

EBXML REGISTRY/REPOSITORY IMPLEMENTATION IN THE AGRI-FOOD INDUSTRY

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Abstract

ebXML (Electronic Business that uses eXtensible Markup Language), sponsored by UN/CEFACT and OASIS, is a modular suite of specifications that enables enterprises to conduct business over the Internet. Researchers from around the world are working towards an implementation of those specifications into electronic business software products. In their mission ebXML partners state that Small and Medium Sized Enterprises (SMEs) need an affordable, integrated set of tools to support integration of their supply chains and to take advantage of the new ways of doing business in the e-business environment

This paper presents a registry/repository information model and a registry services interface. The format of documents stored in the repository is based on the eXtensible Markup Language (XML) standard, which allows keeping any type of business data but is not limited to XML documents and schemas. The practical purpose of the research presented in this paper is the use of ebXML specifications for implementation of the electronic business XML (ebXML) registry/repository model for the purpose of the agri-food industry. A large amount of development has been already done in the area of the implementation of registry/repository ebXML specifications through the ebxmlrr project. This research is going to implement ebXML specifications with the help of ebxmlrr software for the discovery and harmonisation of terms for the agri-food sector. The research also plans to use ebxmlrr registry/repository for the exchange of business electronic artefacts for automation of transaction processing in agri-food industry in Ireland. Ebxmlrr already offers itself a storage system implemented in the form of web services for such meta objects as organisations' details, classifications' instances, services' descriptions, extrinsic objects etc. Finally the software should allow agri-food companies to prepare and view documents for various business activities, e.g. quotations, purchase orders, and invoices in a procurement process. It should communicate with the ebXML registry to load, save and administer XML-based electronic documents and

components for business documents preparation. Although the research plans to conclude in September 2003, some working parts of the designed system are already finished and can be presented in a working stage.

Keywords

ebxml, e-commerce, registry, repository

INTRODUCTION

When in 1997 the team responsible for the development of XML created new standard, nobody could predict how XML would dominate Internet technology. XML is five years old (W3C Recommendation 10-February-1998), but since its beginning it has been an attention grabber, and over last few years the IT world has witnessed a set of initiatives that has been based on XML format and are particularly important for supply chain integration:

- electronic business XML – ebXML,
- Web Services with such specifications as:
 - Simple Object Access Protocol (SOAP),
 - Universal Description, Discovery and Integration (UDDI) and
 - Web Services Description Language (WSDL).

The IT world has welcomed the development of the first industry wide spectrum product:

- BizTalk server from Microsoft, based on BizTalk framework.
- Also RosettaNet, whose purpose from the beginning was to integrate the high-technology industry, started to work with the standards allowing cooperation with other industries.

The good news for the supply chain manager is that there are a lot of initiatives established to address the limitations of Electronic Data Interchange (EDI). The bad news is that there are too many of them – and most of them are an incomplete solution. The supply chain manager should answer the question if his company wants to use Microsoft's BizTalk or Open Buying on the Internet (OBI). There is RosettaNet, Open Application Group (OAG) XML, cXML, XCBL, and at least fifty other XML standards and specification. There are also electronic marketplaces and exchanges. The IT world has been talking a lot about Web Services in recent months. The truth is that there are a lot of very good initiatives promoted by various vendors and associations but there are only two frameworks that have wide support, are completely open, address most of the limitations of EDI, and are created by international standards organisations. One of those frameworks is ebXML – a collection of standards, which together provide a framework for scalable e-business collaborations. The second are Web Services.

ELECTRONIC DATA INTERCHANGE

Several years ago many companies recognised that they needed one industry wide accepted EDI standard. The most important standard for cross-organisational data interchange was

created by the United Nations by development of the UN/EDIFACT (electronic data interchange for administration, commerce, and transport). Some companies started to move from national or industry oriented EDI standards to global standards.

