

A WHITE PAPER by Transentric

TranXML™: The Common Vocabulary for
Transportation Data Exchange



EXECUTIVE SUMMARY

eXtensible Markup Language (XML) technology represents the most versatile and robust format for exchanging business information since the development of open electronic data interchange (EDI) standards. In the last two years corporate entities, vertical industry groups and trade portals have begun to realize the benefits of XML. Many have embarked on a fast-track development effort to establish XML as their preferred format for Business-to-Business (B2B) Exchanges and Enterprise Application Integration (EAI).

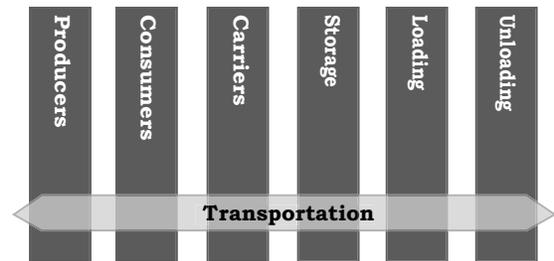
Much of the development effort has centered on vertical industry implementations and has been motivated by the formation of B2B exchanges. Some efforts such as RosettaNet and ChemXML have addressed the supply chain needs of their respective industries (electronics and chemical). In these efforts, the business process models, semantic vocabularies and message functions directly reflect the business practices found in a specific environment. Due to this development methodology, vertical industries are creating collaborative XML dictionaries that are intended to facilitate “one-to-many” trading partner relationships within a specific vertical industry. However, “many-to-many” relationships across industries have different goals and requirements and require a new XML open standard.

Transportation is perhaps the best example of an industry that leverages “many-to-many” relationships. Transportation activities cut across vertical boundaries in industries that produce and consume goods, the carriers that actually move the goods, and those involved in storage, loading and unloading. As vertical industries develop their collaborative vocabularies, Transportation may be asked to adopt and support industry standards inappropriate to its needs. Semantic definition of transport and logistic objects by industry groups may not be based on domain knowledge adequate to support logistics functions.

It is for this reason that Transentric has developed TranXML™, the common vocabulary to support logistics supply chain functions across vertical collaborative vocabularies. TranXML provides the perfect complement to companies who have already implemented EDI, and a perfect solution to those who are now developing XML

solutions for their transportation data exchange. It is envisioned that transportation entities and their trading partners will endorse the TranXML repository and will soon be developing messages and structures to support their electronic commerce needs.

Transportation Cuts Across Many Vertical Boundaries



Leveraging the Extensive Legacy of EDI Formats

The largest obstacle to data exchange is the lack of common semantic structures and repositories supporting the flow of data to and from disparate applications. For instance, in the supply chain, a ‘Buyer’ could be considered as a ‘Consignee.’ And a ‘Seller’ could be considered as a ‘Shipper.’ This is dependent on whether the information is coming from a purchasing or logistics system. This difference in semantic definitions used by different systems (and industries) has hindered the expanded use of data exchange.

The robust nature of XML technology can further complicate data exchange by allowing developers to create their own sets of semantic definitions for each application. The proliferation of tag names and structures impedes interoperability and forces developers to create maps between applications and formats. This proliferation also makes it difficult to exchange data between internal applications and nearly impossible to collaborate effectively with external trading partners.

A quarter century ago, the transportation and logistics industry recognized the benefits of a common format for data exchange and was an early participant in the creation of EDI formats. Carriers and large industrial manufacturers have been heavy users of EDI for

decades and EDI standards represent a stable and effective method of information exchange. These standards were developed in a collaborative environment and provide a high level of interoperability. Indeed, open-standard EDI formats such as X12 and EDIFACT have come the closest to establishing the semantic repositories needed for Transportation and they form the basis of TranXML.

Since EDI has been used extensively for Transportation e-commerce for many years over private networks and through commercial value added networks (VANs), it remains today the backbone of information exchange in Transportation. In most cases, organizations that have successfully implemented EDI will continue to be well served by it for a long time to come. In some cases, organizations have combined EDI with new technologies, including the Internet. The data transmission protocols changed but the dictionaries remain virtually constant.

