Electronic Data Exchange

XML/EDI a powerful union for the future of E-Commerce

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Abstract

This research paper aims to outline and review some of the early applications and developments of electronic data exchange, and how electronic media is developing to further advance global business communication. This paper analyses early forms of business-to-business communication, specifically dealing with Electronic Data Interchange (EDI). The paper also outlines the disadvantages of the traditional EDI approach and provides some analysis of the future direction of EDI. This paper reviews the union of Extensible Markup Language (XML) and EDI in a formidable and powerful partnership called XML/EDI. This union is potentially a great catalyst in opening up E-Commerce to the entire business sector, indeed even individual consumers. XML/EDI provides the opportunity for the whole business sector to have access to the advantages of global markets.

A changing world

Advances in technology in the past century have dramatically influenced the way we as a society have functioned. Technological advancement has pushed us through the industrial revolution to a highly advanced technological society where mechanization and automation are an integral and part of our lives. More precisely it is information technology and electronic media that has changed the way we think, operate, communicate, and increasingly, the way we do business.

With massive developments such as computer networks and more specifically the Internet, there is a greater acceptance of a globally competitive marketplace. With the world getting smaller, through the advances in communication and information dissemination, even the smallest of businesses can display their products or offer their services to a global marketplace. Small isolated companies will find it increasingly difficult to survive. Interdependence, compatibility,

acceptance and speed will be of vital importance in any industry, in any marketplace.

The great potential brought about by new technology offered an opportunity to make business-to-business communication faster, more reliable and more efficient than previous, laborious methods. A dedicated group of visionaries led by Ed Guilbert of Washington, DC sought to revolutionize the way shipping and transport were conducted. With this new method was born the vision of a "paperless office". Guilbert formed the Transportation Data Coordinating Committee (TDCC) in the early 1970s to develop voluntary standards for electronic formats to replace the growing pile of hard copy documents needed for shippers, transportation companies, customs authorities, warehouses, and receiving companies. This committee pioneered a system and set of standards that has later adapted into a method called Electronic Data Interchange (EDI), which was widely recognized as a catalyst in the foundation of E-Commerce.

EDI Background

Traditional business communication occurs in two forms, unstructured, such as messages, memos, and letters; and structured, which includes purchase orders, dispatch advice, invoices, and payments. EDI covers the exchange of structured messages. Traditionally it was the large multinational companies that developed and utilized Electronic Data Interchange (EDI). Operation of such a method brought many advantages. The speed of communication meant that time and resources were not wasted in transporting these documents. The costs of data entry were dramatically reduced, as was the probability of a costly double entry, or error in entering data. The cost of copying and storing paper communications was also greatly reduced. EDI was available 24 hours, which was important to those who were communicating across time zones that could only facilitate a small window of common operating hours. With time, companies were encouraging their suppliers and distributors to adopt compatible systems facilitating a steady growth in electronic data interchange.

In the developmental stages of EDI, formats were developed to meet the needs of individual companies. It was not long before users realized the limitations of voluntary standards, and the need for compatibility. Industry standards were then developed to assist with the compatibility of inter-industry communication. However, companies involved in cross industry trading still faced a number of

barriers, and consequently the need for national standards became apparent.

By 1985 two standards had emerged and were gaining widespread acceptance - ANSI ASC X12 (American National Standards Institute Accredited Standards Committee) in North America and GTDI (Guidelines for Trade Data Interchange) in Europe. While generally meeting domestic needs, the existence of these two significant but different standards was creating difficulties for international trade. The business community came to recognize the need for global standards. The problem then arose as to who would develop maintain such a standard. Whoever controlled these standards would have a great deal of power and influence in world trade. Finally responsibility was issued to the United Nations to establish and maintain such a standard. There was, however, some reluctance to dispense with the existing EDI standard, ASC X12, used by the corporations and government of the United States.

In 1986 the United Nations Economic Commission for Europe (UN/ECE) approved the acronym UN/EDIFACT, which translates to United Nations Electronic Data Interchange for Administration (Government or Public Administrations), Commerce and Transport. The goal was to create a single international EDI standard, flexible enough to meet the needs of government and private industry.

The process of refinement and development of these standards still continues. UN/EDIFACT comprises an extensive set of internationally agreed-upon standards, directories and guidelines. Their purpose is to facilitate the electronic interchange of structured data that relates, in particular, to trade in goods and services between independent computerized information systems.

