UNIVERSITI PUTRA MALAYSIA

WEB-BASED BROKERAGE SYSTEM DEVELOPMENT

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

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DEDICATION

To the soul of my parents

Abstract of thesis presented to the senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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May 2003

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Electronic Commerce (ecommerce) depends on the emergence of capabilities that empower buyers to obtain the product data they need to make informed purchase decisions, quickly and easily. Traditional physical markets are often brokered by intermediaries that facilitate market transitions by providing brokerage services.

In the global Internet Electronic Brokers provide a central marketplace, and provide many essential third party services. Electronic Brokerages are regarded as the core functionality in overcoming many current limitation of Internet Commerce. Also, search costs, lack of privacy, incomplete information, contracting risk, and pricing are better managed with Electronic Brokers. However, Brokers are currently facing the problem of combining all the information within a single coherent structure through which buyers can navigate readily. This is due to the lack of interoperability standards between e-commerce applications, which leads to high costs for the brokers.

The research is to design a framework for building a web-based brokerage system. The system plays a central role in allowing service providers to publish and advertise their offer and at the same time helping the consumer to access easily and in a moderate manner the offered services and information and try to solve the problem of interoperability. Consumer Buying Behavior model which consists of six stages that defines the decision process and acts of people involved in buying and using products had been applied in the design of the system. In addition to offering many essential third party services, the system offers some tasks, which simplify the functionality of brokers, which override the limitations of Internet e-commerce.

Client-server communication that uses 3-tier architecture had been used to override the 2-tier limitations and enhance the security features of the system. To achieve the requirements of such as online e-commerce application Java servlets with JDBC on the server side, HTML and JavaScript on the client side are used. Unified Modeling Language (UML) had been applied in order to determine system structure and system behavior from user/system requirements.

The study shows that online brokerage can replace traditional brokers with additional functionality. By designing reusable components and using certain tools will try to solve Interoperability problem between ecommerce applications. Java servlets shown as a powerful tool to be used on server side in this type of application which can help to override some limitations of Internet e-commerce.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi untuk ijazah Master Sains

PEMBAWGUNAN SISTEM AGEN BERASASKAN WEB

Oleh

MOHAMMED AHMED AL-FARSI

Mei 2003

Pengerusi: Abdul Rahman Bin Ramli , Ph.D

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E-dagang bergantung kepada wujudnya keupayaan yang memberi kuasa kepada pembeli untuk memperoleh data produk yang diperlukan dalam membuat keputusan perolehan dengan cepat dan mudah. Pasaran fizikal tradisi sering dibroker oleh orang tengah yang memudahkan transisi pasaran melalui khidmat broker yang disediakan. Di merata dunia, Broker Elektronik Internet menyediakan ruang pasaran berpusat serta banyak lagi khidmat penting pihak ketiga. Broker elektronik berperanan penting dalam mengatasi pelbagai batasan semasa Perdagangan Internet. Di samping itu, kos mencari, kekurangan privasi, maklumat yang tidak lengkap, risiko kontrak, dan penetapan harga lebih mudah diurus oleh Broker Ekektronik. Walau bagaimanapun, pada masa ini broker menghadapi masalah menggabungkan kesemua maklumat di dalam satu struktur yang mudah difahami supaya sedia diguna oleh pembeli. Hal ini adalah kerana kurangnya standard saling operasi antara aplikasi dagang, hingga menyebabkan peningkatan kos kepada broker.