EDI weaknesses

Computerisation of collaborative business processes has been confirmed to enhance the competitive advantage of participating enterprises. However, computerization to date has been limited to a few key high volume-trading interactions between large companies. These connections have typically been built using EDI or other competing and non-interoperable e-business standards. Although EDI has been successful for long time some key limitations have prevented a more widespread adoption :

- Weak semantics - EDI is a standard for message syntax but not for message semantics. EDI describes the composition of a message but not its content.
- Not extensible – electronic documents frequently need to be extended to suit particular industries. EDI in contrast to XML, represents a positional syntax standard. Elements are defined according to their position in the document rather than by labels.
- No process – transmission of a particular document is merely part of a bigger collaborative process. Unfortunately, EDI does not offer a framework to describe and handle standard processes.
- No registry – in order to trade electronically with company B, enterprise A needs to know some information about B (e.g. which document format to use, where to send it, how to send it, which processes does B support, etc.). Enterprise A need to maintain all this information about B in the EDI subsystem. Unfortunately EDI does not offer any framework for registry services.
- Proprietary messaging – A business document needs to be transported to its destination using some kind of electronic messaging protocol. EDI uses proprietary VANs (Value Added Networks) to manage the physical delivery of documents.

All these limitations mean that integration of supply chains using EDI is un-scalable. A supply chain manager who is developing a new integration strategy must understand these limitations and look for solutions to minimise integration costs.

BARRIERS PREVENTING BUSINESS-TO-BUSINESS E-COMMERCE IN AGRI-FOOD

There are several business-to-business transactions that can be distinguished as potential target for automation in agri-food industry. A review of research into e-commerce and e-business in agri-food industry gives the impression that those potential transactions are buying, selling, trading, delivering and contracting (Shapiro & Varian 1999). There are also several e-business models defined as catalogs, auctions, exchanges communities (Thompson et al. 2000) ready to be used in agri-food industry.

All the models already provide some kind of electronic business-to-business transactions. The analysis of several e-business agri-food websites shows that some e-business transactions, for example electronic invoicing or payments, are already available on agribusines and food web portals.

There are general barriers cited by businesses to adopt Internet-based e-commerce practices, for example unclear return on investments, lack of stakeholder support or too complicated technology (Sachs 2000). However there are three particular, dominant factors that influence the development of e-commerce in agri-food industry (Leroux et al. 2001):

- Industry structure
- Product complexity
- High-touch nature of transactions

Industry structure

For the last ten years, the consolidation of businesses is changing the traditional relationships between partners in their supply chains. Progressing consolidations in agribusiness will influence business-to-business e-commerce in two ways. Firstly consolidation should reduce the need for electronic integration of presently fragmented marketplaces and secondly it should create barriers to the development of the transparent electronic marketplaces.

New technologies offer a great opportunity to create collaborative portals consisting of several fragmented marketplaces that can operate with lower costs and in a more effective way (Pool 2001). The consolidation in agri-food industry is taking place by the concentration of numerous diverse segments constituting this market. Many of authors discuss the increased consolidation that can be observed at different levels of agri-food industry value chains e.g. consolidation in: seed and chemical suppliers, grain handling, meat packing and processing, food processing, food processing and retailing. It is predictable that the large players will drive development of business-to-business e-commerce transactions forward to reduce their transactions and production costs and reach bigger markets. But large companies are also quite reluctant to build common agri-food e-commerce environment so any new player could join. Very extensive studies consisting of 300 interviews in 80 companies and organisations carried out in United States, Canada, Europe and Asia prove that the barriers to e-commerce adoption usually were: inadequate internal evaluation process and information technology staff, employees uncomfortable with change, budget priorities, internal conflicts, lack of partners or capital, and lack of understanding or willingness at the top (Kanter 2001).

The second aspect of consolidation, the establishment of virtual marketplaces, regardless of the potential benefits, brings a threat of greater price transparency. In agri-food sector that results in lower willingness of enterprises to participate in business-to-business e-commerce. By controlling large markets, the major, consolidated agri-food sector players can claim higher margins. With price transparency provided by e-commerce solution, margins have to be cut to keep the existing market share. Regardless of other savings provided by e-commerce solutions this can drive profits and market share of dominant players down.

Product complexity

Agri-food products can be characterised by increasing level of complexity of products being delivered to the final customers. Increasing complexity originates from two different sources: traditional and user-driven.

