.1, and the objective is described in Section 1.2. In Section 1.3, the scopes and constraints of this thesis will be discussed, followed by definitions of technical terms in Section 1.4. Finally, the structure of this thesis is detailed in Section 1.6.

1.1 Problem Statement

Presently, the traditional information exchange is used for years; users have used the upload data by web portal to exchange the data between brokers, or between brokers to SET. The system exchanges information using flat files. So, if continue using this traditional system, this exchange information process will have problem within real time requirements.

The following diagram in Figure 1.1 is the summary of problems. It shows the main problem and sub problems of the traditional system. According to Figure 1.1, the first problem is security of network and flat file. The users export file from a system and then import the flat file upload to web portal by http protocol or https protocol. The next problem is working process. This working process is worked by people. The user is not able to update the flat file with in real time.

The next problem is sub-broker's information exchange. FIX engine provides by 2 sides, the first is Initiator (broker) and the second is Acceptor (SET). Flat file that is used have difference platform such as Window, UNIX and Linux. So that affects to hardly import and export.

The last problem is unreliability. The server is moved or changed. The Initiator is not exchange the information.

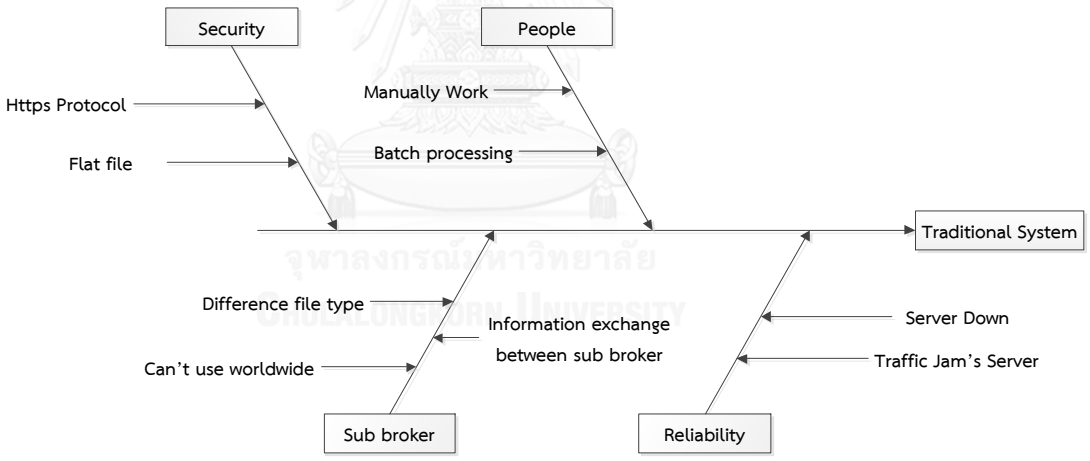

Figure 1.1 Cause and Effect Diagram

1.2 Objective

1. Propose a new architecture to enhance the ability of information exchange in the Electronic Communications Networks (ECNs).
2. Propose a mechanism to maintain reliability of Electronic Communications Networks (ECNs) under the new architecture.

3. Propose a mechanism to enhance security control transaction under the new architecture.

1.3 Scope of Thesis

In this study, the classification system is constrained as follows:

1. Sample financial data are records during the year 2001 – 2005 only.
2. This system connects between SET and a sub-broker.
3. The core network of the entire organization will not be altered.

1.4 Definition

FIX: Financial Information eXchange is a protocol that exchanges and performs electronic communication over networks.

TSD: The Thailand Securities Depository Co., Ltd. is a subsidiary of The Stock Exchange of Thailand. The TSD was established on November 16, 1994 with a registered capital of THB 200 million, and commenced operations on January 1, 1995. The TSD provides three types of securities post trade services.

SET: Stock Exchange of Thailand

Administrator: A login id of a privilege user to access the system.

User: A set of login id of general users.

User Interface: An interface that is implemented for users to interact with the system.

FIXML: A set of XML vocabulary for creating FIX messages, uses the same FIX data dictionary and business logic, focuses primarily on the FIX Application Messages and does not provide a session layer.

ECN: Electronic Communications Network is a type of alternative trading system (ATS) that trade listed stocks and other exchange-traded products. It is usually written as ECNs because there is more than one network at a time.

1.5 Structure of the Thesis

The structure of this thesis will be represented as follows; the literature reviews and related common knowledge will be presented in Chapter 2. Chapter 3 will describe the architecture of traditional system and analysis and design of the proposed system. The experimental results will be discussed in Chapter 4. Lastly, discussions, limitations and conclusion will be illustrated in Chapter 5.

CHAPTER 2

LITERATURE REVIEW AND RELATED COMMON KNOWLEDGE

In this chapter, literature reviews and necessary fundamental knowledge have been briefed. These include information exchange and trading system, design patterns, information security, and Cloud Computing, FIX Protocol, AJAX and business process management.

2.1 Information Exchange

Presently, the information exchange becomes an important issue due to network or communication among enterprises. It is the fact that the information exchange is not only performed in financial organizations, but also another business must exchange the information.

There are several researches who show efficiencies and advantages of the information exchange. Tunstall [3] described the use of the Open Systems Interconnection model (OSI) for financial information exchange between banks. However, the use of OSI notes a small impact that causes some arguments at the senior bank management level on a failure of OSI as a product, or a failure of the bank management to grasp new opportunities.

Another research on the problem of information exchange between the HIS (Hospital Information System) and the PACS (Picture Archiving and Communication Systems) is starving for solution in the construction of hospital digitalization. Since the rapid development of information technology and the popularity of digital medical, medical information is growing. Therefore, the process of hospital digitalization is gradually quickening and both systems, HIS and PACS, are seriously involved. The HIS system mainly deals with patient's information, it follows the standard of HL7 while the PACS system mainly manages image information and follows the standard of DICOM 3.0. Since HIS and PACS deal with different information and follow different standards, the third party software is difficult to

directly communicate. So Lin and el al. [4] presented a method of establishing HL7/DICOM gateway to realize the information exchange of HIS and PACS. The HL7/DICOM gateway was designed based on three modules. First, HL7 messages and triggered events were designed to achieve the function of transaction processing module. According to the designed HL7 messages, four message interface functions were defined to accomplish the function of the send/receive messages module. Finally, the algorithm of construct/parse messages was implemented to complete the function of the construct/parse messages module. The result of this research showed that HIS and PACS realize information exchange successfully under the use of the HL7/ DICOM gateway.

On the other hand, Shangguan [1] presented the significance of exchanging information which consumer perspective, enterprise perspective, administrative department perspective and whole society perspective. In addition, Yao et al. [5] presented a new financial engineering approach to investigate the information flow between the most spotlighted stock markets Shanghai Stock Exchange (SSE), New York Stock Exchange (NYSE) and Tokyo Stock Exchange (TSE). They investigated transmission mechanism of stock market information between China, the US and Japan.

2.1.1 XML

The format for data interchange over the Internet utilize from XML to content specification. In Publish/Subscribe model, producer is the source for an XML document and disseminates the XML content to the consumer using a mediator called a publisher. The XML document is labeled and defined by producer to access control policies for the consumers. Securely labeled XML document is encrypted and sent to the publisher with consumers' access details. To provide confidentiality and integrity for XML content dissemination must use encryption. Consumer enquires the publisher for their accessible content. Then, XML label plays a vital role which locates the XML content uniquely [6].

Xiangyu Hu et al. [7] proposed a mechanism for a XML data storage that can query any relational databases. This XML data set can be stored in relational tables and XQuery expressions can be evaluated as a part of SQL for XML data querying. XQuery grammar tree and Query tree model for XML data query in relational databases were introduced to gain higher performance while querying the XML data. Appropriative algorithm for evaluating XPath was also presented in this paper by which XQuery could be evaluated rapidly and efficiency. Finally, experiments validate the strategy of the XML storage and run the algorithm on real XML datasets to show the efficiency compared with other mechanisms.

2.2 Trading System

There are several studies in the trading system. Fan et al. [8] researched a web-based financial trading system. This article describes an electronic market that traders use to execute bundle orders. Since it is based on distributed objects, it has significant advantages over systems built with CGI scripts. Sharma and Gupta [9] developed a few useful considerations in the development of intra-day trading software: Comparing Indian Intra-day Trading Software with foreign software that factors affecting quality of an intra-day trading system. It was developed using java, SQL server 2005, JBoss 4.2.1, Struts 1.1, BIRT 2.3.2, display tag library 1.1 and JSTL.

Financial market prediction and trading describe a challenging task that attracts great interest from researchers and investors because success may result in substantial rewards. This paper proposed an application of a hierarchical evolutionary fuzzy system called the HiCEFS [10] for predicting financial time series. A novel financial trading system using the HiCEFS as a predictive model that employs a prudent trading strategy based on the price percentage oscillator (PPO) was proposed. In order to construct an accurate predictive model, a form of generic membership function named the Irregular Shaped Membership Function (ISMF) was employed; a hierarchical evolutionary genetic algorithm (HCGA) was adopted to automatically derive the ISMFs for each input feature in the HiCEFS.

2.3 Design Patterns

The design patterns can be counted as important parts of the program. Yuan et al. [11] studied design patterns; and design pattern specifications are explained. The implementation of a prototype for the tool was introduced, and the verification of a real design pattern was illustrated.

R. Badr and H. Hosny presented an UCI Pattern Language Management Tool [12]. One of the real issues confronted by various dialect manufacturers is to deal with their dialects. In the exploration, a Human–computer interaction Pattern Language Management Tool (HCI PLMT) was created in a view of the ontological-approach. The HCI PLMT was a robotized instrument that dealt with the looking and scanning of examples existing inside of the HCI Pattern Language. The PLMT dealts with the outline expansion of a new client interface. It was backing up the alteration of examples and/or joins existing inside of the example dialect, and also the option of new connections between existing sections inside of the HCI Pattern Language.

A model based Heuristic design of web user interface was proposed by X. Lu and et al [13] in the year 2007. This paper proposed A Model Based Heuristic Design of Web User Interface that can bolster heuristic web client interface design patterns. The PNP model consisted of two different models: the article presentation model, and the route and cooperation model. Information data pertinent web client interface was caught by the article presentation model while the route and cooperation model controlled communication, operation, and route among page units. As a result of using this PNP model, web architects can manufacture page presentation models heuristically, which depend on page layout. Along with these lines, the web originators can complete the configuration of complex web client interfaces in a higher conceptual level without expanding the outline troublesome. Moreover, with the assistance of apparatuses, codes are consequently produced through the model change.

In addition, Tram et al. [14] proposed a system that supports the instruction of user interface design. The use of this proposed system had impacts to the product improvement process. Since every application generally has similar user interface,

this paper implemented a methodology with upgrade the reusability of client interface. This new framework, or so called as "Client interface plan design administration framework support for building data framework", proposed principal of the system, such as perform generate source code modules, administering user interface design patterns. The framework had a vital part in making client interface plan designs turn out to be more acquainted with application creators. They can carry out their employments successfully and reuse interfaces.

2.4 Information Security

The most importance issue in the information exchange area is security because traffics between a sender and a receiver can be captured illegally. However, the fundamental theories concerning this problem are considered only into data section and network section until Kehe et al. [15] proposed a business security model. This new model has strong impact to the use of information in every business organization, including the financial area. The new security concept evaluates data sets, more precisely contains the operation on data sets. In model descripts process set, data set, access set process sequence set and business set. The business security must be able to integrate with the existing security mechanisms these are network security and data security.

2.4.1 IP Sec

Essential internet communications is protected by the network layer security. No matter how secure the upper layer protocols are, adversaries can exploit the vulnerability of the network layer, for example IP spoofing and IP fragmentation attacks, to sabotage end-to-end communications. The data in a network is controlled by the network administrator to authorize.

H. Yin and H. Wang [16] proposed an application-aware IPsec policy system on the existing IPsec/IKE infrastructure, in which a socket monitor running in the application context reports the socket activities to the application policy engine. In turn, the engine translates the application

policies into the underlying security policies, and then writes them into the IPsec Security Policy Database (SPD) via the existing IPsec policy management interface. This research implemented a prototype in Linux (Kernel 2.6) and evaluated it in a tested. The experimental results showed that the overhead of policy translation was insignificant, and the overall system performance of the enhanced IPsec was comparable with network setting and protection setting to those of security mechanisms at upper layers. Arranged with the application-mindful of IPsec approaches, both secured applications at the upper layers and legacy applications can straightforwardly acquire IP security upgrades.

2.5 Cloud Computing

Liang et al. [17] presented Cloud Computing: Programming Model and Information Exchange Mechanism, based on internet. Internet application model, Cloud computing will be the leading way to access services and information in the services and resources exchange. This paper focuses on could computer which adapt Map-Reduce distributed system. Park et al. [18] concerned with the design of integrated information system for A+M/PMI data exchange. A+M/PMI (Atomic, molecular and plasma-material interaction data) data are important in applications such as fusion, astrophysics, chemistry, etc. These heterogeneous data have different formats to exchange the data. This paper proposed apply and develop exchange format extend XSAMS; allow easy access of A+M / PMI data system for data exchange. There are three Components: XML (EXtensible Markup Language) Schema (XSAMS) Handler, Users and Database. This paper sketch out the integrate information system and data exchange using XSAMS (XML Schema for Atoms Molecules and Solids).

2.6 FIX Protocol

FIX protocol is a communication protocol that uses tag and value pairs. Each FIX tag is assigned both a name and a number. The pairs are separated by an ASCII

null character to form messages. In various textual representations and log files, this null character is frequently replaced by a readable character such as "|" to make messages easier to read. In addition, this protocol is a messaging standard that was created to automate trading between counterparties for the real time electronic exchange. Additionally, it is used for the securities transaction data. The format of the securities transaction data is called as a document or message spec (see Appendix I). Moreover, all explanations about tags are elaborated in the convention (see Appendix I). Thus, creating a document must follow the defined convention [19].

2.7 AJAX

The sync data is the part of information exchange. In theories, the synchronous data is separated into two types. The first is synchronous. It's used to sync the data and was used long time ago. The second is asynchronous; it communicates by Web server sends a response immediately then closes the connection.

Asynchronous JavaScript and XML (AJAX) is a web technology that used to decouple a user interface from web server processing. The traditional server communication forces users to wait until a request had been delivered and processed, whereas AJAX requests are passed to the web server asynchronously, without interrupting the user experience.

In the year 2010, the Green AJAX that is the enhancement of the original AJAX was proposed by Ridwan S. [20]. The following Figure 2.1 shows the signal arises when the administrator updates the data using Green AJAX.

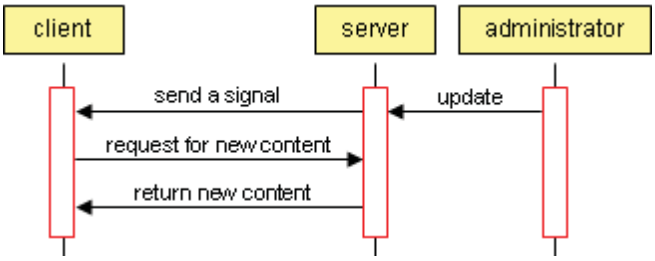

Figure 2.1 The signal arises when the administrator updates the data

Green AJAX [20] had a better performance than the classical AJAX. Those experiments were tested on the case of random and unpredictable update time on a web server. Green AJAX had been proven that it was able to support the web application for faster responses with low resources consumption. However, those experiments were not tested in the fixed update time on the web server.

