

Automating The Small Purchase Solicitation Cycle for Non-EDI Trading Partners Using Internet Technologies

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Abstract

EDI has allowed procurement activities to set up trading partner relationships with EDI enabled vendors to expedite and simplify the procurement process. Automation of processes with non-EDI vendors still presents challenges that until recently have been almost insurmountable. In order to take best advantage of competition, the EDI enabled procurement shop still has a need to make public solicitations to allow small non-EDI businesses to bid on small purchase items. This paper presents a modular architecture that allows the trading partner relationship to occur with both EDI and non-EDI trading partners and leverages the EDI transaction sets that are available for procurement activities by marrying Internet concepts and technologies to existing EDI applications. The architecture automates the business processes with non-EDI vendors, freeing procurement personnel from the routine, repetitive task of keystroking vendor data.

Organizations which have many distributed procurement sites can handle their needs through publication of solicitations and publication of awards notices at a central location. The processing of all transactions still occurs at the local level, but non-EDI vendors have easy access to well known, public locations and are able to participate.

1. Introduction

Procurement activities in many large organizations are moving from a centralized authorization process to decentralized procurement authority as the organizational computing platform moves from the traditional, centralized, mainframe configurations to interconnected local and wide area networks. The organizational financial and accounting application programs that were created for the centralized mainframe environment still exist and are used as the backend processing for the changing environment. These backend processes are typically legacy systems that organizations are reluctant to move away from for cost and reliability considerations.

The legacy applications have well established requirements for management and maintenance. The skills needed to accomplish the mission are well known and the staffing requirements are fairly stable. It is in the best interests of organizations in this situation to attempt to leverage existing hardware, software, and personnel.

The typical computing configuration in large, distributed computing environments today consists of multiple personal computers (PCs) at each of the distributed sites. The sites themselves may be disbursed across wide geographic areas. The PCs are typically connected across a client-server network supporting TCP/IP connectivity. As applications are built on these TCP/IP networks, Intranets increasingly become a reality in the distributed environment. For the purpose of this discussion, a client-server network, supporting TCP/IP connectivity is assumed. The issues of this type of connectivity and the impacts of building and supporting the network are not within the scope of this paper. This architecture assumes that the network already exists and the architecture is built on top of that connectivity, leveraging the network itself.

In addition, organizations are increasingly connecting to their customers and trading partners across the Internet through the use of the TCP/IP protocols. As Internet connectivity approaches ubiquity in the business community, new concepts regarding performance of traditional business processes are evolving to make use of this new connectivity. This architecture puts forward such a new and innovative concept.

The advances made in World Wide Web (WWW) technology over the past year have made a general Internet solution possible for the procurement solicitation cycle for small procurements within a distributed computing environment. Internet concepts can now be applied in solving the security problems that are inherent in electronic commerce over the Internet. The state of both client and server technologies is such that workable solutions exist to build a procurement solicitation cycle architecture for small purchases on top of a full service, enterprise-wide Intranet (Forrester Research, 1996). Building the solution on a full service Intranet enhances the ability to support the application and will make the future transition from modem and faxed based transport mechanisms to router based transport simpler.

The architecture recognizes that traditional electronic data interchange (EDI) applications are very cost-effective and does not propose to replace these applications, but proposes to extend them. These traditional EDI applications are embellished, allowing the EDI user the capability to enhance the enterprise wide EDI applications and allow for the trading of information with non-EDI enabled trading partners as well.

This solution is unrestrictive and relies on tools that are developed using open standards. The architecture is extendible and allows for new technologies to be plugged into the design to replace or add to existing solutions.

The architecture is scalable and allows for the extension of the architecture from single site entities to large, multi-site conglomerations of entities by marrying the power of distributed computing with the security and ease of use provided by current and announced WWW (Web) technologies. By keeping the architecture modular, the different modules can be plugged in to suit the level of desired automation and the level of security required by the purchaser.

The scope of the paper covers small purchases, up to \$100,000 in value, matching the federal government's dollar value for its Simplified Acquisition Threshold as defined by the Federal Acquisition Streamlining Act of 1994 (General Services Administration, 1995).

