System Architecture Design and Implementation of Trading Technology in one of the brokerage company in the Philippines

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Abstract— the overall aim of the project is to design new system architecture with the use of new trading technology to maximize company's profit through fast execution of orders. Together with this objective is to equipped and upgrade the machines with the latest technology solutions, come-up with a full enhancement of front-end trading system, and achieve real-time market fills. After a series of observations and interviews, this paper identified the factors affecting the slow operations of the firm such as manual filling of Instructions/Orders, no pertinent job function of employees, and the dual functions of trader that works as research analyst. However, this paper will address the operation of the company by proposing new system architecture and widely-known trading technology. The result shows that the total project cost of the proposed design with a new trading technology was Php 9,674,975.00 with total expected yearly revenue of Php 60,000,000.00 and a payback period of almost two months. The qualitative evaluation criteria based on the existing and proposed trading technology are cost, control, risk , time, internalization, brand equity, follow customer needs and customer feedback. As per evaluation, the proposed trading technology or Vendor B, can deliver the output product based on time requirement of the company.

Keywords—Execution management system, front end sales, order management system, systems architecture, traders

I. INTRODUCTION

An effective system architecture that provides comfort to employees and clients by giving a comprehensive solutions based on concepts and principles that is logically related and consistent with each other. Wide-range system architecture which ensures productivity through smooth flow of the processes in the operation. System flow has been a long time advocate of the Unified Modeling Language (UML) for diagramming system architectures. A simple approach to diagramming is the most critical ingredient to formal communications in a mixed business /IT environment

The market trends today play a significant aspect to every stock broker company; this provides the company to be responsive through diversification strategy that they are willing to consider seizing market opportunity. In today's market trend, the investor wants an easy/fast transaction using fast and robust technology, they also consider an experienced dealer/trader on investing their stocks and a need of a real time updates of their order instructions via auto fill system, and updates on what stock to buy or sell

A comprehensive study of Patrick Keough (2007) defined order management system (OMS) as an electronic system developed to execute securities orders and used by the brokers and dealers to fill orders for various type of securities. Also, He elaborates the difference of order management system to execution management system. He enlighten that execution management system product is a fast moving on which implementations are quite quick and easy to used compared to OMS products. Moreover a case study of order management system of 42 Consulting Pte Ltd (2015) in a medium size private bank addressed the manual process in placing equities and fixed income order and trade flows. Order management system has been introduced. The OMS is used to deal with equity and fixed income order placement between bank and the market. It is also connected to Execution Management System (EMS) to enhance order execution capabilities

In view of investor's perspective, gaining high profit is the ultimate goal of an investor participating in financial market. There are so many investment opportunities like trading (i.e. buying and selling) bonds, shares, foreign exchanges and precious metals etc. present in a financial market. Trading in stock market is one of the popular channels of financial investment. Investors in the stock market can maximize their profit by buying or selling their investment at appropriate time.

The client of this study is a wholly-owned Philippine-based brokerage company. It serves as a link between businesses, individuals and potential investor to offer services such as securities services. These services are offered to various customers such as foreign and national sectors; their value proposition is to provide superior customer-driven quality service to its customers by providing time-definite, totally reliable and fast transaction. Figure 1 shows the strength, weaknesses, opportunities and threats of the company. The strength aspect of the company are; 30 years of existence in the Stock brokerage Industry, with a good customer relationship and experienced salesman and dealers. The opportunities are to expand locally and internationally, to seize more potential foreign and local investors. Local expansion to Visayas and Mindanao area and Asia shall be prioritized in international expansion. However, on the latter side, the weak point of the firm lies on the current manual system, the unsuitable job functions as some employees has dual functions. The treats that perhaps will challenge the firm are the stiff competition for those companies offering the same technology, the high rivalry between foreign and local stock brokerage firm and the unprecedented economic crisis with relative connection to stock market.

Fig. 1. Comapany X –SWOT Analyis

II. PROJECT ANALYSIS

Figure 1 illustrate a simple diagram of existing business processes, data , technology , vendor and customer channels that together constitute the desired foundation for execution. It shows that, whenever a client submits an order/Instructions from Buy-side OMS, the order is routed through the Sell-side OMS with electronic connections via a FIX Gateway connectivity, in which the order is manually acknowledged by the dealer/trader. Then the order shall be posted to PAM (EMS) based on the instructions given by the client. Once a trade is executed on the exchange, the Trader/Dealer will manually update and fill done orders from the Sell-side OMS updating the Buy side client. A real-time price quotations and market information is readily available and viewable by traders/dealers using a separate Market Data Feed Service from ItradeRS.

