ABSTRACT

There is a years-old debate among Electronic Data Interchange (EDI) professionals concerning the viability of the original X12 standards. Some professionals believe X12 is legacy technology whose time has come to be retired to make way for the new technology -- XML. Others postulate that XML is not robust enough for EDI use. This research is a comparison of the X12 and XML technologies to explain why, after more than ten years of effort, XML is not replacing X12.

INTRODUCTION

Electronic Data Interchange (EDI) is defined as the intercompany, computer-to-computer exchange of data in a standard format (Sokol, 1995). The operative word in this definition of EDI is ‘standard’. Since the purpose of EDI is to allow for machine readable data to be exchanged without human intervention, the data must be in a standard format, unlike other electronically-exchanged data such as a FAX (Sokol, 1995). The EDI data-format most common within the United States (US), used for over thirty years, is known as American National Standards Institute (ANSI) X12. ANSI, which is also known as the Accredited Standards Committee (ASC), is responsible for developing the global X12 standards (The Accredited Standards Committee, 2009). The X12 standards are comprised of transactions that represent the most commonly used business documents, such as purchase orders, invoices, and shipping notices. A simplified example of a typical EDI cycle involves someone at a customer site entering a purchase order (PO) to be delivered to a vendor. The PO is entered into the customer’s enterprise resource planning (ERP) system and then passed to an EDI application known as a translator. The data is translated into the standard 850 format and transmitted to the vendor. The vendor’s EDI translator application receives the PO and translates it into a format matching the vendor’s ERP
system. A potential problem in this process lies in the fact that not all companies use the same communications protocol or line speed (Sokol, 1995). Therefore, the communications problem increases exponentially for the sender if a customer has multiple vendors with varying protocols and line speeds. In order to rectify these issues, value-added networks (VANs), such as those of Sterling and Harbinger, manage outsourced communications for companies. A VAN acts as an electronic post office containing mailboxes (Sokol, 1995). EDI transactions transmitted to the VAN contain envelope information that serves the same purpose as a paper envelope used in a traditional post office. Sender and receiver information is contained within the transaction that lets the VAN know who is sending and who is receiving the transaction. Based on this identification, the VAN places transactions in the appropriate receiving company’s mailbox; when the receiving company logs into the VAN, they retrieve transactions from their mailbox and process them on their ERP system.

As the usage of the Internet expanded during the 1990s, emerging technologies began to explore the possibilities of using the Internet for Business-to-Business (B2B) transactions. Within the realm of EDI, the Internet was viewed as a means of bypassing VANs to reduce the cost of doing traditional EDI. However, security became a major issue in utilizing the Internet for EDI transactions, particularly financial transactions. In August 1997, The CommerceNet consortium completed interoperability tests for the usage of encryption to send EDI messages via the Internet (Sherif, 2004). EDI over the Internet (EDIINT) was developed to allow for the use of the encryption of EDI messages utilizing the Public Key Infrastructure (PKI), but the cost of implementing EDIINT put the technology out of the financial reach for many small to medium businesses (SMB) (Medjahed, et al., 2003). SMBs often do have XML at their disposal – an affordable standard that is flexible enough for them to compete in the B2B world. In addition, security is an inherent part of XML design, which allows for the encryption of an entire document, or a single data element within a document, such as a social security number (Bartlett & Cook, 2003). With two conflicting standards, X12 and XML, a quandary has developed. X12 has a huge infrastructure cost along with complaints of being too rigid and lacking security capabilities, making it undesirable for Internet usage. This quandary leads to the following research questions:

1. What is the future of X12 and XML?
   a. Will one eventually overtake the other or will there be a convergence?
2. What are the risks of a company relying solely on X12?
   a. What if, e.g., Wal-Mart, the largest X12 user, decides X12 is no longer useful?
   b. What if a company incorporates XML as part of its EDI practice and becomes more flexible to work with SMBs than an X12 competitor?
3. What are the benefits of X12, and what are the benefits of XML?
   a. As technology continues to evolve, so do the capabilities that are available to B2Bs. Therefore, is it feasible for a 30+ year old technology (X12) to remain viable today?

**Historical Backgrounds of EDI and X12**

EDI’s roots trace back to Master Sergeant Ed Guilbert of the US Army during the 1948 Berlin Airlift, where he was faced with the problem of coordinating the arrival of food and consumables consignments from several countries (Swatman, 1996; Vanderbist, 2002). The Berlin Airlift was
a response, by the U.S., England, and France to the Soviet Union’s cutting off all access to ground transportation between Western Germany and parts of Berlin after World War II (Hayes, 2002). Guilbert designed a standard manifest, which was one of the first standardized trading documents that he required to be completed before permission was given to unload.