EDI in action

The following is an example of a set of business-to-business transactions that utilize EDIFACT. This illustration is just one example of how EDI is used by companies to facilitate paperless trade. To understand the true benefit of such a transaction, it is important to remember that well-established systems can handle hundreds and thousands of such transactions per second.

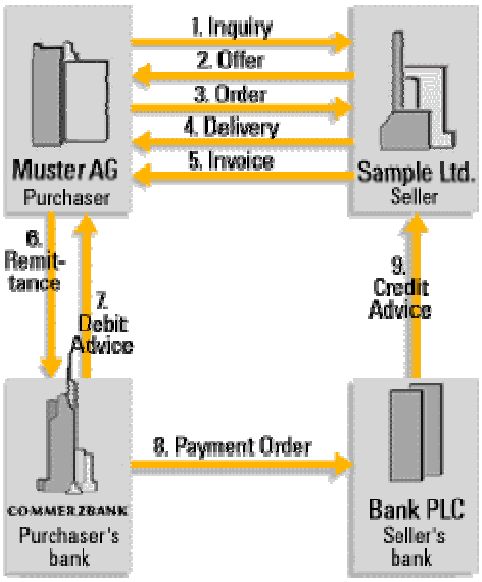

Figure 1

EDI step by step

1. An EDIFACT inquiry is transmitted from one business partner to another. For example Muster AG sends an order to Sample Ltd. for 20 cases of its finest award winning beer, **XXXX**ML
2. Sample Ltd. returns the inquiry with data relevant to the order, which is in the form of an offer. It would contain information such as price per case, shipping costs, availability of delivery, and a reference or account number.
3. Muster then converts this information into an order and returns it to Sample Ltd. Step 3 really states, yes I realize the financial costs of ordering the 20 cases of beer, I want them, I just hope I do not suffer too much from the physical costs of consumption!
4. Sample Ltd. would then use the order to create the shipping documents and customs papers if necessary, as well as all other necessary information relevant to the shipping company, e.g. directions, storage instructions, does the beer need to be kept cold etc.
5. The information from the previous correspondence is collated and delivered in an invoice sent to Muster from Sample Ltd. Under Australian law this is the point at which a legitimate contract had been entered into as all elements have been satisfied, offer, acceptance and consideration. This is the step basically says, order received now please pay.

6. Step 6 is where Muster uses some of the messages that are part of the EDIFACT message standards and creates a remittance e.g. (PAYEXT-an extended payment, or PAYMUL-a multiple payment) which is then transferred to Muster's Bank, Commerzbank.
7. Commerzbank receives this remittance, and sends back an EDIFACT message type (DEBADV-Debit advice or DEBMUL-Multiple Debit Advice). This step says, your account has been debited such an amount, or one payment has been made in a series of payments.
8. Commerzbank then transmits an EDIFACT interbank message (FINPAY) to the supplier's bank, in this case Bank PLC. This is much like a wire transfer of the money from Commerzbank to Bank PLC.
9. Bank PLC then converts the interbank message into some form of credit advice (CREEXT-extended credit advice, or CREMUL-multiple credit advice), which is sent to immediately inform Sample Ltd. that payment has been made. This step says yes the money is in your account, now send them the beer!

Back to Figure 1

So after all that, Muster received information about prices, made an order, was invoiced, made payment and was given receipt of payment from the bank, all without the need for any party to the transaction to meet, discuss, copy or sign anything. Such an exchange may have only taken seconds. This was a paperless transaction, quick, efficient, with a greatly reduced chance of a costly human error.

EDI Problems

The main problem with the modern EDI system is the massive expense involved with its implementation and subsequent maintenance. This has meant that EDI has been limited in its accessibility. Presently EDI is only operated by 1% of US firms. The great majority of these are fortune 100 companies. Such large corporations are the only businesses that have the financial, technical and network recourses to support EDI. The greatest potential lies in the small and medium businesses. With new technologies such as XML (to be discussed latter in this paper) it is hoped that interest and support will inundate the market offering a new world of possibility to businesses and the individual consumer.

In the early days of EDI, little thought was given to a fully linked and integrated worldwide network. As a result EDI systems were set up according to individual agreements. This created problems with the compatibility of data and indeed the need to translate compute, and retranslate information to be exchanged between businesses. This was gradually addressed as standards such as X12 and EDIFACT became developed and accepted. The problem still remained that EDI information and data used and stored in the applications and programs utilized by companies are often incompatible and require translation.