Figure 2 shows an innovative approach as it integrates seamlessly both the SSEOMS (Sell-side OMS) and TEDS (EMS). Whenever a client submit an order/Instructions from the Buy-side OMS, the order can be manually or electronically acknowledged by the dealer/trader. The Sell-side OMS is connected to the TEDS (EMS) which enables an order to be automatically filled once a trade is executed on the exchange. The proposed system architecture allows the company to host its own server for the database, proxy and quotes server.

The main objective of this project is to maximize company's profits by Introducing new Trading Technology to potential Investors, in connection to full enhancement of trading system on Front-End Sales, achieve real time market fill orders, real time update of price feeds with zero downtime connectivity, fast and reliable access to the exchange and high performance robust computer.
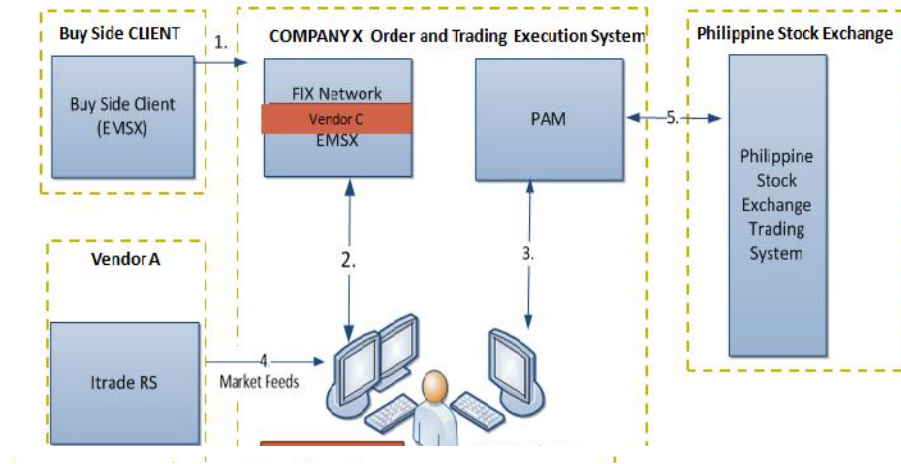
A. Existing System Architecture

Fig. 1. Existing Sytem Architecture

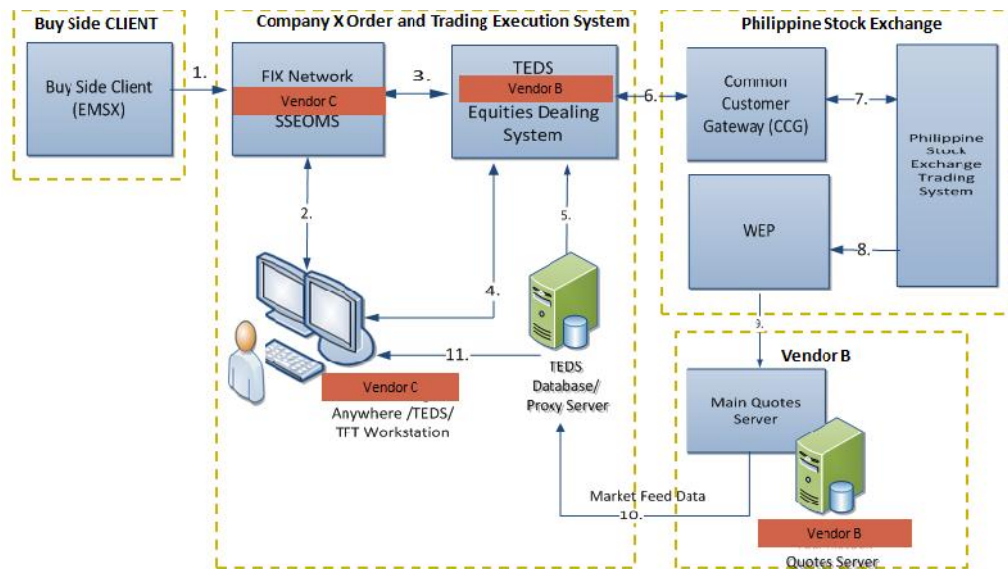### B. Proposed System Architecture

Fig. 2 Proposed Design Architecture

C. Summary of Proposed Process

1. Client will send BUY/SELL Orders from their own OMS System, this orders will be routed to Vendor C SSEOMS.
2. The dealer/broker may confirm receipt by manually acknowledging orders within SSEOMS. Orders can be acknowledged via batch or single ACK. The administrator of SSEOMS can assign books to another dealer, dealer who acknowledged the order will be displayed on the blotter, this enable the users to access who is working on a specific order.
3. Orders can be sliced to child order from SSEOMS and will be sent through execution passing through TEDS
4. Upon sending those orders for execution, orders that has been done on the exchange will automatically fill the orders

From SSEOMS, showing the remaining balance to execute. (Note: SSEOMS does not limit the amount of users who access the SSEOMS database as Vendor C are the one hosting this solution, thus, it will allow users of Vendor C Anywhere to access and execute an orders from SSEOMS.

