Gas Industry Standards Board

XML White Paper
DRAFT

Prepared by the GISB XML Task Group

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Executive Summary

GISB executive committee assigned the XML task group to explore XML and report back its findings to determine if GISB should proceed with creating a standard for XML. While GISB has long been a leader in developing EDI transactions for the gas industry, the use of XML has not been embraced by GISB thus far. XML is a new tool that can be used to conduct Electronic Commerce in conjunction with EDI. Many industry groups are recognizing XML as the "next wave" of sending information electronically to various Trading Partners.

The XML subcommittee has met monthly over the past few months to discuss XML and conduct research to put together this "GISB white paper" as a basis for determining whether GISB should join other industry groups in developing XML transactions.

While this group has differing opinions on what the next step should be, the group is in agreement that the executive committee should continue to explore XML with the XML task group within GISB. That group would then continue it's work to determine the next steps for GISB with XML, whether that be develop new standards for GISB in XML, develop current GISB standards in XML, start an XML pilot program, etc. This group should also consider working with other industry XML work groups, like UIG XML, to see if any synergies could exist between the two groups.

1. Overview

Electronic Business Transactions (EBT) between Trading Partners are often complex, data-intensive communications that are costly to establish and maintain. eXtensible Markup Language (XML), is a mark-up language that formats data values while identifying each data element through the use of readable tags. Traditional standards, like Electronic Data Interchange (EDI, have the identification of the data externally defined and are not included in the transaction itself. XML is applicable to GISB in the following sectors:

- Business-to-business (B2B)
- Business-to employee (or enterprise) (B2E)
- Business-to-customer (B2C)

This broad base of applicability is one of the items that EDI does not offer and makes the adoption of XML technology so attractive. Currently EDI is extensively used for Business-to-Business electronic process integration. EDI has had many years to perfect its structure and it works well for existing transactions, but may not support ever-changing data structures. XML "extensibility" is quite powerful, and while you could "extend" EDI documents, EDI is not as user friendly to customize.

XML offers benefits that EDI, in the past, has not been able to accommodate:

- XML is designed for use on the Internet. The Internet itself provides opportunities for companies to minimize their costs by reducing their dependence on traditional Value Added Networks (VANs).
- Application programs can optionally read and write XML natively for real-time needs.
- Translators are an option with XML, not a requirement as with EDI.

So why should GISB incorporate the use of XML into its business processes? Some of the benefits of XML are as follows:

- Flexibility for users while interacting with a wide range of Trading Partners as a result of its ease of development and maintenance.

- Encourages the formation of Trading Partner communities as a result of its growing acceptance across many industries.

- Method to provide a simple, cost effective, standard framework to transfer data and display documents over the Internet; XML is designed to be

readable by people and easily parsed by computers. Both of these design decisions help reduce development and quality assurance costs.

- Software, development tools and parsers for XML parsers are inexpensive and rapidly flooding the development workforce domain.

- XML separates the data from display elements allowing more flexibility and easier manipulation of both data and presentation. This means that the data is standard and more accurately reflects actual database data while the display of data may be customized to Client specific requirements and displayed via web browsers.

- Customized formatting of documents through the use of style sheets. This allows the business User community to view (via browser technology) XML documents in a language they understand while simultaneously application server's process this file in a language they understand. Additionally, XML documents can be intelligently searched with standard browser tools.

- Allows for advanced data typing including structure, data types, and enumeration's. This means that the data component of a document can be processed through a stringent set of data validation rules prior to production application processing. This XML validation is achieved with supporting XML schema or data type definition files resulting in only acceptable data continuing into production systems.

- Aligns itself with object oriented technology providing a means for dynamic method calls to surrounding application objects independent of system platforms. An XML message with the appropriate developer tool set may be "piggybacked" on an existing Internet protocol (i.e. HTTP). The XML message structure can be designed to allow request and response method calls to application objects. This powerful combination of XML and object oriented design allow message calls to other platform independent applications as the transaction works its way through the business process workflow.

The following are inhibitors that GISB will have to address through the XML committee:

- XML document standards are either not established or not in wide use today. Although other industry groups are reviewing the use of XML and some are developing standards for their use, as of today the use of XML is sparsely used.

- Today most applications won't speak XML natively.

- In addition to “EDI experts and specialized translation software” there will also be a need for companies to have “XML experts and specialized parsers”

- "Back end systems" will still have to interface with an XML “translator”, just as with EDI. Whether this same interface can be used for both is uncertain. It is uncertain at this time if EDI and XML can be supported by the same interface.

- XML as an alternative for communicating data exchange will require the conversion of current data formats and languages resulting in costs and technical resource commitments.

- XML industry standards bodies must keep pace with this rapidly expanding technology. Standard business data structures across horizontal and along vertical business domains must be established for XML to truly reach its potential.

Various entities are working to combine traditional EDI with XML to create XML based syntaxes for horizontal (cross industry) use of XML. These include EDI standards bodies (DISA/X12, CEFACT, STEP and EDIFACT), industry associations (FIX, EDIX, MBA, OTA, HL7), and trade consortiums (BizTalk, OASIS, ebXML, RosettaNet, CommerceNet, OFI, OTP, ICE). The W3C as a whole is working on extending and improving XML to meet the challenges of deploying interoperable e-Business systems. The XML standards community is encouraging industry specific groups to develop XML vocabulary appropriate for industry specific B2B requirements.

