FAST - A Research Project in Electronic Commerce

FAST is a research project in electronic commerce at the University of Southern California's Information Sciences Institute. It is funded by the Advanced Research Projects Agency (ARPA) in Washington, D.C.. The work on FAST involves both the creation of an EDI-based prototype parts broker and the operation of an actual procurement service utilizing the prototype broker. FAST's intention is not so much to create a new distribution channel for participating vendors as to create a procurement tool for customers. The FAST project is therefore unusual among EDI efforts in that it looks at procurement from the customer's/buyer's perspective.

FAST's procurement service invites customers to request quotes and place orders via EDI (using FAST's proprietary format or X12/EDIFACT). FAST acquires

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and returns (via EDI) competing quotes from multiple online vendors. When ordered, merchandise is drop shipped to FAST's customers and FAST is invoiced for the goods. FAST pays the vendor and invoices the customer. The broker currently serves about 120 registered customer accounts and has acquired off-the-shelf parts from more than 2'000 suppliers. To date, FAST has delivered more than 30'000 quotes and sold over 13'000 line items worth more than $5 million. Over the last few years, the commodities supplied by the broker have been expanded from electronic items to practically any type of off-the-shelf item. FAST is unusual among EDI efforts in that it looks at procurement from the customer's/buyer's perspective. It concentrates on automating the total procurement process while recognizing that human intervention cannot be fully excluded from the process. As a result, much attention is currently focussed on how to efficiently integrate the manual and automated components involved in the total process.

FAST Broker - Business Approach

The original motivation behind the FAST project was to explore, in an actual electronic brokerage setting, the issues involved in automating the total procurement process. This motivation sets FAST apart from most contemporary electronic commerce efforts that focus on the use of electronic bulletin boards. The main purpose of bulletin board approaches is to act as an information bridge between customers and suppliers. FAST, in contrast, is a value-added parts broker. It takes the responsibility for actively finding sources for its customers' quote requests, places orders on behalf of its customers, handles change orders and expediting and performs real-time accounting for its customers. FAST initially chose electronic components as its procurement commodity, because an electronic parts broker was regarded as key to promoting fast prototyping of new computer architectures and electronic systems. In addition, it was expected to be easy to find an EDI-capable customer community for the chosen commodity. The availability of the MOSIS fabrication service at USC/ISI (an electronic silicon broker) pointed FAST to an email-literate, potential customer base with a need for standard electronic parts. When assessing availability of EDI-capable transaction partners on the vendor side, FAST was surprised to find that most electronics vendors were not using standard EDI (X12/EDIFACT) with their customers. Instead, most larger distributors used proprietary software ("inplant terminals") that allowed larger customers access via modem to the vendors' on-site inventory databases. Therefore FAST decided to redefine its original X12/EDIFACT communications criteria and interact with the vendor community via multiple channels (see below). This support for heterogeneity has since grown to be one of FAST's special and unique strengths.