From a software point of view, the EDIFACT language, or syntax, is a very out dated and overly complex way to exchange data. Modern computers are able to process much more compact and flexible formats. Originally the EDIFACT syntax was based on the idea that one should be able to exchange messages by telex, an archaic method by modern standards. Communication methods of today do not only rely upon simple text, but also illustrations, photographs, sound, video, and even subprograms. These limitations are seen as a great weakness in EDI. This has led to the need for a new language for the function of EDI, a language such as XML.

The importance of the EDIFACT standard lies not in the syntax, but in the knowledge embedded in the standardized messages such as the examples used in the EDI in action section of this paper (e.g. PAYEXT). There should be a greater focus on content and not appearance. Due to the complexity of the technical nature of EDI, it is the developers that have the majority of the responsibility for designing EDI networks. Software developers have it in their own interest to design systems that generate subsequent business for themselves. If standards were applied to all aspects, this could result in increased competition, and less of a need for overly complicated translation. Often the field of vision of some developers is limited to their own applications, and they are not aware of what the requirements and demands are placed on their creations in a linked network.

Despite their similarities there are difficulties in having two types of standards. EDI ASC X12 is the standard used in North America, while EDIFACT is the United Nations standard used in the European Community, and the rest of the world. While the standards are gradually being merged into a global definition, some ambiguity still exists between the two sets of standards. At present those who use EDI for transactions need to keep two copies of standards and transaction sets if they are trading in networks involving both set of standards. Firms have made considerable investment in developing

EDI networks over the past 25 years and are reluctant to simply change their allegiance. There are also deeper political issues, with EDI X12 being a United States standard, and EDIFACT falling under the jurisdiction of the United Nations.

Traditionally EDI networks were enhanced and maintained by Value Added Networks (VANs). VANs are like intermediately service providers. These VAN providers were responsible for creating the links for EDI data to be transported. This means that they are also responsible for ensuring that the data gets to its original location, it is secure and unhindered, as well as ensuring that such links and transfers are always available. The need to maintain these service agreements is very costly to the users. Security and reliability come at a definite cost.

XML/EDI The Future Direction

XML was officially born in December 1997. The result of a working group funded by the World Wide Web consortium (W3C) and various vendors. In some ways XML was born out of frustration, with developers and users of complex web applications discouraged by the limits of HTML. XML is a subset of the Standard Generalized Markup Language (SGML). XML is a compromise between the complexity and extended function of SGML, and the overworked, and yet underpowered HTML. As stated by Richard Light in *Presenting XML*, "(XML) has been described as having 80% of the functionality of SGML, with only 20% of the complexity."

Markup encodes both logical structure, and a description of the document's storage layout. This means that XML is able to define constraints on storage layout and logical structure, a quality that is previously lacking in EDI communication. XML is set to replace the overly complicated and very limited HTML as the standard markup language of the Internet. Such a transition would not only be beneficial to enhanced web browsing, but would serve as a catalyst in the development, expansion, and acceptance of EDI transactions, not only to the larger businesses sector, but more importantly the small to medium enterprises (SME's), and even individuals.

SGML was used to create the HTML Document Type Definition (DTD). The HTML DTD provides a common tag set creating syntax that is used and understood by all Web browsers for presenting information over

the Web. HTML does not possess semantic markup, which is crucial for EDI over the Internet. Semantic markup allows a method of ensuring that the information being exchanged is both understood and put in context by all parties to the transaction. XML provides a way to display and transport data, allowing the data to be published or presented; however the data can also be processed and utilized by software applications. XML greatly overshadows HTML in the range of functionality it provides, this is best highlighted below in Figure 2.

HTML	XML
• *HTML describes the content of the document and no application control over presentation*	• *XML describes the format, presentation and provides application control over the content of the document*
• *Usually only easily readable with a browser*	• *Documents can be read, exchanged and manipulated with many applications*
• *Non-extensible mark up*	• *Extensible markup language to create industry and client specific applications*
• *No context or access control*	• *Context and access control*

Source: ©1998 Harvard Computing Group

Figure 2 Limits and bounds of HTML

The ability to publish as well a read and manipulate data with a greater number of applications is highly suited for business transactions and documents. The great benefit of having a single standardized representation of data that, not only allows printing and publishing of the data, but indeed the automated processing of such data, creates great prospects for the further development of EDI. Further to that the opportunity of being able to transport this information across the Web is not just an exciting innovation for EDI but creates fantastic opportunities right throughout the Information Technology industry.