The first factor driving product complexity, originates in the development of universal prices references for commodities. The particular transaction of an agri-food commodity is a very complex, based on difference in location, period of shipment and actual quality of delivered

product. Agri-food products are only partly uniform and it is rather hard to standardise all their attributes for electronic transactions. The same two products, produced within a couple of days of each other may have dramatic difference in price. The electronic description of such discrepancies is rather hard to achieve.

End-users are drivers for the next factor preventing e-commerce in agri-food. Consumers force makers to produce healthier, convenient and more flavoursome foods. This kind of complexity also progressed due to development of trait-specific products valuable to processors along the value chain (Leroux et al. 2001). Both of those drivers form a need for agri-food products seclusion inside of their value channels. In the past, the agri-food sector addressed to complexity requirements by vertical integration of the supply chains backwards. There are several reasons for agri-food companies to form more integrated supply chains; for example integration enables capturing profits through ownership, reduces risk, lowers costs, assures adequate inputs or markets and responds faster to changing consumer demands.

The two types of the product complexity in agri-food sector form opportunities and threats for the business-to-business e-commerce. Businesses are in the process of testing various solutions that presently slow down the whole progression of the adoption of the e-commerce in the sector. Various solutions may be appropriate for different types of activities carried out by agri-food companies and it is highly improbable that there will be ever one solution adjusted to everybody. That may slow the whole process of adoption of e-commerce procedures in sector.

High-touch nature of transactions

The last factor influencing implementation of business-to-business e-commerce practices in agri-food industry is the high-touch nature of agri-food transactions. Agri-food industry transactions, as for example obtaining credit for production, coordination of transport, purchasing of the technology, or selling final products, are heavily based on personal contact and are characterised by one-to-one relationships. Detailed studies indicated that agri-food companies recognised personal relationships as very difficult to be recreated over the Internet (Boehlje et al. 2000).

Agri-food business partners have to recognise the role of Internet in their industry. E-commerce in agri-food sector is an innovation that must go through extended adoption curve (Leroux et al. 2001). Success of e-commerce in agriculture cannot be predicted, and the factor of high-touch relationships can heavily influence business-to-business e-commerce implementation.

ELECTRONIC BUSINESS XML – EBXML

Standardisation consortia believe that the new frameworks will allow companies to migrate from rigid systems, based on local network EDI to more flexible and user-friendly eXtensible Mark-up Language formats. The ebXML specification is built on three concepts, which are believed to become the key factors of its success namely:

- The infrastructure should provide data communication interoperability,
- Semantics framework should enable commercial interoperability

- Adopted mechanism should allow organisation to search for a partners

ebXML has become the global electronic business specification, that defines a framework for global electronic business. The ebXML initiative has been sponsored by United Nations Center For Trade Facilitation And Electronic Business established in Geneva and OASIS Organization for the Advancement of Structured Information Standards from US and their purpose has been the definition of a framework for global electronic business that can allow businesses to find partners and conduct business through exploitation of well-defined XML messages.

There are following ebXML standards :

- **Process standards** – ebXML provides a language for describing business processes called ebXML-BPSS (Business Process Specification Schema). A trading partner describes his business process capabilities using BPSS and the result is called a CPP (Collaboration Protocol Profile). Two trading partners may have different CPPs and the overlap of the two defines joint collaborative capability. This agreement between two trading partners is called a CPA.
- **Registry based** – ebXML provides a central registry where trading partners can publish their profiles. A profile includes; names & identifiers (“white pages”), categorisation – geographic and by good/service (“yellow pages”), and finally the electronic capability in the form of CPPs (“green pages”). The relevant standards are ebXML-RIM (registry information model) and ebXML-RSS (registry service specification).
- **Strong semantics** – ebXML provides a solid framework for common understanding of the meaning of message content. This framework is called ebXML-CC (“Core Components”). A core component is a syntax neutral description of a data element such as for example an address.
- **Open messaging** – ebXML provides a messaging framework for the secure and reliable delivery of business documents over the Internet. The messaging standard is called ebXML-MS (“message service”).