Data tags and schema standards are in various stages of development throughout some industries. There is no "transaction standard" or not in wide use as there is in EDI. If GISB is to adopt XML, they may be some duplication of effort from what other industry groups have done, however this is not different from EDI.

2. What is XML?

The XML specification was officially ratified by the World Wide Web Consortium (W3C) in February 1998 as an extension of the capabilities of HTML and Standard General Markup Language (SGML). XML is a tag-based framework used primarily to exchange data in a universally understood format. XML is a subset of the Standard Generalized Mark-up Language (SGML) and is similar to HyperText Mark-up Language (HTML). XML contains significant design features to keep it simple and consistent and avoid the incompatibilities and complexities found in HTML. Also, XML is subject to an official International Standards Organization (ISO) standard. Support of ISO standards is essential to the implementation of XML, ensuring simple and consistent behavior across a broad range of systems and Trading Partners.

XML was created to deliver structured, readable, usable information over the Internet platform. In traditional data formats, such as Electronic Data Interchange (EDI), data is defined by the position it takes in the file structure. In XML itself, the position of the data is not important; “tags” identify or define the data content. It can be used to specify the presentation of a document (font size, indentation, etc.) or to specify structure of the document through Document Type Definitions (DTDs) or schemas. Schemas and DTD’s are content and element code used to support each XML instance document. They are a collection of statements that define the structure of XML data and the constraints of that structure. Such constraints include syntax and data-typing. XML is validated through the implementation of schema / DTD files. Schemas provide more specificity about the XML document as compared with DTD’s, however the W3C has not issued their final recommendation for schemas.

Repositories are used to provide a standard reference point for XML content documents and processes. As standards develop and common schemas/ DTDs are frequently required by vertical communities, a number of online repositories to house such documents will be developed. GISB would have to control these DTD's or schemas as a way to ensure the XML documents are maintained to the "GISB standard".

3. Why use XML?

The implications of XML based B2B commerce are profound. XML enjoys the advantages of its heritage as an Internet-centric protocol. XML is easily viewable by people via applications such as desktop browsers. XML also leverages existing Internet HyperText Transfer Protocol (HTTP) based communications and security infrastructure. Moreover, XML-based communications support real-time application-to-application and Web-to-application document flow and integration. In short, XML leverages existing Internet investments.

XML allows developers to separate the presentation layer (forms) from the data interchange layer (information). It is specifically targeted to support forms and document based interchanges via the Internet by defining the metadata details. XML's structure facilitates deployment architectures that improve Internet delivery performance and better information manipulation via the Web over HTML. These techniques allow developers to better handle unstructured information interchanges, as well as providing the means to represent traditional fixed structured (EDI type) data interchanges.

XML adds the ability to define message structures with the interchange transaction (XML linked to Document Type Definition (DTD) formats). It also adds the ability to model the business rules and interchange requirements (extended XML based process templates). Finally, XML uses software technologies (HTML forms and business application components) driven from the XML formats that are adaptive and self-maintaining.

Among the benefits of using XML, are reduced operational cost and ease of use. XML delivers comparable functionality that is comparable to EDI using standard browser technology and is already built into several software packages and development tools. This allows the use of XML-based (EBT) in smaller companies that normally could not justify more expensive, traditional EDI implementations. Transport of XML EBT files using the Internet promises to reduce the cost of sending and receiving documents when compared to the use of VANs (Value Added Networks) or dial up connections between Trading Partners.

XML uses bracketed tags to annotate the data, enabling the interpretation of EBT's by a wide community of users. These tags may be used rather than the cryptic codes found in the more complex language of traditional EDI.

4. Infrastructure of XML

The XML Specification is, like the technology it has given rise to, a hybrid. It is more than the set of rules of the formal grammar it contains. It assumes a set of generic technologies. It requires UNICODE. It defines a specific set of markup symbols, etc. The specification is open and under the control of the W3C.

The mathematical rigor, with the clarity and simplicity of XML's grammar, means that software tools can be easily created to generate, format, reformat, evaluate, and manage well-formed documents of tagged data. Data objects, which are subject to the constraints of a formal grammar, are also mechanically testable for "formation" and "validity". These are valuable properties of XML - compliant data-objects. They are particularly valuable because the XML Specification contains a meta-language; it provides rules for the creation of distinct families of compatible data objects.

XML Infrastructure includes management, technology, and process context of XML. Infrastructure specifically encompasses the family of secondary technologies and specifications currently under parallel development at W3C. Some important XML related infrastructure technologies include Xlink, Xpointer, XSL, CSS, DTD, XSLT, DOM, NameSpace, XQL, RDF, and Schemas.

A description of these components of XML infrastructure, mostly as described by W3C standards and documents, follows.

