From Theory to Reality
Using the papiNet XML Standards

A Case Study by Stora Enso North America

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Appreciation
The leadership and sponsoring organizations of papiNet would like to express their gratitude to Stora Enso North America for their initiative and hard work in the preparation and creation of this case study. The lead individuals in the development of the case study at Stora Enso were Palmi Moller, Director of IT/e-Commerce, and Kevin Shibilski, XML Project Leader. This project would not have been possible without their dedication and commitment.

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About papiNet
The purpose of papiNet is to develop, maintain, and support the implementation of global electronic business transaction standards for parties engaged in the buying, selling and distribution of paper and forest products. The aim is to improve the reach and richness of communication throughout the supply chain, increase efficiencies in transactions, and to support interoperability among trading partners. The papiNet standards are open and freely available. Critical mass is achieved by involving key players globally and across the supply chain. Approximately 50 customers, producers, and technology firms from Europe and North America are involved in initiatives to test and adopt the papiNet standard. Feel free to contact the associations operating papiNet NA: the American Forest and Paper Association (Sara Freund at (202) 463-2450 or sara_freund@afandpa.org) and IDEAlliance—formerly GCA (David Steinhardt at (703) 837-1066 or dsteinhardt@idealliance.org). Learn more at www.papinet.org.

Table of Contents

Introduction

This white paper discusses Stora Enso North America's implementation of the Extensible Markup Language (XML) using the papiNet XML standard. It will outline the thought process for the decisions that were made leading up to final implementation. The history of the implementation is followed from the initial proof-of-concept through to the production-level implementation. During this journey Stora Enso facilitated the development of a new document standard, playing an important part in promoting the global acceptance of this standard.

There are many ways to implement XML and the software in this environment. The software selected was based on how well it fit the environment at Stora Enso, the options available at the time and how Stora Enso wanted to utilize its resources.

Background

Stora Enso North America, formerly Consolidated Papers Inc., places great importance on the quality and innovation that go into engineering its products. Accompanying this is a determined customer service support network that pays attention to detail and whose theme is, "The customer is always right." A part of the customer service formula is a dedication to providing Electronic Data Interchange (EDI) service to customers who request it. This dedication to customer service resulted in Consolidated Papers growing to Fortune 500 status and its stature as a North American leader in coated paper. This also made Consolidated Papers and its brand quality an appealing acquisition in 2000 for Stora Enso Oyj, a leading global forest products company.

During the period leading up to the acquisition, management realized that to remain competitive in today's business climate, information technology needed to be an integral part of the business. The Internet's ease of use has helped shift the business world toward a new age of computer systems. Customers are demanding more information about the products they purchase and the flexibility to use this information for their own competitive advantage. Organizations are beginning to use this information to drive the business process in search of cost savings and marketing niches.

Information technology has not escaped the search for cost savings. EDI, a process of connecting two organizations electronically, is expensive and requires a substantial investment to implement and maintain. Additionally, finding knowledgeable EDI staff is difficult. Consequently, Stora Enso North America, like other organizations, began to look for alternatives by which to communicate electronically. The team sought a solution that would save costs relative to traditional EDI and connect to trading partners in a less complicated manner. Leveraging the availability and accessibility of the Internet was one logical possibility.

Extensible Markup Language (XML)

Why XML?
XML provides a number of opportunities. First, it enables organizations to pass richly structured documents and share information. The recipient has the flexibility to do whatever he wants with this data. The end result is an information exchange between trading partners, similar to what organizations do today with EDI but with more flexibility.

Second, this information can also be viewed with a standard Internet web browser. This provides the opportunity to expand the business community to any organization that conducts business electronically, including medium and small business partners. No costly IT infrastructure is required.

Third, by transmitting the data over the web, conventional Value Added Networks (VANs) and the costs associated with them can be eliminated. Web transmission offers a real-time environment and dramatically speeds up the process over traditional VAN mailbox schemes where trading partners at both ends of the pipeline periodically pick up and send the data in batches.

Last, the searching capabilities within XML can be great. A search can be performed based on the data within the document or by a particular element tag. This provides a powerful feature for analysis and data mining. Security schemes can be implemented on top of this to restrict access to specific parts of the document, according to the level of access a given individual is assigned.

What is XML?
XML is a markup language for documents providing structured information.