Currently, the AJAX is used in many websites since AJAX can increase the user's experiences (UX). One interesting research was proposed by X. Zhang and H. Wang that is the AJAX Crawling Scheme Based on Document Object Model (DOM) with breadth-first AJAX crawling algorithm [21]. This AJAX crawling algorithm could assemble a State Transition Graph (STG) of an AJAX web application by following the progressions of DOM tree activated by some AJAX occasions, and after that produced a static mirror website of the first AJAX web application. The AJAX crawler could be used to arrange DOM components that equipped for activating AJAX occasions, to conjure comparing JavaScript capacities, then created a State Transition Chart (STC) that includes the states and moves of the slithering process. There are various advantages obtained from this paper, such as easily managing JavaScript Safety Inspector, Document Object Model, State Transition Graph (STG), AJAX Crawl Controller and Indexable Page Generator.

2.8 Business process management

Business process management (BPM) is a new kind of management theory that appeared and developed quickly in the recent years. It was established in the

foundation of modern information technology. It focused to the managers' attention on the enterprises' business process instead of business functions as appeared in the traditional model.

Firstly, the research of SIMULATION STANDARD FOR BUSINESS PROCESS MANAGEMENT [22] analyzed the traditional views of the business process management, and referred to its theory insufficiency. For further use of the system, another new business process management model had been built, based on this new model, the enterprises' manager could improve their business process dynamically, including no interruption of the enterprises' normal production activities. The new model is composed of five departments: a business process workbench, a business process monitor, an interface, a business process engine, and a business process/business rule database. The new BPMS could realize the business process's dynamically. This leads to the improvement of creation of a real world case of any business processes.

CHAPTER 3

METHODOLOGY

This chapter describes the financial information exchange architecture both in the traditional method, existing FIX system, and the proposed method that based on FIXML. The content starts with traditional financial information exchange concept, follows by the existing FIX system and analysis of the current situation. Then, the design and implementation of the proposed system which is a new interface of FIX System, named as IFIX, are drawn.

3.1 Traditional Business Process of Financial Information Exchange

Figure 3.1, the traditional business process starts from a user exports a flat file from the SBA database. Then, the flat file will be saved on the user's hard drive. In the next process, the user must upload the flat file data to the web portal. The web portal validates the file before uploading the file to SET.

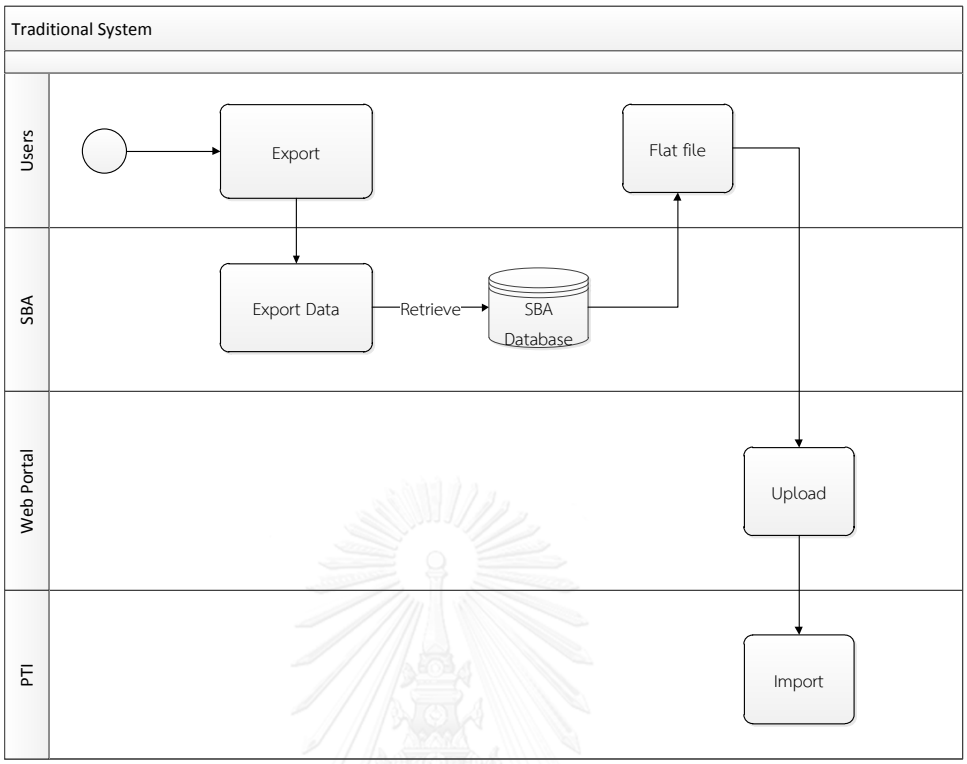

Figure 3.1 Traditional Business process of financial information exchange

Figure 3.2, in the web portal, the displayed screen contains two parts. The first part is a menu bar and the center part is used to define the selected file. The users must select the menu then the screen. The users selected a task on menu screen, and then users find a flat file to upload. Unfortunately, the web traffic was interrupted; the users must re-send the file again.

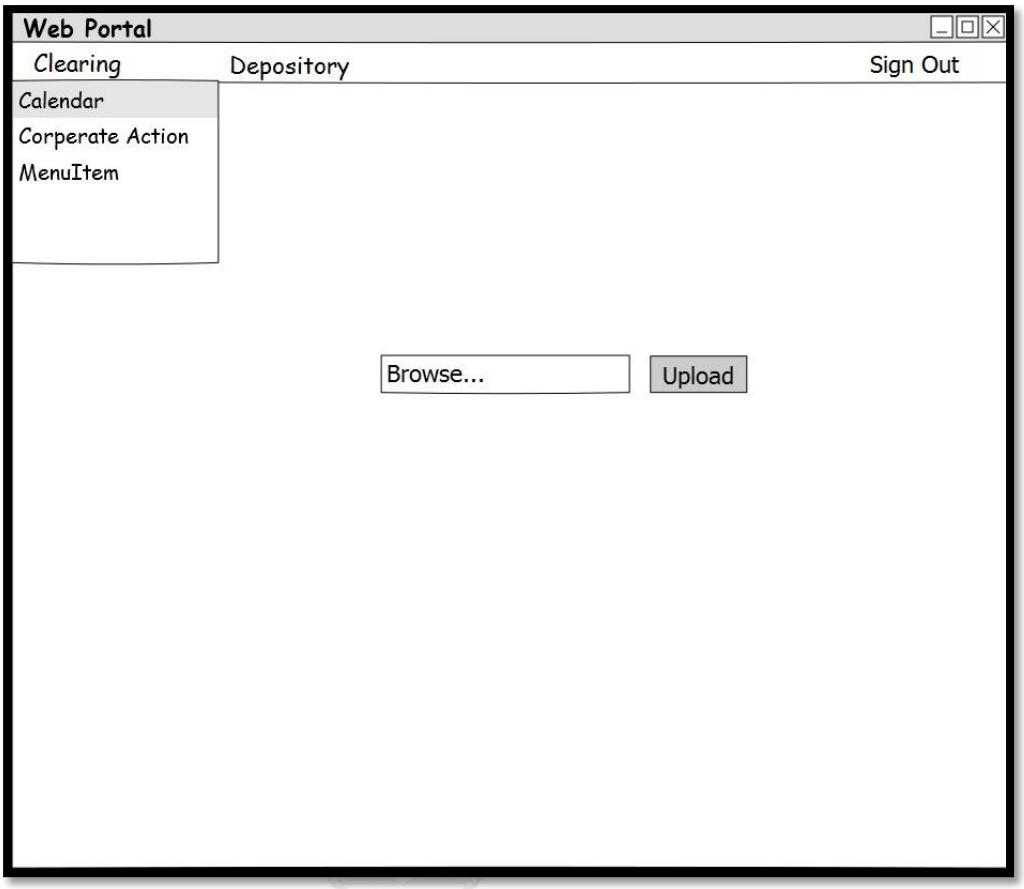

Figure 3.2 The web portal to upload file

3.2 Existing FIX System Architecture

Presently, the FIX system is widely implemented in various financial organizations. The implemented architecture of this software is drawn in Figure 3.3.

One significant component in this FIX system is the depository FIX Architecture that is responsible for 2-side communication between brokers and The Thailand Securities Depository Co., Ltd. (TSD). This component is described as follow.

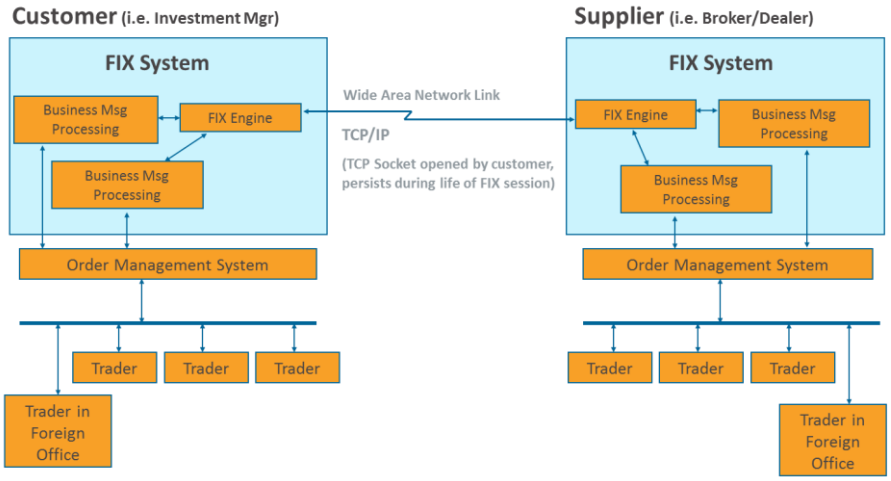

Figure 3.3 FIX System Connectivity [2]

3.2.1 Depository FIX Architecture

In the current FIX system, the functions are performed by two sides, broker and TSD, using FIXML as shown in Figure 3.4. At the broker side, the FIX engine is responsible for exchanges and electronic communication network (ECNs) to the back office application. Moreover, an order message from brokers will be sent to TSD for depositing stock of customers and documentations.

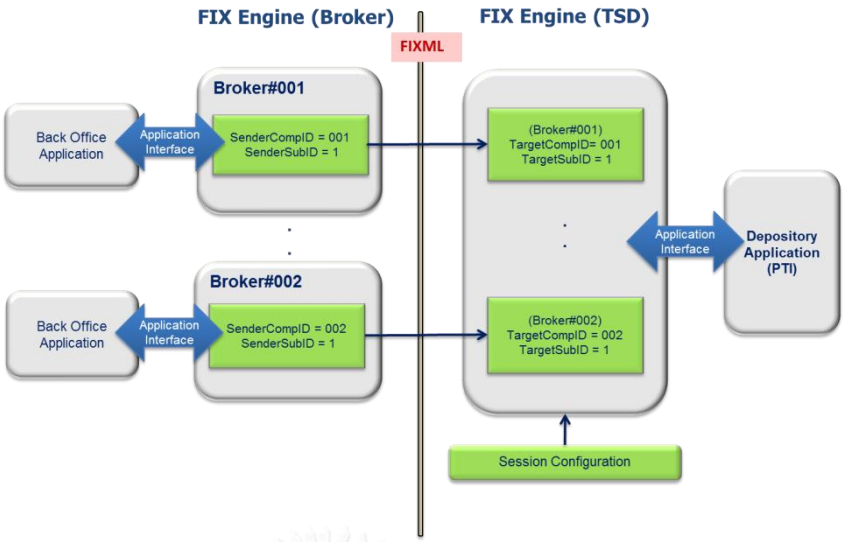

Figure 3.4 Depository FIX Architecture

For each participant, the Broker, later will be called as FIXInititator, connects to the TSD, which will be called as FIXAppector. The configurations are presented in Table 3.1.

According to Figure 3.4, the FIX engine must be installed in both sides: the broker and TSD. Thus, details of this engine are elaborated in the following subsection.

3.2.2 FIX engine (The QuickFIX/N)

FIX engine was developed and delivered by various vendors. Moreover, there are many versions for any financial businesses, products in the future and IT. QuickFIX is composed of two engines: QuickFIX/J, and QuickFIX/N. QuickFIX is an open source of FIX engine that addresses the session level messaging of the FIX protocol thereby providing a foundation for sophisticated applications. Once a session is configured, QuickFIX establishes each connection and keeps it alive. The application programmer's only responsible to create and handle application messages as seen in the

previous section [23]. QuickFIX/J is used for implementing FIX by Java while QuickFIX/N is used for implementing the FIX by .NET.

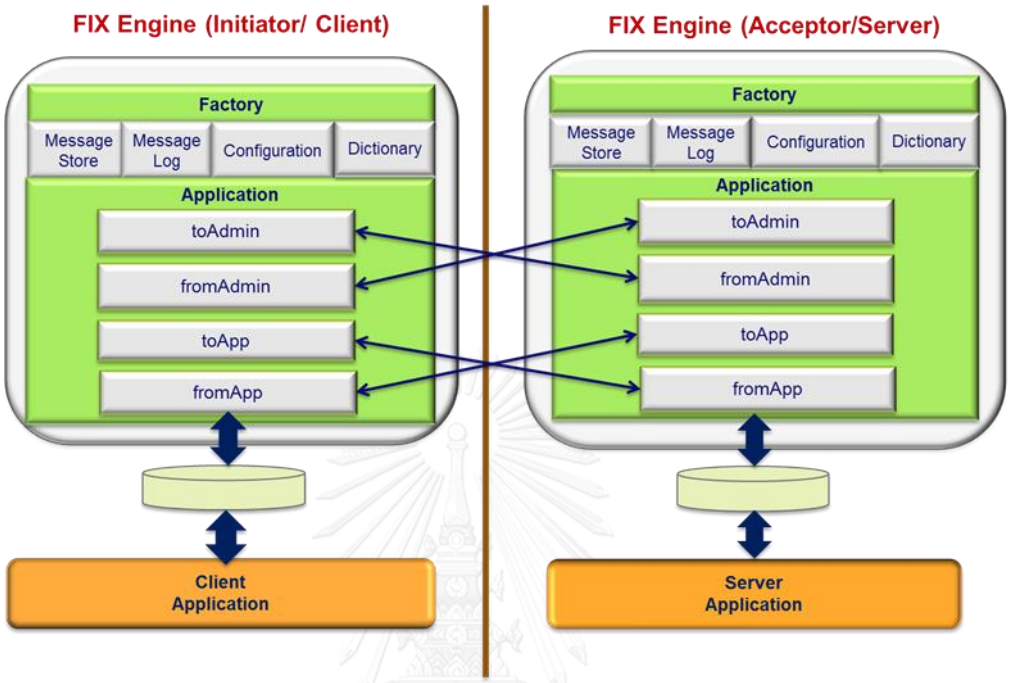

Figure 3.5 QuickFIX Structure [2]

According to Figure 3.5, there is one session for each participant. A session is able to authenticate to support a request or response and notify messages. The diagram below shows how FIX works.

1) Request and Response Message

1.1. Interactive

A request message starts from the initiator requests the message then the acceptor returns the response message. This activity diagram is the same as general request and a response, as shown in Figure 3.6.