4.1 XML Pointer Language (XPointer) and XML Linking Language (XLink)

Defines a standard way to represent links between resources. In addition to simple links, like HTML's **<A>** tag, XML has mechanisms for links between multiple resources and links between read-only resources. XPointer describes how to address a resource, XLink describes how to associate two or more resources.

4.2 XSL (Extensible Stylesheet Language) stylesheet processor

Accepts a document or data in XML and an XSL stylesheet and produces the presentation of that XML source content that was intended by the designer of that stylesheet. There are two aspects of this presentation process: first, constructing a result tree from the XML source tree and second, interpreting the result tree to produce formatted results suitable for presentation on a display, on paper, in speech, or onto other media. The first aspect is called tree transformation and the second is called formatting. The formatter performs the

process of formatting**.** This formatter may simply be a rendering engine inside a browser.

4.3 XSL Transformations (XSLT)

A language for transforming XML documents into other XML documents. XSLT is designed for use as part of XSL (a stylesheet language for XML). In addition to XSLT, XSL includes an XML vocabulary for specifying formatting. XSL specifies the styling of an XML document by using XSLT to describe how the document is transformed into another XML document that uses the formatting vocabulary. XSLT is also designed to be used independently of XSL. However, XSLT is not intended as a completely general-purpose XML transformation language. Rather it is designed primarily for the kinds of transformations that are needed when XSLT is used as part of XSL.

4.4 XML namespace

A collection of names, identified by a URI reference [RFC2396], which are used in XML documents as element types and attribute names. XML namespaces differ from the "namespaces" conventionally used in computing disciplines in that the XML version has internal structure and is not, mathematically speaking, a set.

4.5 XML Schema

Like a DTD, an XML schema can be used to specify the schema of a particular class of documents. Unlike DTDs, however, XML Schema uses XML syntax. This is convenient since you are not required to learn a completely new syntax just to describe your grammar—although you do need to learn how to declare elements and attributes using XML Schema. In addition, XML Schemas offer a number of other significant advantages over using DTDs. An abundance of information related to this is at http://www.w3.org/TR/xmlschema-0/ and HTTP://msdn.microsoft.com/xml/reference/schema/start.asp.

4.6 XQL (XML Query Language)

Provides a natural extension to the XSL pattern language. It builds upon the capabilities XSL provides for identifying classes of nodes, by adding Boolean logic, filters, indexing into collections of nodes, and more. XQL is designed specifically for XML documents. It is a general purpose query language, providing a single syntax that can be used for queries, addressing, and patterns. When XML is used as a universal interchange format, it is often desirable to also have a universal query language for requesting relevant data. When applets use Java to persist or parse data, it is helpful to allow them to query for the data they need. When multiple views of document data are desired, a query language is an ideal means of specifying these views. Intelligent agents using XML for data discovery are much more powerful if they can discover and query their data

sources. In short, most of the applications to which XML is particularly well suited are enhanced by the availability of a suitable query language, which XQL is destined to become.

4.7 The Resource Description Framework (RDF)

A foundation for processing metadata; it provides interoperability between applications that exchange machine-understandable information on the Web. RDF uses XML to exchange descriptions of Web resources but the resources being described can be of any type, including XML and non-XML resources. RDF emphasizes facilities to enable automated processing of Web resources.

RDF can be used in a variety of application areas, for example: in resource discovery to provide better search engine capabilities, in cataloging for describing the content and content relationships available at a particular Web site, page, or digital library, by intelligent software agents to facilitate knowledge sharing and exchange, in content rating, in describing collections of pages that represent a single logical "document", for describing intellectual property rights of Web pages, and for expressing the privacy preferences of a user as well as the privacy policies of a Web site.

RDF with digital signatures will be key to building the "Web of Trust" for electronic commerce, collaboration, and other applications. RDF Schemas might be contrasted with XML Document Type Definitions (DTDs) and XML Schemas. Unlike an XML DTD or Schema, which gives specific constraints on the structure of an XML document, an RDF Schema provides information about the interpretation of the statements given in an RDF data model. While an XML Schema can be used to validate the syntax of an RDF/XML expression, a syntactic schema alone is not sufficient for RDF purposes. RDF Schemas may also specify constraints that should be followed by these data models.

4.8 Document Object Model (DOM)

A platform- and language-neutral interface that allows programs and scripts to dynamically access and update the content, structure and style of documents. The Document Object Model provides a standard set of objects for representing HTML and XML documents, a standard model of how these objects can be combined, and a standard interface for accessing and manipulating them. Vendors can support the DOM as an interface to their proprietary data structures and APIs, and content authors can write to the standard DOM interfaces rather than product-specific APIs, thus increasing interoperability on the Web. In summary, the goal of the DOM specification is to define a programmatic interface for XML and HTML.

In conclusion, it is important to summarize some important basic features of the XML technology:

- XML can support format-independent, plain-text transfer of structured data.
- The underlying technology is open-sourced, non-proprietary, and free.
- XML supports cross-system portability.
- XML is network transparent.
- XML technology is Internet based.
- XML resources can be globally distributed.
- Browsers can be either open or proprietary; proprietary browsers can use proprietary implementations of XML.
- URL based resources are not necessarily guaranteed.
- The WWW is global; international standards bodies have an important role to play.