In 1968, Guilbert expanded his concept of EDI by applying it in the U.S. to the rail and road transport industries by forming the US Transportation Data Coordinating Committee (TDCC) (Swatman, 1996). The TDCC worked toward eliminating the exchange of paper documents and developed its first electronic standard in 1975. Through Guilbert’s efforts with the TDCC, he is credited with creating the first system to exchange data electronically (Data Interchange Standards Association, 2009). ANSI consolidated standards from a number of organizations, including TDCC. As EDI matured, it became clear that a standard supporting electronic document exchange between industries was needed. In response to this need, ANSI developed the X12 standards which sought to standardize the exchange of electronic B2B documents across industries (123 EDI, 2007).

EDI offers many cost-saving advantages to its users: reduction of business process cycle times (Westarp, et al., n.d.), improvement of accuracy, cost reduction, and operational efficiencies (GXS, 2009). In the U.S., X12 is the primary standard supporting EDI; yet, research has shown a major dissatisfaction centering around the rigidity it imposes (Kotoc, 1999). Ironically, it is X12’s rigidity that has allowed it to withstand the test of time. X12 transactions are hierarchical with processing beginning from the highest level to the lowest. An X12 transaction has a series of ‘envelopes’ identifying portions of its structure and content. Processing proceeds hierarchically from the outermost envelope to the innermost. These processes are described briefly from the interchange envelope, to the group envelope, and finally to the transaction set (Sun Microsystems, Inc., 2009).

**X12 Status**

A contributing factor to X12 rigidity is its attempt to provide a common format across all businesses (AP Commerce, Inc., 2009). Each industry has its own requirements and uses a subset of the X12 standards. For example, the subset used by the retail industry is known as the Voluntary Inter-industry Commerce Standard (VICS), and the subset used by the automotive industry is the Automotive Industry Action Group (AIAG) (Cummins, 2009). Within each of these industries, each trading partner has its own unique needs based upon its application system, and these needs will lead to each trading partner using elements and segments in ways they were not meant to be used to fulfill its needs (AP Commerce). Another example of X12’s rigidity is the type of transactions defined within the standards. X12 defines 315 business documents. If a document being used by a business is not defined within the X12 standards, it simply cannot be traded utilizing the X12 standards (Medjahed, et al., 2003). Therefore, an X12 transaction closely resembling the document would be used, thus allowing an X12 transaction to be used for purposes it was not intended (AP Commerce, Inc., 2009).
XML

XML was initially developed so that highly-structured data could be exchanged over the web with a flexible format (XMLUK.org, 2008) However, an early complaint was XML’s lack of any type of standardization (Usdin & Graham, 1998). For example, X12 has standard outlines of how business transactions are formatted, location of specific information, and the size of each element within a transaction. In contrast, because of XML’s flexibility, there was no way of knowing how transactions were formatted and how to locate pertinent information within the transaction. In addition, anyone using XML has the ability to name the data tags anything they wish. In order to alleviate the ‘to much variability’ issue, the Data Type Definition (DTD) was developed as a way to imbed standardization in XML. The DTD is essentially a schema defining the document type and the data that may appear in a related transaction (W3Schools.com, 2009). A company could develop many DTDs, defining all of the business transactions it uses, and either publish the DTDs or store them in a public repository. Any company conducting business transactions with the company can obtain the DTDs and begin trading using the transactions (Huemer, 2000; Medjahed, et al., 2003; Gregory, n.d).

There is now a desire within the EDI community to create the next generation of EDI which will reduce its cost, and provide for ease of use and flexibility. During the early years of XML’s evolution, Webber & Dutton (2000) stated, “…the next generation of [X12] EDI must address the following business requirements, which XML provides:”

1. Provide extendable and controllable technology.
2. Integrate with today’s systems.
3. Utilizes open standards.
4. Provide a successor to X12 and interoperability for XML syntax.
5. Globally deployable and maintainable.