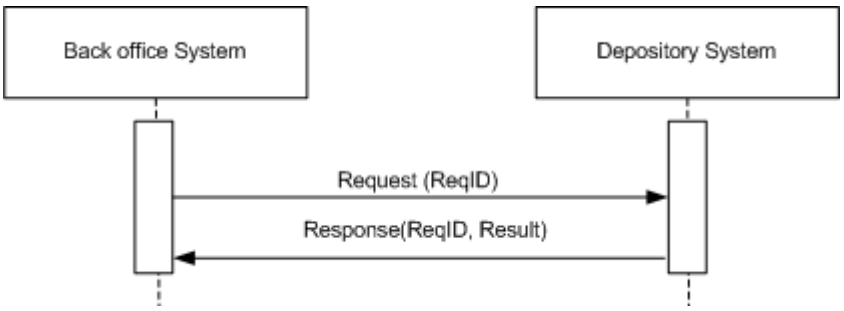

Figure 3.6 FIX engine Interactive

1.2. Submit

A request message working is the same Figure 3.6 but this diagram is named as “submit”. The “submit” means the initiator submits the data to the acceptor. In term of “submit”, the initiator must know whether the status process is accepted or not. So the response could be two responses. The first is called “response”. The “response” shows the acceptor response. Under some situation, the response is added with a notifying message. This notifying message relates to any unusual situations and a warning message is sent, as shown in Figure 3.7.

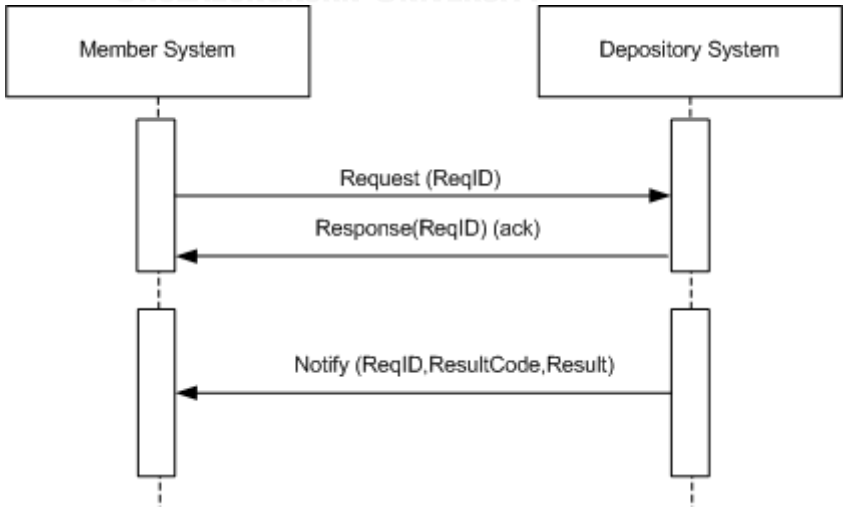

Figure 3.7 FIX engine Submit

Nevertheless, the proposed IFIX in this thesis is implemented by QuickFIX/N since QuickFIX is a free and open source implementation of the FIX [24].

3.2.3 FIXML

FIXML is built on FIX pattern base XML. It uses message type (35=n) for XML message because in standard message not enough for information exchange. eXtensible Markup Language(XML) was designed to describe data using format tag and value. FIXML is built on FIX pattern base XML.

Table 3.1: Configuration of A General Fix engine [24]

Parameters	Description	Value
BeginString	FIX Version	FIXT.1.1
DefaultApplVerID	FIX version ID	FIX.5.0
ConnectionType	Initiator and Acceptor	initiator
HeartBtInt	Heartbeat/second	30
ReconnectInterval	Reconnection again in seconds	60
StartTime	Start time to connect FIX	HH:MM:SS
EndTime	End time to connect	HH:MM:SS
SocketConnectHost	Socket Host	IP Address
SocketConnectPort	Socket port	
TargetCompID	Counter parties ID that communicate	FIXAcceptor
SenderCompID	Broker , Sub-Broker, Custodian	FIXInitiator
SenderSubID	Sub Sender ID	>1
ResetOnLogon	Session state is restored from persistence layer.	N
Username	User name to connect FIX	
Password	Users password.	

3.3 System development paradigm

This IFIX was developed by System Development Life Cycle (SDLC) Model is also known as a system development paradigm. This model has the following in activities that divide by 7 processes as shown in Figure 3.8.

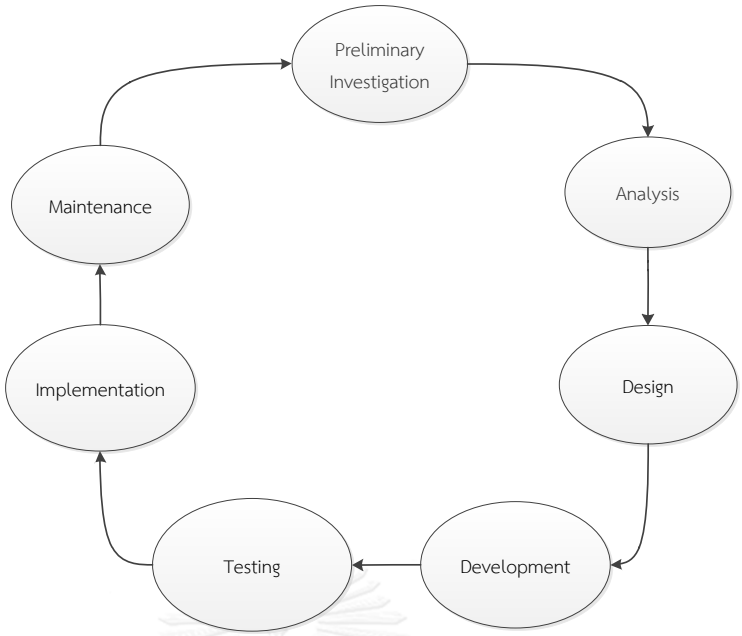

Figure 3.8 System Development Life Cycle (SDLC)

Based on Figure 3.8, each process can be elaborated as follows.

3.3.1 Preliminary Investigation

One of the most tedious tasks is to recognize the real problem of the pre-installed system. The requirement between developer and users must be defined before the new system is developed. The first process is also known as feasibility study where all software requirement specification (SRS) is partially uncovered.

In order to gather requirements, interviewing with users and defining problems of the traditional business process in the financial information exchange are performed. The results of this study can be classified as functional requirements and non-functional requirements.

- Functional Requirements

- Users can exchange information. The traditional system the user exchange data by web portals. It's difficult.

- The system can authenticate and authorize. The system must check username and password to identified and check permission.

- The system can directly interface with the database to retrieve data. The user can direct to the securities back office database.

- Non-Functional Requirements

- The path to exchange is able to enhance security.
- The reliability a data is able to send when server down.
- Users can use this system by user interface.

3.3.2 Analysis

System Analysis is the process of analyzing the traditional financial information exchange. There are six perspectives in performing the domain analysis: the context of IFIX domain, customers and users, environment, tasks and procedures, competing software, and domain similarities. Figure 3.9 shows six perspectives of domain analysis.

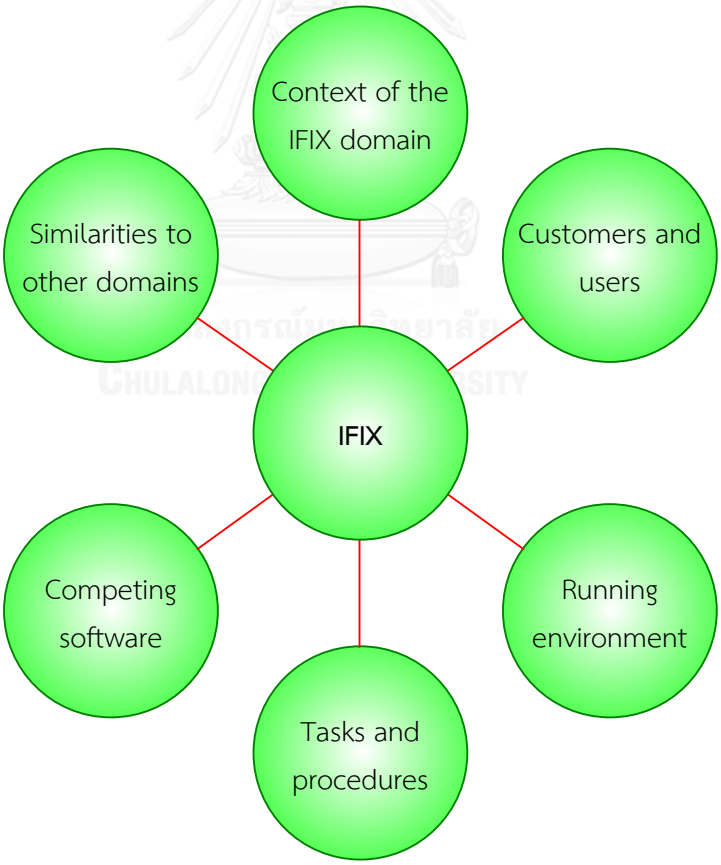

Figure 3.9 perspectives of domain analysis

A) Context of the IFIX domain

- This system, IFIX, focuses on a new mechanism of the financial business flow of orders from the forwarded orders.
- The information exchange must be updated in real-time over the electronic communication network.

B) Customers and users

- Broker, the representative of customers, receives orders from customers and a send to SET (TSD).
- Foreign Broker, Sub Broker and Custodian who have no license for trading equities and others are able to use IFIX.

C) Running environment

- Computer or laptop e.g. Window XP, Window 7 or Window 8 with .NET 4.0

D) Tasks and procedures

- For depository system: the user can select command to perform a task or sending message of FIX to TSD.
- For security: this system uses firewall to protect hackers and malicious software.

E) Competing software

Many companies try to develop software similar to IFIX such as Freewill and Reuters. However, most of them had withdrawn their software implementation except DST. Nevertheless, the software of DST cannot fully support internal process requirements as much as the IFIX since IFIX is developed based on the requirement specifics than the DST's product, as shown in Table 3.2.

Table 3.2: Compare IFIX and Software Vendor

Issue	IFIX	Software Vendor
Price	Expensive	Cheap
Reliability	Support	Not support
Direct Interface Database	Support	Not Support
Sub-broker	Support	Not Support
Time to build software	Fast	Slow
Security	Support	Not Support
Data	Confidential	Leak

F) Similarities to other domains

The similarity of this system with other domains, it's similar to XML (EXtensible Markup Language) or another data exchange system.

3.3.3 Design

All requirements from the previous process, the analysis process, are derived to the Unified Modeling Language (UML). As a consequence, all problems can be uncovered. The derived UMLs are Use Case and Sequence diagrams. The result of these UMLs leads to the design of IFIX that includes two main designs: the screen design, and the database design.

1) UML Use Case

The UML Use Case is drawn in Figure 3.10 and Use Case Description is shown in Table 3.3, Table 3.4 and Table 3.5.

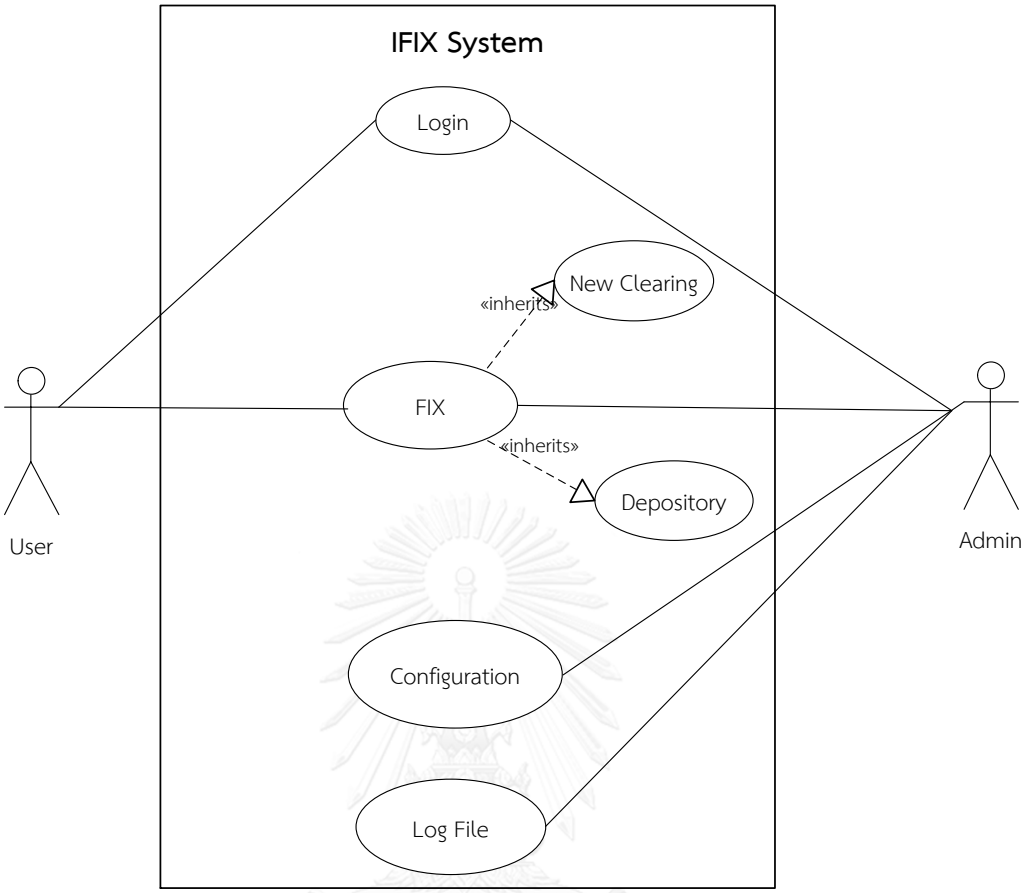

Figure 3.10 Use Case Diagram

Table 3.3: Use Case Description

Use-case Name	IFIX (Interface Financial Information eXchange)	
Actors	User, Admin	
Description	A user wants to exchange information.	
Goals	A user sends a command and waits for a response.	
Pre-Condition	The system must check heartbeat, the connection situation.	
Related use cases	**Include of:** New Clearing, Depository	
Step	**Actor actions**	**System responses**
	1. User or Admin keys Username and Password to login process	
		2. The Username and Password are checked.
	3. A command is selected: new clearing, or depository.	
	4. Admin can configure the IFIX system.	
		5. IFIX saves the new configuration.
	6. Admin can see the log file.	
		7. IFIX retrieves the required log file.

Table 3.4: Use Case Description

Use-case Name	New clearing	
Actors	User	
Description	The use-case is included by IFIX. The user wants submit or request new clearing information.	
Goals	A user requests the command and waits for a response.	
Pre-Condition	The system must check heartbeat.	
Related use cases	**Include of:** FIX(Financial Information eXchange)	
Step	**Actor actions**	**System responses**
	1. Fill data in Textbox	
	2. Click “Request” Button	3. Save “Response” Message

Table 3.5: Use Case Description

Use-case Name	Depository	
Actors	User	
Description	The use-case is included by FIX. The user wants submit or request depository information.	
Goals	A user requests the command and waits for a response.	
Pre-Condition	The system must check heartbeat.	
Related use cases	**Include of:** FIX(Financial Information eXchange)	
Step	**Actor actions**	**System responses**
	1. Fill data in Textbox	
	2. Click “Request” Button	3. Save “Response” Message

1.2) Sequence diagram

1.2.1) Login and Logout

There are messages in Figure 3.11. The first is to connect to the FIXML Gateway. The IFIX Server must send the Username and Password that configure in Table 3.1. While connecting to the FIXML Gateway, the IFIX server will Heartbeat (message codes are listed in Appendix I) that sends every 30 seconds until the IFIX server terminates the system.