The impact that this type of solution has on personnel and the way time is spent is considerable. Using Internet technologies to allow the automation of data input by customers and trading partners allows the personnel who are collecting and keystroking this information to accomplish other tasks that are not quite as routine and repetitive.

2. System Design for the Small Purchasing Internet Application

The entire design and the implementation of the prototypes for this architecture are documented as part of an unpublished thesis and reside in the Computer Science department at Southwest Texas State University (Copeland, 1996). For the purposes of this paper we would like to take a brief look at the overall architecture, focus more closely on a single aspect of the architecture and then see how this impacts personnel issues.

2.1 Design Rationale

The rationale behind the design is to fully automate the procurement life cycle on the purchasing side of the trading partnership. By using forms on a Web site, non-EDI trading partner inputs can be standardized into a format that can be used by existing applications. In the case where the Web application is made available as a service for fee to another organization, the forms can be mapped to an EDI translator and forwarded to the using organization in a standardized format.

2.2 Use of Credit Cards Increases Application Value

Providing the use of credit cards with the ordering modules further enhances the utility of the design. In today's world credit cards have revolutionized payment processing. By including credit card payment with the electronic order, the need to phone, fax, or mail the credit card information is no longer existent, adding to the utility of the architecture.

Much of the small purchasing that is done using EDI today takes place with businesses who make use of VANs. Using a VAN alleviates the cost of an EDI translator and removes the need for the maintenance of the EDI system. The small business can sign up with a VAN and the VAN works with the business to provide the mapping and translation services, as well as providing the business with a mailbox from which to send and retrieve the flat files that the business can use in the business environment.

In the just described environment credit cards are not used. The reason that credit cards are not used is because the information is not encrypted during transport (Copeland, 1996). Purchasers have no problem phoning or faxing a credit card number to a vendor. Phone and fax are generally viewed as being secure and the only people that see the credit card number and expiration date are the two principals. If one accepts the argument that modem to modem transport is just as safe from interception as voice or fax, one is still left with the fact that a third party is introduced into the transaction cycle when using a VAN. The VAN will necessarily receive and transmit the unencrypted credit card number and expiration date.

Two solutions exist to solve this problem: licensing agreements and encryption. Neither of these solutions is being employed today in the VAN environments. Licensing agreements, worded to protect the purchaser from misuse or compromise of the credit card number, is a simple solution. It does not add security but offers contractual recourse. Encryption of the transaction set or the portion of the transaction set that contains the credit card transaction is an even safer solution. This only works, however, when the cryptographic processes are moved from the VAN down to the actual trading partner. Neither of these solutions is in general use today. The encryption solution requires expensive proprietary software and/or hardware. The Van licensing agreement has generally not been employed.

2.3 Prospective System Architecture

This architecture spans the breadth of the procurement solicitation cycle for small purchases including publication of RFQs, submission of quotations, award selection, notification of awards with and without credit card information, purchase order acknowledgments, publication of award notices, order status inquiries and reporting, and receiving reports. The paper does not include invoice auditing. It is recognized that invoice auditing is performed by purchasing in some organizations, but technically, as explained by Dobler, Burt, and Lee (1990), invoice auditing is an accounting function. For the purposes of this paper the purchasing cycle is completed when the order has been received and the receiving report is submitted. The architecture does, however, include credit card payment at the time of the order which alleviates most of the requirements placed on the traditional accounting settlement process.

Inclusion of credit card payments in this architecture greatly increases the architecture's utility as it meets the needs of both the procurement and financial sides of the organization. The ability to pay at the time the order is placed alleviates the traditional need for invoices and the complicated accounting processes that are involved with settling the financial accounting needs that invoices bring. Making payment on all small purchases, from all vendors, both EDI enabled and non-EDI enabled, at the time of the order, helps to ease the resistance that is normal when moving from an old way of doing business to a new way.