Open Standards

The focus of current research centers on open standards and its use in B2B. Open standards are defined as “…recognised [sic] national or international platform independent standards. Open standards are developed collaboratively through due process, are vendor neutral, do not rely on commercial intellectual property” (Australian Government, 2008). Open standards are also defined as being based on three criteria: the standard is publicly available at a minimal cost, no entity controls the standard, and the development process for creating the standard involves public participation (Kesan and Shah, 2008). Another defined benefit of open standards is its interoperability, meaning that implementations can be swapped seamlessly.

How open standards can be used in the realm of EDI is being discussed through the creation of organizations such as the Organization for the Advancement of Structured Information Standards (OASIS). OASIS was originally formed in 1993 under the name Standard Generalized Markup Language (SGML) Open as a consortium of vendors and users who were devoted to the interoperability of SGML. OASIS changed its name in 1998 to reflect its expansion of work to include XML and other related standards. Since the scope of this paper deals with the X12 and XML standards, only these are discussed in relation to OASIS and related organizations. To address standardization issues noted by early XML research and use, OASIS launched Electronic
Business using Extensible Markup Language (ebXML). ebXML is a site containing a library of specifications that allows a company of any size and location, to use a standardized method to exchange business over the Internet (ebXML, 2006).

Methodology

The focus of this research was to provide a comparison between the X12 standards and XML, and to gain an understanding of why X12 continues to be the standard in the EDI community. Furthermore, the focus was also an effort to gain an understanding of why the EDI community is slow in adopting XML as the next generation of EDI. The primary method of gathering data for this research was through analysis of prior research, interviews with decision makers and technicians, and questions posed in an EDI user group on the social network LinkedIn. The ten respondents all worked as technicians developing code for either or both X12 and XML, and all worked in multi-national corporations. Interviews provided insights from these EDI professionals about their opinions of X12 and XML, and the influence each technology has on the future of EDI for B2B. All respondents were asked the following two questions: “What do you foresee as the future of X12?” and “With the advent of open standards, why do you think the industry is slow to adopt XML?” Other questions were posed, depending on their answers.

Analysis

Eight of the ten respondents discussed sunk cost as preventing wholesale conversion of X12 to XML. Several stated that converting from X12 to XML would yield an unacceptably low return on investment due to the amount of capital already invested in their company’s use of X12. This same group of respondents also felt that due to the size of XML transactions, companies that still utilize a VAN for communications would see a drastic increase in their expenses if they were to convert to XML, negatively affecting their bottom-line. Organizations such as ANSI and OASIS are working to standardize XML by developing standards that can be used cross-industry in B2B transactions. However, the perception of these organizations as slow to develop XML standards is primarily due to the lack of XML acceptance by the industry as a whole (Hartig, 2009). The feeling is that OASIS does not go far enough to standardize XML; OASIS standards are merely a formatting standard, but still allow a freeform use of names (Hartig, 2009).

X12 and XML have their unique places in the world of EDI. One practitioner stated that X12 is in no danger of being overtaken by XML for a couple of reasons (Akinremini, 2009). One reason X12 is secure in its use, is the increased size of XML transactions over X12, causing increased communications costs (Nurrenbrock, 2009; Linssen, 2009; A. Akinremini, personal communication, July 15, 2009). One service provided by a VAN is support for lost or failed transactions. Any company doing a cost benefit analysis for leaving a VAN to utilize the Internet must also consider the loss of such services and the added cost of hiring support staff. X12 will likely continue to be the primary standard for the trading of business documents B2B, and XML will likely become the choice for internal applications (Pool, 2009).

Companies are experiencing cost savings in B2B today, due largely to their use of X12 (Travis, 2009). Since X12 has been around for so long, working successfully within the realm of EDI, it will be difficult for XML to replace it. In addition, the cost associated with switching from X12
to XML, makes the transition unattractive. However, XML has less cost associated with transactions if starting new applications with electronic transactions. The respondents reported that new applications in their companies were mostly intranet-based and intra-company, and most likely to benefit from XML, which then would stay within the organization for all processing. X12 will be dead once Wal-mart says it is dead, giving the implication that Wal-mart’s status in the world of B2B would have a great influence over the lifespan of X12. (Pool, 2009). However, many organizations outside the influence of Wal-mart rely on X12 for their B2B needs and could change. Further, Wal-mart suppliers would react adversely to the notion of converting to XML, or any other standard, due to the cost of conversion in terms of time and money (Pool, 2009). X12’s rigid standardization is considered both a hindrance and benefit as the dominant standard in traditional EDI. Using organizations know that fields within an EDI transaction always have the same identification and position, making the implementation of partner relationships easier and more cost effective. The ability to be able to trade data with as few characters as possible makes it cost effective for data storage as well. XML, on the other hand, affords an organization the flexibility to build internal applications with data in a human-readable format. As Korhonen & Salminen, (2003) stated, with XML’s capabilities, data can be automatically transformed into a readable document, such as PDF and HTML.

