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REBUILDING THE LEGACY DATABASE SYSTEMS FOR THE E-BUSINESS OF ELECTRIC UTILITY COMPANY

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ABSTRACT

A large established firm with mainframe based hierarchical databases have encountered serious problems to accommodate new databases from the e-business activities. This paper attempts to develop a framework for an interface between the existing legacy database systems and the web server based database systems. A middleware system using Enterprise Data Access/Structured Query Language (EDA/SQL) is proposed. If the proposed systems are properly implemented, more interactive e-business activities between the customers and the corporate web site are expected, which in turn, leads to enhance the customer service and increase corporate revenue in the future. An electric utility company is used for a real life application for this study. This web-based application is putting new demand on database products and is changing the way companies evaluate database management systems.

KEYWORD; Web-based Database, Middleware, Electric Utility Company

1. INTRODUCTION

The Internet is a new cyber space for commercial online services and data sharing. It is also a new system for transforming information that people search and exchange throughout the world. The terms "web workstyle" and "web lifestyle" have been used to emphasize the effectiveness of corporations and customers using those digital accesses. Especially, "web workstyle" is giving rise to the revolution of commerce entirely. As a result, companies are restructuring knowledge management systems and business operating systems. Thus, this paper researches the electronic commerce system in terms of electric utility service, and provides a framework to develop e-business systems for the new digital generation customers. Many electric utility companies may have temporarily overlooked what they could accomplish if they established a presence on the Internet. Several utilities and industry service companies are using their home pages as repositories of information related to business deals such as procurement activities, equipment sales, power purchase agreement buyouts, and various other offerings. Online business, however, is still in its infancy, and much remains to be done in order to establish the web as a valid transaction medium.

Recent developments in the utility industry report that fifteen of the America's largest electric and gas companies have formed a consortium to build an Internet business exchange with suppliers. The exchange will be open to use by any firm in the energy and utilities industry, but the independent company will initially be owned by the founding utilities. As the technology for web-enabled wireless devices continues to evolve, utilities are being forced to consider strategies for the deployment of wireless applications. In addition, utilities are being forced to roll them out so they may cut costs or establish new service revenues.

Managers in an electric utility firm may be a step behind the Internet revolution, but in one key respect, they may have an advantage over anyone else building an e-business web portal for business-to-business (B2B) procurement. Executives in utility firms do not fear government regulation, as they are already caught in the net. That affinity may in fact prove downright useful. The possibility of the Federal Trade Commission (FTC) taking a more active role in overseeing B2B platforms is of particular interest for many e-procurement ventures by the electric utilities industry. FTC rulings on e-business marketplaces also may affect the scores of energy trading platforms being constructed by utilities and power marketers.

E-business, electric trades that connect public organizations with private customers, as yet, is not running at full capacity, even in developed nations where it could be an enormous

contribution to society. Expected contributions are: (1) preexisting confidence, (2) predictability, (3) reliability, and (4) convenient payment. Preexisting confidence is defined as customers (demanders) trusting suppliers since they trade with public organizations (other suppliers). Thus, the customers have strong confidence buying public goods. The next contribution, predictability, is enhanced by the following factors: the price of each good is always based on both the details of the contract which is made when customers apply for the first time, and on the user's meters being measured monthly. In addition, the price of each unit is fixed by the contract. There is no extra process to trade because the same condition of contract and the same goods complete the supplement and consumption of every month periodically and permanently. Reliability is the third contribution. Other procedures to deliver the services or products are not required. The goods can simply be delivered by wires which are provided through public organizations and the equipment of each customer. Consequently, consumers do not worry about the time aspect, or whether they can use the products right now or in the future, as public products are limitless. Lastly, convenient payments play a significant role in the e-business. Electricity is served periodically, continuously, and permanently to the same customer at the same place and conditions. Thus, e-business of utility products like electricity certainly enjoys the convenience when paying the bill.

The structure of the electric commerce system and the prototypes on the web for e-business will be addressed next, along with the contributions of e-business by the new system and directions for future study. Lastly, a conclusion will be drawn.