Structured information contains both content (words, pictures, etc.) and some indication of what role the content plays. The XML format provides the facility to define descriptive tag sets to encapsulate the contents of a document and the structural relationships between

items contained within the document. Since there are no predefined tag sets, there are no preconceived semantics. All of the semantics of an XML document are defined by the applications that process the document.

Where did XML come from?
The development of XML began in 1996. The base specification, XML 1.0, became a World Wide Web Consortium (W3C) standard in February 1998. It was revised in October 2000. Additional features of XML, such as Namespaces and XSLT for stylesheets, are currently being enhanced, and the W3C is aggressively trying to keep up with the recommendation process.

In order to appreciate XML, it is important to understand why it was created. XML was created so that richly structured documents can be used over the web. In the past, the only viable alternatives that existed were HTML and SGML documents, which were not practical for this purpose.

HTML, a format used primarily by web browsers, uses definitions in which both the tag semantics and the tag set are fixed. HTML does not allow for document flexibility and does not provide structure.

SGML, used widely in the past by the United States military and aerospace industry for maintaining manuals of part specifications, provides structure but is too difficult to implement just for a web browser. Full SGML systems solve large, complex problems that justify their expense. Viewing structured documents sent over the web rarely carries such justification.

The following terms will be useful in understanding the issues discussed herein:

Document
The word document refers not only to traditional documents, like the one that you are reading, but also to the myriad of other data formats. These include vector graphics, e-commerce transactions, mathematical equations, object meta data, server APIs, and other kinds of structured information captured within electronic media. In other words, a document is any group of characters that can be stored in electronic format.

XML Document Type Definition
A Document Type Definition (DTD) is the format of an XML document. It defines the hierarchical relationship of how the data within the document will be represented. This includes making pieces of data—called elements—mandatory, optional, single or repeatable. Attributes can also be incorporated into the DTD, limiting the options or choices available to describe an individual element. In laymen's terms, a DTD is a tree diagram of the file layout.

XML Schema
An XML schema further defines and qualifies the XML DTD. The most noticeable enhancement a schema offers over a DTD is the ability to define data types—such as numeric or text—enforce a data length and define set formats for individual elements. XML Schema was approved as a W3C recommendation in May 2001.

Mapping XML
Mapping is a term traditionally used in EDI. It represents the process of taking data from one format and moving it into another. Typically, the beginning and ending formats are

different. Data is mapped into, or from, a business system into a predefined format. For this white paper, mapping will mean the process of moving business-system data into, or from, a predefined XML format or DTD.

Parsing XML
In XML terminology, parse means "to look for and extract." To parse the document means to search the document looking for particular data content, a defined tag or a block of information within the document that is grouped together by a particular tag set. This information can then be processed or interacted with.

Proof of Concept

For many years, Stora Enso North America has been actively involved with the International Digital Enterprise Alliance (IDEAlliance[1]) B2B Paper Steering Committee.[2] This committee helped define and further refine how EDI documents in the North American paper supply chain should be used. One responsibility of the B2B Paper Steering Committee is to continuously look for better ways to help the industry become more efficient. Consequently, when the W3C XML 1.0 specification became a standard and gained wide support as a viable means of trading information between organizations, the B2B Paper Steering Committee began to seriously review and explore its potential.

Throughout the North America paper supply chain, the shipping manifest is the most widely exchanged electronic document. It is transmitted in one of two EDI formats—the Electronic Manifest and Bar Coding of Paper Stock Shipments manifest (EMBARC, a proprietary roll-based format developed by IDEAlliance) or the newer IDEAlliance subset of the American National Standards Institute's (ANSI) Advance Shipment Notice (ASN) document. Consequently, IDEAlliance members agreed that if a proof of concept was to take place in XML, shipping information should be the target for this test.

To continue exploring XML possibilities, Stora Enso North America and Time Inc. proactively partnered and agreed to a proof of concept by processing the shipping information in XML format. It was agreed that knowledge gained from the exercise would be shared with the paper industry.

[1] IDEAlliance was formerly the Graphic Communications Association (GCA).
[2] This committee was formerly named the EDI Committee.

In order to launch a proof of concept—that may ultimately someday be a standard for the industry—the data had to be converted to an agreed upon XML format. Consequently, within the IDEAlliance EDI arena, an XML DTD format for the manifest was designed. It contained all the required elements necessary to convert the current EDI document to XML, as well as additional attributes to make it more flexible.