5. GISB Sector Perspective

5.1 XML - Producer perspective

5.1.1 Internet -- public infrastructure

Benefits:
Using the Internet to transfer data is less expensive than private networks.

Inhibitors:
There is no guaranteed service level yet. IPv6 supports quality of service but is only beginning to be adopted. Transfers are subject to delays and outages.

5.1.2 GISB scope

Inhibitors:
GISB standards are voluntary. Currently membership is focused on the US, Canada and Mexico. There is nothing in the GISB charter that prevents international firms from adopting its standards. In the US certain standards have been adopted by the Federal Energy Regulatory Commission (FERC) and those standards are now mandatory for the US Interstate pipelines. If XML standards are not required by the regulatory agencies, companies may require multiple interfaces to do the same kind of business with compliant and non compliant partners.

5.1.3 Lower Application Development Cost

Benefits:
In certain situations, XML should enable reduced costs for development of interfaces between applications. However, there is still a large dependency on C++ and Java development skills for the applications that use the content transferred via XML. If the XML standards are broadly adopted, there will be a saving in the cost of translations because they will be done in a standard way.

5.1.4 Validation

Validation is included in existing EDI standards.
Benefit:

XML enables validation of the schema, structure, relationships and dependencies of the content but does not enable validation of the actual content.

Inhibitor:
You could receive a valid XML data stream full of garbage numbers.

5.1.5 Readability

Benefit:
XML is easily readable and parsible.

Inhibitor:
There is increased overhead in parsing and validating XML data streams, which could slow large data transfers. The data is more readable by humans but this can lead to misinterpretation by someone who thinks they know how to read it...It is easier to tamper with the content of an XML data stream.

5.1.6 Opportunities

- Members that adopt the XML standards will be easier to establish B2B with because they will be able to respond quicker to changes. Those that don't may lose market share.
- Standardizing may enable automation of some trading and transportation functions.
- Since ERP and supplier management applications are tending to use XML, it's use in trading and transportation systems will enable easier interfacing with these other enterprise systems.
- Standardizing metering devices to send XML data streams instead of proprietary protocols would simplify the use of meter data.
- XML is being adopted as a storage structure for other applications like word processors. This will enable sharing of additional types of data between applications.

5.2 XML - The Pipeline Perspective

Usage

The use of XML in the pipeline sector will allow customers a new method of sending to, and receiving data from their transportation service provider. XML offers benefits such as the flexibility to integrate with existing systems and re-usability of information.

Implementation

As discussed in other sections of this subcommittee document, XML is a method of "tagging" data to provide meaningful information *about* that data. From these tags, systems can be instructed to process this data on receipt provided that the receiving system is aware of the relevance of the tags. A very basic example of XML tagging of data is offered. In the example, an inventory transfer record is created for a laptop computer (example from Charles F. Goldfarb's *"XML In an Instant"*):

XML Tagged Data

<PRODUCT>
<MODEL>P266 Laptop</MODEL>
<DEALER>Friendly Computer Shop</DEALER>
<PRICE>1438</PRICE>
</PRODUCT>

Possible XML Physical Implementation Methods

EMBED Word.Picture.8 **Error! Objects cannot be created from editing field codes.**

Integration Flexibility

XML is an extremely flexible language for the transmission of data. XML can be generated and sent directly from a variety of systems including databases, messaging systems, web servers, application servers and custom developed software. Any of these systems, as well as (in the near future) most standard web browsers can also interpret XML for the storage or presentation of data.

Internet as Communications Enabler
Because XML was designed to be an Internet-ready communications language, XML is well suited to extend the capabilities of Web-implemented Customer Activities systems. XML can be used along with HTML to present data to customers in a web browser, format data for reporting and generate XML formatted data for internal systems from customer input through standard web forms.

Integration with Existing EDI or Flat File Systems
XML is being adopted by several other industries, and as such the pipeline sector should be prepared that some of their customers may be in a position to implement XML before they would be in a position to implement an EDI infrastructure. The Pipeline industry, however, is more likely to have already

implemented an EDI infrastructure, and may not want to spend the time or money developing an XML solution.

To accommodate this possibility, XML can be integrated into existing EDI communications architectures by utilizing an EDI-XML translator. Shippers could send an agreed upon XML formatted document to the Transporter's EDI-XML translator which would then interpret and reformat the document to either the X12 or Flat File format the Transporter's system requires. Market-ready systems such as GISB Agent are already available with the ability to provide this service. Other EDI products are bound to follow. Using this path would require the least changes needed by the transportation service provider who already has EDI in place.

For further information on EDI-XML co-existence, please see the white paper "XML and EDI Peaceful Co-Existence" at http://www.xmls.com/library/whitepapers/co-existence.pdf

System to System Communications
Because most database and messaging systems are now being developed to be XML capable, it is possible for systems to be written that would allow direct communication from internal system to internal system. This could require a significant development effort and may be more appropriate for review in the future, however the opportunity is presented in an XML environment.