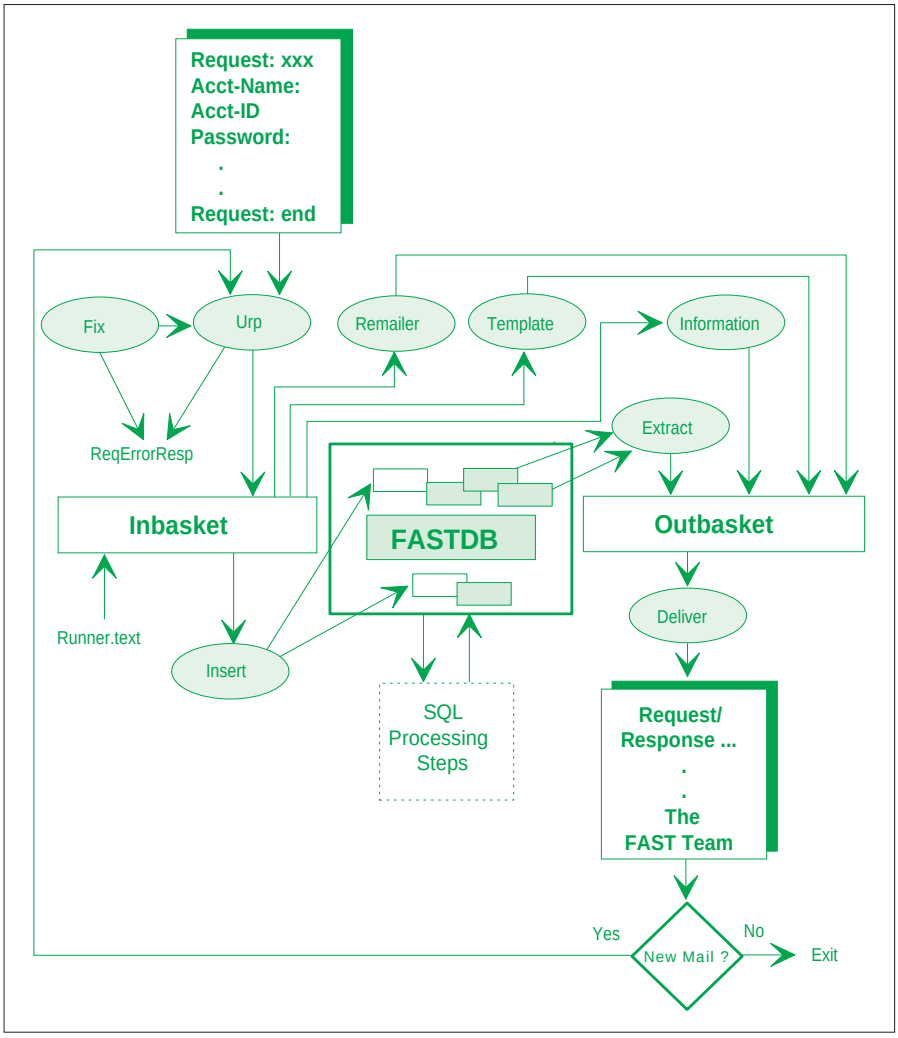

Figure 1: Automated processing in FAST - "brain.csh"

Technical Approach

FAST's exploration of electronic commerce issues was intended from the beginning to be highly empirical. This required actual brokering with real customers and vendors as early as possible. The basic design guidelines underlying the architecture of the FAST broker's system software therefore called for an open, modular and extensible procurement system. An open system can interact with and be built up of components from different sources. A modular system allows its individual components to be replaced by different implementations without disturbing the overall functioning of the system. An extensible system can have new functions added to it without disturbing previ-

ous functions or use of the system. To achieve the goals above, the broker was implemented as a relational database (Oracle on a Unix Sun server) with a uniform EDI interface to the external world. For further modularity and extensibility, the broker was designed with a user-friendly forms interface. It supports FAST's operators for all processing in the manual phase of each module and for manual error processing and recovery in the automated phase.

Automated Processing

EDI messages sent to the broker wake up FAST's main processing loop ("brain.csh"), itself designed as open, modular and extensible (see Figure 1). The messages are parsed by custom software ("urp") and inserted ("insert") into the database where they are flagged for further action. If a message is incomplete or incorrectly formatted, the software will reject it ("Remailer") or send it to a "Fix"-module, where operators can manually correct it. Simple information requests or requests for transaction templates are parsed immediately and the resulting response messages are queued for delivery. Following message insertion, 'brain.csh' takes action on information already in the database. These actions, based on various status values of the database items, include part identification, sourcing, creation of vendor quote requests, verification of vendor quotes and quote evaluation. Finally, "brain.csh" creates and sends outgoing messages to FAST's transaction partners (through "extract" and "deliver").

Communication with FAST

Figure 2 illustrates the uniform EDI interface (email) between the broker and FAST's different intermediaries to the external world and the diversity of communications protocols used between those intermediaries and FAST's transaction partners. Since all early customers had access to the Internet and used standard ASCII text editors and mail handlers, FAST's database structure was modelled on FAST's proprietary template format rather than on general X12/EDIFACT syntax/semantics. A simple keyword-value ASCII-text template was created for each transaction type (information request, rfq, order, quote-and-order etc.) and made available to potential customers via email. As X12/EDIFACT is becoming more prevalent, FAST will have an X12/EDIFACT-structured database supporting either of the two EDI standards. In addition to more "traditional" translators between a proprietary format and X12, Figure 2 illustrates other kinds of bridges between the broker and its vendor community. "Appscan" is used in FAST's automated inplant terminal lookups to simulate an operator's manual interactions with various external vendor databases. "Appscan" is a program that allows a programmer to define interactions with target applications in an external script. This script specifies high-level events which can occur in the application and actions to take when these events occur. For example, an email message containing a vendor quote request triggers "Appscan" to perform its query. The output of the remote database query is then automatically returned to the broker via email, parsed and inserted into the database. For vendors without on-line capability, FAST sends an email message to its online faxserver which automatically generates a fax to the referenced vendor.