Now that a prototype standard had been set, research was conducted by Stora Enso North America to determine the requirements needed to process XML documents. From that research, four primary components were identified.

Stora Enso North America Requirements for XML Processing
1. XML Mapping Tool—to create and interact with XML
2. Processing Environment—to manipulate XML documents
3. Repository—to save and store documents
4. Communications—to guarantee delivery in a secure form

First, an XML tool was needed to map and convert the shipping information from the business systems into the XML format based on the IDEAlliance manifest DTD. Research was conducted to identify a cost-effective and efficient way of doing this. Middleware vendors were reviewed, including BlueStone Software, Data Junction, eXcelon, IPNet, webMethods and XML Solutions. Stora Enso North America selected Data Junction. Shortly thereafter, Stora Enso North America created XML shipping manifests based on the IDEAlliance manifest DTD.

Second, a processing environment was needed to pick up and interact with an XML document. Most of the vendors that were reviewed provided a flow solution as a part of their package. However for a proof of concept, neither Stora Enso North America nor Time Inc. was prepared to heavily invest in a software solution. Consequently, documents were manually processed on demand.

The third piece that had to be identified within the XML space was a repository. New databases were coming out that supported object-oriented processing, but Stora Enso North America had little experience with object processing and how it worked. While Stora Enso North America was anxious to try this technology, it decided to rely on a stable and proven technology. Since XML documents are just files, they can be loaded into a flat-file repository—the same as any other document. Therefore, a database for document information processing combined with a file reference to where the XML file resided was used.

The fourth piece in the puzzle was to identify a method of communication that would be reliable and cost effective compared to past communications methods such as Value Added Networks (VANs). Security and guaranteed delivery were also crucial. Again vendors were solicited, but many of the companies required proprietary installation of software at both ends of the communication pipeline. Costs of these software products could be offset in time, but the initial investment of $50,000 to $500,000 was too steep an investment for a proof of concept. In the long run, there was also the question of requiring others to install the selected software, and whether those third parties could afford—or would want to—implement it. Consequently, email was selected as the communication mechanism for the proof of concept between organizations. Stora Enso North America and Time Inc. acknowledged that a better tool would be needed for production purposes.

To summarize, Stora Enso North America was able to extract shipping information from its legacy system, map it into a shipping manifest based on the IDEAlliance XML DTD and deliver it to Time Inc. via email. Time Inc. was able to interact with this document and move the data into their business system. The proof of concept was a success. This raised the question of whether to continue pursuing the XML alternative to EDI. Cost benefits, including both hard and soft dollars, had to be weighed carefully. If Stora Enso North America pursued this direction, other business partners would have to be convinced to do the same.
Since Time Inc. agreed that this would open new opportunities, as well as save costs over EDI, Stora Enso North America decided to proceed.

XML Standards, the Foundation

More XML Document Standards Needed

With the successful processing of the shipping manifest, it was evident that to replace EDI, all current EDI document standards would have to be converted to an XML document standard. Within the IDEAlliance arena, the North American paper supply chain began to develop XML document standards for the other documents currently traded via EDI.

As part of this process, a review and assessment of what other industries and software organizations were doing was made. B2B stocks had become bullish on Wall Street, and software vendors were touting new technologies and proclaiming new standards.
The review revealed that most of these standards were too shallow or too deep for what the paper supply chain needed. Additionally, the immaturity of this space was such that a clear frontrunner in standards development had not yet emerged.

Deciding to leverage the wealth of electronic trading and industry business expertise from within, the IDEAlliance EDI Committee continued to march forward. It embarked on an aggressive agenda to involve Internet companies related to the paper and printing industry, and to unite all its members in the search for a B2B solution. IDEAlliance updated its committee name to the B2B Paper Steering Committee and began developing XML document standards for the North American paper supply chain.

A subcommittee was appointed to develop the XML standards; Stora Enso North America provided the technical lead. During the development process, the committee quickly realized that the data contained within the business documents were very similar and in many ways constant. The observation was made that the business process simply adds additional information as the business process matures. For example, when an order is placed, the buyer identifies the parties involved, requests the product and states when he need its. A confirmation of the order states whether the supplier will or will not honor the order. It also might contain manufacturing and production information. The shipping manifest adds

the transportation and delivery information to the order when it is time to deliver the goods. The invoice states a request for payment after goods or services have been rendered.