Inhibitor

Redevelopment Effort
In any event, some amount of redevelopment or "retooling" of existing systems will likely be required to integrate XML into operations, however, because it is possible to implement XML into existing systems, the impact should be lower than if XML had to replace technologies such as EDI.

Need for Standards
XML (like EDI) is only effective when an agreed upon format is defined for the transmission of data. A well thought, clearly defined schema would need to be defined which could require considerable effort. Further, there is already movement by groups to begin the definition of such a schema for the Gas sector, which means that there is potential for conflicting schemas if not carefully managed.

The Growing Number of Interfaces
X12, Flat File, Customer Activity Screens, now XML. The number of methods the industry needs to support for receiving / transmitting data grows again. Is it in the industry's best interest to support this growing number of technologies? The answer may simply be that by preparing in advance for these things is simply a

requirement of doing business in the day and age of rapid changes in technology. Customer systems for office supply ordering, travel management, and other business to business processes are already being built and adopted using XML based systems. This is bound to have a carry over effect to the core business of our customers.

5.3 XML - LDC Perspective

On the issue of standardized electronic communication, there may be as many LDC positions as there are LDCs. Whether acting in its service requester role (e.g. placing nominations to a pipeline, executing capacity release transactions, etc…) or in its service provider role (e.g. processing customer choice enrollment and history requests), there is little debate that standardized electronic communications play a role in making business processes more efficient. XML shows significant potential towards achieving efficiencies in either LDC role.

As a service requester, LDCs may communicate their transactions to pipelines in at least two (X12-EDM and EBB-EDM) standard means and sometimes a third means (FF-EDM). LDCs have, with a few significant exceptions, avoided X12-EDM because they generally lacked the volume of transactions necessary to justify the investment in systems infrastructure to support X12. Many pipelines only had a few (if any) X12 Trading Partners because LDCs, who historically have held a large share of pipeline firm capacity, did not move to standardized electronic communication. One of the reasons LDCs, through the EIITF, advocated development of FF-EDM was that flat files, in a simplistic sense, emulated the batch nature of the X12 datasets. FF-EDM permits a service requestor to utilize standard electronic communications with tools simplistic as common spreadsheet software.

Pipelines are not required to provide FF-EDM and in many cases, have not yet indicated that they have plans to do so. While interactive standard electronic communication is handled via EBB-EDM, X12 remains the only batch option in some cases. XML could provide another batch alternative, for example, a flat-file created out of a spreadsheet could interface with X12 EDI via an XML translation. Because XML is similar to HTML, presentation to the user can be optimized for visual effectiveness. XML may develop into a technology that utilizes the best features of GISB three formats:

- The user interface of EBB-EDM
- The accessibility of FF-EDM
- The efficiency of X12-EDM

As a service provider, there are both differences and similarities to the electronic communications requirements faced by pipelines. The primary business process

driving the need for standardized electronic communication is customer choice. While many states have gas unbundling initiatives in progress, most do not. There are perhaps 5-10 states where customer choice programs have evolved to the point where standardized electronic communications make practical sense today. Nevertheless, when one considers the number of burner tips and the types of transactions (enrollment, measurement, billing, etc.) that can happen each month on a per burner tip basis, the potential number of transactions is staggering. When some envision the end-state of customer choice through the eyes of today's technology, X12 EDI appears to be the only reasonable choice upon which to build standardized electronic communications.

While the end-state appears daunting, most customer choice programs are in their nascent stages. Many programs function well with manual or limited systems because the number of customers in the choice programs is very small. Web based enrollment combined with provision/acceptance of non-standard flat files drive larger programs successfully. Yet to reach to the next level, many believe standardized electronic transactions are necessary. Several states have initiated proceedings to develop such standardized transactions. Further, there are several industry groups who approach the same issues at a national level from different perspectives of the transactions.

In those cases where LDC customer choice programs have grown or project growth to the point where standardized electronic communications make sense, X12 EDI has most often been the choice upon which to standardize. A few years ago, many thought that large industry players would participate in most LDC customer choice programs and develop a communications infrastructure that supported a relatively small number of Trading Partners trading large quantities of data. While this prediction might some day come true, a more accurate description of the retail customer choice market shows large industry players participating in only a few programs and smaller regional marketers and utility affiliates holding significant market shares, albeit in a few markets here and there.

Many see the lack of standardized electronic communications as one reason the market has not developed as predicted a few years ago. Yet many regional marketers and utility affiliates have been hesitant to adopt X12 EDI because they do not necessarily have national aspirations and are willing to customize the operations to work in a select few territories.

Utilities need to be responsive at a system level to their customers (the marketers) yet there is no clear consensus to move to X12 EDI for a variety of reasons elaborated above. Implementation of standardized electronic communications should not come at the expense of current market participants, rather it should be a natural evolution that makes sense for the market as a whole. Utilities can, in some cases, maintain dual systems to accommodate both sets of marketers. Where the dual system is somewhat sophisticated (e.g.

internet based forms entry and flat file transfer) this may not prove too difficult but where the systems are manual, this can be very inefficient for the utility.