Status of FAST's Automation

FAST's relational database contains detailed information about all customers and vendors and their up-to-date account status, a composite linecard that represents all online vendors and a complete procurement history that is auditable at the line item level. FAST does not keep information about parts (with the exception of information in its own procurement history) in its relational database. Instead, FAST initiates remote lookups to external parts databases (commercial and government) that are maintained by third parties, thus eliminating FAST´s need to maintain large bodies of parts data. Since many of these databases assume a human , interactive interface, FAST's "Appscan" program has been extensively applied to handling these queries. For a small subset of transactions, the process is *fully automated*. A quote request which references a part number that can be fully identified via local or remote database lookup and that can be sourced via automated lookup in FAST's composite linecard will be automatically sent to all vendors identified through the sourcing process. If the vendors are capable of returning the quotes to FAST via EDI, the quotes are automatically parsed and inserted into the database, compiled into one response message and sent back to the customer via EDI. A larger subset of transactions is *semi-automated*. Often, the sourcing process is automatic (i.e. the software finds vendors through the automated linecard lookup), but the automated part number verification might not succeed. Here, FAST's operators will manually intervene (via FAST's forms interface) and pursue the parts identification via manual use of online tools. They might, for example, retrieve and manually scan logfiles produced by "Appscan" or initiate further queries (via email) to remote databases. These queries might focus on information other than the part numbers (i.e. parametric search). Once the part number has been verified, the request for processing resumes along its automated path. If an incoming quote response from an EDI vendor cannot be automatically parsed by FAST (perhaps due to the existence of a human readable remark in the message), the vendor response will be looked upon as semi-automated. If the linecard search has failed, the operator has to resort to querying remote databases (often via email) to find vendor(s) for a requested item. This process, called Computer Aided Manual Processing, often leads to a new vendor being added to FAST's database, requiring the operator to perform all the steps necessary to add a new vendor to the service.

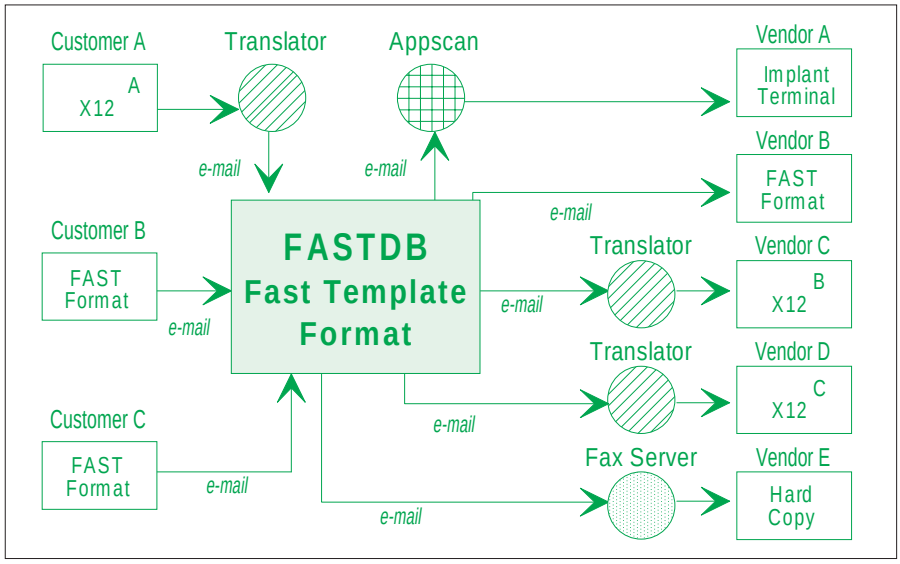

Figure 2: Message formats used in FAST

Lessons Learned

Operating an online electronic brokerage service for six years has taught the FAST project a set of useful lessons. First, for improved automation of the re-

quest-for-quote process, we need access to much more sophisticated parts databases. For example, in the commercial sector, no attempts have yet been made at standardizing the names and definitions of commodities (for US government buys this has been done with Federal Supply Classes). Without a standard nomenclature, any attempt at combining different vendors' linecards into a composite linecard is going to be idiosyncratic and of use only to transaction partners with access to that nomenclature.

Second, there will always be a need for human operators in an EDI-based procurement service. For a truly useful service of that kind, there should be help available for suggesting substitute parts where the original parts are out of stock or obsolete, and to help with part number identification in general. Though access to good parts databases can automate great parts of that problem solving, many tasks will still require human intelligence.