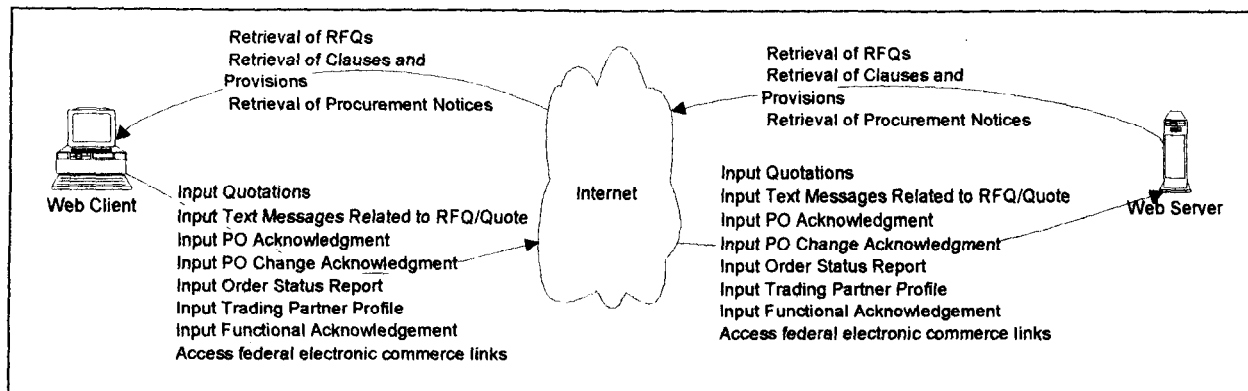


Figure 1 - Application Modules for Small Purchasing Solicitation Processes

3. Application Modules for Small Purchasing Solicitation Processes

The following application modules, related directly to business processes, are implemented in order to transact the small purchase solicitation cycle electronically with both EDI and non-EDI trading partners (Copeland, 1996). Existing EDI trading partners already have trading partner profiles and have connectivity issues resolved with the purchaser and are already doing business electronically. The Web site still affords utility to the EDI trading partner because there is a central location to view all public RFQs and there are easy forms for changing trading partner information. The Web application also allows new EDI trading partners to establish a profile electronically. The Web application is essential to the non-EDI trading partner because it may be the only place that public RFQs are posted by the purchaser. Figure 1 depicts the applications available for use at the RFQ Internet Site. The rationale is to automate all standard business processes. Even though the purchaser may not be able to convince every single potential vendor to use the automated process, if the application has enough utility for both the vendor and the purchaser, the application will sell itself.

Vendors who normally do business by phone and fax have to keep records of their telephone conversations and keep copies of their faxes even if they have an in-house business application running on a PC. If their applications do not communicate with their trading partners they are stuck with manual processes and administration of paper documents to support their transactions with their trading partners. This architecture will allow the non-EDI vendor to at least automate a portion of their transaction and reduce the paper filing and storage requirements that are typically incurred. Every time the vendor sends information to the purchaser by way of an electronic form on the Web site, an email message containing the data can be sent back to the vendor. This gives the vendor an electronic copy of the data that can be stored electronically, saving time and space. The email copy of the Web transaction also serves as a functional acknowledgment that the information was received by the purchaser. This kind of utility makes the application very attractive to paper oriented, phone and fax businesses.

Each of the modules identified in this section have representative EDI transaction sets defined in the American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12 standard. These are the transaction sets that are sent between the

EDI trading partners and also define the transaction sets that data input at the Web site are translated into when translation is needed. The transaction sets are defined and formats explained by the Data Interchange Standards Association (DISA, 1995).

3.1 Publication of Solicitations

RFQs are published by the purchaser to alert potential vendors of items that are open for bid. Widest possible broadcast of solicitations increases competition and allows the purchaser a better selection of bids to make awards from. The theory is that competition allows a wider bid pool for the selection process and that competition also drives prices downward.

“Public” RFQs, which are meant for widest dissemination, are posted on the Web site for the public to view. EDI trading partners who want to receive public RFQs electronically will receive them through the 840 transaction set.

In some instances the purchaser may issue an RFQ to a single or several identified vendors. RFQs which are targeted to specific vendors are sent to the vendor in the manner indicated in the trading partner profile.