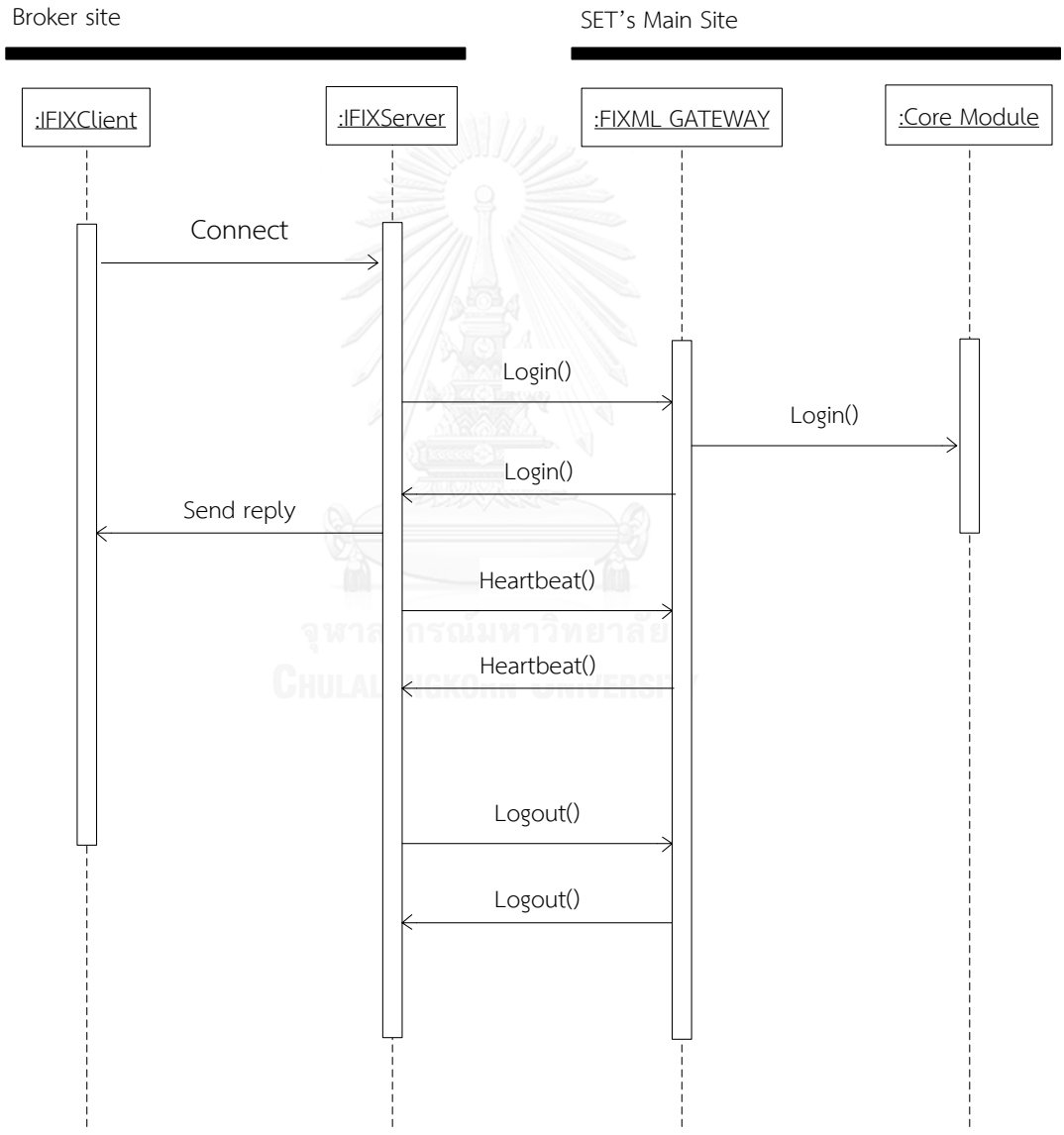

Figure 3.11 Login and Logout Diagram

1.2.2) Request and Response

1.2.2.1) Interactive

There are messages in Figure 3.12. The first is “Request”; the next is “Response”. The IFIX Server keeps a log and sends a result to the IFIX Client.

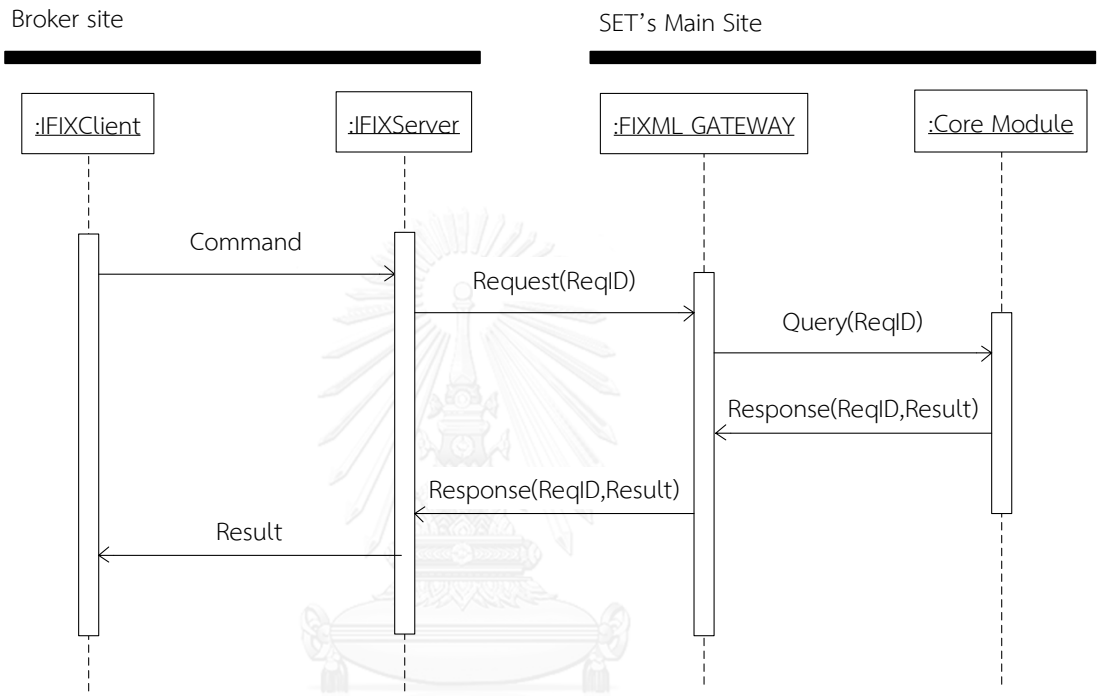

Figure 3.12 Interactive Diagram

1.2.2.2) Submit

There are messages in Figure 3.13: “Request” and “Response”. The IFIX Server keeps log and sends a result to the IFIX Client. The submit have two types of notify. The first is notify that is a response from the request. The second is notify where no request and initialized from the system.

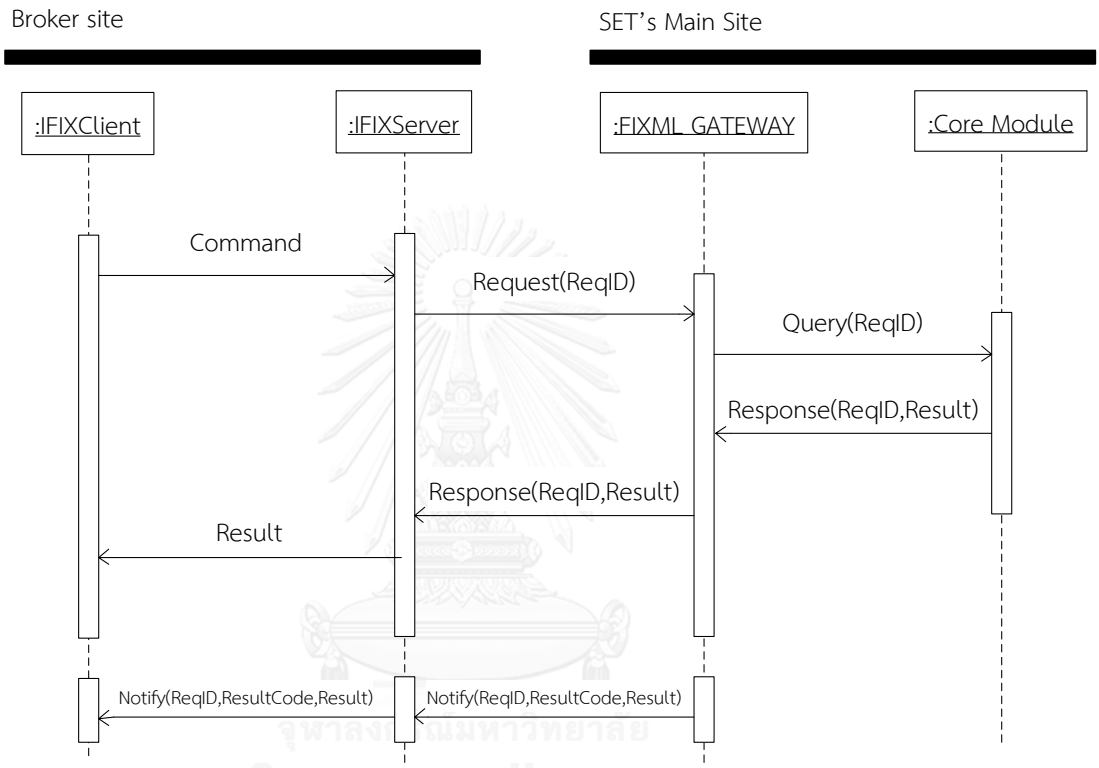

Figure 3.13 Submit Diagram

2) Database Design

Table 3.6: event_log

No	Field	Type	Length
1	id	int	
2	time	datetime	
3	beginstring	char	8
4	sendercompid	varchar	64
5	targetcompid	varchar	64
6	session_qualifier	varchar	64
7	text	text	

According to Table 3.6, it shows the details of event_log that contains id, time, beginstring, sendercompid, targetcompid, session_qualifier, and text.

Table 3.7: messages

No	Field	Type	Length
1	beginstring	char	8
2	sendercompid	varchar	64
3	targetcompid	varchar	64
6	session_qualifier	varchar	64
7	text	text	

According to Table 3.7, it is the messages table that contains beginstring, sendercompid, targetcompid, session_qualifier, and text.

Table 3.8: messages_log

No	Field	Type	Length
1	Id	Int	
2	time	datetime	
3	beginstring	char	8
4	sendercompid	varchar	64
5	targetcompid	varchar	64
6	session_qualifier	varchar	64
7	text	text	

According to Table 3.8, it shows the details of table messages that contains id, time, beginstring, sendercompid, targetcompid, session_qualifier, and text.

Table 3.9: sessions

No	Field	Type	Length
1	beginstring	char	8
2	sendercompid	varchar	64
3	targetcompid	varchar	64
4	session_qualifier	varchar	64
5	creation_time	datetime	
6	incoming_seqnum	int	
7	outgoing_seqnum	int	

According to Table 3.9, it shows the messages table that contains id, time, beginstring, sendercompid, targetcompid, session_qualifier, creation_time, incoming_seqnum, and outgoing_seqnum.

3) Screen Design

The screen design of the IFIX can be separated to 3 types: Login, Command menu, and Response and request.

3.1) Login

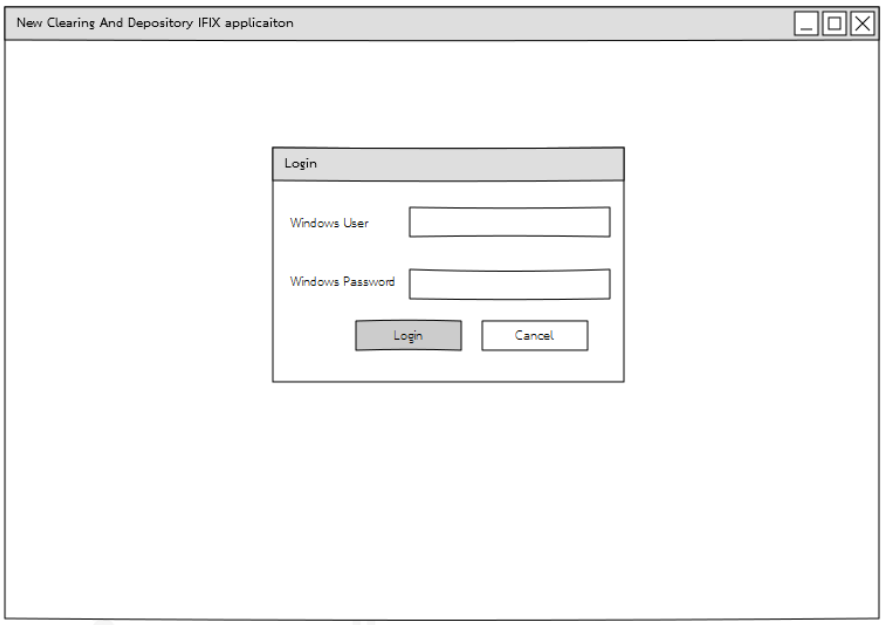

Figure 3.14 Designed login

Figure 3.14 shows the design layout of login box that is placed on the center of the screen due to easily access. Moreover, the screen is designed using the top-down approach.

3.2) Command menu

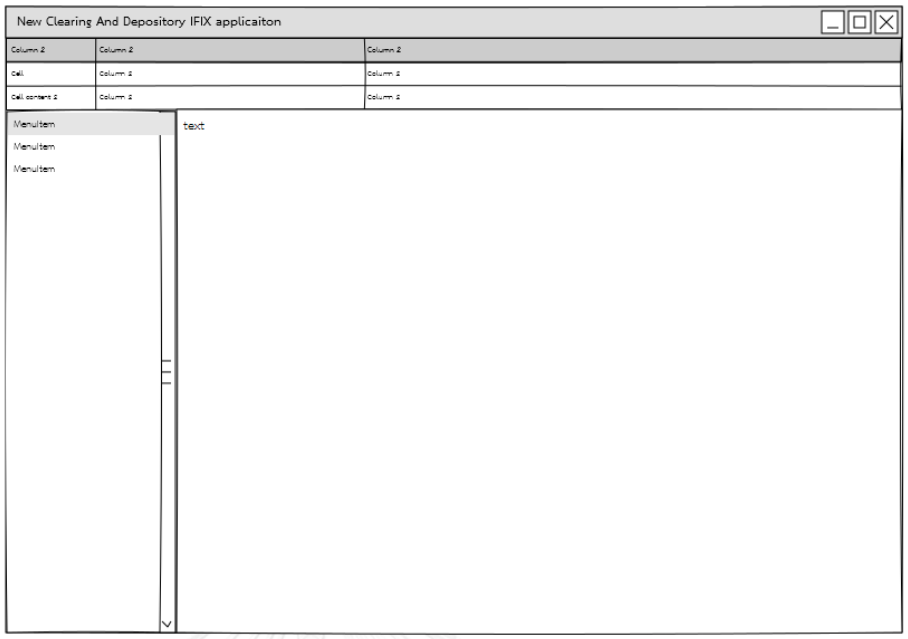

Figure 3.15 Designed command

According to Figure 3.15, the screen is designed using top-down approach and it is separated into two parts. The first is the heading that shows all states of connections. The second part is located at the left hand side which shows the command menu.