The use of XML to tag data gives rise to a semantically clean approach that enables immediate and direct interpretation and application of data using standardized translators. This is the thrust behind XML/EDI. XML provides a way to put the information into context clearly and

precisely. For example in a traditional EDI transactions the data might contain a ‘date’ in the transmission. This creates some ambiguity as to the context of such a date. It may have been the date of order, date of shipping or delivery date. Previously EDI utilized standard messaging and individual agreements between partners to order and display the information that was sent or received. Such agreements created problems for partners using different versions and releases of standards or programs, or indeed, different standards themselves. With XML, tags can be used to define each data element, and place it in context.

XML enables style and formatting characteristics to be passed along to a browser layout engine for presentation, while at the same time making it possible to translate from XML to EDI using translation software by embedding EDI information "behind the scenes". Browsers supporting XML will allow documents and transactions to be displayed in the manner specified by the user. It may be necessary to have the information displayed in traditional paper format, of information may be required in spreadsheet or database format. XML provides a great deal of flexibility and control in this respect. The inclusion of layout information opens the door of possibilities to potential interfaces. Information can be rendered not just for traditional browsers, but also for other communication devices that will become more and more important as technologies continue to expand. XML technology will allow devices such as electronic organizers, palmtops, even mobiles phones to receive, display and possibly even manipulate EDI information.

As mentioned earlier traditional EDI is facilitated through secure Value Added Networks (VANs), which are responsible for transporting the data between companies and their internal applications and networks. The use of XML poses to make this expensive process redundant, or at the very least threatens to dramatically revolutionize this method of transportation. Sharing or transferring data from one company's purchasing system to another company's inventory is just a matter of coding the XML document structure, constraints, and tags. As XML develops and its adopted into an EDI format, XML could easily allow companies to create secure extranets, or pipelines with other companies over the Internet. This would eliminate the need of the middleman, and alleviate some of the cost problems with EDI as discussed in the EDI problems section of this paper.

VAN companies will need to shift their business strategies from the large business sector and move to become a multi-processing center,

providing a flexible, reliable and affordable window to all consumers on both established networks, as well as through the general Internet community. As the VANs make this shift, it will be crucial for them to maintain security, audit, and data retention services provided currently. They will, however, need to make them more affordable to smaller businesses, if VANs are to remain competitive. Internet EDI will not become the standard instantly. At present there are concerns about compatibility, security, and reliability. Internet security is improving with innovations such as digital signatures and smart card technology. Although such methods are not completely safe, they are one step closer to offering an acceptable option. As more of these problems are slowly addressed E-Commerce via the Internet will emerge as a more attractive way of doing business, not just for small to medium firms but for individual consumers also.

The XML language is structured in such a way to allow users to develop XML/XSL (a high powered linking system available to XML). XML/XSL are templates that can contain mapping and processing rules for parts of the message. E-Commerce using XSL and software agents would allow firm specific data to be stored within user databases instead of directly copied into a transaction and submitted to a trading partner. EDI transaction sets could then comprise pointers to the database information. In this manner, instead of each message containing information that is copied from the database it was generated from, it would contain a pointer from which the data could be retrieved. This has two functions; firstly it relieves the pressure on the initial EDI transmission, eliminating wasteful transmission back and forward between partners. This also allows data to be stored in a single location, which means that the data is easier to keep correct and up to date. However, this does raise the problem of the need to have constant access to the data, and indeed the reliability of the data itself and those who maintain and have access to it.

XML provides an avenue for a less expensive approach to the previously described traditional method of receiving the data, translating it, processing it and then translating it back for further EDI transmission. This is achieved through the use of XSL and software agents. This combination further reduces the problem of the great expense of traditional EDI systems and the associated translation of data for processing.

The use of XML as a development tool does not mean that previous EDI standards and practices need to be abandoned. It is possible, using DTDs to allow traditional EDI methods to facilitate backward

integration and incorporated into EDI/XML. However there is a need to decide upon which standard sets will constitute the foundation of EDI/XML.