Common clauses and provisions are referenced in the RFQs and posted on the Web site. The EDI vendor has the option of receiving these clauses and provisions in the form of a 504 transaction set.

3.2 Quotations

Quotations are the bids from the vendor back to the purchaser. Depending on complexities and required detail, free form text of some type may need to be exchanged between the trading partners to clarify or embellish information.

Non-EDI vendors enter their quotations and text messages through the Web site application. EDI vendors submit their data using the 843 and 864 transaction sets.

3.3 Awards Selection

Although agent technology is not within the scope of this paper, research and development is needed to offer an intelligent agent that can be employed to make purchasing decisions within

specified dollar limits and complexities. These agents will be able to compare quotes and select awards based on the same criteria currently used by purchasing offices. The competing quotes will be evaluated and the agent will decide which quotation is selected for each line item in the RFQ.

The agent must have the ability to factor in past vendor performance and pricing history. This data can be mapped directly from the appropriate database to the agent. In the case of the database services offered for fee to other EDI purchasers, the data can be translated into the 501 and 503 transaction sets.

3.4 Purchase Orders With and Without Credit Card Payment

Once the selections have been made the awards are transmitted using the information trading partner criteria that was defined at the time of vendor registration (EDI, fax, email). The awards module generates a separate award for each vendor that is awarded one or more line items from a specific RFQ. This module also allows for change information to be submitted for changes to previously issued purchase orders. The EDI vendor receives the purchase order through the use of the 850 transaction set and the purchase order change request through the use of the 860 transaction set.

Delivery orders are purchase orders issued off of existing contracts. In practice, delivery orders generated from a contract in place are much more common than purchase orders generated from an RFQ process. Many procurement activities are now requiring that all purchasing contracts that are awarded include EDI capabilities.

The purchase/delivery order allows for inclusion of credit card information. Security is not generally required for point to point transfer of data. When the transfer is not point to point security is required. This issue is important enough that it is dealt with in a separate module.

3.5 Publication of Awards Notices

Generally the publication of award notices is a business process that alerts all interested parties of the dollar amounts and numbers of items purchased when an award is made. Since the widest possible dissemination encourages competition and benefits the purchaser through lower prices for like products, publication of the award notices on the Internet Web site benefits the purchaser.

All awards including amounts and prices are published on the Internet site for viewing by the public. EDI vendors have the option of receiving award notices through the 836 transaction set.

3.6 Purchase Order Acknowledgment

Acknowledgment of the purchase order, as defined here, is broader in scope than a simple functional acknowledgment that data was received in a useable format. The purchase order acknowledgment includes shipping information and alleviates the need for a shipping notice.

Non-EDI vendors are required to send the purchase order acknowledgment and the purchase order change acknowledgment by entering the data into a form on the Web site. EDI vendors send

the purchase order acknowledgment by way of the 855 transaction set and the purchase order change acknowledgment by way of the 865 transaction set.

3.7 Order Status

During the normal course of business the purchaser may want to follow up on an order that has been placed but not yet received. Non-EDI trading partners are required to answer status inquiries through the Internet site. In this event the status inquiry would be sent to the vendor by the normal means of trading information. The reply is through the use of a form on the Internet site. The EDI trading partners use the 869 transaction set to send an order status inquiry and the 870 transaction set for the order status report.

3.8 Receiving Report

The warehouse or other recipient of the shipment fills out the receiving report to complete the purchasing cycle. Normally this is accomplished by accessing an existing financial application package through the Web browser on the enterprise Intranet. The data is then stored in a database for use by the accounting function for its settlements process. The 861 transaction set exists for the receiving report to be transmitted using EDI.

3.9 Dataflows for the Application Modules

The dataflows for the modules described are depicted in Figure 2 below.

Besides the data storage and query capabilities afforded by the use of the database, additional utility comes into play when maintenance of the Web application is considered. Automating the maintenance of the Web application without the database requires new formatting and new programming every time data changes on the Website. For this Web application updates are a daily occurrence as new RFQs are issued daily. However, if the data is dynamically fed to the Web application from a database, then little maintenance is required on the Web site itself, the maintenance will occur at the database. If backend applications feed the database, maintenance is minimized.