So why wouldn't new trading partners simply use EDI formats over the Internet? There are several reasons. Because of its complexity, traditional EDI has a steep learning curve and it is relatively difficult to implement. Less obvious, but perhaps more important, is the opportunity to go beyond message formats and to create definitions that can be used both for inter-enterprise messaging and for internal information systems. XML provides the opportunity to do just that. With appropriate schemas, XML formats can become "approachable" to application developers. This means that the data can be tied to business processes rather than to a physical structure defined by the EDI format and it can have semantic meaning on its own. Properly implemented, the schemas promote the use of common objects between applications within an enterprise and between enterprises. Additionally, with the use of eXtensible Stylesheet Language (XSL), it is possible for developers and others to view and intuitively comprehend a message in a human readable format.

The challenge is to leverage the semantic content of open-standards based EDI in order to create meaningful and approachable XML structures.

TranXML Brings it All Together

TranXML provides a standardized set of XML structures to foster the flow of information between various internal and external applications. It allows for the optimization of data structures to ensure interoperability that are based on existing EDI formats. Additionally, it allows for a format that is both human and machine readable, allowing for greater flexibility than traditional EDI.

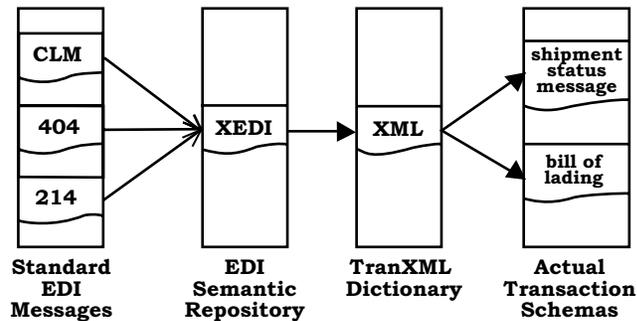
The challenge was to find technology that would facilitate these objectives. The solution was found in the pioneering work of XMLSolutions Corporation in creating XEDI, an XML representation of EDI. TranXML has leveraged this semantic repository by using the XEDI Document Type Definitions (DTDs) as the base for mapping from EDI to meaningful XML objects. In XEDI, the machine-readable EDI element codes are the attributes of the XML-EDI objects, and the human readable meaning for the attribute is maintained in the contents of the XML elements. This approach preserves the semantic integrity as well as the validation capabilities of EDI.

The XEDI approach allows EDI programmers to leverage what they have used for the last twenty years. It offers users the wealth of common semantics contained in the X12 and EDIFACT dictionaries, but its close binding to EDI constrains it. XEDI is restrictive in its ability to create common structures as it maintains the structural integrity of the EDI. This limits the interoperability of the objects, as all elements are tied to the higher-level structures on the segment and message levels.

One of TranXML's primary goals is to ensure an approachable — and interoperable — format. To that extent, TranXML applies business rules for the transformation of data into objects that can be used by many disparate applications. This was no easy task. It required a wealth of experience in logistics and transportation to create the transformation rules. The new core components create a common XML data dictionary that can be used for both internal and external applications.

The following diagram illustrates the transformation process:

The Transformation Process



Notes:

The knowledge of EDI is expressed in XEDI, retaining EDI structures, but creating XML tags. Tags retain their Segment IDs, Element References and Attributes (Code List Values), which are derived from the EDI data dictionaries. Use of eXtensible Stylesheet Language Transformations (XSLT) transforms the XEDI definition to provide the “rough draft” for TranXML. This automatic conversion covers roughly 80 percent of the transformation to TranXML and provides a basis to evaluate the common structures and core components that make up the TranXML dictionary. Applying domain knowledge and creating common objects that are interoperable across applications develop these core components.

The common objects are then mapped directly to the applications, without further translation and/or transformation. This direct mapping means that TranXML is no longer just a message format but can be used without translation by both sending and receiving systems.