Since each document builds on the prior document, it was logical to design a format that would keep the data consistent throughout the process. Consequently, reusable data constructs were developed. These were small subsets of the entire business document that could be reused wherever a particular type of information was needed. For example, a reusable party construct, containing name and address information, was developed to keep this information consistent. Other common business elements such as product, manufacturing specifications, transportation and unit-of-measure information were also created. These constructs could be snapped together like Legos® until a complete document was built. By the end of the summer of 2000, IDEAlliance was approaching the final review of its standard. A beta version of the most commonly used electronic documents—purchase order, order confirmation, manifest and invoice—was nearly complete.

Simultaneous Efforts in Europe

During the same period of time that IDEAlliance was doing a proof of concept and embarking on developing new XML standards for North America, the European paper suppliers began a similar quest, searching for a more efficient method of conducting business. This was initially launched by a number of European printers. The result of this effort was presented to the Confederation of European Paper Industries (CEPI), a group made up of European paper and forest products manufacturers.

Many members of CEPI began to support the concept and decided to unite to support the effort. The project was named papiNet. This group's strategy quickly identified two facets that would be important to the success of this effort. One was to have an inexpensive communication software tool so that all could participate easily and at low cost. This messaging software would also have to provide secure transmission and guaranteed delivery. A contract to develop this software was reached with a German company, Ponton Consulting. A unique agreement by sponsoring organizations was made. All who contributed to the software's funding were free to use the software and share it free of charge with their customers. This would help clear one major and costly hurdle and help encourage companies to join in electronic document trading.

The other facet of the initial papiNet project was to develop XML standards for the common business documents (purchase order, order confirmation, delivery note, call-off and invoice) to be processed by the messenger software. These messages were precursors to the papiNet standard.[3]

[3] This initial release of the papiNet messages unified the European paper industry and paved the way for the subsequent global release of the papiNet standard messages.

Collaboration

During 2000, mergers and acquisitions were occurring in the paper industry at a higher-than-usual rate. International Paper acquired Champion International. Stora Enso acquired Consolidated Papers. The number of players in the industry was shrinking, and those who remained were becoming more global.

The European paper suppliers knew that one of the biggest paper markets in the world was in North America. Therefore, it was important to have a standard that would be accepted by their North American business partners. The IDEAlliance B2B Paper Steering Committee's standards work had been widely accepted in North America. Consequently, the European papiNet group extended an offer to IDEAlliance to begin collaboration on a global XML standard. IDEAlliance and its members accepted the invitation. Later, this effort was extended to the broad U.S. paper and forest products industry through the involvement of the American Forest and Paper Association (AF&PA). A European project leader was selected and Stora Enso North America offered full commitment by filling the technical-lead position.

However, one item of controversy was the proprietary messenger software that had been a part of the initial papiNet project. Focusing on standards, North American companies did not want to endorse a software package. Therefore, it was agreed that papiNet efforts would focus only on the XML standards development. The messenger software would be distinct and separate and no longer part of the papiNet standards initiative.

An aggressive workgroup schedule was set to develop and complete the new global XML message design. The design would support both the North American and the European paper industry by the end of 2000. The workgroup agreed to target the five most prevalent messages used: the purchase order, order confirmation, delivery message, call-off and invoice. Beta versions for all five messages were completed on time in December 2000. This unique effort by competitors and business partners to develop an industry standard provided benefits for both the industry and consumers.

XML Implementation Design

With the papiNet beta version complete, Stora Enso North America began to focus its priorities on implementation. Time Inc. and Stora Enso North America, who had partnered earlier during the IDEAlliance proof of concept, decided to take the lead in papiNet implementation. It was time to begin designing the architectural specifications for XML processing and integration at Stora Enso North America.

Employee education would be one of the primary issues. The concepts of XML and its terminology were new to the majority of people involved at Stora Enso North America.

Educating all involved, while focusing on the importance and vision of the end product, was essential to ensure successful implementation. For Java developers with background in web development, the XML, electronic document-trading concepts and processing were not new. But business users would have to be educated on the business rules and benefits of XML. Team members had to be educated on how to use the software and how the papiNet business rules applied to the processing of documents.