5. The trading database and proxy server will be hosted by the Company X.
6. TEDS (Trading Equity Dealing System) as an Independent trading solution will serve as Company X primary trading system, capable of transmitting orders via CCG connection to PSE.
7. The CCG Connection TEDS (EMS) to PSE provides a single point of access which allows posting of transaction to the Exchange.
8. The WEP facility from PSE captures the information on its Live Stock Price and Volume.
9. Connection of Vendor B to WEP of PSE allows real-time market feeds linked to their main quote server.
10. There will be a proxy server which will stand as an intermediate server between Company X quotes server and the actual main quotes server from the solutions vendor.

III. RESULTS AND DISCUSSION

A. SOFTWARE REQUIREMENTS

TABLE 1. PROJECT COST FOR SOFTWARE REQUIREMENTS

	Vendor	No.of Purchased	One Time Cost	Monthly Cost	Yearly Cost	Total
1.	Vendor C	1		337,500.00	4,050,000.00	4,050,000.00
2.	Vendor C	1		78,750.00	945,000.00	945,000.00
3.	Vendor B	3(Inclusive)	500,000.00	50,000.00	600,000.00	1,100,000.00
4.	Vendor B	3 (Inclusive)	30,000.00	18,000.00	216,000.00	246,000.00
5.	Vendor F	5(Inclusive)	115,135.00			115,135.00
Total Amount of Software Subscription			645,135.00	484,250.00	5,811,000.00	**PHP 6,456,135.00**

As what was shown on the table above, the project cost for software requirements has the total cost of PHP 6,456,135. It has one time, monthly and yearly cost of software subscriptions.

B. CONNECTION REQUIREMENTS

TABLE 2. PROJECT COST FOR CONNECTIVITY REQUIREMENTS

Lease Line facilities		Vendor	Lease Line	Monthly Fee	Yearly Fee	Total
to PSE	1.	Vendor D	Primary lease line to PSE	15,120.00	181,440.00	181,440.00
	2.	Vendor E	Backup lease line to PSE	22,275.00	267,300.00	267,300.00
to VENDOR B	3.	Vendor D	Primary lease line to Vendor B	15,120.00	181,440.00	181,440.00
	4.	Vendor E	Backup line to Vendor B	22,275.00	267,300.00	267,300.00
to VENDOR C	5.	Vendor E	Backup line to Vendor C	22,275.00	267,300.00	267,300.00
			Total Price	97,065.00	1,164,780.00	**1,164,780.00**

Table 2 shows leased line connection to Vendor C, Vendor B and PSE to facilitate the company's connectivity requirements which has a total cost of PHP 1,164,780.

C. HARDWARE REQUIREMENTS

TABLE 3. PROJECT COST FOR HARDWARE REQUIREMENTS

Hardware Facilities	One time Cost
TEDS/TFT Server (Vendor B Database/Proxy Server)	248,820.00
UPS for TEDS/TFT Server	71,000.00
(SSEOMS,Vendor C Anywhere ,TEDS/TFT)Workstation	589,200.00
UPS for TEDS/TFT Workstation	105,840.00
(SSEOMS,Vendor C Anywhere ,TEDS/TFT)Workstation- Back-up and Additional One for foreign Dealer	589,200.00
Firewall to set-up connection (Primary and Back up)	450,000.00
Total Price	**2,054,060.00**

Table 3 shows a total cost of PHP 2, 054,060 for the Infrastructure requirements of the proposed project.

D. COST COMPARATIVE ANALYSIS

TABLE 4. EXISTING SOFTWARE SUBSCRIPTION

EXISTING SOFTWARE SUBSCRIPTION	Qty	License Fee (one-time)	Monthly Fees	Yearly Fees	Total Cost (in a year)
Service Licenses					
Vendor A OMS Local Single Site	1	250,000.00			250,000.00
Vendor A Server Apps	1		50,000.00	600,000.00	600,000.00
Vendor A Remote Gateway			25,000.00	300,000.00	300,000.00
Setup Fee		50,000.00			50,000.00
Vendor A Trader Apps (remote)Php 3,500.00/terminal/month	3		10,500.00	126,000.00	126,000.00
12% VAT		36,000.00	9,000.00	108,000.00	144,000.00
Total Amount		**336,000.00**	**84,000.00**	**1,134,000.00**	**1,470,000.00**

TABLE 4. PROPOSED SOFTWARE SUBSCRIPTION

PROPOSED SOFTWARE SUBSCRIPTION	Qty	License Fee (one-time)	Monthly Fees	Yearly Fees	Total Cost (in a year)
Trading Execution Facility (Inclusive of 3)	3	500,000.00	50,000.00	600,000.00	1,100,000.00
Trading Financial Terminal (Inclusive of 3)	3	30,000.00	18,000.00	216,000.00	246,000.00
Fix Gateway License Fee		500,000.00	100,000.00	1,200,000.00	1,700,000.00
Total Amount		**1,030,000.00**	**168,000.00**	**2,016,000.00**	**3,046,000.00**

The difference in the amount of the proposed software subscription appears to have increased by 100% from the existing software subscription since the requirements of the front-end sales/dealer rely to the new trading technology function.