CONCLUSIONS

This research has shown the standards development organizations, such as OASIS and ANSI have not been able to develop anything that is better than X12 for accomplishing traditional EDI. For this reason, a change from X12 to XML lacks the support of EDI professionals and their organizations. Opponents of X12 state that the standards are too rigid, yet it is this rigidity that has allowed X12 to survive the test of time. In fact, standards organizations are working to build rigidity into XML using the rubric that a standard must have some rigidity. Knowing the pros and cons of the two standards, what is the future of X12 and XML? This research has shown that there is some movement to incorporate XML, or even replace X12 with XML. However, this research has also shown that there is resistance to this proposed change, and X12 is not likely to be replaced by XML as a standard for traditional EDI. The majority of companies utilizing the X12 standards have significant investments in their EDI software and infrastructure from which they are now benefitting (Nurrenbrock, 2009). Considering that X12 has worked successfully in companies for over 30 years, there would be a low ROI to start utilizing XML as a replacement. Therefore, in order for XML to gain a foothold in the traditional world of EDI, there would have to be a significant need that X12 is not meeting that can be fulfilled with XML (Travis, 2009; Sorensen, 2009). The benefit of switching must outweigh the cost.

This research has shown that there is a future for both technologies in the world of B2B which favor convergence. A company that had the capability of doing both X12 and XML would be at an advantage. The company that could do both X12 and XML could transact B2B transactions with larger organizations that utilize X12 and also accommodate the SMBs that use XML for B2B. In addition, XML has transformational capabilities, meaning it can be used to transform data into a readable format, such as a PDF or HTML (Korhonen & Salminen, 2003). XML also offers benefits for the internal encapsulation and transport of data within an organization. The third question explored what would happen if an organization such as Wal-mart decided to transact B2B transactions only in XML, and the effect that would have on their suppliers.
Currently, Wal-mart successfully uses both X12 and XML as part of its EDI operation. Wal-mart continues to trade using X12 for traditional EDI, using XML as part of a web services environment for suppliers to send and receive transactions over the Internet (ACOM Solutions, Inc, 2009).

**Recommendations for Business**

Organizations that utilize an X12-only operation, should investigate convergence opportunities, particularly where the organization has a number of SMBs with which they transact business. If the SMBs cannot afford VAN charges, and EDIINT is out of the SMBs financial reach, having the ability to send and receive XML allows the SMBs to compete with their larger counterparts. Standards organizations such as OASIS and ASC should do a better job of marketing any beneficial qualities of XML. OASIS and ASC have been working on developing standards that mimic X12 for XML’s use in traditional EDI. However, as this research has shown, that without acceptance from the decision makers and technicians working with EDI, their efforts will be futile. If there are no added benefits over X12 by XML, it would be better for these standards organizations to concentrate on developing the capabilities of XML that would be beneficial to an organization. At the onset of this research, we sought to present the benefits of moving from X12 to XML. However, as a result of this research, we have determined that such a move is not always warranted. This conclusion is based upon the investment organizations have made into the usage of X12, and no identifiable benefits that would warrant making such a move. We would suggest, however, that organizations utilize XML to accommodate the suppliers and customers who have chosen this technology as their choice of doing B2B.

**Recommendations for Research**

This research is based on a small, convenience sample of practitioners in the EDI world. The sample is very small and may not be representative. However, the convergence of opinions that XML will be used for small, new, internal applications and that X12 will continue to be used for external B2B, led us to be comfortable with the sample. Empirical research of a broader sample of companies that also included IT executives may provide interesting perspectives and more representativeness. Research on specific details of the costs involved in X12 transactions and the nature of the differences in costs between X12 and XML might provide additional insights that could inform OASIS and/or ANSI standards development.

This research describes the current state of the two primary methods used for electronic transaction sharing across organizations – X12 and XML. The positive and negative aspects of each standard were developed, showing that X12 is more mature but less secure for Internet processing without significant added cost, and showing that XML is less standard but provides acceptable security. As a result, X12 is likely to continue to be the choice for B2B processing while XML is likely to be used for SMB interactions and small, internal transaction-sharing applications.
REFERENCES