Internally, Stora Enso North America had other major initiatives in the works that further complicated the papiNet implementation. JD Edwards, a software consultant, was in the process of implementing an ERP system for customer service, order processing, billing and other functions. Consequently, data integration points would become moving targets. Stora Enso North America had to make hard decisions on solid integration points without compromising data integrity. The end result was to tie into existing systems wherever they were working and later integrate and convert to new interfaces as they became available. Consequently, for the first round of XML integration, purchase orders and invoicing would be integrated to JD Edwards software, and delivery messages (manifests) and order confirmations would be implemented with the much older legacy systems.

Stora Enso North America had also developed a website for customers to track their orders. This site had been developed in Java, and Stora Enso North America resources supported these programs. XML had been introduced into this environment in a limited capacity. Therefore, it was logical to use this space for development and processing of papiNet XML documents.

To process the information contained within an XML document, one must be able to interact with the XML document; that is, get data into or out of the document. In many languages, it is called parsing. In EDI terminology, it is called mapping. For the proof of concept, Stora Enso North America had purchased inexpensive software to do the mapping that executed in a Windows NT run-time environment.

At the request of the papiNet Main Work Group, Ponton Consulting conducted an evaluation of integration and mapping tools. Stora Enso North America decided to purchase Seeburger for its XML mapping. Seeburger had a mapping tool that provided a graphical interface for importing and working with the DTD. Seeburger was Java based, which provided a match for the development environment in Stora Enso North America. External Java utilities could be developed to do a number of functions while building or interacting with the XML document. Therefore, the first of the four essential pieces had been found.

Next, the processing method had to be identified, evaluated and selected. Many middleware vendors offered workflow solutions. However, this space was relatively new and expensive. Anxious to move forward, yet keep costs in mind, Time Inc. and Stora Enso North America shared ideas and technical solutions. Time Inc. had identified how to build and create a daemon, which is a program that continually runs off the operating system or service program. Consequently, instead of using a flow system, Stora Enso North America built daemons for the processes that would continually monitor and check for data and process it in real time. Daemons were built for inbound, outbound, printing and audit processes and would operate in a Microsoft NT environment, the corporate software standard used by Stora Enso North America.

Stora Enso North America also sought to leverage the business-document information that would be shared between business partners using XML, while tracking the processing and transmissions. Therefore, Stora Enso North America decided to load all XML documents into a repository. Since the proof of concept worked relatively well and database sources were difficult to come by, Stora Enso North America decided to continue using Oracle tables, which includes a reference to where the XML file is located. This database could also be used as the focal point to query and retrieve XML documents. Stora Enso North America also had a website; it was only logical to provide an XML document search screen so that users—internal and external—could query the status of documents. The website could also be used to view the documents via a stylesheet.

During the development of the original papiNet messages, a consortium of European forest products companies had commissioned Ponton Consulting to build the messenger software. Stora Enso Oyj was one of the contributing organizations. The agreement made earlier—that all who contributed would have access to this software and share it with customers—helped clear the communication hurdle[4] that had not been resolved during the earlier proof of concept between Stora Enso North America and Time Inc. Therefore, both organizations installed the Ponton-built messenger and began testing it immediately.

Stora Enso North America Solutions for XML Processing
1. XML tool—Seeburger Mapping Tool
2. Processing Environment—Java daemons
3. Repository—Oracle database with file reference to Windows NT flat-file system
4. Communications—Ponton Messenger

Audit and Controls

A key component of the system—one that embeds itself in all processing—was the audits. As a document was processed, each event would be chronologically logged by the Stora Enso North America XML document processing system in an audit database table. If an error occurred during the processing, the error would be logged, the document suspended to an error directory and an email sent to the support team.