E. QUALITATIVE CRITERIA ANALYSIS

TABLE 5. VENDOR CRITERIA ANALYSIS

CRITERIA	Vendor B	Vendor A
COST		✓
CONTROL	✓	✓
RISK	✓	
TIME	✓	
INTERNALIZATION	✓	✓
BRAND EQUITY	✓	
FOLLOW CUSTOMER NEEDS	✓	✓
CUSTOMER FEEDBACK		✓

There are eight criteria for choosing the right solutions provider; it includes cost, control, risk, time, internalization, brand equity, follow customer needs and customer feedback. Choosing Vendor B as our solutions provider can be seen as committing to a need and must requirement for company front-end users.

Existing Trading Technology (Vendor A)

- One of the leading domestic financial data provider in the Philippines
- Reinforce their presence on stock markets - Internalization
- Increase the relationship with local companies
- Readily made available trading system / Fix Gateway integrated to SSEOMS.
- More cost yet effective with the Time Frame requirement of the client.

Proposed Trading Technology (Vendor B)

- Adapt their products to the local customers (Understand the consumer needs)
- Follow the customer's needs based on the requirements of the broker
- Continuously strive to develop their knowledge and constantly searching for better solutions to meet client's needs.
- Will entail two to three months time of Integration to Vendor C

I. CONCLUSIONS AND RECOMMENDATIONS

In this paper, the proposed trading technology has an advantage compared to the current used. Benefits are; orders can be auto filled at multiple prices (partial fills) Traders/Dealers without manual inputting done trades to the OMS. (Ensures that prices are market driven and fair) Traders can focus more on improving their strategy and money management rules because of the autofill capability of SSEOMS with Vendor B Integration. Minimizes dealing error because of human typo intervention from one terminal to another terminal. Maximizes profits by fast execution. Eliminates client facilitation through slow execution. No re-quotes; no dealer intervention and highly scalable to handle increasing volumes and expanding business requirements.

As per evaluation, best option for the company is Vendor B which provides a fully integrated seamless solution and has a readymade system that can deliver the output product based on the time requirement of the company. Future works of this project would be online trading, enhancement of back office, and local expansion of the branch.

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BIOGRAPHY

Maricar M. Navarro is an Assistant Professor in the Department of Industrial Engineering at the Technological Institute of the Philippines, She earned B.S. in Industrial Engineering from Technological Institute of the Philippines-Quezon City, Masters in Engineering major in Industrial Engineeering from Mapua Institute of Technology, Manila Philippines. She has published journal and conference papers. Engr. Navarro has done research projects that deals on optimization of production, warehouse operations and service operations. Her research interests are production engineering that includes manufacturing,simulation, optimization, facility layout and design .She is a Professional Industrial Engineer and an active member of Philippine Institute of Industrial Engineers (PIIE) organization in the Philippines.

Mary Grace M. Benignos is an IT Professional with seven years solid hands-on experience in the area of System/Network , Application development, System Integration and Support Role. She finished her B.S Computer Engineering degree at AMA Computer University-East Rizal Campus. After receiving her education, she later worked as a software developer/programmer from a multinational IT company and then worked as Information Technology Support at Maybank ATR KimEng ,one of the leading trading participants of the Philippine Stock Exchange. She is currently on-board in a multinational Payment Industry as Technology Operations Analyst. Her former professional achievements include implementation of various application system that enhances both the Front-End and Back-End trading, network rehabilitation structure and OMS/EMS Integration. She is proficient in project implementation and execution and has in depth experience in systems, database administration, network infrastructure and IT Operations. She is a member of I.T. Interaction Philippines, an IBM User Organization.

Bryan B. Navarro is an Assistant Professor in the Department of Electrical Engineering at the Technological Institute of the Philippines and currently a Staff Engineer at Manila Electric Company (MERALCO). He earned B.S. in Electrical Engineering from Technological Institute of the Philippines-Quezon City, Masters of science in Electrical Engineering major in Power System from University of the Philippines Diliman Quezon City. He has published journal and conference papers. He is an active member of Institute of Integrated Electrical Engineers of the Philippines (IIEE).