3.3) Request and response

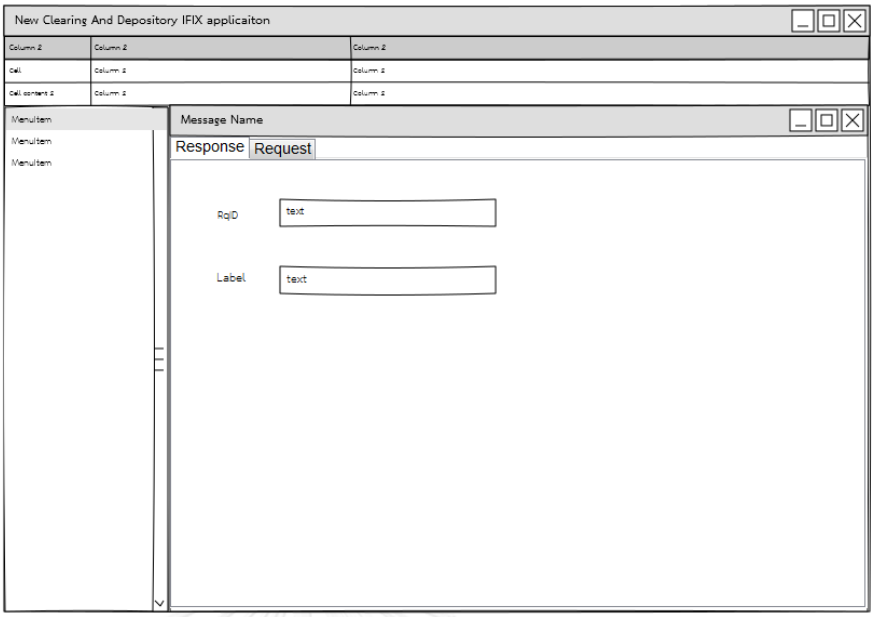

Figure 3.16 Request and Response

When the user clicks menu at the left hand side, the form of request and response message will be displayed to receive parameters, as shown in Figure 3.16.

3.3.4 Development

The development is the most important of the system development life cycle. The development can be called as coding. All designs are implemented to create the complete IFIX system.

The development tools for IFIX system are Microsoft Visual Studio by C#.NET and Microsoft SQL server. The Microsoft Visual Studio by C#.NET is used to design UI and the Microsoft SQL server is used for implementing the database. The description of each development module is elaborated in Table 3.10 below.

Table 3.10: Descriptions of developed modules

Module	Description
Login	The login module is responsible for receiving two parameters: username and password. Then, it checks the authorization and authentication of the user based on the receiving values.
NewClearing	The NewClearing method contains many methods, such as calendar, corporate action, instrument and etc. All of these are related to financial business messages. Every method within the NewClearing consists of parameters that are sent to the acceptor. For examples calendar have four parameters, such as calendar ID, date type, from year and to year.
Depository	The Depository method also contains many methods, such as account management, balance movement, foreign room, credit securities and PSMS. Functions of these methods are related to financial messages as same as the NewClearing except that it relies on different business areas.
Configuration	The Configuration module is authorized for administrators only. The module is used to configure all initiators of the system.
Logfile	This module is created for logging data that will be requested and response from a FIX message (NewClearing and Depository).

2) FIXML Message

Each FIX message is distinguished by the MsgType (35) label that is a required field in each FIX message. This tells receiving applications for what the purpose of the message is. So the messages can be appropriately handled.

Within 46 distinct messages that can be generated in the FIX 5.0 rendition, there are 7 that can be characterized as the session level messages. These messages guarantee that the right session is built up and kept alive. In addition, a component that confirms the receiving message is completed will be built and embedded into the message.

In each session, it is beforehand concurred that one gathering is going to start an association while another will acknowledge an approaching association. Once both applications are running, a session is started by sending a logon message as takes after.

An example of a request message is shown in Figure 3.17.

Figure 3.17 An example of a request message.

According to 1 in Figure 3.17, the logon message is indicated by the third tag in the message, 35=n, or MsgType (35) being set to the value “n” is a session level message. So, if the MsgType has value set as “n”, then it is the XML message. The example is a single line from a Logfile. It appears on 2 lines due to a space constraint that causes the line to break at the SendingTime (52) field “52=20140326-07:31:22.367|.”

3.3.5 Testing

IFIX system is tested in many methods as listed below.

- Module testing

  Referring to the list of modules in Table 3.10, all of these modules must be tested in the module testing process. Each test will be performed individually by the test plan and the testing data are obtained from the User Accepted Test (UAT) server before delivering the software to the production server.

- System testing

  After passing the module test, every module will be integrated to be a system. This new system is tested again using the testing data from the User Accepted Test (UAT) server as same as the module testing. The objective of this test is to confirm that every module can work correctly and properly, including that it serves users as expected.

The following contents are details of the module testing and results.

1) Login

- Test plan

System: IFIX **Phase**: 1

Module or Object Name: Login

The module is divide two methods. The first is authentication to check username and password. The next is authorization.

Instructions:

1. Input the username and password.
2. Check authentication and permission of this username.

Expected result:

1. The system can authentication and set permission user collect.

Cleanup:

1. Hit Alt+F4 to close a window.
2. Click close button.

- Result

The testing result after repeating the test for 5 times is the error-free. The user can login whenever the username and password are input correctly.

2) NewClearing

- Test plan

System: IFIX **Phase**: 1

Module or Object Name: NewClearing

There are many methods such as calendar, corporate action, instrument and etc. The all of methods is about financial business message.

Instructions:

1. Before exchange message of NewClearing, this system must start initiator to heartbeat.
2. Select the financial business menu that you wanted such as calendar then fill in parameter for exchange calendar data.

Expected result:

1. This IFIX can heartbeat and exchange the corrected data.

Cleanup:

1. Hit Alt+F4 to close a window.
2. Click close button.

- Result

After repeating the test for 5 times, it can conclude that this module is the error-free module as expected. This means every request has a response and the response will be shown on the screen.

3) Depository

- Test plan

System: IFIX **Phase**: 1

Module or Object Name: Depository

There are many methods such as account management, balance movement, foreign room, credit securities and PSMS.

Instructions:

1. Before exchange message of Depository, this system must start initiator to heartbeat.
2. Select the financial business menu that you wanted such as account management then fill in parameter for exchange account data.

Expected result:

1. This IFIX can heartbeat and exchange the corrected data.

Cleanup:

1. Hit Alt+F4 to close a window.
2. Click close button.

- Result

After repeating the test for 5 times, it can conclude that this module is the error-free module as expected. This means every request has a response and the response will be shown on the screen.

4) Logfile

- Test plan

System: IFIX **Phase**: 1 **Module or Object Name**: Logfile Every message that requests and responses must be logged to database. **Instructions:** 1. While the IFIX is working, the tester must check the database has a log or not. **Expected result:** 1. There are log files in every transaction data. **Cleanup:** 1. Hit Alt+F4 to close a window. 2. Click close button.

- Result

According to 5 time of running test, it can find that every message is kept as logging in the database as expected.

5) System testing

- Test plan

System: IFIX	**Phase**: 1
Situation, working process of the day, the IT operation must login to IFIX and process working.	
Instructions: 1. Login with username and password. 2. Select the method that has to working process. 3. The IFIX client can connect with IFIX server.	
Expected result: 1. The IFIX system can handled and follow user requirement.	
Cleanup: 1. Hit Alt+F4 to close a window. 2. Click close button.	

- Result

After integrating every module to become the IFIX, the IFIX can handle and work for the required daily job.

3.3.6 Implementation

After passing the testing process, the IFIX is implemented in clients and the production server for the real use. However, the implementation of the IFIX is parallel with the use of the old system, as shown in Figure 3.18. The time 1, when IFIX was lived, the traditional system was lived. After IFIX lived completely, the traditional system is stop and continues to use the IFIX only. The parallel implementation is good because the old system still lives if the new system is broken. Unfortunately, the disadvantage of this parallel implementation is that the system has to live two systems as prompt which causes a duplicate task for users.

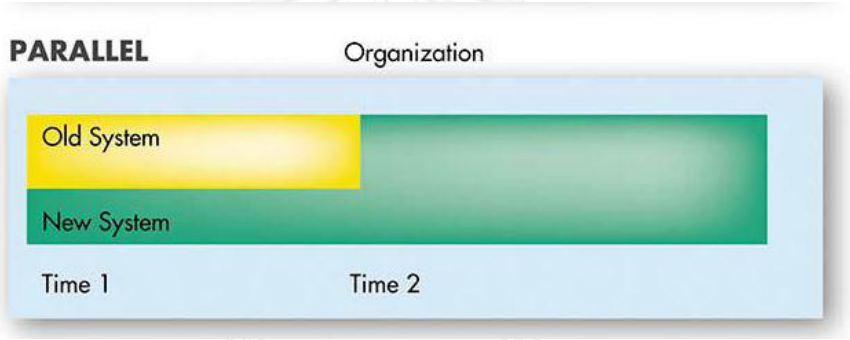

Figure 3.18 Implemented by parallel [25]

When the IFIX live, there are many problems show in the Table 3.11 below.

Table 3.11: Records after implementation

Issue	Problem
Acceptor destination moves	The IFIX can't heartbeat. The system shows connection state false. The solving is changing a new destination and connects again.
The acceptor response wrong format	Some data exchange is wrong. The acceptor will send notify to tell warning. The users have to amend the data and send it again.
The acceptor broken	The IFIX provide reliability. The messages that not send will send manually again when IFIX alive.

3.3.7 Maintenance

After the IFIX was implemented, it may have the problem and changing requirement. The system will provide advice and recommend the use of The IFIX.

3.4 Proposed Solution

IFIX System is responsible for receiving and sending a fix message. The FIX engine is a library that is used to implement a FIX System. It manages a connection between TSD and a broker, including creating and parsing messages. The FIX session has functions of establishing and terminating the connection message delivery data integrity, sequencing, addressing. This function provides processes layered on the Transmission Control Protocol (TCP).

A general system should have kept a logging in database. So that IFIX must have same as the trading system. Most trading applications are configured with a desired set of logging options that are never changed during runtime. The database used by IFIX for logging is named FIX DB. There is an important storage that must work with every FIX system, called as the FIX DB. This FIX DB contains 9 tables:

messages_rr_in, messages_mlt_in, messages_out, messages_request_ledger, messages_in_log, request_seq, messages_out_log, message_code, and xmlmessagetemplate. The main benefit of logging to a database is that information can easily be extracted using simple SQL queries and stored data. A reporting feature within the IFIX System provides access to the data available in the database at runtime.

1) Security

a) IP security protocol (IPSec)

IP security protocol (IPSec) is a package that enhance IP (Internet Protocol) layer to communicate higher security since it provides authentication and encryption in every IP package.

To access via Site-to-Site IPSec VPN over the Internet, every participant has to prepare its own Internet access environment. SET will provide the necessary information for each participant to configure the IPSec on the participant network equipment. After the IPSec connection has been created between participants and SET, all data will be encrypted in the most standard secure method, as shown in Figure 3.19.

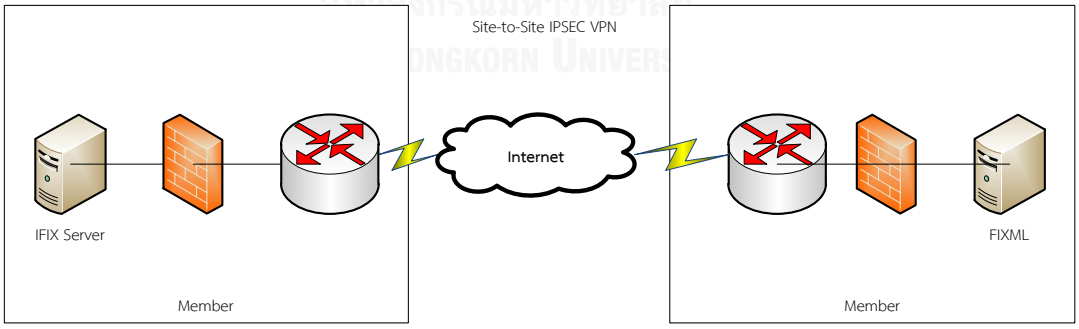

Figure 3.19 IPSec

2) Reliability

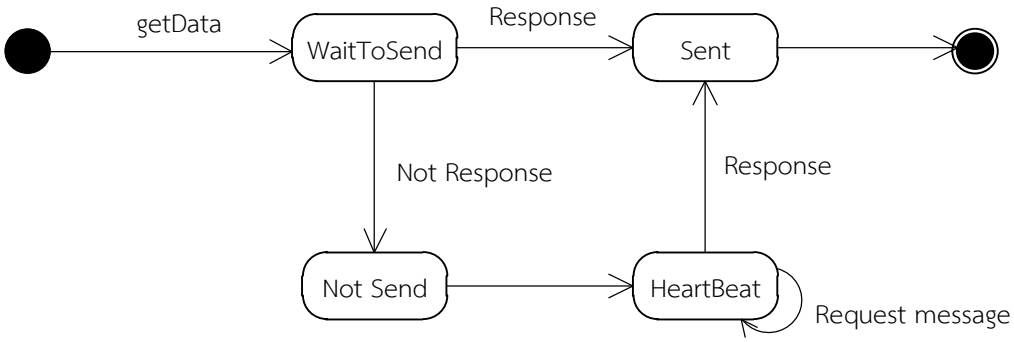

Figure 3.20 Reliability state diagram

The following Figure 3.20 shows the state diagram. The state diagram starts from get data. When the IFIX selects the message, the data will be retrieved to prepare to submit. In the normal situation, the data is sent and marked as 'sent'. However, there is a possibility that the acceptor server at the receiving site downs and causes the interruption of the information exchange process. The IFIX that generally performs heartbeat to check the status of the acceptor can recognize the failure of this sending process. Then, the sending data is marked as 'not sent'. Moreover, the message will be manually sent by IFIX so the IFIX state, in the state diagram, will be terminated after data is sent completely.

3) Sub-broker

This thesis proposed an interface among brokers and TSD, namely an Interface FIX System (IFIX). Both of them must have the FIXAcceptor at the server and FIXInitiator at a client application, as shown in Figure 3.21.

In order to define a communication standard among financial industries, the system environment of the proposed mechanism is drawn in Figure 3.21. According to Figure 3.21, the data flow can be clearly identified between organizations. Moreover, various modules are defined, such as FIX engine, PTI Application, and an interface application. This interface application, named as FIX System, is responsible

for receiving and delivering messages. This FIX System is developed using C#.net and a fix engine, or QuickFIX/N.