4. A Closer Look at a Labor Intensive Part of Small Purchasing

One of the most time consuming and labor intensive processes of typical procurement activities is the need to key in data that is provided from the vendors doing business with the procurement activities. A typical case in point is the U. S. Department of Veterans Affairs (VA), which has 300,000 vendors that sell items to its 178 purchasing activities (VA hospitals, VA regional benefits offices, and VA national cemeteries). Of those 300,000 vendors only 201 are EDI enabled. This leaves 299,799 non-EDI vendors who sell goods and services to the VA. These 299,799 vendors do business with the VA by means of telephone, fax machine, traditional mail, electronic mail, and over the counter selling. When an RFQ is posted, these vendors submit their bids in all of the above manners. Each of these methods of submitting a bid require manual efforts on the part of VA to record and store the information.

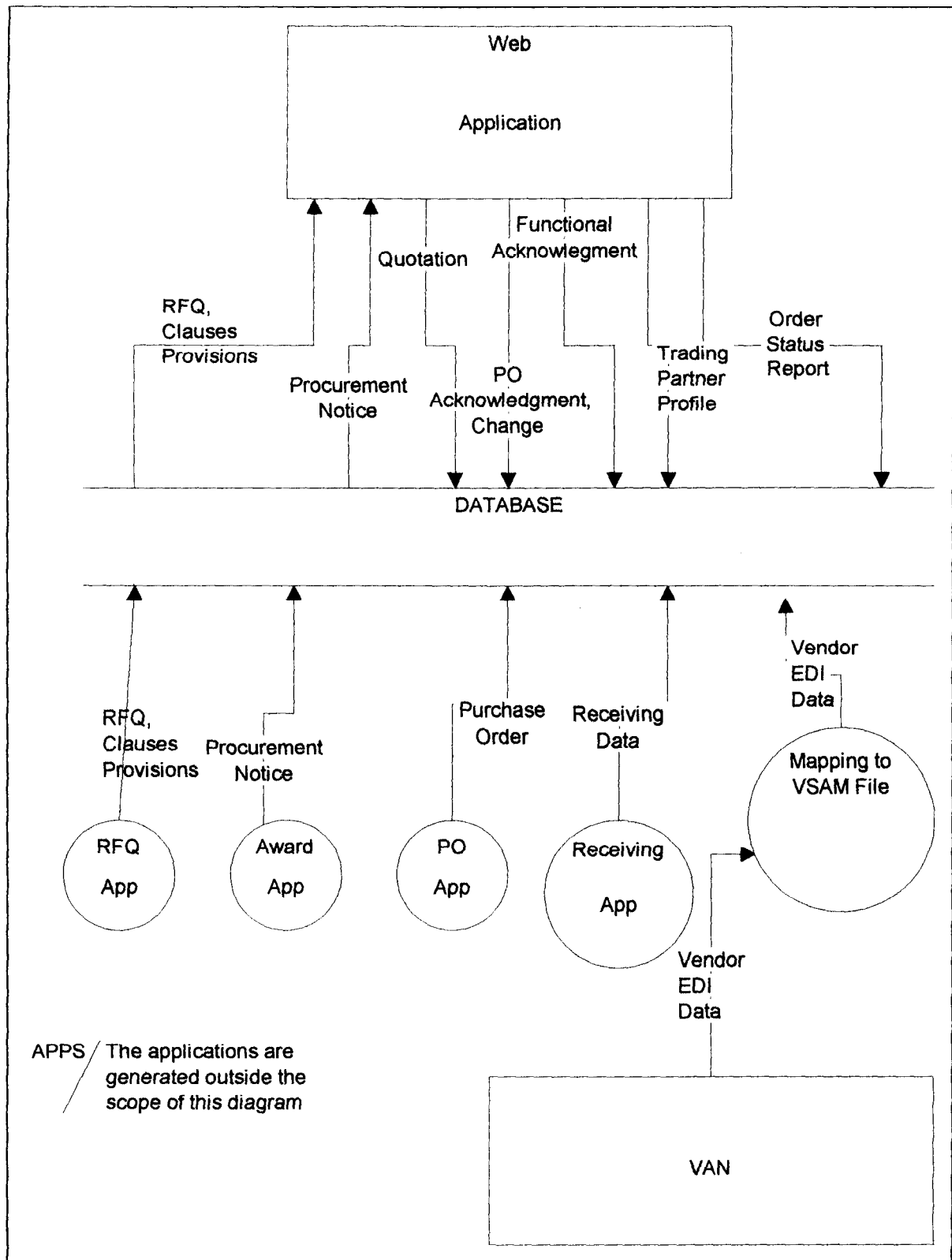


Figure 2 - Data Flows for Small Purchasing Solicitation Cycle Applications

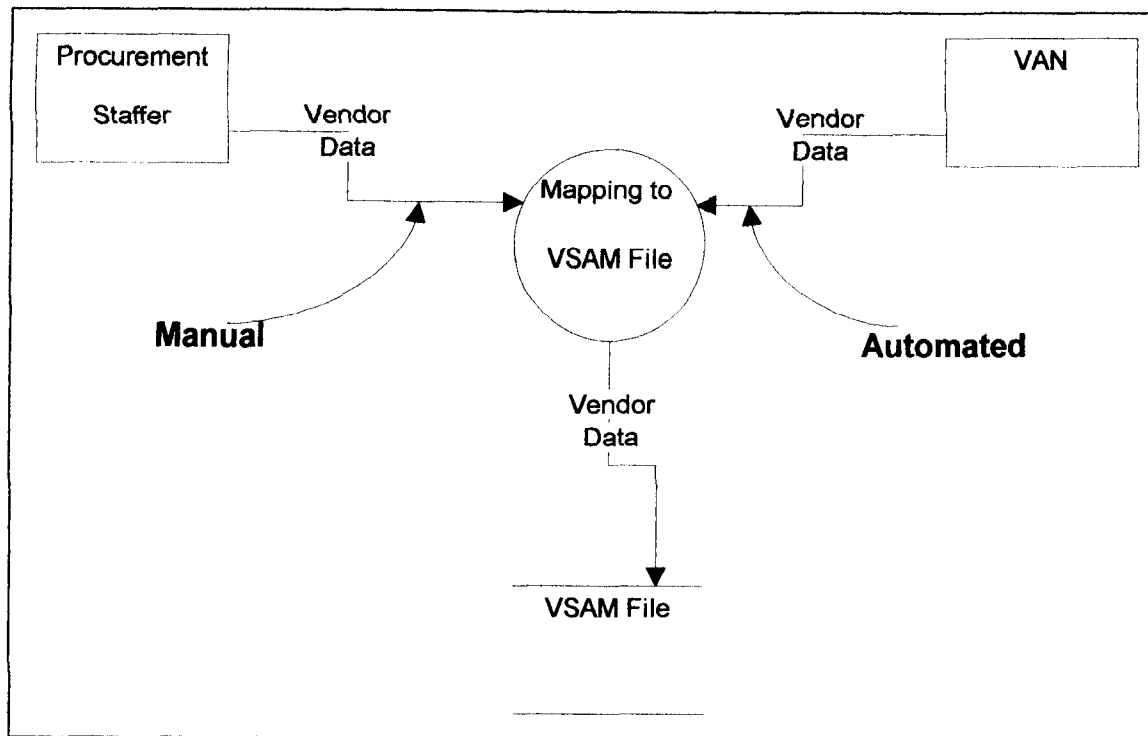


Figure 3 - Dataflow Prior to the Introduction of the Web Application

All procurement activities keep vendor information. Typically a data process is needed to keep track of vendor information, enabling the procurement activity to keep an active list of vendors and stored data about the vendor. By storing the data, the procurement activity does not need to obtain vendor profile information each time a transaction takes place. The data is normally entered into the system by the procurement activity by keystroking the data elements onto a computer system. Of course, when the vendor information changes, a manual process is usually involved with the vendor providing the information to the procurement activity and then the procurement activity manually keystroking the data into their computer systems to provide the update.