2. LITERATURE REVIEW

Mullen (2000) insists that established energy companies are extending their web infrastructures beyond basic information presentation adding online customer service features such as electronic bill payment, access to account information, and historical energy use. Kennedy and Sabin (1999) reports a more cost-effective way to use the web for the utility company. Some utility companies have found that the Internet provides a cost-effective way to disseminate the information to key customers. Monitoring and reporting systems tied to the Internet can be linked to just a few or a few hundred power quality monitors. Size and scope is dictated by the monitoring needs of the power provider and its customers. At the heart of such a monitoring system, is a server computer, optimized for database management and analysis. The server provides file management, database administration and access to databases via access to the World Wide Web. Seine (2000) explained that the e-commerce light bulb has suddenly flashed on in the utility industry. After a slow start, many utility companies are stampeding into the e-business world in an effort to cut costs, improve service and lure potential new customers in deregulated markets to their web sites. To maintain their competitive edge, many utility firms are offering a variety of front-end capabilities to customers on Web sites. Potential back-end office savings are behind the March 2000 decision by 15 major US electric and natural gas utilities forming an Internet-based business-to-business procurement exchange to coordinate the purchase of billions of dollars of products and services. However, web exchanges are not the only e-business play in the utility industry. Many of the existing examples of e-business are simple front-end operations.

Dysart (2000) explains the hacker attacks on electric utility company. With the Internet community still unnerved by the demonstrated vulnerability of the Net to hacker attacks, each utility firm should be taking precautions to bulletproof its Web site. Now that more electric-utility mainframes, networks, and PCs are linked to the Net via high-speed always-on Internet

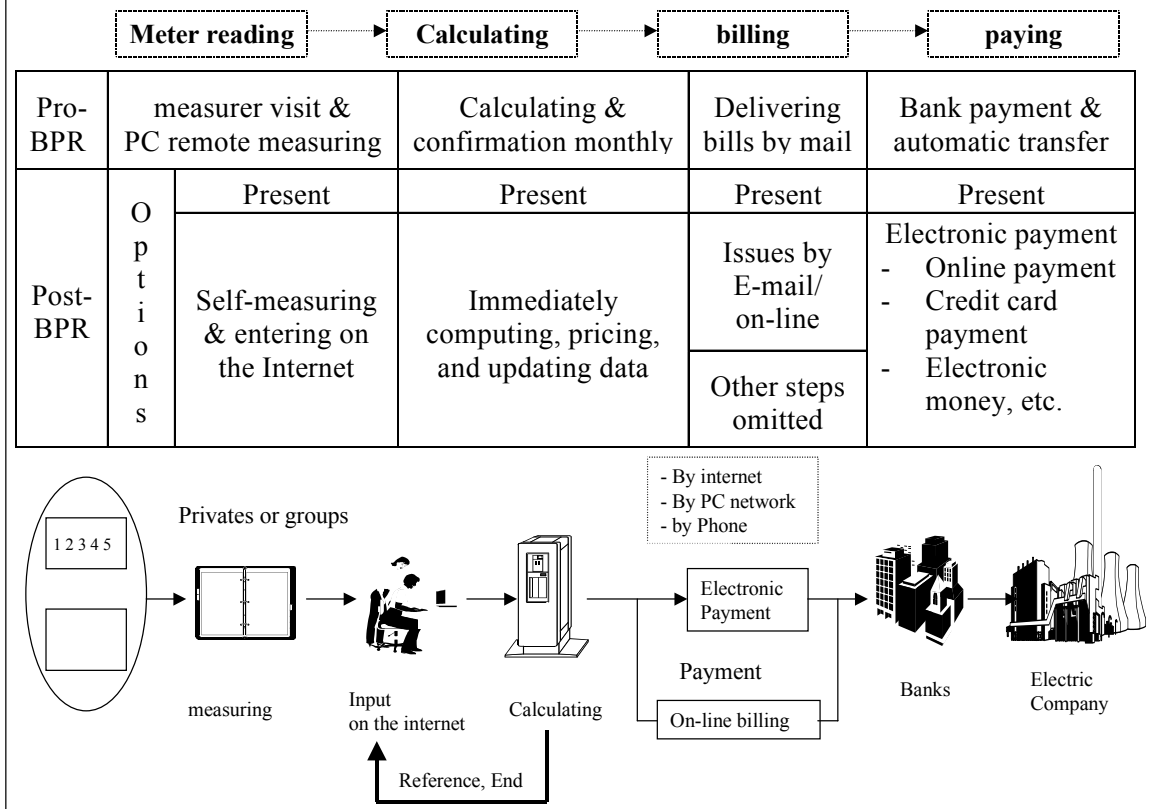
connections, hackers may enjoy a 24-hr window of opportunity breaking into Internet-based systems. It is difficult for Internet system administrators to stay current with the latest Internet security options. John Cox (2000) cites security of middleware as one example. An e-business application that moves data between clients and servers on the Internet can traverse scores of computers, which offer the chance for compromising the data. Malde and Gavurin (1999) conclude that to Web-enable a legacy system, the following issues should be considered: (1) OS and platform, (2) middleware and component model, and (3) network performance and security. Architectural options, which are discussed in detail, should include: (1) web-enabled terminal emulation, (2) web-capability using middleware and component models, and (3) web access to legacy data stores and warehouses.