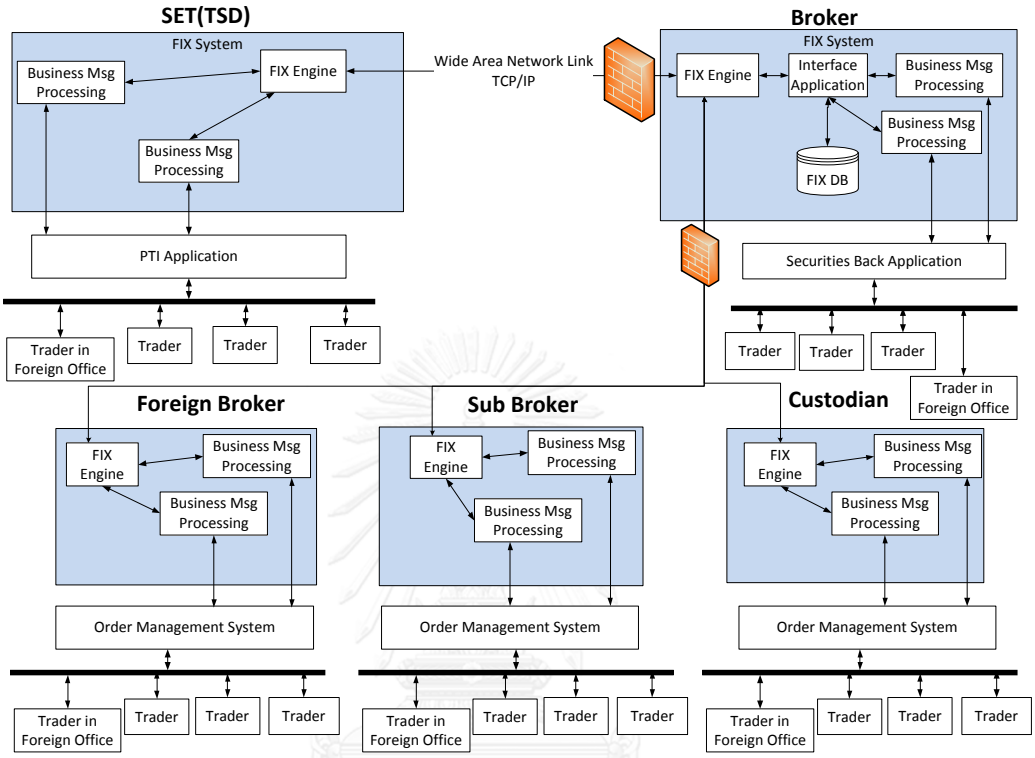

Figure 3.21 IFIX new architecture of Sub-broker

The following Figure 3.21 shows the new architecture. It adapts from the existing FIX because the existing FIX does not support sub broker's information exchange.

3.4.1 Proposed Workflow

The flow of the proposed IFIX System starts from a customer orders securities transactions, then trader receives the order via the IFIX System. After receiving the order message, or FIX message, the FIX engine describes its format layout to receive executions. Consequently, this order will be recorded at the broker side waiting for matching orders. This will be performed the order to match at the buy side and the sell side. If success, the broker will clear equities and send to deposit equities to the customers at TSD. These processes can be elaborated in Figure 3.22.

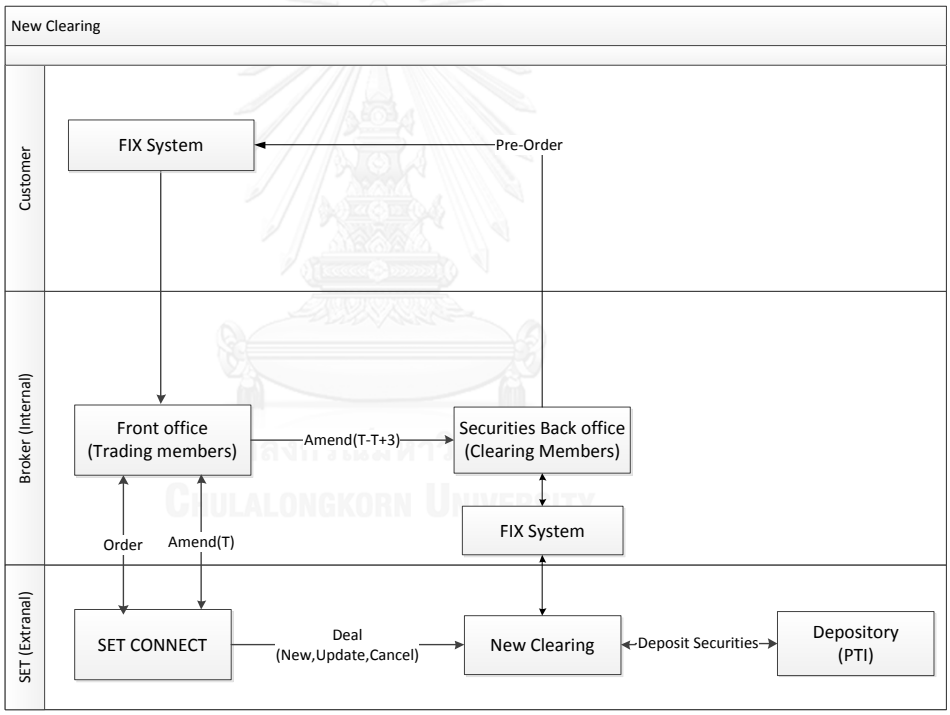

Figure 3.22 Workflow of New Clearing and Depository under the IFIX system

IFIX is implemented upon the FIX protocol. It enhances the FIX protocol to communicate between a broker and a sub-broker. A database is used to log data and store data. In section of the network security, it uses a firewall to protect data from outside and inside. SSL (Secure Sockets Layer) is

appied as a standard security technology for an encrypted link between a client that access to a server in the network.

For the problem of the authetication and authorization of TSD, the new system provides one username and password per one broker. It's used to configure the FIX engine in Table 3.1 but the IFIX is developed in the authetication section. The authentication of the IFIX has only unique username and password per one user. This advantage is to identify each user that uses the IFIX. For the authorization, the new system classifies users into two groups: admin group, and general users or operation group. The admin group who has permission to manage all of system while the another group has permission to use this system to run commands of the IFIX.

3.4.2 Comparisions between IFIX and the existing FIX

According to Table 3.12, IFIX is much complicated than standard FIX. The first, standard of FIX protocol processes between broker(initiator) and institutional investors(acceptor), in this thesis is TSD. For the proposed framework, IFIX, brokers can be both initiator and acceptor. For the initiator role, the broker performs information exchanges and ECNs to TSD. On the other hand, being an acceptor, the broker will receive from sub-broker, foreign broker, and custodian, to receive and to send in one process.

Table 3.12: System Comparison between the IFIX and FIX

Topic	**IFIX**	**FIX**
Financial Information Exchange(Sell-Buy)	✓	✓
Financial Information Exchange three or more enterprise (Forward Order)	✓	
Network Security	✓	
FIX Standard Message	✓	✓
FIXML	✓	✓
Read and Write XML Tag	✓	
Reliability	✓	
Database Server	✓	
Graphic User Interface	✓	

Based on the network security issue, FIX only exchanges information without security consideration. In this paper, IFIX includes the message security protection using a firewall. Every exchanged message, the security will be checked; the system must be protected because the data is important. IFIX uses a firewall filtering mechanism for what is allowed in or out the financial network, or, may implement several security methodolodies to protect unexpected and unwanted events.

Pattern base XML, in FIXML includes XML tag for new message in which messsage xmldata (213= =<FIXML><symbol>BBL</symbol><price>44.60</price> </FIXML>). The advantage of FIXML is the inclusion of a new data message that can be customized by the acceptor which requests additional a financial message.

Another special characteristic of IFIX is the use of a library to read and write XML tag while FIX engine can only built the FIX tag. In the later version of FIX 4.3, it can exchange XML data between FIX enging or FIXML. However, the disadvantage is a big size to tranfer due to the XML tags.

As the fact that the FIX system does not support reliablity, when the traffic bad or it is not normally situation, the users must check the data which have not been not sent. The IFIX included this. The IFIX provides the field that contains the “send” and “not send” status. In the term of financial information exchange, it may have interruption of an electornic communication network. When a server is avalible, IFIX can reconnect to exchange the information and select the record mark not send then send it again. From this propose, the users need not be worried for the sending message.

Consider the database usage. The logging data from IFIX has been stored in the database for checking and verifying all data. Thus, any users can enqury of logging that the IFIX processes.

Lastly, using a new user interface can show users for the correctness or incorrectness of exchanged information. Moreover, this user interface allows users of the system to use IFIX in easily select commands as wished.

CHAPTER 4

EVALUATIONS AND EXPERIMENTAL RESULTS

This chapter will contain the evaluations of the test results on the sample video files using the methodology from the previous chapter. This chapter is divided into 3 sections; Raw Data is in Section 4.1, Installation in Section 4.2, and finally User Satisfaction Evaluation in Section 4.3.

4.1 Raw Data

The information is significant. The raw data is the part of information exchange. The data should be record in the table. The table data is able to retrieve and generate format easily. Table 4.1 shows the raw data. The field Mkt shows market stock or derivative. The next, MktAb shows the market type. The SecuNmEng shows the full name. The next, SecuAstAbb shows the security abbreviation.

Table 4.1: Raw Data of Query Securities Profile from PTI

Mkt	MktAb	SecuNmEng	SecuAstAbb	ISIN	CreateBy	CreateDate
A	SET	ADVANCED INFO SERVICE PUBLIC COMPANY LIMITED	ADVANC	TH0268010Z03	EXECUTOR	19/2/2015
A	SET	ADVANCED INFO SERVICE PUBLIC COMPANY LIMITED	ADVANC-F	TH0268010Z11	EXECUTOR	19/2/2015
A	SET	AEON THANA SINSAP (THAILAND) PUBLIC COMPANY LIMITED	AEONTS	TH0664010Z03	EXECUTOR	19/2/2015
A	SET	AEON THANA SINSAP (THAILAND) PUBLIC COMPANY LIMITED	AEONTS-F	TH0664010Z11	EXECUTOR	19/2/2015
A	SET	AREEYA PROPERTY PUBLIC COMPANY LIMITED	A-F	TH0770010Z16	EXECUTOR	19/2/2015

4.2 Installation

The implementation of the IFIX, the hardware is able to run completely and support functions of the IFIX. The hardware should be in the Table 4.2 below.

Table 4.2: Typical Hardware specification

Device	CPU	RAM	Hard Disk
Computer			
Developed	2.7GHz dual-core Intel Core i5	8GB	20 GB or upper
Client	Intel Core i3 2.4 GHz	4GB	5 GB or upper
Database Server	Intel Xeon(R) 3.07GHz	8GB	100 GB or upper
Application Server	Intel Xeon(R) 3.07GHz	8 GB	20 GB or upper

4.2.1 The IFIX Client

The IFIX Client is the system that install in the user's computer. The IFIX client is connected to the IFIX Server for sending commands to exchange data.

4.2.1.1 Logon screen

From the Figure 3.14, the draft is layout in screen that shows in Figure 4.1. This screen shows the username and password to the user to fill in. When users click ok, the system will check the authentication group and set the authorization group in this system.

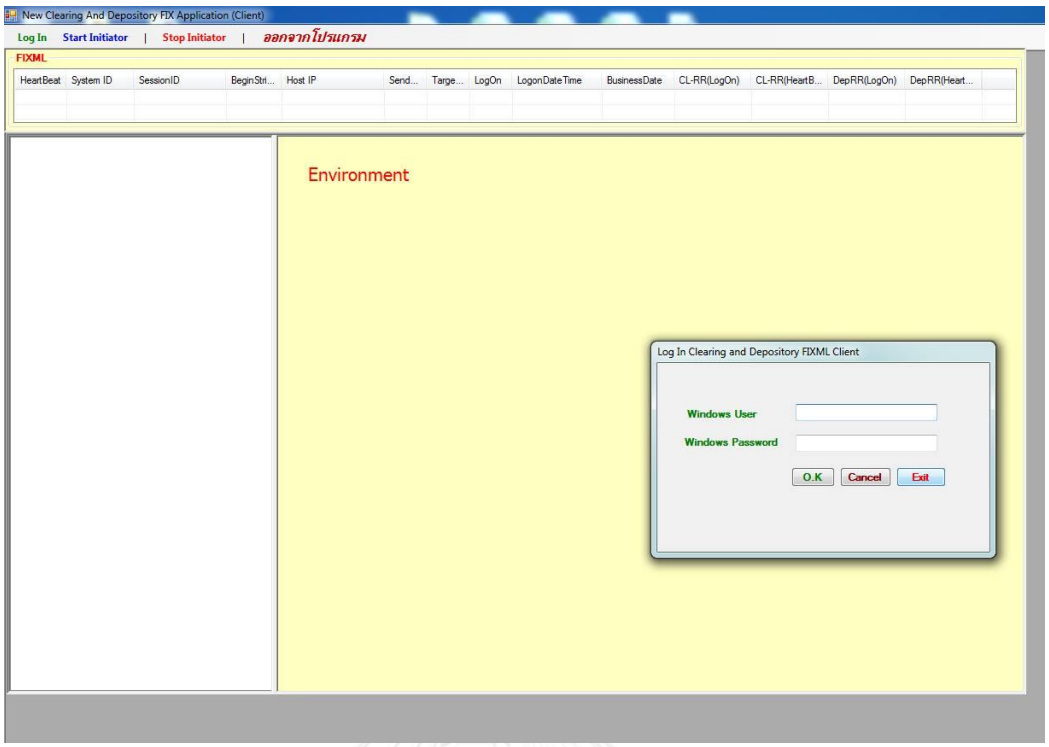

Figure 4.1 IFIX client logon screen

4.2.1.2 Command menu

From the Figure 3.15, the draft is a layout of a screen that shows in Figure 4.2. This screen shows the commands when the users click the command, another screen will show the form to screen.

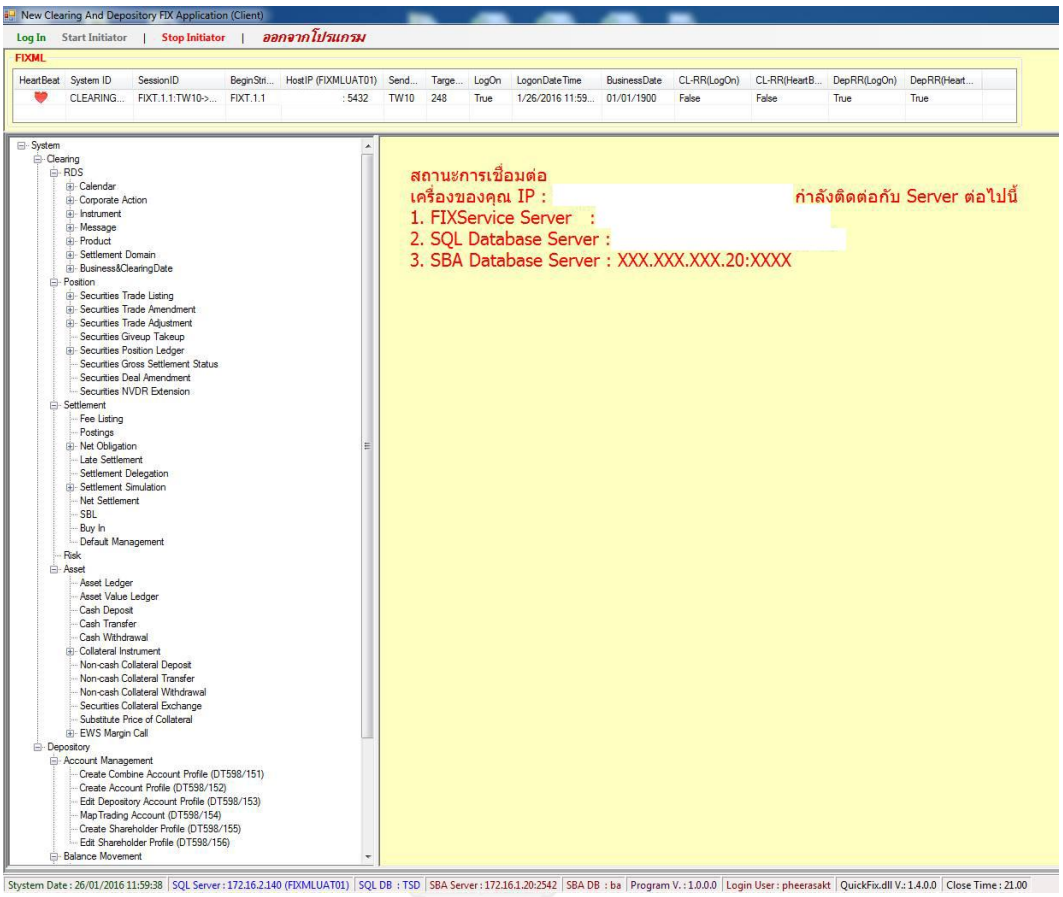

Figure 4.2 Command menu screen

4.2.1.3 Response and Request

Figure 3.16 presents a draft of a screen layout that shows in Figure 4.3. This screen shows the query calendar. It received parameters, such as calendar ID, data type, from year, and to year. Then, all these parameters are sent to the IFIX server, and the IFIX server will be call as a Fix acceptor.