Backend systems already exist for EDI vendors to electronically send EDI transaction sets to record or upgrade their trading partner profiles. Using Internet technologies, these processes can also handle the non-EDI data if this data is formatted properly and mapped to the process. Using a Web browser, a vendor can access a Web application and enter his own data and trading partner profile. With proper security and access authority, the same vendor could maintain his own trading partner profile, making updates as changes occur. Using the same Web application, the vendor has the capability to send all of its vendor data to the procurement activity electronically, whether it be profile information, bids, or purchase order acknowledgments. This data, once received, can then be mapped directly into existing applications.

4.1 Database Requirements for Trading Partner Profiles

For trading partner profiles, a relational database management system will do nicely. The dataflow diagrams, figures 3 above and figure 4 below, depict a typical flow of data for an existing EDI

IBM mainframe system before and after the introduction of the Web application.

As can be seen in figure 3 the procurement staffer has to manually input data received from non-EDI vendors. In figure 4, below the addition of the Web application and the database add to the utility of the existing applications while automating the input of the data from all sources.

5. Personnel Issues

The concepts presented allow the procurement activity the opportunity to leverage existing backend applications while automating inputs into the backend applications from all trading partners, both EDI and non-EDI enabled. The impact this has on the procurement personnel is considerable. At the same time these concepts increase the value of existing skills of the information systems (IS) staff because it leverages the applications those personnel support rather than replacing the applications they support.

For an organization to have EDI capabilities in a distributed environment, a set of skills is already evident. Additional knowledge required by information systems personnel to take advantage of the suggested architecture includes the ability to create and maintain a Web application. This in itself is not a trivial task and the marketplace is filled with books and courses that will teach the new wave of Web developers the HTML formatting, Java programming, and Webmastering skills that are required to create and maintain Web applications. As the tools to accomplish these tasks become more sophisticated, maintenance of these Web applications will be reduced to maintenance of the database that feed them data.

