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E-PROCUREMENT FRAMEWORK FOR SHIPPING

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ABSTRACT

The existing procurement process in shipping is paper-based and labor-intensive. Looking to cut costs and improve delivery times, while simultaneously enabling companies to take a more strategic approach to their jobs, an e-procurement framework is proposed to automate and streamline its procurement process by bringing it online. In this paper we present an intranet Web-based electronic procurement infrastructure. The shipping organizational process requirements was fully analyzed and evaluated. The ships as end-users were provided with access to the application taking into account the existing communication cost and restrictions. The logical Architecture is presented including the schema of the databases, the catalog management, the workflow of the purchase order plus the end-users interaction with the procurement system through Web browser. Then the physical architecture is described when security, load simulation and several well known technologies are applied. In all step the shipping environment and its specific characteristics are fully assessed. The application in its pilot implementation (marine engines spare parts procurement) shows that is scaleable, has a supplier integration strategy that met the shipping company's core requirement, is relatively eas y to install, configure and use and can be integrated with ERP.

Introduction

Procurement encompasses all activities involved in obtaining material and services and managing their inflow into a shipping organization toward the ship. Purchasing, which is the central act in the procurement, can be divided into three step: information, negotiation, and settlement.
- Information. The shipping company identify its needs and evaluate potential sources to fulfill them, gathering information about market conditions, products, and sellers.
- Negotiation. Individual business partners start to interact with each other and determine prices and availability of goods and services as well as delivery terms. Successful negotiations are usually finalized with a contract
- Settlement. The terms of the contracts are carried out and goods and services are transferred in exchange for money or other forms of compensation.

Procurement processes in shipping can take many different forms but generally we distinguish between three categories

- Procurement of raw material and production goods, is usually characterized by large quantities, high frequencies, and important and unique specifications: just in time delivery (JIT) is often critical
- Procurement of maintenance, repair, and operating supplies is usually characterized by low unit cost and low volume, but relatively high frequency; examples include consumables for a ship's engine.
- Procurement of capital goods dealing with goods of high value at low frequency or procuring items outside the regular purchasing process, often because of convenience of speed requirements.

A shipping organization is mainly emphasized the two last categories when the Information Technology plays a very important role and gives rise to new markets which may, at least in shorter run, have largest impact on maintenance, repair and operating supplies. The Internet has some characteristics that make it a very powerful influence on the business world as well as the maritime sector[1]. Those characteristics are
- Ubiquity and connectivity. The number of Internet and WWW users is growing steadily, resulting to a very flexible and powerful method for organizations to connect with business partners and to access information electronically.
- Interactivity. All internet technologies facilitate instant interactivity, especially when compared with traditional communication media, such as paper documents, and electronic systems like EDI.
- Multimedia. The new technologies supports the information exchange in various formats from graphics and texts to sounds and video clips, thus enabling the transmission of very complex information
- Human interface. The open standard architecture helps to overcome the limits of proprietary and closed systems and exchange across different performance capabilities. The Web browser also is mainly user friendly.

A Web/Internet based procurement must have all the potential to support all aspects of procurement such as:
- Search engines to help users find items using keywords supporting the information phase, in particular to find new sources or to fulfill unexpected requirements.
- Internet based catalogs allow maritime organizations to browse, search and place orders on-line . they combine the rich content of printed catalogs, the convenience of on-line shopping and the sophisticated searching capability of CD-ROM catalogs

- Internet bases EDI links can be less costly than the traditional leased lines and value added services regarding network access and data transmission.
- A growing number of on-line auctions and bidding systems supports the negotiation phase by providing negotiation mechanisms.
- The strongest developments in Internet-based procurement are probably happens in the area of procurement of repair, maintenance and operation supplies, where many organizations are trying to be the first to present viable business models and software. So the pure systems beyond the pure transaction processing to add workflow elements and made possible for procurement to let end users do individual purchases, while maintaining control over the process.

Development methodology

The main problem that software developers have to deal with is to understand the context of the procedure that is to be automated. It is commonly accepted that the best way to extract accurate information about the characteristics of the system under development is the intensive personal communication between the end-user and the development team. In the case of the shipping e-procurement system there were held numerous interviews and special workshops in order to understand the current business policies and perform the capturing of the user requirements at the premises of both the end-users and the technical partners. The system aims at designing and implementing a e-procurement framework that will relate a core transaction area with major impact on the efficiency (and cost) of shipping operations, the procurement. In the system a certain methodological approach is needed not only for deriving the requirements, but also a methodology for requirements management.

The requirements definition and analysis of e-procurement framework is based on an iterative approach that consists of five phases that will be repeated until the requirements are met.[2]. These phases along with their interactions are as following:

- Logical view : This is the first and most important phase of the development. Here, the software developers of the system are guided by specialists of the shipping procurement process. In order to clarify all the aspects of the procurement process, the software developers or analysts, identify who are the users and stakeholders of the system. The completion of this phase a business model is created in order to describe the procurement process.
- Use cases scenarios: Based on the interviews as well as on the business model a number of use cases that covers the procurement process in great extent is produced. Some of these use cases, are further analysed in subcases in order to allow the system analyst to have a thorough understanding on the procurement process. As soon as the analyst manages to describe all the use cases that the users need, then is precisely defined what the procurement system is to do.