Third, without a seamless connection between in-house MIS systems and EDI software, most transaction partners are going to grow dissatisfied with EDI. Having to re-key information into a set of different software packages (standard or proprietary) for communication with several partners was NOT the idea behind EDI. It is, however, all too common.

Last, judging from the interest in and satisfaction with our brokerage service, we believe that there is a genuine need for such a service.

Future Directions

The lessons learned have led us to a current research and development agenda with two thrusts: automation environments for internal operations and software for electronic partnerships.

With respect to FAST's *internal operations*, we mentioned earlier that FAST focuses on the efficient integration of the manual and automated components in the operating environment. Some of the FAST researchers have developed a package for other ISI projects, called Scenarios/Agendas. It provides mechanisms for defining triggering events that require human intervention, for planning sequences of tasks to be performed by humans and/or the computer, for collecting and displaying tasks related to an activity, and for collecting and displaying activities in agendas of work to be done. FAST plans to implement Scenarios/Agendas in its operating environment in the near future.

With respect to *software for electronic partnerships*, FAST plans to create an "Environment Configuration Library" that will provide a library of data structures, specialized tools, and linking software to allow developers to rapidly compose an interface processor for a site entering into electronic partnerships with others. It will provide aids to help developers make selections from the library appropriate to their needs, and to help them combine the selections with their preexisting software for maximum overall interoperability of the system components at their site. As for FAST's business future, we hope to be able to increase its business volume during the next three years. An increased transaction intensity will test the system's robustness and efficiency and, we hope, demonstrate the feasibility of our electronic brokering concept.

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Electronic Agricultural Auctions in the United Kingdom

Electronic auctions are increasingly presenting an alternative to traditional auctions for agricultural, forestry and fishery products in the United Kingdom. This article describes the United Kingdom's leading electronic agricultural auction house, Electronic Auction Systems (Europe) Limited.

In a study of twelve small- and medium-sized enterprises in the Scottish economy, exemplary applications of telematics and, in particular, the business use derived from such services were examined [1]. One of the companies was Electronic Auction Systems (Europe) Limited (EASE). EASE was founded in April 1989 as a wholly owned subsidiary of the United Kingdom's largest co-operative auction group, Aberdeen & Northern Marts Limited, and, as its trading name suggests, the company seeks to introduce information technologies and telecommunications into the auction process.

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Electronic Auction Systems (Europe) Limited

EASE is based in Thainstone, a small town near Aberdeen in the northeast of Scotland. The main reason for the choice of this location was the proximity to its parent company. However, EASE could have been located virtually anywhere in the United Kingdom. There were two principal factors behind the creation of EASE. The parent company firstly wanted to gain experience in the application of new technologies, and secondly wanted to expand its trading area geographically. EASE employs a full-time general manager and a part-time marketing manager. In addition, the company has access to the clerical and computing staff of the parent company. It also has ten franchise partners who run the regional centres. During the first year of operation, EASE recorded a loss of over £ 200'000 which was largely due to the high capital costs incurred in installing the computer system that forms the backbone of the company's operations. While the company is still trading at a loss, this has been substantially reduced (less than £35'000 in the most recently published accounts).

EASE's Electronic Auction System

The company runs an electronic auction system, which is accessible anywhere in the United Kingdom and is used for the sale of livestock, particularly cattle, sheep and pigs, and grain. The company plans to handle a larger number of products in the future, including fish, timber and hides, and is considering expanding its activities into other European countries.

Electronic auctions are held several times a day Mondays to Fridays, and the process is as follows: Suppliers of agricultural products, in most cases the farmers themselves, contact their local EASE franchise holder. There are ten franchisees, located throughout Scotland and England. EASE chose the franchise system to defray the high capital costs of the computer installations over several partners. Information about the products for sale is fed into IBM compatible PCs or terminals at the local franchise office and sent to the company in Thainstone, using British Telecom's (BT) Global Network Service (GNS). At Thainstone it is stored on a Digital Equipment Corporation (DEC) VAX server. This information, including the actual geographical location of the sellers, is made available electronically to potential buyers several hours prior to the auction in the form of an electronic catalogue. In contrast to the sellers, who have access to the electronic auction system only through the regional franchises, the buyers have direct access to the system, using their own PCs and modem links. This is shown graphically in Figure 1. The electronic auctions themselves are very similar to the traditional