Harmon and Matthews (1999) developed the Internet application and application server. Application servers are designed to support applications with transaction processing or with complex decision processing requirements and should be termed enterprise application servers for clarity. The enterprise applications servers are discussed in detail. Slater (2000) explains the needs of middleware. Essentially, middleware is software that connects applications allowing them to exchange data. Different types of applications and integration needs are best served by different middleware systems. Spinner (1998) researches various middleware solutions. Recently, trading desks and portfolio management organizations have begun implementing various middleware solutions allowing market data as well as transactional data to be integrated and delivered to a plethora of mission-critical applications. Now, the challenge is to determine how to manage many different fragmented forms of middleware in order to ensure that data are rapidly distributed to the correct applications in the proper format and that data integrity is maintained. Middleware functions aimed at transforming and distributing data are being quickly incorporated into common database platforms.

3. E-BUSINESS SYSTEMS ARCHITECTURE FOR ELECTRIC UTILITY SERVICE

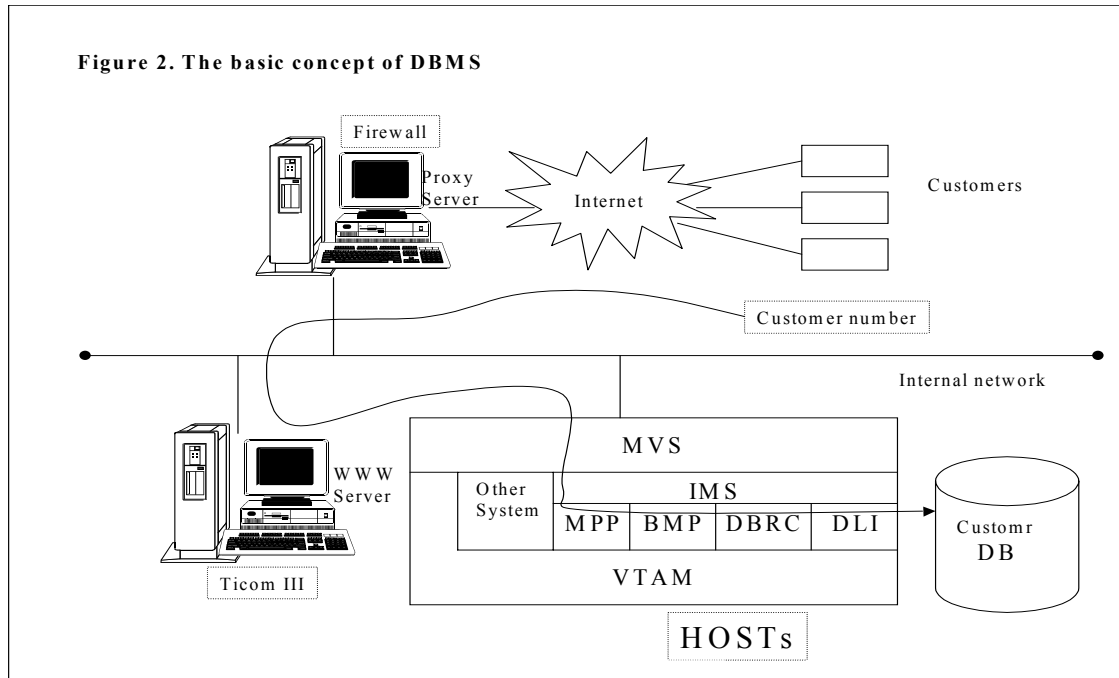
The cycle of e-business for electric utility service is a cycle of measuring, computing, billing, and paying on the web. On the Internet, customers can easily find out exactly how much energy they have used during a certain period by pointing their web browser to the electric utility company's web server. Also, customers can request information related to their usage of goods and obtain the results themselves. Moreover, customers can measure the amount of electricity used on their own meters and enter the result on the Internet. If the web and the consumer database are connected, both the amount of products used and the price per month are computed. In addition, the used amount and the computed price are updated after the customers approve the output. The systems offer the customers several convenient ways to pay the bill. Finally, the electric bill is paid as the customer chooses. The cycle of e-business is shown on figure 1.