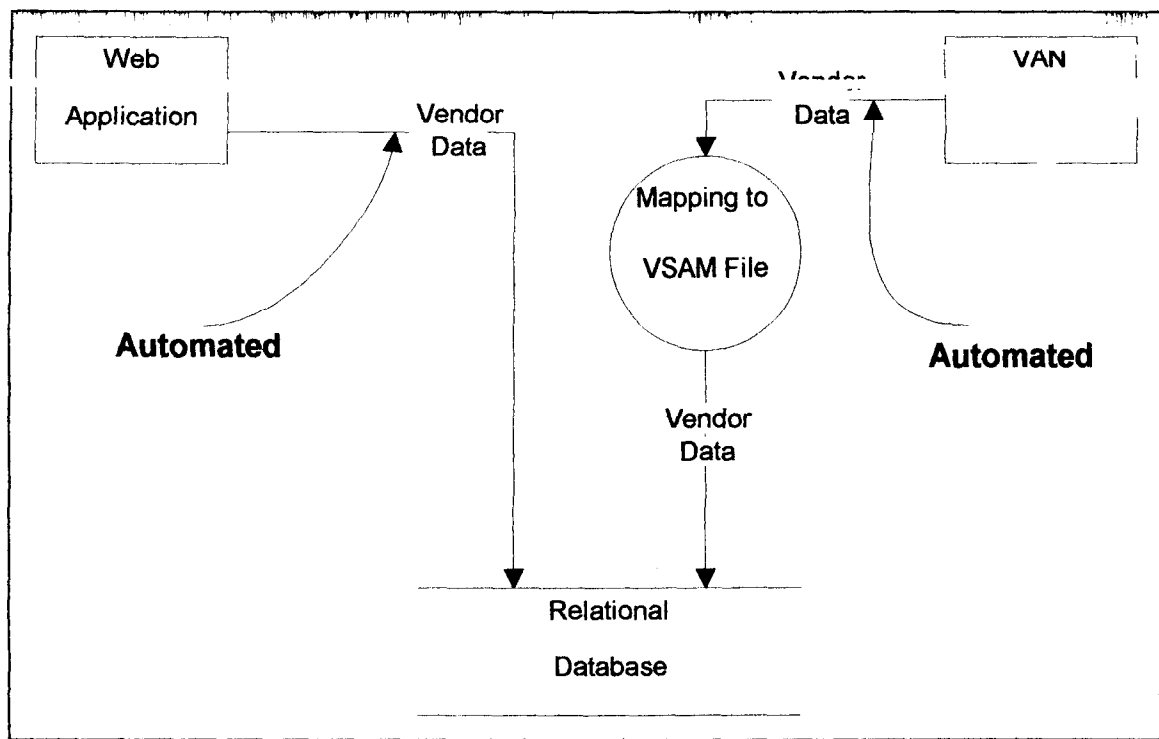


Figure 4 - Dataflow After the Implementation of the Web Application

The legacy skills that were in existence prior to this architecture are still needed. The backend applications do not change, new interfaces are added. The legacy applications are still created and maintained as they always have been. If anything this architecture leverages these skill sets and leverages the applications developed and maintained by these personnel.

Where the major shift in skills comes into play is the on the procurement side of the organization. Employee slots that have been required to collect, keystroke, and maintain vendor data can now be applied to the business of obtaining contracts and prices for goods and services, better serving the organization. It becomes a win-win situation for both the IS and the procurement sides of the organization as the Web skills mastered by the IS staff to enable the architecture are applied to many other areas of the organization.

6. Conclusions

In the narrow view, the architecture described in this paper allows an entity to marry Internet technologies with current EDI business systems to allow for the publication of public RFQs and the processing of bids and purchase orders that arise from these publications. Using this architecture, EDI enabled purchasers are able to leverage their existing systems and include non-EDI enabled businesses in their automated processes as well. This architecture allows procurement activities to automate all business processes with both EDI and non-EDI vendors.

In the broader view, even though the architecture described in this paper is related to small purchasing activities, the utility of the concepts is much broader than the use presented in this specific implementation. Across the spectrum of organizations, regardless of the type of activity the organizations engage in, data is routinely created by an external entity and then manually entered into the

using organization's computer systems. This same data is maintained by the using organization's personnel. In many cases data could be entered into the organizational computing systems by mapping data captured on a form on a Web site directly into using applications and databases. The actual keystroking of this information is only done one time, by the external entity who creates the data. The maintenance of the data can, in many cases, also be handled by the external entity, particularly in cases where the external entity has the need to change the data.

The skills needed to acquire basic Website development can be obtained through books and commercial courses. These training opportunities are, however, generally narrow in scope and only cover one activity. Universities should be encouraged to teach and possibly expand their roles in providing networking and graphical user interface courses at both the undergraduate and graduate levels. It is apparent that when the Internet moves into the realm of business to business processing, these technical skills will be even more in demand than they are today. It would be useful to both industry and the graduates themselves if computer science graduates routinely had this expertise.

References

- Copeland, K. W. (1996). Streamlining procurement through electronic commerce: An internet approach for small purchases. Unpublished master's thesis, Southwest Texas State University, San Marcos, Texas.
- Data Interchange Standards Association (1995, December). Electronic data interchange X12 standards: draft version 3 release 6. Alexandria, VA: Author.

Dobler, D. W., Burt, D. N. & Lee, L., Jr. (1990). Purchasing and materials management: Text and cases (5th ed.). New York: McGraw-Hill.

Forrester Research (1996, March 1). The full service intranet. The Forrester Report: Network Strategy Service (Volume Ten, Number Four), [Online] 13 pages. Available HTTP: http://www.forrester.com/hp_mar96nsr.htm [1996, June 26].

General Services Administration (1995, July 3). Simplified acquisition procedures. [Online] 23 pages. Available HTTP: <http://www.gsa.gov/far/90-34/html/13.html> [1996, July 15].