Overview of ebXML based system

There are three key phases that a company performs to enable business transactions with other companies using ebXML specification (Irani 2001):

- Implementation Phase,
- Discovery of Partner Information and Negotiation Phase,
- Transaction Phase.

Implementation Phase (Zaremba et al. 2002)

The central point of every ebXML-based system is the repository. The repository contains industry specific Business Processes and Scenarios, which in most cases can be adapted to most of the businesses transactions. Businesses can directly apply these processes and scenarios or extend them to adapt to specific conditions in the organisation. The repository also includes a record of each company. It is necessary for each company to register in order to carry out electronic transactions with other business partners.

There are three steps required to complete the implementation phase of adopting ebXML-based system in the company:

- Requesting information from the repository,
- Implementing the ebXML System in the company,
- Publishing the company's own Business Profile.

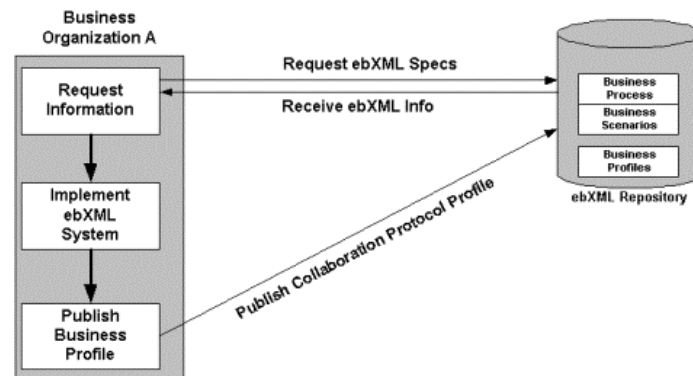


Figure 1. Implementation phase(Irani 2001)

The company requests the ebXML Specs such as Business Processes and Business Scenarios through the Internet (see figure 1). After understanding the downloaded standards the supply chain managers have to decide which business processes will be adopted to cooperate with other partners. They also have to decide if the company will implement the completely new system or if the new system will be built on top of the legacy software. When such systems are already in operation, the company needs to publish its profile known as Collaboration Protocol Profile (CPP). Again the company connects to the repository and uploads its CPP there. This CPP can be updated at any time. The CPP describes, in ebXML specification, the profile of the company e.g. the messages exchanged and transport mechanism for them, business processes supported in the company, security issues etc. The CPP becomes a widely accessible source of information about the business the company performs and allows other organisations to search and access this data.

Discovery of Partner Information and Negotiation Phase (Zaremba et al. 2002)

Organisations can search through the repository and find the most suitable partner with whom to perform business (see figure 2). The company retrieves CPP and in this way finds the information of the prospective partner. The profile includes information on, which business processes are supported in the company, the messages to exchange and transport mechanisms or security – all the valuable information required to conduct business.

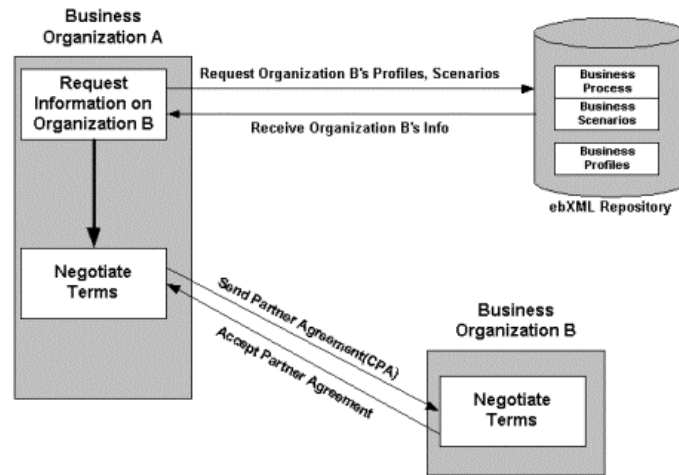


Figure 2. Discovery of Partner Information and Negotiation Phase (Irani 2001)

The specific issues of new contracts have to be negotiated among managers from both companies very often through personal meetings. The ebXML specification also addresses that problem by implementing Collaborative Program Agreement (CPA), which is the reflection of the CPP of both companies. The CPA has to meet the businesses needs of both organisations to conduct business over the Internet.