Technology is evolving rapidly to the extent that multiple options exist for standardized electronic community, it would appear solutions that satisfy a broader spectrum of market participants are on the horizon. The general expectation in the industry is that XML many prove to be a viable successor to, or a more efficient alternative, to the X12 format. Because XML appears to incorporate browser like capabilities from the service requestor perspective and EDI like formatting from the service provider perspective, it may well be the optimal path for customer choice programs that are not yet at a stage where X12 implementation makes sense. Additionally, where X12 has been implemented or is about to be implemented, it appears likely that XML would complement X12.

5.4 XML - Services Perspective

5.4.1 Overview

With the deregulation of the retail-energy industry in the 1990's, the need for a mechanism to exchange transactions amongst trading partners emerged as a critical enabling factor. At the time, pioneering states such as California, Pennsylvania and Massachusetts looked to EDI/Van technology as the most efficient and effective way to achieve such exchanges. At the time these states had to make their decisions, XML was in its infancy. There was no clear alternative to EDI.
For example, in 1997, a Massachusetts working group looking at the issue developed a report to the Massachusetts regulators. According to the Massachusetts DTE order which addressed deregulation:

> **"The Report states that, after a review of the technologies and services available for packaging standardized transaction formats for transmission over public and private networks, the Working Group unanimously recommends the use of the electronic commerce industry's Electronic Data Exchange ("EDI") implementation guidelines. The Report states that the EDI format to be implemented will use 'existing ANSIASC X.12 transactions which will be tailored for use in the exchange of information of distribution companies and suppliers'"**
>
> *Source: D.P.U./D.T.E. 97-65, p.70, December 31, 1997*
> *(http://www.magnet.state.ma.us/dpu/electric/97-65/97-65or2.pdf)*

STATE OF NEW YORK PUBLIC SERVICE COMMISSION, OPINION NO. 00-05, CASE 98-M-0667 – In The Matter of Electronic Data Interchange, OPINION AND ORDER ON IMPLEMENTATION OF ELECTRONIC DATA INTERCHANGE, Issued and Effective: April 2, 2000, Page 12.

In the three years since that time, additional jurisdictions have adopted EDI as well. However, at the same time, development of XML has continued at a ferocious pace. Today, numerous industries are exploring XML as a standard for trading partner communications.

5.4.2 XML & Software Development

As jurisdictions around the United States, and for that matter around the world, deregulate their energy markets, they face a myriad of issues as they consider how best to deregulate energy markets. One of those issues is how best to enable the flow of transactions amongst trading partners. While on the surface this may seem like a technical infrastructure detail, the decisions made here can have a profound impact on the ability for new participants to gain access to the markets.
The adoption of XML as a standard has several benefits as relate to the basic "infrastructure" for trading partner relations.

Benefits include:

- Lower Application Development cost
- Reduction of translation cost
- Lower testing/operating cost
- Designed for the internet

Lower Application Development Cost:

As compared to traditional EDI-based application development, XML offers a lower cost alternative because applications can read it directly. Applications written for a business environment where XML is adopted as a standard can be designed and coded to take full advantage of direct integration of the XML-based transactions.
XML as an Internet technology draws interest from a large and growing community of software vendors and engineers. XML software and development tools including utilities and parsers are inexpensive and rapidly flooding the development workforce domain.
XML separates the data from display elements allowing more flexibility and easier manipulation of both data and presentation. This means that the data is standard and more accurately reflects actual database data making it easier to understand for database administrators.
XML shortens the development lifecycle of user interface development using XSL style sheets. Quicker development equals lower cost. Style sheets allow the business User community to view (via browser technology) XML documents in a language they understand while simultaneously application server's process this file in a language they

understand. Additionally, XML documents can be intelligently searched with standard browser tools.
XML with supporting industry wide common schema/dtd technology allow for advanced data typing including structure, data types, and enumeration's. This means that the data component of a document can be processed through a stringent set of data validation rules prior to production application processing. This XML validation results in only acceptable data continuing into production systems reducing numerous operation costs of data cleansing downstream.
XML aligns itself with object oriented technology providing a means for dynamic method calls to surrounding application objects independent of system platforms. An XML message with the appropriate developer toolset may be "piggybacked" on an existing Internet protocol (i.e. HTTP). The XML message structure can be designed to allow request and response method calls to application objects. This powerful combination of XML and object oriented design allow message calls to other platform independent applications as the transaction works its way through the business process workflow.
All of the above benefits would mean little if XML were difficult to implement. Thankfully, this is not the case. The resources required to develop XML-based applications require skills that are generally available in greater quantities in the marketplace, and at a lower cost than those with programming skills such as C++ and Java. Thus, not only does XML offer cost saving functionality, but the resources required to develop that functionality are less expensive than in other development environments.
In jurisdictions where the rules of trading partner relationships have not been established, the adoption of XML offers the greatest advantage. New applications can be written to take full advantage of XML. In addition, legacy system programmers can benefit from some of the inherent benefits of XML such as ease of readability as they modify their systems to accommodate the new trading partner transactions.