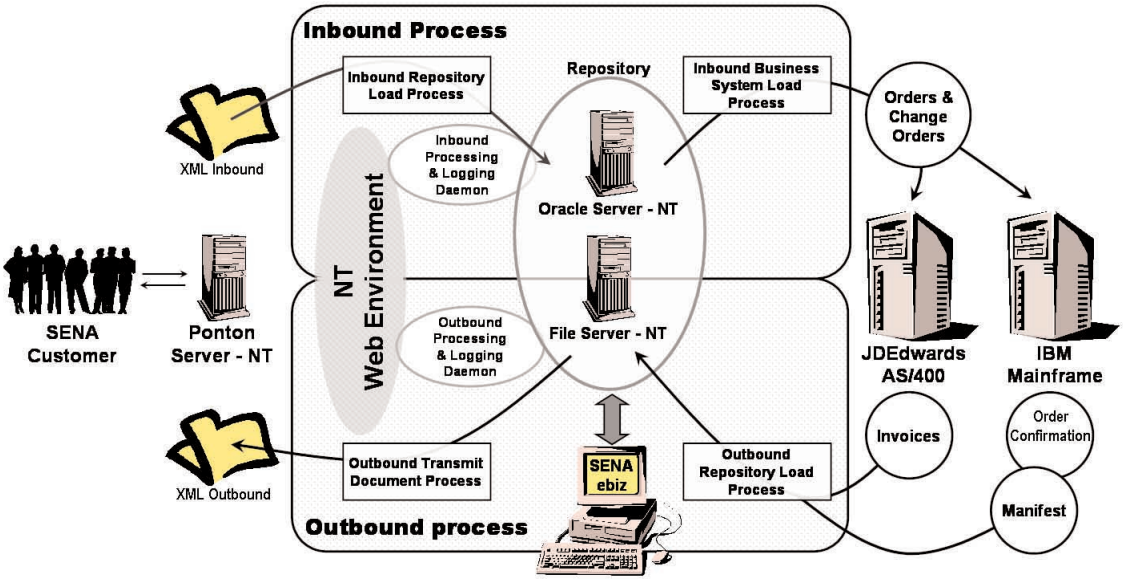
An audit daemon was also developed to verify the processing outside an XML-document processing system. For example, the audit daemon would independently check JD Edwards ERP software for invoices that should be sent to XML trading partners and log an event in the audit database table. In theory this is the first audit step of each invoice's processing life cycle. The audit daemon would then continually check the audit table, scanning to ensure that all of the required steps in a document's life cycle were completed successfully in an acceptable amount of time. The audit daemon also prepared a completion check report and emailed the results of all documents that did not successfully complete their life cycle to the support team.

[4] Communications had to be reliable, cost effective and secure with guaranteed delivery.

Stora Enso North America continued to leverage its existing website, where each audit step logged would be available for display. This would provide internal users a monitor to verify successful document processing and a tool for viewing a document in question.

Audit Notification

1. Error processing
2. Database integrity or orphan check
3. Document completion check



XML Testing

Stora Enso North America took a multi-tiered approach to testing. First, each object, method, map or routine was individually tested as it was developed. Then the team began snapping these parts together one piece at a time, creating modules or groups of methods and routines that would interact. Next, specific document types were tested. These included document mapping, integration with data sources, multi-step processing and user feedback of each message to be used. Finally, entire processes, such as the inbound or outbound, were tested.

Below is a list of items that were tested.

1. Software—External
    a. Seeburger
        i. Mapping of data for XML
            1. Purchase Order
            2. Invoice
            3. Delivery Message
            4. Order Confirmation
    b. Parsers
    c. XML Breeze
    d. Style Sheets
    e. Fire Walls
    f. HTTPs
2. Applications Processing
    a. Java Toolbox
    b. Daemons
        i. Inbound
        ii. Outbound
        iii. Printing
        iv. Audit
    c. Web System use of XML
    d. Business system processing of data
        i. Purchase Order
        ii. Invoice
        iii. Delivery Message
        iv. Order Confirmation
    e. Printing
    f. Partner use of data
    g. XML DTD standards
3. Repository
    a. Connectivity
    b. Integrity
    c. Completion
4. Communications
    a. Connectivity
    b. Integrity
    c. Completion

Testing External Software

Neither XML as a language, nor the software to support XML, had fully matured. Consequently, it was inevitable that bugs would be found. The primary factor in software selection was design and how well it fit into Stora Enso North America's development environment. The selection of Java-based packages enabled Stora Enso North America staff to take a proactive, interactive approach versus a black-box approach when testing the software pieces. This made it possible for team members to identify problem areas and work with vendors toward rapid solutions.