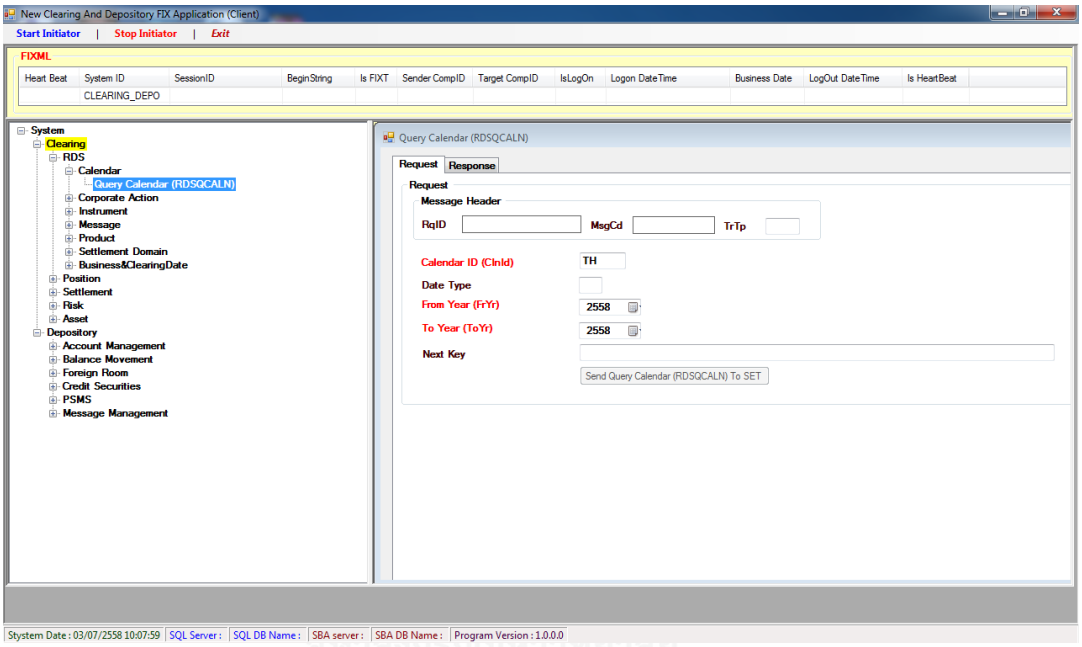

Figure 4.3 Request and Response

4.2.2 The IFIX Server

Figure 4.4 shows the IFIX server that connects to clients. The IFIX server functions are information exchange to FIX acceptor. The FIX initiator creates the FIX message to FIX acceptor by request and FIX accepter will response to IFIX. The IFIX server will keep the response and log data stored into the database.

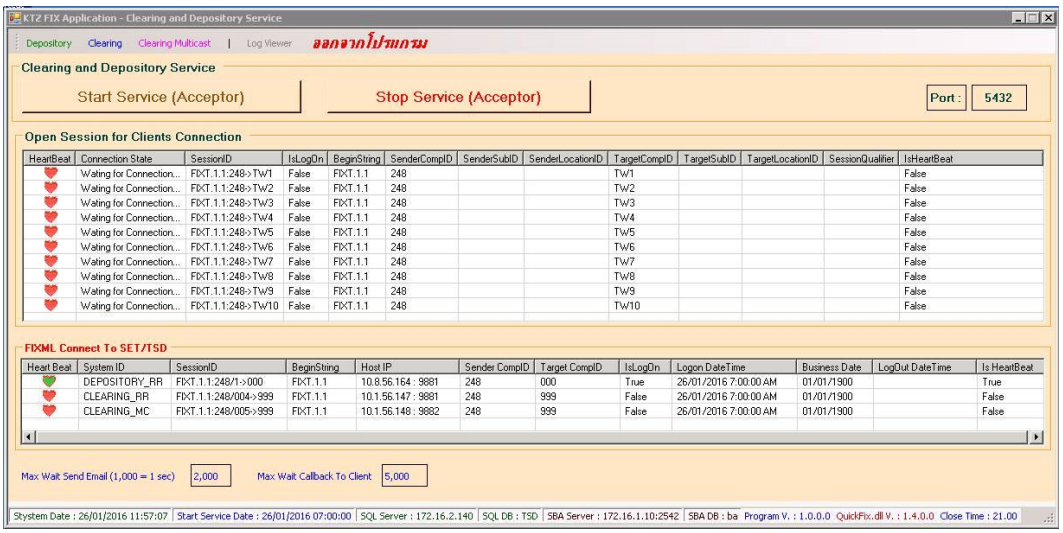

Figure 4.4 IFIX Server screen

4.3 User Satisfaction Evaluation

This experiment was evaluated by 2 groups. The first group is experts, the people who work in software engineering 3 people. The second group is users, the people who use IFIX 20 people. The sampling method in the first group is called as purposive sampling where the expertise in the area is selected for providing their opinion. The second group is sample based on the accidental sampling method.

The questionnaire was distributed to users after the IFIX was completely implemented by five months. The external used the IFIX everyday per hour by one month to evaluation.

4.3.1 Experts' evaluation

4.3.1.1 Primary data of experts

This section shows general data of experts that contains position, external/internal and experience, as shown in Table 4.3.

Table 4.3: General data of experts

No	Position	External/Internal	Experience
1	Vice President-IT	External	13 years
2	Senior Consultant	External	7 years
3	Management Director-Business Technology	Internal	20 years

4.3.1.2 Experts' opinions

4.3.1.2.1 Design: Opinions of experts on the design.

Table 4.4: Results of design evaluated by experts

Listed	Mean	Std. Dev.	Result
– The beauty of the design and proper screen overall.	5.00	0.00	Very Good
– The appropriateness of the font.	3.67	0.47	Good
– The appropriateness of the color.	3.67	0.47	Good
– The appropriateness of the notification's system.	4.00	0.82	Good
– The language and pictures to communicate.	4.33	0.94	Very Good
– The designing with ease is easy to use	5.00	0.00	Very Good
Average	**4.28**	**0.45**	**Very Good**

From Table 4.4 shows the evaluation results by the experts for the IFIX system. According to the results above, it is clear that all experts agree that the screens are beauty and prefer design with ease of use (Mean = 5.0, S.D. = 0.0). The

next is the appropriateness of using language and pictures to communicate (Mean = 4.33, S.D. = 0.94). The next is the appropriateness of the notification's system (Mean = 4.00, S.D. = 0.82). The last is the appropriateness of the font and the color (Mean = 3.67, S.D. = 0.47).

4.3.1.2.2 Comparison existing system: Opinions of experts on the existing system.

Table 4.5: Results of comparisons existing system evaluated by experts

Listed	Mean	Std. Dev.	Result
–The workflow of the IFIX was sequenced clear.	4.33	0.47	Very Good
–The workflow of the IFIX reduces the workflow from the existing system.	4.33	0.47	Very Good
–The information exchange of the IFIX increased accuracy.	4.67	0.47	Very Good
– The reliability of the IFIX is increased.	4.00	0.00	Good
– The speed of information exchange is increased.	5.00	0.00	Very Good
Average	**4.47**	**0.28**	**Very Good**

From Table 4.5, it confirms that the speed of information exchange is increased (Mean = 5.0, S.D. = 0.0). The next is the information exchange of the IFIX increased accuracy and reduces the workflow from the existing system (Mean = 4.33, S.D. = 0.47). The last is the reliability of the IFIX is increased (Mean = 4.00, S.D. = 0.00).

4.3.1.2.3 Data and Information Exchange: Opinions of experts on the Information.

Table 4.6: Results of data and information exchange evaluated by experts

Listed	Mean	Std. Dev.	Result
–Information is accuracy.	4.33	0.47	Very Good
–Data format and information are able to define clearly.	4.00	0.82	Good
–Data format and information is tidy.	4.00	0.82	Good
– Reports are is accurate.	4.33	0.47	Very Good
Average	**3.80**	**0.38**	**Good**

From Table 4.6, the conclusion from all experts points to the accuracy of information and reports (Mean = 4.33, S.D. = 0.47). In addition, the characteristics of data format and information are in a good level (Mean = 4.00, S.D. = 0.00).

4.3.1.2.4 Security: Opinions of experts on the security.

Table 4.7: Results of security existing system evaluated by experts

Listed	Mean	Std. Dev.	Result
–Data transfer between organizations with security breaches.	4.00	0.82	Good
–The system is able to authentication and authorization.	5.00	0.00	Very Good
–Information exchange is able to arrive destination.	4.00	0.00	Good
Average	**3.80**	**0.27**	**Good**

From Table 4.7 shows the evaluation results by the experts for the IFIX system. According to the results above, it is clear that all experts agree that the system's permission is able to authentication and authorization (Mean = 5.0, S.D. = 0.0) and the Information exchange is able to arrive destination (Mean = 4.0, S.D. = 0.00). The last is Data transfer between organizations with security breaches (Mean = 4.00, S.D. = 0.82).

Table 4.8: Summary Results over all evaluation by experts

Summary Listed	Mean	Std. Dev.	Result
–Design	4.28	0.45	Very Good
–Comparison existing system	4.47	0.28	Very Good
–Data and information Exchange	3.80	0.38	Good
–Security	3.80	0.27	Good
Average	**4.13**	**0.34**	**Very Good**

Table 4.8 summarizes the results of the analysis of the experts. The technical experts to develop a program of 3 people found that when considering all aspects and has a value of Mean = 4.13 and, S.D. = 0.34. So that means quality is very good.

4.3.2 Users' evaluation

4.3.2.1 Primary data of users

This section show general data of user that contains age, experience and position.

4.3.2.1.1 Age

Table 4.9: Age of users

Age	Amount	Percent(%)
–Less than 30 years old	4	20.00
–30 – 40 years old	7	35.00
–41 – 50 years old	6	30.00
–More than 51 years old	3	15.00
Total	**20**	**100.00**

From Table 4.9 shows the analysis age's data of users. The most of user is 30-40 years old have 7 people or 35.00%. The next is 41- 50 years old have 6 people or 30.00%. The next is less than 30 years old have 4 people or 20.00%. The last more than 51 years old have 3 people or 15.00%.

4.3.2.1.2 Experience

Table 4.10: Experience of users

Experience	Amount	Percent(%)
–Less than 3 years	5	25.00
–3-5 years	4	20.00
–5-10 years	4	20.00
–More than 10 year	7	35.00
Total	**20**	**100.00**

From Table 4.10 shows the analysis experience's data of users. The most of user is less than 3 years have 5 people or 25.00%. The next is 3-5 years have 4 people or 20.00%. The next is 5-10 years have 4 people or 20.00%. The last more than 10 years have 7 people or 35.00%.

4.3.2.1.3 Education

Table 4.11: Education of users

Experience	Amount	Percent(%)
–Below Bachelor Degree	0	0
–Bachelor Degree	17	85.00
–Master Degree	3	15.00
–Doctor Degree	0	0
Total	**20**	**100.00**

From Table 4.11 shows the analysis education's data of users. The most of user is Bachelor Degree have 17 people or 85.00%. The last is Master Degree have 3 people or 15.00%.

4.3.2.1.4 Position

Table 4.12: Position of users

Position	Amount	Percent(%)
–Employee	16	80.00
–Admin	4	20.00
Total	**20**	**100.00**

Table 4.12 shows the analysis position's data of users. It can be seen that most of the users is employee have 16 people or 80.00%. The last is Admin have 4 people or 20.00%.

4.3.2.2 Users' opinions

4.3.2.2.1 Design: Opinions of users on the design.

Table 4.13: Results of design evaluated by users

Listed	Mean	Std. Dev.	Result
– The beauty of the design and proper screen overall.	4.32	0.78	Good
– The appropriateness of the font.	4.26	0.62	Good
– The appropriateness of the color.	4.32	0.64	Good
– The appropriateness of the notification's system.	4.53	0.66	Good
– The language and pictures to communicate.	4.37	0.65	Good
– The designing with ease is easy to use	4.16	0.73	Good
Average	**4.32**	**0.38**	**Good**

Table 4.13 shows the evaluation results by the users for the IFIX system. According to the results above, most of the users are the appropriateness of the notification's system (Mean = 4.53, S.D. = 0.66). The next is the appropriateness of using language and pictures to communicate (Mean = 4.37, S.D. = 0.65). The next is the appropriateness of the color and the beauty of the design and proper screen overall (Mean = 4.32, S.D. = 0.76, S.D. = 0.64). The next is the appropriateness of the font (Mean = 4.26, S.D. = 0.62). The last is the Designing with ease is easy to use (Mean = 4.16, S.D. = 0.73)

4.3.2.2.2 Comparison existing system: Opinions of users on the existing system.

Table 4.14: Results of comparisons existing system evaluated by users

Listed	Mean	Std. Dev.	Result
–The workflow of the IFIX was sequenced clear.	4.32	0.55	Good
–The workflow of the IFIX reduces the workflow from the existing system.	4.63	0.47	Good
–The information exchange of the IFIX increased accuracy.	4.32	0.90	Good
– The reliability of the IFIX is increased.	4.21	0.81	Good
– The speed of information exchange is increased.	4.74	0.43	Good
Average	**4.44**	**0.63**	**Good**

From Table 4.14, it confirms that the speed of information exchange is increased (Mean = 4.74, S.D. = 0.43). The next is the workflow of the IFIX reduces the workflow from the existing system (Mean = 4.63, S.D. = 0.47). The next is the information exchange of the IFIX increased accuracy and the workflow of IFIX was sequenced clear (Mean = 4.32, S.D. = 0.90, S.D. = 0.55). The last is the reliability of IFIX is increased (Mean = 4.21, S.D. = 0.00).

4.3.2.2.3 Data and Information Exchange: Opinions of users on the Information exchange.

Table 4.15: Results of Data and Information Exchange evaluated by users

Listed	Mean	Std. Dev.	Result
–Information is accuracy.	4.42	0.66	Good
–Information meet the user requirement	4.53	0.58	Good
–Data format and information are able to define clearly.	4.58	0.58	Good
–Data format and information is tidy.	4.63	0.57	Good
– Reports are accurate.	4.26	0.83	Good
Average	**4.48**	**0.64**	**Good**

From Table 4.15, the conclusion from all users points to the data format and information is tidy (Mean = 4.63, S.D. = 0.57). In addition, the data format and information are able to define clearly (Mean = 4.58, S.D. = 0.58).

Table 4.16: Summary Results over all evaluation by users

Summary Listed	Mean	Std. Dev.	Result
–Design	4.32	0.38	Very Good
–Comparison existing system	4.44	0.63	Very Good
–Data and information Exchange	4.48	0.64	Very Good
Average	**4.41**	**0.55**	**Very Good**

Table 4.16 summarizes the results of the analysis of the users. There users 20 people found that when considering all aspects and has a value of Mean = 4.41 and S.D. = 0.55. So that means quality is very good.

4.3.2.3 Suggestion

This section is open question. The users comment and suggest addition to complete of the questionnaire.