- Development view: The major effort in capturing requirements is to develop an initial model of the procurement system by employing the already defined use cases. There are two kinds of requirements that need to be captured the functional and the non-functional ones. The functional requirements are normally structured as use cases , while the non-functional requirements derive from specific system properties, such as environmental or implementation requirements, performance etc. Furthermore, some initial thoughts about the user interface are made. By the end of this procedure a list of candidate requirements is produced. We have to mention though, that since the requirements might be updated (normally regarding minor changes) the updates have to be done in a controlled way. This is achieved iteratively, where the number of requirement updates changes decreases as we get further into the construction phase and thus the requirements are stabilized.
- Process view: Using the information gathered so far, a list of design ideas and a first system concept is produced. At this stage a peer review is useful so that if necessary some changes take place. These changes take place iteratively until the production of a final shipping procurement system.
- Physical view : This is the final phase of the systems development. Here, procurement experts along with engineers evaluate the system in order to estimate the degree in which the fulfils its primary goal. If the system fails in some aspects, then the problems have to be detected and fixed, using again the iteration process.
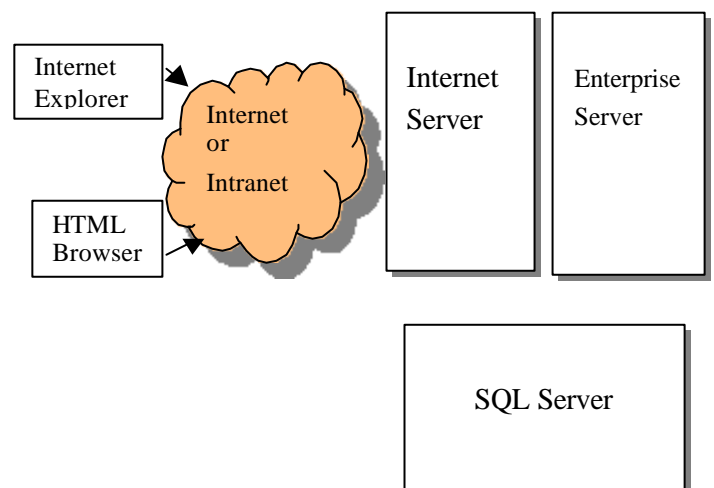

Figure 1: Logical Architecture of e-procurement framework

E-procurement framework description

Using the methodology described in the previous section and taking into account the e-procurement development for other enterprises of different sectors the e-procerement framework was derived. As can be seen the system consists of three

servers namely the Internet server the Enterprise server and an SQL server. The database SQL server maintains all transactions, profile and catalog index data . The schema contains tables of several entities such as user, supplier, catalog item, routing rule, order, and report. Outside the SQL server database there is a file structure where purchase order attachments and rich content information such as pictures are stored.

The Internet server has components such are active server pages, VBScript and JScript capabilities in order to facilitate the end-user interaction with the procurement function. On the other hand the Enterprise server supports Business objects, workflow, Messaging, Catalog Management, Enterprise management and Report generation.

All end-users interact with the procurement system through Web browsers. Users with Internet Explorer can view Active Server pages using ActiveX components. Users with other browsers can view the HTML version of the application. In all the e-procurement workflow an existing Lotus Notes desktop used. Once a service is requested the system perform the following actions.

- Displays the user interface
- Controls navigation through the procurement process
- Manages the interactions between both the client and server side business objects and the database.

All users start the procurement session through default active page which prompts for user name and password, then starts the session. After querying the database for user information, it sets session variables, and determines the user's browser type and version. Next another Active Server Page is opened according to the browser type and version (ActiveX or HTML). It creates a frame set at the highest level of the browser interface, and houses scripts used throughout the application. Five categories of active server pages always displayed: catalog, shopping basket, orders, reports and preferences. When one of them is selected, the functionality available on any given page depends on the user's authorized role. When a user submits a requisition, e-procurement systems routes it to the appropriate approver via e-mail. Once all approvals are received, purchase order are transmitted. Available transmission methods include hardcopy, e-mail, fax and EDI like message.

The one of the most critical components of the e-procurement framework the catalog management. The errors created by the old, manual paper-based process would be dramatically reduced, and eliminated. The main requirements of this catalog management are

- Users access product information without going to the Internet
- Users find products without knowing the supplier
- Accommodation of all suppliers, regardless of size of technical sophistication
- Suppliers not required to buy new technology in order to do business with the company
- The system allows for the adoption of new catalog maintenance methodologies
- Easy catalog maintenance

To allow access to product information without going to Internet, the cross-supplier catalog is situated on a trusted intranet protected by a firewall. This permits quick, secure access to the information required for decision making. The search procedure incorporates user search by partial or complete part numbers, keywords, suppliers or manufacturers. Additionally, any of these keys can be combined to refine the search. The suppliers can populate the catalog by three ways namely: manual(i.e. basic data entry), import (standard ASCII format), dynamic.

The configuration of the system can be done using a Graphical User Interface created in Visual Basic which allows to the administrator to:

- Configure the user interface
- Create and maintain user profiles
- Create and maintain supplier profiles
- Populate and maintain enterprise information, such as accounting codes, etc.
- Add, change and delete business rules and approval workflow

All the messages are formatted using an OAGIS compliant message set, with messages formatted as XML. There is also a reporting system implemented in the e-procurement with the following reports on the average money expenditure per transaction per supplier on the average expenses per transaction, the average number of line items per transaction per supplier and an average number of line items, the order processing time from the submission of request to approval and transmission to the supplier, categorized by commodity.

A very important issue of physical architecture is security. Users must provide an ID and password to gain access to the network and the application. E-procurement user profile indicate functional, access-level authorization. Each user can be authorized as *requisitioner* able to create and submit requisitions and receive against their own orders, *approver* able to approve orders, *receiver* able to receive orders , *buyer* able to manage catalog.

Conclusions

In this paper an e-procurement framework was presented. The main development steps were presented together with a brief description technical description of an e-procurement system in a shipping environment. Its pilot application for spare parts of a marine engine, in spite the existing infrastructure problems shows that the system is scalable, has a potential supplier integration strategy that met the shipping company's core requirement, is relatively easy to install, configure and use ands can be integrated with existing sytems.

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