Reduction of translation cost:

Since XML can be read directly by applications, there is no need for translation from XML to other formats (such as flat files). Thus, for systems designed for markets where XML is adopted, trading partners can avoid the cost of translators and/or translation services.
Even where the XML interface for a given system differs from the XML-standards, relatively simple translation can occur using eXtensible Stylesheet Language Translation (XSLT). XSLT allows for the transformation of XML documents. As with other XML-related development, it is relatively straightforward and can be learned quickly.

Lower operating cost:

Another benefit of XML is that it can be read by humans as well as applications. In the example below, there is little room to question the meaning of the data contained between the tags:

<CustomerInformation>

```
        <FullName>John William Smith</FullName>
        <LastName>Smith</LastName>
        <FirstName>John</FirstName>
        <MiddleName>William</MiddleName>
        <CompanyName>Smith Appliances</CompanyName>
</CustomerInformation>
```

This ease of readability can be especially beneficial in the testing and operational considerations of trading partner relations. As analysts work to test new trading partner relationships, transactions can be readily debugged.

In addition, schema can be utilized by the trading partners to assure the quality of the transactions being sent. As the changes in the industry occur, XML's ease of parsing and validation help developers quickly adapt to such changes.

Designed for the Internet:

XML is well positioned to exploit the benefits of the Internet and existing investments in Internet infrastructure. As tools that support all aspects of the Internet continue to proliferate, applications, which rely upon XML, benefit.
XML is viewable by users via desktop browsers. XML can leverage HyperText Transfer Protocol (HTTP) based communications and security infrastructure as well as other common protocols. XML facilitates deployment architectures that improve Internet delivery performance. XML as an Internet enabled technology facilitates EBT transaction creation, modification, and distribution with great ease.
Many small to medium size companies have not adopted EDI due to the investments required. On the other hand, most companies have some Internet investment. XML is the vehicle by which those small/medium companies can leverage their Internet investments for the purpose of interacting in the deregulating energy markets.
The adoption of XML as a standard may also have certain inhibitors.
Inhibitors include:

- XML as a relatively new language must prove itself.
- XML as an alternative for communicating data exchange may require the conversion of current data formats and languages resulting in costs and technical resource commitments.
- XML industry standards bodies must keep pace with this rapidly expanding technology. XML is about structured extensible business data. Standard business data structures across horizontal and along vertical business domains must be established for XML to truly reach its potential.
- XML used in conjunction with object oriented designed systems will result in major benefits to an Organizations bottom line. However, in that many of today's production systems may not yet be object oriented, it will take time and technical resources to achieve many of the XML benefits.

XML is a text format, which uses tags to delimit the data resulting in files larger than comparable binary formats. Not much of a disadvantage in that disk space is not as expensive as it once was and inexpensive zip programs can compress files very well and very fast. Also, most communication protocols can compress data on the fly, thus saving bandwidth as effectively as a binary format.

5.5 XML - End User's Perspective

(None supplied as of this writing)

6. Glossary

DTD: Document Type Definition. A description of the content of an XML document that can be industry, application, or business-specific.

EDI: Electronic Data Interchange. Computer-to-Computer transfer of business transactions using standard message formats.

HTML: HyperText Markup Language. A suite of markup symbols, embedded with a Web page file.

HTTP: HyperText Transport Protocol. An application protocol that defines how information is exchanged on the World Wide Web.

Markup Language: Commands that define how the contents of a file are displayed or printed and how individual data elements within a file are to be processed.

Namespace: Used in XML documents to ensure that element and attribute names are used unambiguously.

Schema: Provides structure definition and validation capabilities similar to those provided by DTDs.

SGML: Standard Generalized Markup Language. The parent language used to describe tag-based, structural document languages, such as HTML and XML.

XML: eXtensible Markup Language. An emerging data format developed by the W3C that separates data content from business rules therefore making it easier for independent computer systems to communicate with each other.

XSL: eXtensible Stylesheet Language. A proposed standard that allows Web developers to apply formatting rules to XML documents to display by a browser.

7. References

1. www.w3c.org : W3C XML Specifications
2. XML's Impact on E-Commerce: A Closer Look at its Role in EDI, EAI, and Supply-Chain Processes, http://www.gegxs.com
3. The Design of XQL Jonathan Robie, Texcel Research
4. http://msdn.microsoft.com/xml/xmlguide/
5. Utility Industry Group XML White Paper
6. Excelergy XML for Retail Energy Transactions: A White Paper
7. http://msdn.microsoft.com/xml/reference/schema/start.asp
8. State of New York Public Service Commission, Opinion No. 00-05, Case 98-M-0667

8. Appendix

XML as an Electronic Business Transaction Strategy and Standard
A Case Study: Ontario, Canada Energy Deregulation

As part of the strategy to encourage participation in the open marketplace in Ontario, the Ontario Energy Board (OEB) has mandated in the Retail Settlement Code (RSC) dated February 28, 2000, the use of an Electronic Business Transaction (EBT) Clearinghouse. Transactions such as enrolments, requests for meter data, billing data, and payment history will be processed electronically via the Ontario EBT Clearinghouse (Hub). The implementation of a Hub will expedite transactions between the various market participants once the market opens in November 2000.