Administrative Control of XML/EDI

XML was developed by an XML Working Group (originally known as the SGML Editorial Review Board) formed under the jurisdiction of the W3C in 1996. It was chaired by Jon Bosak of Sun Microsystems with the active participation of an XML Special Interest Group, consisting mainly of individual companies. While XML is a public and open standard and not a proprietary development of any company, it is still administered by W3C, made up of some 400 'member' companies. This poses a question of conflict of interests. Being members with appropriate voting power, large corporations have the potential to take XML in a direction that would not be in the best interests of the whole Internet community.

If XML/EDI were to become the new standard, it would have to be accepted by the industry as a whole not just some of the more powerful players such as Microsoft and Sun Microsystems. Although ASC X12 has acknowledged that it will need to conform more to EDIFACT standards to ensure global compatibility, the fact remains that there are still two sets of EDI standards used. Optimally it would be best to have one set of standards administered by an international body like the UN. Additionally that body, if it is not to administer XML, should have considerable influence in the organization that does administer it. In reality though, it is likely that the W3C will maintain ownership of the XML specification, while EDI standards bodies develop and maintain ownership of the various DTDs for EDI messages.

Conclusion

Electronic Data Interchange was established as a paperless way of conducting business-to-business transactions. Since its conception, more that 25 years ago there have been massive advances in technology, making traditional methods of EDI cumbersome and expensive. Technologies such as Extensible Markup Language (XML), offer the chace to revitalise EDI and strengthen it to become the future backbone of E-Commerce.

By utilizing EDI dictionaries, and XML, data can be searched, decoded, manipulated, and displayed consistently and correctly without the need

to create special interfaces. XML may be the means to bridge EDI into Internet, by making the existing EDI knowledge base more palatable for E-Commerce developers. With traditional EDI, trading partners who have implemented traditional style EDI systems could potentially add the ability to interact with new trading partners using XML-enabled messaging formats of their traditional EDI messages, thus providing the ability to reach new and lower cost deployment environments via the Web and Internet. XML/EDI offers the opportunity to finally give small and medium enterprises a way of access a global marketplace, which due to extreme costs was previously unobtainable. Potentially XML/EDI allows all members of the business and retail sectors to take advantage of access to a diversified world market.

References

1. World Wide Web Consortium (W3C), http://www.w3.org.

2. http://www.edi-info-center.com/html/ec_xml_101.html

*3.*http://www.commerzbank.com/firmen/service/edifact/edifact.htm

4. http://www.edi-tie.nl/

5. http://www.hl7.com/

*6.*http://www.wpc-edi.com/Insider/Articles/Categories/EDIFACT.html

7. XML/EDI: Not Your Father's Translator, C. Shih, Gartner Group, July 1998.

8. XML/EDI: Why `Standards' Will Increase Incompatibilities, C. Shih, Gartner Group, June 1998.

9. ANSI ASC X12/XML FAQ Sheet DRAFT Version 0.2.

10. XML Complete, Holzner, McGraw-Hill, 1998.

11. Private Networks: An Internet Alternative, Beyond Computing, October, 1997, Volume 6, Number 8.

12. Department of National Defence (DND) CALS Homepage http://cals.debbs.ndhq.dnd.ca/english.

13. United Nations Economic Commission for Europe, http://www.unece.org.

14. United Nations EDIFACT in Australia http://edifact.standards.com.au/

15. The XML/EDI Group's Homepage, http://www.geocities.com/WallStreet/Floor/5815.

16. Introducing XML/EDI Frameworks, Electronic Markets, David Webber, 41 Volume 8 D Number 1 D 1998.

17. CORBA/ Internet Inter-ORB Protocol (IIOP) 2.2 Specification http://www.omg.org/corba/corbiiop.htm.

18. The CEN/ISSS European XML/EDI Pilot Project. http://www.cenorm.be/isss/workshop/ec/xmledi/interim.html.

19. Preliminary Repository White Paper, A White Paper for the DOD CALS IDE Project, ManTech Advanced Systems International, Inc.

20. W3C work in progress, Extensible Stylesheet Language (XSL), Version 1.0, World Wide Web Consortium Working Draft August 18, 1998, www.w3.org/TR/WD-xsl.

21. XML – The Adoption Curve, Harvard Computing Group Report, Volume 1 Number 4, 1999 http://www.harvardcomputing.com/Resources/Reports/XML/xml.html#Perfectcocktail

22. W3C Proposal for XSL.

23. 971208 W3C press release.

24. www.w3.org/Style/.