Figure 1. Cycle of Electric trade

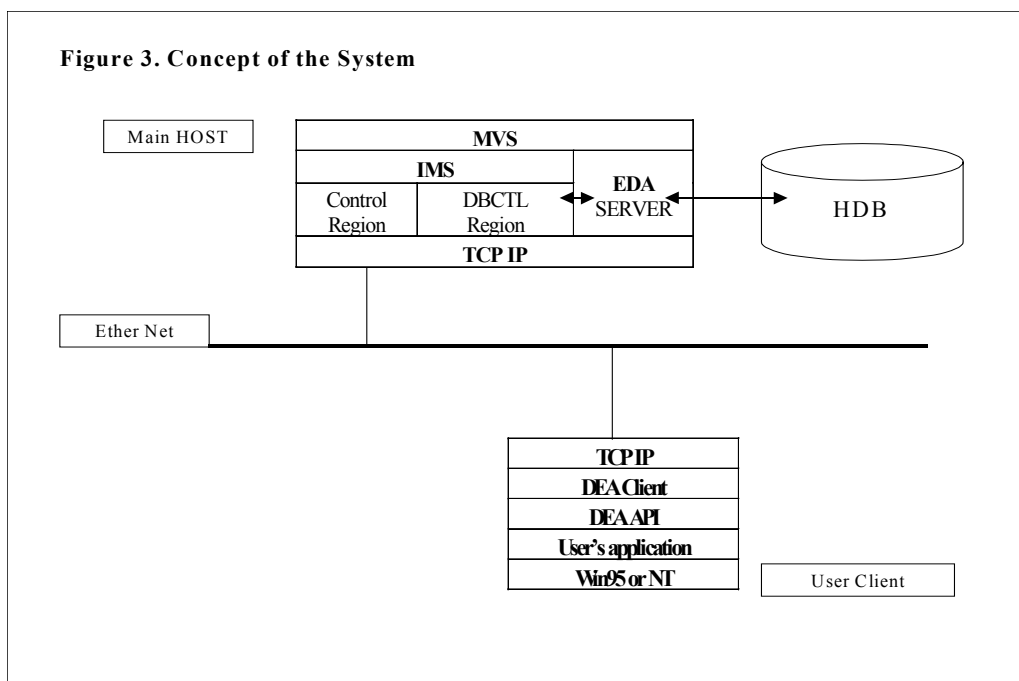


This study focuses on how to link business on the web to the existing customer DB. In order to enable users to look up stored data on the existing DB and manage a large quantity of the information efficiently, many researchers are currently attempting to develop the technologies of integrating the web and the existing DB systems. Client/server technology can smoothly connect multi-clients with multi-DB servers that are widely and locally distributed. As network technologies and web technologies have developed tremendously, the interests in both the client/server technology and the connection of multi-DBs follow increasingly. To integrate the web and the existing DB systems, this paper proposes a middleware systems which apply Enterprise Data Access (EDA)/SQL technology. Figure 2 shows how to integrate the web and the existing DB systems

Figure 2. The basic concept of DBMS



EDA/SQL is an enterprise middleware system handling mainframe as well as super-parallel servers. It supports client/server systems development. EDA/SQL allows end-users to use user-friendly applications software such as Microsoft Excel and Access. Also, EDA/SQL employs SQL, an industry standard, which enables multi-data access among DBs regardless of their DB architectures (relational or non-relational DB architecture). When users connect their private web browsers with the web server, the nature of the request is transmitted to the EDA client. EDA clients link to the EDA server and then call for the process from the EDA server to IMS. During the treatment of IMS DB, SQL commands should be used. Next, the result from IMS is returned to the EDA server again, to the EDA client, to the user's web server, and finally to the user's PC in reverse order. Client/Server systems shows on figure 3.