Transaction Phase (Zaremba et al. 2002)

The final phase is simply the phase of conducting the every day business by using ebXML standard messages (see figure 3). Both companies agreed to the CPA, and each of the organisations plays the predefined role.

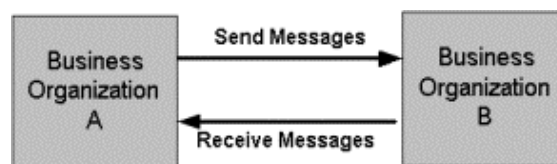


Figure 3. Transaction phase (Irani 2001)

In that way the ebXML specification implemented in both companies leads to initiating new business over the Internet.

EBXML REGISTRY/REPOSITORY (EBXMLRR)

The goal of the ebxmlrr project has been to deliver a functionally complete reference implementation for the OASIS ebXML registry specification. The registry/repository is available through Source Forge portal as an open-source project, released under an Apache style open source license that permits free use of the source and binaries. Both the registry and client software are the results of an international collaboration with developers from around the world. ebxmlrr is already a powerful and flexible registry and repository

implementation based upon a generic and extensible information model. The registry is a way of storing meta information about entries in the repository. Any type of data can be stored in the repository including:

- Web Service descriptions,
- XML data and documents,
- Binary data (such as images, sound files, video data, executable application files, CAD files, etc.).

Using the registry, this data can be searched and classified using advanced and ad hoc query mechanisms such as

- XML filter query,
- SQL query.

The OASIS ebXML Registry/Repository standard enables to implement registries that can be deployed as

- Public registry,
- Private registry used within an organization,
- Shared Registry by an organization and its partners.

The ebxmlrr client software provides user interface for graphically visualizing registry content. It is based on the Java API for XML Registries (JAXR). JAXR provides a single standard Java API that allows Java programmers to interact with standards for XML Registries including both ebXML Registry and UDDI .

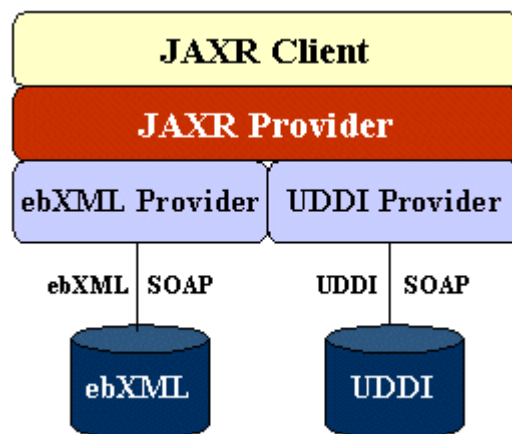


Figure 4. High-level architecture of JAXR

A Web service must be first published over the Internet in a manner that provides the ability to discover it by interested organisations. A company needs to upload a service description (WSDL document) to an Internet-based registry, which defines procedures for service descriptions storing and for service discovery through search-built engines. The ebXML architecture defines a Collaboration Protocol Profile (CPP) for the purpose of service publication and discovery. A CPP uses an XML format and allows an organisation to express both the business collaborations in which they are able to engage and the kind of processes and messages they can support in delivering that service. A CPP provides the description of the capabilities of an organisation, from both a technological and a business point of view. Uploading the document to an ebXML global registry publishes a CPP. The ebXML and

UDDI registry services can complement one another and it is possible that in a future UDDI will be used to discover services published through UDDI registries but will be also able to explore ebXML registries to discover ebXML compliant services.

The client software uses the Java API for XML Messaging ('JAXM') in order to send SOAP based messages between the client software and the registry. These SOAP messages are used to send requests to the OASIS ebXML Registry and to receive responses from the registry.

ebXML Registries

ebXML registry can store information for current and future use. When used with a repository, which in fact stores the referenced objects, an ebXML registry provides methods for finding organisations, CPPs, components, Business Process Specifications, classification schemes, and even software or other objects. Once Java Web Start downloads the software, a window opens to reveal the main registry browser (see figure 5).