Kajian ini bertujuan mereka bentuk rangka kerja untuk membangunkan sistem broker berasaskan web. Sistem berkenaan memainkan peranan penting dalam menggalakkan pihak yang memberi khidmat untuk menerbit dan mengiklankan tawaran mereka dan dalam masa yang sama membantu pengguna mengakses dengan mudah. Mereka juga menawarkan khidmat dan maklumat dengan cara sederhana dan cuba mengatasi masalah saling operasi. Model Tingkah Laku Membeli Pengguna yang mengandungi enam tahap yang menjelaskan tentang proses membuat keputusan dan tindakan orang ramai yang terlibat dalam membeli dan menggunakan produk telah dipraktikkan dalam mereka bentuk sistem ini. Di samping menawarkan pelbagai khidmat penting pihak ketiga, sistem ini juga menawarkan tugas-tugas yang memudahkan fungsi broker dengan mengetepikan batasan e-dagang internet. Komunikasi khidmat pelanggan yang menggunakan arkitek 3-tier telah digunakan untuk mengetepikan batasan 2 – tier serta mempertingkat ciri-ciri keselamatan sistem berkenaan. Bagi memenuhi syarat-syarat seperti aplikasi JAVA e-dagang atas talian bersama JDBC, HTML dan Javascript di pihak pelanggan telah digunakan. Unified Modelling Language (UML) telah digunakan bagi menentukan struktur sistem dan tingkah laku sistem dari pihak pengguna/sistem. Kajian menunjukkan bahawa dengan menambah pelbagai fungsi, broker atas talian boleh menggantikan broker tradisi. Dengan mereka bentuk komponen yang boleh diguna semula dan menggunakan peralatan tertentu dapat membantu mengatasi masalah saling operasi antara aplikasi e-dagang. Server JAVA menunjukkan alat yang ada kuasa yang akan digunakan di pihak server dalam aplikasi jenis ini boleh membantu mengetepikan batasan-batasan e-dagang internet.

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Lastly, my appreciation to all those who in one way or another help me to finish this work.

I certify that an Examination Committee met on 26th May 2003 to conduct the final examination of Mohammed Ahmed Al-Farsi on his Master of Science thesis entitled "Web-Based Brokerage System Development" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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This thesis submitted to the senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirements for the degree of Master of Science. The members of the Supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

Mohammed Ahmed Al-Farsi

Date: 2-6-2003

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CHAPTER I

INTRODUCTION

Many business leaders might think of ecommerce simply as the exchange of goods and services for payment over the Internet. But this view overlooks internal commerce and the competitive advantages that result from linking members of the supply and value chains (those people involved in the flow of goods, services, money,and information necessary to get products from raw material to consumers). In its broadest sense, electronic commerce encompasses any commercial activity that takes place directly between a business, its partners, or its customers through a combination of computing and communications technologies.

Because electronic commerce can help organizations to achieve business goals by using the most effective technology to employ the power of the Internet. Ecommerce rightfully encompasses all of the activities that heighten a customer's interest before, during, and after a sale. In this way, ecommerce can be used to create brand equity and to improve an organization's public image, as well as to develop and strengthen direct relationships between an organization and its customers, distributors, suppliers, and retailers (Trepper,2001).

Electronic commerce is defined as "the use of electronic means and technologies to conduct commerce" (Whinston et al.,1997). By enabling new ways of doing business through information technology, electronic commerce transforms industry structure, improves organizational effectiveness, and increase consumer welfare. However, since the new electronic markets on the Internet are different from traditional physical markets, new strategies and business logic are required (Benjamin and Wigand,1995). Consequently, there is a need to bring new theory to the problem of how the competitive environment changes in the on-line world, and to explain the conditions for the success and failure of new on-line players and established firms in an industry (Chircu and Kauffman,2000).

Placing electronic commerce only on the field of direct selling would be a strong business restriction even though it is a quick way to improve productivity over new technologies. Management strategies will have to be redefined in several ways in order to offer a valuable service to the end user. The consequences have to be well defined in a specific strategy completely adapted to electronic transactions that might disrupt the enterprise business models. They are different business values like product promotion, new sales channel, direct saving, time to market, customer service, brand or corporate image, technology learning and organizational laboratory, customer relationships, new product capablities, new business models. Electronic commerce is the ability to perform exchanges of goods, services, content, assets and money, between two or more participants using electronic tools and techniques (Merz et al.,1997). Electronic commerce

offers several advantages over traditional ways of doing business. In contrast to the conventional market model, electronic market systems allow to abstract away geographical distances and automate the selection of offers. Technology can be used in new ways to offer original and innovative services, which would not have been possible otherwise. It can be enhanced by electronic negotiation, contracting and ultimately collaborative specification work (Bichler et al.,1998).

Electronic Brokers

The information superhighway brings millions of individuals who could exchange information with one another. Any conception of a traditional market for making beneficial exchanges, such as an agricultural market or trading pit, or any system where individual respond to posted prices on a computer screen is woefully inadequate for the extremely large number of often complex trades will be required.