4. EMBODYING A PROTOTYPE OF E-BUSINESS FOR ELECTRICITY

The prototype concept of Electric Exchange System (EES) is proposed in this study. A system of e-business called Electric Exchange System is opened to enable authorized users to register. When an end-user registers as a customer, an electronic customer number called a PIN is provided. The customer can also register his own password and manage the account. At the same time, the customer's bank account or credit card number is also required for electronic payments. A mailing address and telephone number is requested to offer information about products including new services, complaints, or abnormal conditions which may occur later. A separate server, equipped with firewall and acting as an authorization server in the EES architecture, should operate the data process for customer registration.

After completing the authorization process successfully, customers can browser their personal information, historical records, detailed report on their current electric usage and bill payments. In addition, they can ask questions and request information including explanation of billing rates, terms of service, etc. If a customer's request comes through a web browser, the contents are moved to IMS via EDA/SQL. IMS settles the asking and returns the results to a separated screen of the EES.

When customers calculate their bill or settle their accounts due to regularly scheduled reading or moving, they can record the amount of electricity used and enter it through their web browser. Through this process, the types of reading errors are reflected in the program in advance. And the users can confirm the amount of the error if an invalid reading is recorded. When the user inputs the amount read, the customer enters only the value of each factor in accordance with the basic information. Then, the data necessary to calculate a bill is called from the customer database automatically by the EDA/SQL. Next, the amount actually used by the customer and the accompanying price are computed by pre-programmed formulas with data from the customer DB and the user entered data in the EES. Finally, the output is displayed on the

screen. The customers receive the detailed record on the current usage, and checks for the bill on the screen.

If the bill is correct and the customer would like to make a payment, it is possible for the user to make the payment on the screen. The master database is updated, accordingly. The customers prefer to not update the database. The result of processing is for the customer's reference only and avoids updating the database. When the customer makes the payment on the screen, the contents of the entire process are reserved and saved to another separated database. This process protects the customer and the company from incorrect transactions.

It is convenient for the customer to make from which screen displays the electronic payment, online billing, and automatic transfer. Customers have two ways to pay bills, either by choosing the previous way or by electronic payment. If electronic payment is chosen, the system is linked to an electronic payment system where the payment is completed by the electronic method the user chooses using a credit card or debit card.

5. CONCLUSION

If the proposed e-business system is used, the following contributions are expected to occur: first, less disputes and less customer inquiries will occur due to "exact billing" in accordance with the amount "actually used." Higher consumer confidence about electric bills will occur because customers will receive a detailed report on the current electricity usage which can be obtained at anytime through the web browser. Also, the customer may choose the payment method. Lastly, the customers may have additional discounts and value-added service available through company incentive programs.

The contribution to the electric utility firm will include (1) the company can reduce large amount of fixed costs such as the expenses of meter readings and mailing bills. As a result, improved management is expected in proportion to the increase in the customer's rate. (2) As the customer's data can be used immediately, the response time for management will be faster and information quality will be enhanced in terms of reliability. (3) The electronic payment results in better cash flow since the collection period is shorter, especially, since companies can often receive payment the same day via electronic transfer.

If a remote automatic measuring system is developed and linked to this system, the cycle of the electric trade, meter reading, bill delivery and bill payment may be completed totally by automation on the web. Consequently, the system will contribute to the innovation of management techniques.

Concerns to be expected when the system is used are imperfect computer access/internet access by customers and security which can be controlled with a strong security system. Also, the users can change their password. Fraud/wrong input data by customers is covered by a company's manual check-up once or twice a year.

The key factor in deciding whether the system is considered successful is to encourage more and more customers to use it. However, customers may avoid using the proposed e-business system for the following reasons: (1) the imperfect computer access/internet access, (2) uncertainty of the system and procedures on the web, and (3) complex steps to register and input the amount measured. Thus, incentives for customers are strongly suggested. The more informed customers are, the more they will participation in value-added service. Finally, the attempt to connect public sectors with private sectors in e-business has been examined.

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