- Overall of the IFIX is compactible to process. The human computer interactive is good.
- The recovery system is good when the SET's server down.
- The design screen and program should be up to date.

CHAPTER 5

CONCLUSIONS AND DISCUSSIONS

In this chapter, the discussion will be discussed in Section 5.1, limitation of the experiment in Section 5.2 and finally conclusion in Section 5.3.

5.1 Discussion

Many researches indicated the architecture and advantage about information exchange. This thesis proposes a new interface that includes third parties such as sub-brokers, foreign brokers, and custodian. They must send the order to the broker and the broker sends the order to SET. This work focuses on a new mechanism the financial business flow of orders from that forwarded orders. The limited of IFIX is the data source should be stored in database system to exchange easily. The advantage is to deduct the manual system, a fat file and different platform which problem of information exchange. Apart from this, IFIX can retrieve logging data or enquiry data from database that keep log.

5.2 Limitation of the experiment

A major limitation of this experiment is that, it is able to exchange data only but not include media such as video, picture, voice and other.

5.3 Conclusion

The development the IFIX concluded that the IFIX can help in any works since it can be involved in the information exchange process. It can work with people, and cuts in the budget. The experts' opinion of the quality of the program, there are 3 experts, found that the design with an average of 4.28 shows that the quality of the design program is very good. For comparison existing system with an average of 4.47 shows that the quality of the program is very good. Data and

information Exchange average score of 3.80 on a massive scale. Security has an average score of 3.80 on a massive scale.

Since the financial information exchange can be used to support various messages, including equities and derivatives like market data, allocations, confirmations and program trading. However, the messages and new forms of financial industry keep changing. Thus, to support new messages and flow information exchange for the new forms, a new architecture must be implemented. Many researches indicated that the exchanging of information mostly occurs among three or more enterprises. This thesis proposes new architecture to forward order and the financial information exchange pattern base on FIXML. This work focuses on sub-broker that can send orders to brokers and forward orders to SET. The target of studies is trying to find new method to enhance the performance of the current FIX and new exchanges between many financial industry and related industry without flat file, such as text file, excel file and other that happen many problems for using the data.

In this thesis, the IFIX, a new information exchange framework of FIX, is proposed. The significant issue in this paper is to break the communication limitation between accepters, initiators, and sub initiator that exists in the general FIX system. The proposed IFIX can communicate among these three parties so the customers' orders will be treated in a short time.

REFERENCES

[1] Xuming, S. *Logistics Information Exchange Pattern Base on ebXML*. in *Business Intelligence and Financial Engineering (BIFE), 2010 Third International Conference on*. 2010.

[2] ITClub, *FIXML Depository API*. 2014, Stock Exchange of Thailand.

[3] Tunstall, J.S. *Using OSI for the exchange of information between financial institutions*. in *Application of Standards for Open Systems,1990., Proceedings of the 6th International Conference on the*. 1990.

[4] Liu, B., et al. *Design and implementation of information exchange between HIS and PACS based on HL7 standard*. in *2008 International Conference on Information Technology and Applications in Biomedicine*. 2008.

[5] Feng, Y., Y. Yirong, and Z. Lingwen. *Analysis of stock market information, 2014; a new financial engineering approach*. in *Information and Automation (ICIA), 2010 IEEE International Conference on*. 2010.

[6] Sankari, S. and S. Bose. *Secure XML labeling for efficient XML content dissemination*. in *2014 Sixth International Conference on Advanced Computing (ICoAC)*. 2014.

[7] Hu, X., et al. *Query XML Data in RDBMS*. in *Web Information Systems and Applications Conference (WISA), 2012 Ninth*. 2012.

[8] Ming, F., J. Stallaert, and A.B. Whinston, *A Web-based financial trading system.* Computer, 1999. **32**(4): p. 64-70.

[9] Sharma, A. and S. Gupta, *A few useful considerations in the development of intra-day trading software: comparing indian intra-day trading software with foreign software.* SIGSOFT Softw. Eng. Notes, 2011. **36**(4): p. 1-5.

[10] Huang, H., M. Pasquier, and Q. Chai. *Application of a hierarchical coevolutionary fuzzy system for financial prediction and trading*. in *2008 IEEE Congress on Evolutionary Computation (IEEE World Congress on Computational Intelligence)*. 2008.

[11] Jie, Y., M. Huaikou, and C. Liang. *A design pattern verifier in two-tier programming environment*. in *Computer and Information Technology, 2004. CIT '04. The Fourth International Conference on*. 2004.

[12] Badr, R.O. and H.M. Hosny. *An HCI Pattern Language Management Tool*. in *2006 International Conference on Computer Engineering and Systems*. 2006.

[13] Lu, X., J. Wan, and J. Hou. *A Model Based Heuristic Design of Web User Interface*. in *2007 IEEE International Conference on Information Reuse and Integration*. 2007.

[14] Tram, T.N.Q., C.G.T. Tai, and D.T.B. Thuy. *User interface design pattern Management System Support for Building Information System*. in *2006 1st International Conference on Digital Information Management*. 2007.

[15] Wu, K., et al. *Security Model Based on Network Business Security*. in *Computer Technology and Development, 2009. ICCTD '09. International Conference on*. 2009.

[16] Yin, H. and H. Wang, *Building an Application-Aware IPsec Policy System.* IEEE/ACM Transactions on Networking, 2007. **15**(6): p. 1502-1513.

[17] Liang, H., W. Chen, and K. Shi, *Cloud computing: programming model and information exchange mechanism*, in *Proceedings of the 2011 International Conference on Innovative Computing and Cloud Computing*. 2011, ACM: Wuhan, China. p. 10-12.

[18] Park, J.-H., M.-Y. Song, and J.-S. Yoon, *Design of Integrated Information System for Atomic, Molecular and Plasma-Material Interaction Data Exchange.* 2013.

[19] Miller, O., *QuickFIX/n, http://xml.coverpages.org/fixML-WhitePaper.html.* 2015.

[20] Sanjaya, R. *Trade-off analysis for web application using Green Ajax*. in *Management of Innovation and Technology (ICMIT), 2010 IEEE International Conference on*. 2010.

[21] Zhang, X. and H. Wang. *AJAX Crawling Scheme Based on Document Object Model*. in *Computational and Information Sciences (ICCIS), 2012 Fourth International Conference on*. 2012.

[22] Tian, G.s. and L. Quan. *An improved framework of business process management system which integrating the strategy management*. in *2008 International Conference on Management Science and Engineering 15th Annual Conference Proceedings*. 2008.

[23] Feledy, Z., *FIXimulator: A Financial Information eXchange Protocol Compliant Sell Side Trading Application*. 2009, Harvard University.

[24] Miller, O., *Configuration QuickFIX, http://www.quickfixengine.org/quickfix/doc/html/configuration.html*. 2015.

[25] P. Sophatsathit, T., et al., *Information and Technology Management*. 2015.

APPENDIX A

FIX Dictionary

MsgType	Name
0	Heartbeat
1	TestRequest
2	ResendRequest
3	Reject
4	SequenceReset
5	Logout
6	IOI
7	Advertisement
8	ExecutionReport
9	OrderCancelReject
A	Logon
AA	DerivativeSecurityList
AB	NewOrderMultileg
AC	MultilegOrderCancelReplace
AD	TradeCaptureReportRequest
AE	TradeCaptureReport
AF	OrderMassStatusRequest
AG	QuoteRequestReject
AH	RFQRequest
AI	QuoteStatusReport
AJ	QuoteResponse
AK	Confirmation
AL	PositionMaintenanceRequest
AM	PositionMaintenanceReport

AN	RequestForPositions
AO	RequestForPositionsAck
AP	PositionReport
AQ	TradeCaptureReportRequestAck
AR	TradeCaptureReportAck
AS	AllocationReport
AT	AllocationReportAck
AU	Confirmation_Ack
AV	SettlementInstructionRequest
AW	AssignmentReport
AX	CollateralRequest
AY	CollateralAssignment
AZ	CollateralResponse
B	News
BA	CollateralReport
BB	CollateralInquiry
BC	NetworkCounterpartySystemStatusRequest
BD	NetworkCounterpartySystemStatusResponse
BE	UserRequest
BF	UserResponse
BG	CollateralInquiryAck
BH	ConfirmationRequest
BI	TradingSessionListRequest
BJ	TradingSessionList
BK	SecurityListUpdateReport
BL	AdjustedPositionReport
BM	AllocationInstructionAlert

BN	ExecutionAcknowledgement
BO	ContraryIntentionReport
BP	SecurityDefinitionUpdateReport
C	Email
D	NewOrderSingle
E	NewOrderList
F	OrderCancelRequest
G	OrderCancelReplaceRequest
H	OrderStatusRequest
J	AllocationInstruction
K	ListCancelRequest
L	ListExecute
M	ListStatusRequest
N	ListStatus
P	AllocationInstructionAck
Q	DontKnowTradeDK
R	QuoteRequest
S	Quote
T	SettlementInstructions
V	MarketDataRequest
W	MarketDataSnapshotFullRefresh
X	MarketDataIncrementalRefresh
Y	MarketDataRequestReject
Z	QuoteCancel
a	QuoteStatusRequest
b	MassQuoteAcknowledgement
c	SecurityDefinitionRequest

d	SecurityDefinition
e	SecurityStatusRequest
f	SecurityStatus
g	TradingSessionStatusRequest
h	TradingSessionStatus
i	MassQuote
j	BusinessMessageReject
k	BidRequest
l	BidResponse
m	ListStrikePrice
n	XML_non_FIX
o	RegistrationInstructions
p	RegistrationInstructionsResponse
q	OrderMassCancelRequest
r	OrderMassCancelReport
s	NewOrderCross
t	CrossOrderCancelReplaceRequest
u	CrossOrderCancelRequest
v	SecurityTypeRequest
w	SecurityTypes
x	SecurityListRequest
y	SecurityList
z	DerivativeSecurityListRequest

APPENDIX B

QUESTIONNAIRE

IFIX: New Information Exchange Framework for Financial Organizations

Questionnaire Form

Explanation

Quality assessment is part of a study of thesis of the Degree of Master of Science Program in Computer Science and Information Technology. The objective was to assess the quality of the system. The results of the evaluation are to improve and develop the IFIX system in the future. Please answer the questions on your opinion. Your responses will be extremely valuable to the development and distribution of IFIX: New Information Exchange Framework for Financial Organizations.

The questionnaire is categorized into 3 parts

1. General information
2. The quality of IFIX contains 3 topics
    - 2.1 Design
    - 2.2 Comparison existing system
    - 2.3 Data and Information Exchange
    - 2.4 Security
3. Some more suggestion

The evaluation of IFIX: NEW INFORMATION EXCHANGE FRAMEWORK FOR FINANCIAL ORGANIZATIONS for experts

Section 1 General information

Direction Please make ✓ sign into the box ( ) and fill in space

1.1 Age

( ) less than 30 years old ( ) 30 – 40 years old

( ) 41 – 50 years old ( ) 51 years old more than

1.2 Experience

( ) 1-3 years old ( ) 3-5 years old

( ) 5-7 years old ( ) 7 years old

1.3 Education

( ) Bachelor Degree ( ) Master Degree

( ) Doctor Degree

1.4 Position

( ) Programmer/System Analyzer ( ) IT Security

( ) System Engineer ( ) Other.....

1.5 Company Name

.....

Section 2 the quality of IFIX: NEW INFORMATION EXCHANGE FRAMEWORK FOR FINANCIAL ORGANIZATIONS for experts

Direction Please make ✓ sign into the box

(The level of number 5 = Very Good, 4 = Good, 3 = Fair, 2 = Poor, 1 = Very Poor)

Listed	Opinion				
	5	4	3	2	1
1. Design					
1.1 The beauty of the design and proper screen overall					
1.2 The appropriateness of the font					
1.3 The appropriateness of the color					
1.4 The appropriateness of the notification's system					
1.5 The language and pictures to communicate					
1.6 The designing with ease is easy to use					
2. Comparison existing system					
2.1 The workflow of the IFIX was sequenced clear					
2.2 The workflow of the IFIX reduces from the existing system					
2.3 The information exchange of the IFIX increased accuracy					
2.4 The reliability of the IFIX is increased					
2.5 The speed of information exchange is increased					
3. Data and Information Exchange					
3.1 Information is accuracy					
3.2 Data format and information are able to define clearly					
3.3 Data format and information is tidy					
3.4 Reports are is accurate					
4. Security					
4.1 Data transfer between organizations with security breaches					
4.2 The system is able to authentication and authorization					
4.3 Information exchange is able to arrive destination					

Section 3 Suggestion

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Sign.....expert

( )

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Thank you for your co-operation

IFIX: New Information Exchange Framework for Financial Organizations

Questionnaire Form

Explanation

Quality assessment is part of a study of thesis of the Degree of Master of Science Program in Computer Science and Information Technology. The objective was to assess the quality of the system. The results of the evaluation are to improve and develop the IFIX system in the future. Please answer the questions on your opinion. Your responses will be extremely valuable to the development and distribution of IFIX: New Information Exchange Framework for Financial Organizations.

The questionnaire is categorized into 3 parts

1. General information
2. The quality of IFIX contains 3 topics
    - 2.1 Design
    - 2.2 Comparison existing system
    - 2.3 Data and Information Exchange
3. Some more suggestion

The evaluation of IFIX: NEW INFORMATION EXCHANGE FRAMEWORK FOR FINANCIAL ORGANIZATIONS for user

Section 1 General information

Direction Please make ✓ sign into the box ( ) and fill in space

1.1 Age

( ) less than 30 years old ( ) 30 – 40 years old

( ) 41 – 50 years old ( ) 51 years old more than

1.2 Experience

( ) 1-3 years old ( ) 3-5 years old

( ) 5-7 years old ( ) 7 years old

1.3 Education

( ) Bachelor Degree ( ) Master Degree

( ) Doctor Degree

1.4 Position

( ) Admin ( ) Employee

Section 2 the quality of IFIX: NEW INFORMATION EXCHANGE FRAMEWORK FOR FINANCIAL ORGANIZATIONS for user

Direction Please make ✓ sign into the box

(The level of number 5 = Very Good, 4 = Good, 3 = Fair, 2 = Poor, 1 = Very Poor)

Listed	Opinion				
	5	4	3	2	1
1. Design					
1.1 The beauty of the design and proper screen overall					
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1.6 The designing with ease is easy to use					
2. Comparison existing system					
2.1 The workflow of the IFIX was sequenced clear					
2.2 The workflow of the IFIX reduces from the existing system					
2.3 The information exchange of the IFIX increased accuracy					
2.4 The reliability of the IFIX is increased					
2.5 The speed of information exchange is increased					
3. Data and Information Exchange					
3.1 Information is accuracy					
3.2 Information meet the user requirement					
3.3 Data format and information are able to define clearly					
3.4 Data format and information is tidy					
3.5 Reports are is accurate					

Section 3 Suggestion

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Sign.....user

( )

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Thank you for your co-operation

VITA

Mr. Pheerasak Tongkamonwat was born on February 20th, 1989 in Bangkok, Thailand. In 2010, he received his second class honour from Rajamangala University of Technology Krungthep of Bachelor degree in Computer Information System. After graduation, he pursued his graduate study for Master's Degree in Computer Science and Information Technology at Department of Mathematics and Computer Science, Faculty of Science, Chulalongkorn University in 2014. On August 20, 2015 he was invited for oral presentation on "IFIX: A New Information Exchange Framework for Financial Organizations" at The 2015 International Conference on Advanced Informatics, Computer, The Tide Resort Hotel, Thailand.