In non-brokered commerce, customers contact suppliers directly, searching for offers and/or conducting one-to-one negotiations. Non-brokered commerce often happens in very small markets, transparent markets, or in markets with monopoly/monopsony structures. A broker is a party, which mediates between buyers and sellers in a marketplace. Brokers typically provide services that may include searching for a suitable business partner, negotiating the terms of the deal providing letters of credit and/or banking/payment services, and ensuring delivery of goods. Brokers are often useful when a marketspace has a large number of buyers and sellers.

Current electronic commerce applications, such as those on the world wide web, primarily support information collection. There is little or no support for brokerage. However, sophisticated mediators can make the exchange of information between consumers and providers of services cheaper and better. Electronic brokers aim to find the best conditions for their clients (consumers and providers) and they help to overcome the limitations of direct negotiations between customers and suppliers (Bichler et al.,1998).

Electronic brokers will be required to permit even reasonably efficient levels and patterns of exchanges. Their ability to handle complex, albeit mechanical, transactions, to process millions of bits of information per second, and to act in a demonstrably even-handed fashion will be critical as this information market develops. Electronic brokers can also run pricing systems, charging and crediting slight amounts to individual accounts as bits careen along the superhighway.

Web Browser Technology

The web browser technology, the so-called first-wave of the Internet (Dreyfus,1998), brings the explosive usage of the Internet in terms of world wide information shared resources. The convergence of the Internet and distributed-object technologies, extend this "information-based" Internet to the "services-based" web. This evolution is referred to, as the Internet's second-wave (Dreyfus, 1998), where software services and content are distributed over the Internet, Intranet, or Extranet. In this context, a

software agent can search for available software services on the Internet, select them to compose new applications, invoke the services remotely, and obtain the results utilizing the web. Such an infrastructure offers the opportunities for the web-based enterprise integration and ecommerce to function.

Web-Based Enterprise Computing

Recently web technologies have emerged as a credible alternative to client-server; they are more cost effective, cross platform, and offer universal access. The Web enables user control of information by empowering individuals to access data when and where they need it rather than depending on intermediaries.

The Internet has also necessitated a broader definition of an application user. In addition to supporting traditional corporate users, corporations are now planning to give mobile employees, as well as prospects, customers, and suppliers limited access to their corporate data through the Web. From enhancing customer service by providing customers the ability to check the status of their orders online to enabling Just-in-Time inventory management through supplier access to materials inventory databases - companies are looking to selectively expose their business processes and applications to key partners, thereby improving customer satisfaction, enhancing profitability, and gaining an overall competitive advantage.

Today's web solutions are effective for disseminating static information or browsing a database. These solutions meet the requirements for a class of applications such as online availability of a company's product literature or a corporate directory. However, the requirements for enterprise applications are not addressed by current web solutions. Web-based enterprise applications demand five key requirements, they are: transactional integrity, scalable high performance, robustness, interoperability, and security.

Enterprise computing allows Web-based corporate IT to bring together disparate systems into a single, manageable environment that facilitates business processes and allows corporations to effectively service internal and external customers. In deploying corporate intranets, IT professionals face some key challenges - the biggest being the marriage of web-based enterprise computing with existing enterprise applications. To take advantage of this new paradigm, IT professionals must integrate web-based solutions without having to rearchitect their IT infrastructure, completely rewrite their enterprise applications from the ground up, and retrain their staff. In implementing web-based enterprise applications, protecting the existing corporate investment in infrastructure is a key IT requirement, as is the ability to integrate numerous heterogeneous environments and enable access to legacy systems and data. Lastly, traditional corporate requirements relating to manageability and extensibility remain paramount.

Interoperability

Historically, interoperability meant the ability to link two or more software applications or services together in a consistent and predictable manner. That ability was revolutionary in itself. However, today we are moving to a new level where we are concerned not just with interoperable software applications but with the ability of companies to interoperate with one another. We believe that this represents the next fundamental step in the evolution of the Internet and e-commerce and will dramatically change the way business is done around the world.

The result is that the focus shifts from company Web sites to Web-based relationships between multiple companies - using the power of the Internet to support dynamic business processes and negotiation in the space between organizations. This requires an approach that lets different e-commerce systems readily identify likely trading partners, exchange basic trading information, and negotiate transactions - at today's rapid pace of business. The idea is to make products and services instantly available to any potential trading partner anywhere in the world. By accomplishing this, rigid supply chains can be transformed into supply webs where both large and small companies are able to spontaneously structure deals that respond directly to emerging market opportunities.