Ontario Electronic Business Transaction (EBT) Clearinghouse Sub Team Background

To assist in expediting the use of EBT in Ontario, Toronto Hydro and Ontario Hydro Networks Company (OHNC) formed a consortium that worked closely with the OEB for the purpose of developing detailed business processes and defining electronic transactions necessary to support retail choice. An Advisory Committee was formed, consisting of a consortium of market players – Brantford Hydro, Direct Energy, Enlogix, Hydro Mississauga, Milton Hydro, Ontario Hydro Networks Company (OHNC), Ottawa Hydro, Toronto Hydro, Union Gas, and Utilipro. The EBT Sub Team was then formed to establish the standards for the business rules, transaction sets, and protocol to be used in Ontario. The EBT Sub Team consisted of staff from some of the above companies, as well external expertise. The external team members consisted of ExtenSys, Excelergy, Systrends, and Ernst&Young. Their vast knowledge of deregulation and prior EBT experience was drawn upon. The EBT Advisory Committee reviewed the progress of the EBT Sub Team approximately every two weeks and provided feedback on progress to date. Both the Advisory Committee and the OEB received daily updates on project progress and assisted in clarifying the code and in closing issues.

One of the first recommendations of the EBT Sub Team that was reviewed and approved by the Advisory Committee was the choice of XML as a standard for the EBT format.

The EBT Sub Team formed five Working Groups. This allowed them to focus on each of the detailed transaction sets and to build the required process flows in order to adhere to what was mandated in the OEB RSC. These teams were: Infrastructure, Invoices, Meter Data, Payment Remittance Advice and Application Advice, and Service Transaction Requests (STRs). The focus of the Working Groups was to define the EBT standards, the business rules and to put in place the required transaction sets.

Phases of work of the EBT Sub Team will incorporate:

- Complete detailed documentation of all EBT XML standards and formats
- The selection and recommendation of required computer equipment and software, assuring that any software selected supports the required EBT transactions.
- The completion of pre-production testing of the software, application interfaces and data exchange according to the EBT Implementation Guide. (Contained in Appendix C)
- The training of Trading Partners.

Guiding Principles
The EBT Sub Team worked with the following guiding principles.
Transactions should be developed to:

- Facilitate Consumer choice and mobility in an open market.
- Lower the requirements for entry into the market for participants.
- Act as a single point of contact for all participants and Trading Partners.
- Controls cost and increase efficiency, speed, and accuracy.
- Minimize exception and manual processing.
- Focus on the use of electronic solutions rather than paper-based ones.
- Minimize the number of transactions.

Amendments
These EBT standards have been developed by consensus, maintaining the objective of practical and operational results. Recognizing that the processes outlined in these standards are new to many stakeholders, the EBT Sub Team will work with the OEB and all parties to resolve issues that are certain to arise during the implementation stage of these standards.

Choice of XML as the EBT Standard Technology

Several technology choices were evaluated by the membership of the Advisory Team:

A. XML (following currently available proposed utility industry standard transactions with Internet transport)

B. EDI (traditional VAN-centric with ANSI ASC X12 transactions)
C. Internet EDI (traditional ANSI ASC X12 transactions with an Internet transport)

A survey of participants aided in the technology choice of XML over the rest. The following criteria was used:

1. Ease of Implementation (best=1, worst=3)

2. Cost of Implementation (least costly=1, most costly=3)

3. Ongoing cost (least costly=1, most costly=3)

4. Adaptability to change (best=1, worst=3)

5. Technology risk (lowest risk=1, highest risk=3)

6. Strategic Positioning (best=1, worst=3)

7. Technology Maturity (most mature=1, least mature=3)

Transactions Standardised

Electronic Business Transactions standardised with XML formats included:

- Service Transaction Requests
    - Enrollment Request
    -
    - Enrollment Response t
    - Enrollment Response Reject
    - Enrollment Response Accept
    -
    - Historical Usage Request
    - Historical Payment Request
    - Historical Usage
    - Historical Usage Reject
    - Historical Payment Accept
    - Historical Payment Reject
    - Drop Request
    - Drop Response Accept
    - Drop Response Reject
    - Change Request
    - Meter Changeout Request
    - Change Billing Option Request

        - Seamless move Request
        - Change Response Accept
        - Change Response reject
        - Meter Changeout Accept
        - Meter Changeout Reject
        - Change Billing Option Accept
        - Change Billing Option Reject
        - Seamless move Accept
        - Seamless move reject
- Metering Transactions
    - Monthly usage
    - First time usage
    - Cancel Monthly usage
    - Cancel First time usage
- Invoice Transactions
    - Invoice
    -
    - Cancel
    -
    - Settlement Total Invoice
    - Settlement Detail Invoice
    - Market Participant Invoice
    - Cancel Settlement Total
    - Cancel Settlement Detail
    - Cancel Market Participant
- Payment Remittance Advice Transactions
    - Payment Summary
    - Payment Details
- Application Advice Transactions
    - Application advice accept
    - Application advice reject
- Status Advice Transactions
- Functional Acknowledgement
    - Functional Acknowledgement (FA) accept
    - FA reject (bad doc level data)
    - FA reject (all bad transactions)
    - FA partial (some good transactions)