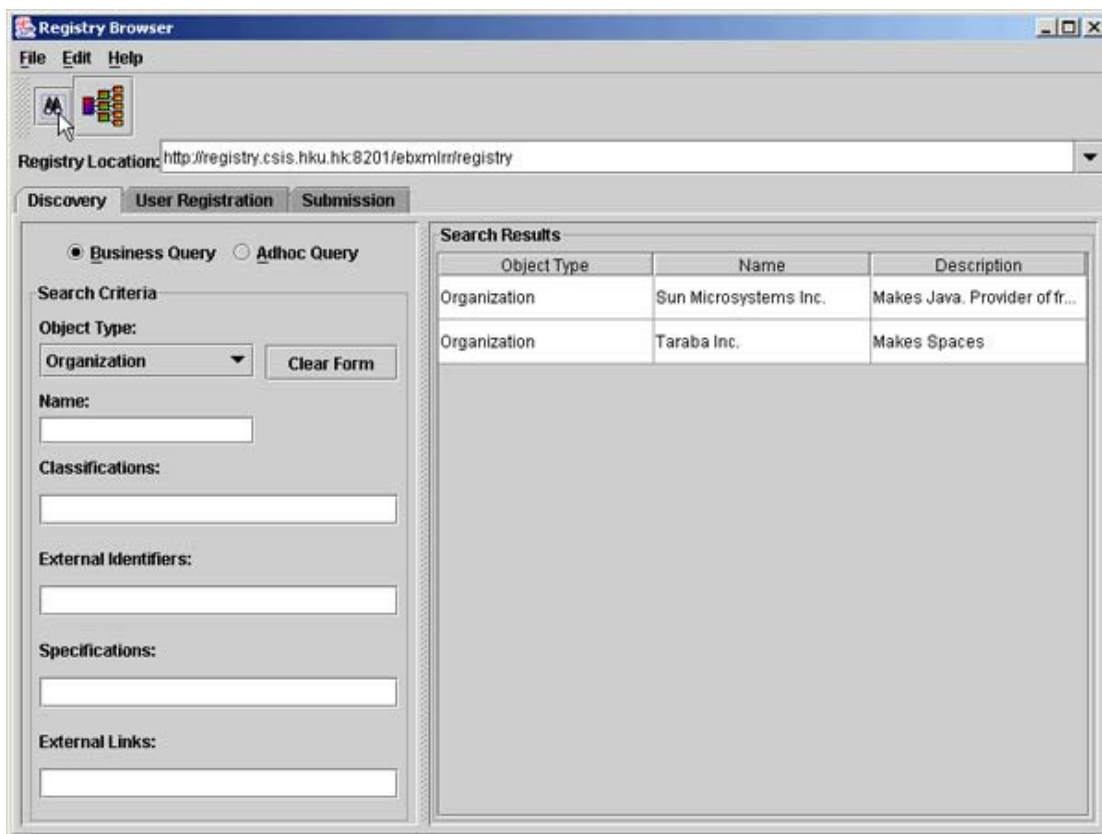


Figure 5. ebxmlrr browser

When the specific parameters are entered, the browser shows all the appropriate information in the registry.

CONCLUSION

In a further study the researchers plan to implement ebXML specifications with the help of ebxmlrr software for the discovery and harmonisation of terms for the agri-food sector. This

research will use ebxmlrr registry/repository for the exchange of business electronic artefacts for automation of transaction processing in the agri-food industry in Ireland. ebxmlrr already offers itself a storage system implemented in the form of Web Services for such meta objects as organisations' details, classifications' instances, services' descriptions, extrinsic objects etc. This research uses links to the EU funded projects such as Smartisan (IST-2000-26267) and Aforo (IST-2001-37258) to exemplify the adaptation of general-purpose registry/repository software for the agri-food industry. Finally the software will allow agri-food companies to prepare and view documents for various business activities, e.g. quotations, purchase orders, and invoices in a procurement process. It should communicate with the ebXML registry to load, save and manage XML-based business documents and components for business documents preparation.

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