With its universal connectivity, the Internet offered an obvious alternative to the use of proprietary networks. But, to date, standards

ensuring consistent interpretation of business data exchanged by way of the Internet have been conspicuously absent. To fill the void, many companies looking to build on their existing trading relationships and a small but growing number of industry groups have set out to create their own ad hoc standards for information exchange. With the help of these, some companies have managed to better integrate with their supply-chain partners, but what these ad hoc standards clearly are incapable of providing is a way to quickly, easily integrate with an ever-expanding network of future trading partners regardless of industry or location.

The problem we face is that currently there are few broad standards that will enable this type of environment to exist. Furthermore, the fundamental approaches to setting standards may be far from acceptable in a world of highly dynamic changing business relationships. Our challenge is to develop a new approach to enabling businesses to find one another and quickly establish a business relationship.

Distributed Object Technologies

A distributed computing system can be defined as a system of multiple autonomous processes that do not share the primary memory, but that cooperate by sending messages over a communication network (Hoque,1998). This definition denotes the behavior of physically separated components and logically autonomous modules communicating via message passing. On the other hand, a distributed system can also be defined as a

system whose services and functionality are encapsulated in objects so that only specific interfaces allow to mediate message passing between processes. These objects are referred to, as distributed objects.

In real life, the distributed objects can be Java servlet, Enterprise JavaBeans and, CORBA objects, which communicate by Java RMI or, IIOP protocols.

Three-Tier Architecture

The three-tier architecture is fundamental to the deployment of the distributed objects on web-based environment. As shown in Figure 1.1, a web server acts as front-end between client processes (Tier1) and to the middleware (Tier2). The middleware in its turn facilitate the interoperability of many disparate software applications or distributed objects (Tier3). The web clients (Tier1) send the requests to the web server for the software services to be invoked over the HTTP protocol. The Web server invokes the requested service on behalf of the clients.

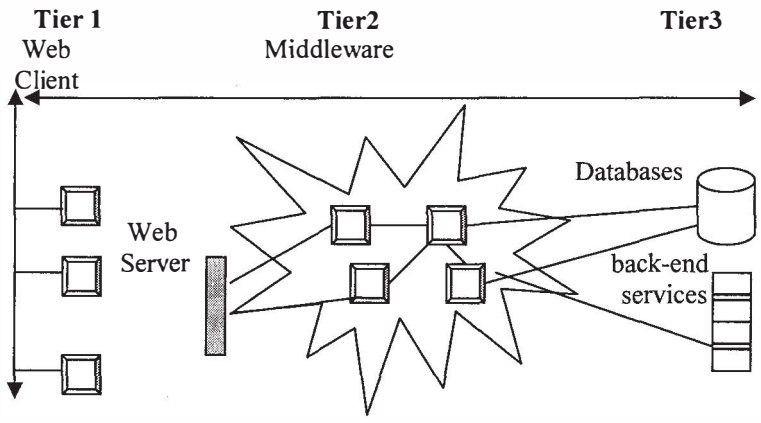

Figure 1.1: Three-Tier Architecture

From another point of view, the three-tier architecture consists of into four layers, they are: presentation layer (web browser), content layer (Web server), application layer (application server) and back-end data and services layer.

The web server and the application server can be located in the same machine or on different machines. The web server is responsible to accept HTTP requests from Web clients, and delivers them to the application server, while the application server is in charge of locating the services and returning responses back to the web server.

The client in the presentation layer has little or no application logic. It sends the request via HTTP to the web server for an interactive view of the static and dynamic information. For static information, the web server upon receiving a request from the client, the web server can retrieve the requested document from the content repository and send it to the client. In this case, the client entirely relies on the web server. Programming languages, such as Java, and scripting languages, like JavaScripts and CGI, can be used to access databases and other on-line resources.

To provide dynamic information, generated by software services, the web server needs to constantly interact with the application server. A servlet, which is a Java program, provides a dynamic HTML content to clients. When the web server receives the request for a servlet, it re-directs the client's request along with the parameters to the application server,