Application Processing

The ultimate test of any business system is the one it experiences every day in production. It is difficult or virtually impossible for any test team to identify all the production scenarios or situations that a system may experience. Processes can be tested for proof of concept through design analysis. They can be unit tested by each test-case scenario. And, they can be volume tested. But the ultimate test is to volume-test production data through a system that parallels the actual activity it will experience when in production. Because Stora Enso North America had a solid EDI system in place, it had the luxury to do just that. Application interfaces that were used for EDI were now also captured for XML. These interfaces were mapped to the papiNet standard for each business document. The detailed mapping exposed some shortcomings in the papiNet beta design; consequently, change requests were submitted to the papiNet Main Work Group to resolve.

All outbound documents such as invoices, delivery messages and order confirmations were mapped to production data sources, and XML documents were created when production data became available, paralleling the production EDI documents. This also allowed Stora Enso North America test partner, Time Inc., to better understand how Stora Enso North America intended to implement the papiNet XML standard when they compared it to EDI already in production.

On the inbound side, more steps were taken. Time Inc. began by unit testing purchase orders based on their identified test scenarios. Stora Enso North America worked on loading these orders into the purchase order database where ultimately a response—the order confirmation—would be generated. However, the purchase order confirmation process needs to interact with a number of other business systems, including the mill-scheduling system, which determines when and where the product will be made.

The orders Stora Enso North America receives from Time Inc. are primarily "making" orders; that is, they are scheduled and manufactured after the order is placed. They are not shipped out of stock. Given these parameters, it was difficult for Stora Enso North America to thoroughly test all scenarios on a unit-test basis. Different functional users and different systems made it manually intensive to test different scenarios. Using the approach that a system is most thoroughly tested in production, the Stora Enso North America information technology staff requested that a month of production orders received in EDI be sent in parallel via XML. These orders were then loaded into Stora Enso North America's test system. Stora Enso North America periodically updated the test system and databases with production data as it was generated on these orders in production. This process allowed Stora Enso North America to thoroughly volume test and simulate different production scenarios.

Repository

Stora Enso North America had taken a more traditional, but proven, approach to a repository. This did not exempt it from testing. With multiple daemons interacting within the Oracle repository database at one time, there was a chance that issues could occur. However, because the Stora Enso North America staff was knowledgeable and proficient in the use of Oracle, most database issues were avoided during programming design.

Communications

The Ponton Messenger had been tested internally. Stora Enso North America had set up a number of servers and tested different scenarios. As issues were found, they were brought to Ponton's attention for remediation. Small-scale testing between organizations had also revealed some issues, and again Ponton worked to resolve them. However, the partners wanted to give the Ponton Messenger software one last volume test prior to production to ensure the software could withstand production use, because during earlier testing, an occasional document would not be properly acknowledged. Again, Ponton was contacted to update the software after an unacceptable rate of acknowledgment failures occurred.

Recommended Skill Sets of Team

The leading edge of technology implementation frequently runs into unforeseen challenges. The key to success is clear communication among team members and the ability to prioritize and make prudent decisions that will work within the personality of the organization. The manufacturing and customer implementation groups, working as a coordinated team, should each have individuals proficient in the following positions or skill sets. This will enable the team to ensure proper design, address technical issues, thoroughly understand the business process, and ensure that proper controls are in place.

- Systems Analyst (liaison between technical staff and business users)
- Proficient Developers
- Technical Systems Person with knowledge of transmissions protocols (HTTP) and firewall issues
- Individual with electronic commerce background or EDI
- Business users within respective areas of implementation (EDI background a plus)
- Auditor

Stora Enso North America's XML implementation went fairly smoothly. Facilitating good communication among team members played a key role toward its success. Good communication helped educate and sell end users on the benefits of implementing XML

with its multi-environment use and capabilities. Good communication also leveraged the knowledge of team members, enabling good decisions to be made on a wide array of technologies.

Conclusion

XML technology, although young, has demonstrated it is mature enough to provide a stable, reliable environment in which to conduct business. It has also demonstrated that it can be used across multiple software platforms and can be leveraged for both data transport and document-content functionality. Both of these attributes, coupled with the use of the Internet and its accessibility, provide the opportunity for business partners, large and small, to benefit from the efficiencies of electronic document processing.

The key to wide-scale success and implementation is to have an agreed-upon standard for trading partners. The more trading partners that can adopt the implementation in the same fashion, the more efficient the implementation will be. Developed by the paper industry for the paper industry, papiNet is such a standard.