Internal Application Development

TranXML will also be used to create XML structures for internal applications. The first release of TranXML includes some of the more common semantic structures for messages relating to tracing and load tenders, as shown in the list below:

- Car Location Message (CLM)
- Motor Bill of Lading - LTL (211)
- Rail Bill of Lading (404)
- Motor Load Tender - Bulk (204)
- Shipment Status Message (214)
- Ramp and Gate Activities Status Message (322/622)
- Shipment Weights (440)
- Simple Bill of Lading (404)

Later releases extend the list to include numerous additional messages and structures for logistic and supply chain functions. Transentric has encouraged a collaborative process where other organizations will develop TranXML messages and structures to support additional e-Commerce needs and internal application requirements.

By applying specified transformation rules, there is only one map from TranXML for all the applications that are populated by the messages named above. The common objects greatly reduce the Application Data Interface (ADI) programs and formats needed to integrate the data. Work is being done to develop new systems using the TranXML Dictionary in order to reduce internal ADI maintenance.

To ensure that the TranXML Dictionary is as interoperable as possible, TranXML developers are drawing upon internal domain knowledge as well as standards established by other authorities such as ChemXML, RosettaNet and ebXML. As of this writing, the only logistics messages developed in an open standard environment have been those under the auspices of the Chemical Industry Data Exchange (CIDX) and Bolero, which is designing a cross-industry XML definition called BoleroXML. TranXML will draw upon these implementations to ensure that it will be interoperable via XSLT with trading partners that use those standards.

Major Standards Groups

Given the absence of global tagging standards, corporate entities, vendors, application service providers (ASPs) and industry groups are free to develop their own schema and semantic definitions. Various bodies are developing standards for use in vertical markets. Other bodies are taking a more global approach to standards development, using cross-industry collaboration. Some of the standards groups are listed below:

- **RosettaNet**

RosettaNet develops and maintains a collaborative dictionary based on the business practices of the electronics industry. The dictionary and tag names are copyrighted by RosettaNet. The collaborative dictionary and resulting schemas are specific to that industry, with a supply chain focus. The schemas supporting logistics and carrier functions are not heavily supported.

- **CIDX - ChemXML**

The ChemXML effort is also a collaborative dictionary based on the RosettaNet standards. The Phase II dictionary and schema, released in January 2001, support the logistics and transportation functions. This standard is developed, maintained and copyrighted by CIDX and represents a collaborative effort of Chemical Manufacturers and their trading partners.

- **BizTalk**

BizTalk is a private trading partner community facilitated and maintained for Microsoft. It uses the BizTalk framework, which supports all levels of trading partner communications and application integration

- **ebXML**

The United Nations body for Trade Facilitation and Electronic Business (UN/CEFACT) and the Organization for the Advancement of Structured Information Standards (OASIS) have joined forces to initiate a worldwide project to standardize XML business specifications. UN/CEFACT and OASIS have established the Electronic Business XML initiative to develop a technical framework that will enable XML to be utilized in a consistent manner for the exchange of all electronic business data. Industry groups currently working on XML specifications are participating in the 18-month project. A primary objective of ebXML is to lower the barrier of entry to electronic business in order to facilitate trade, particularly with respect to small- and medium-sized enterprises (SMEs) and developing nations. The Core Components group is developing recommendations for the creation of semantic objects based on standard EDI.

Although the standards bodies above represent collaborative efforts, many of them are still based on the business practices and semantic objects of a particular vertical industry. However, looking at large-scale collaborative efforts supporting e-commerce will show that the X12 and EDIFACT dictionaries represent the largest collaborative repository of information in the world. By contrast, TranXML is based upon that collaborative effort and draws the semantic meaning of the XML objects directly from the open-standards dictionaries. TranXML is licensed as Open Source and licensees are encouraged to collaborate on additions and enhancements to incorporate the needs of other trading partners.

Technical Structure of TranXML

A set of transformation rules was used to develop the TranXML core components, structures and elements. It is important to distinguish carefully between what data can or cannot be automated by these rules. Structures that cannot be automated are called Core Components, and must be developed using domain knowledge. Then, general rules may be applied across multiple messages and applications. However, when new messages are transformed, new rules may have to be defined.

As mentioned earlier, via XSLT, data element definitions and segment names are transformed into XML tags. This will provide approximately 80 percent of the transformation from EDI to TranXML. The other 20 percent must be evaluated and manually added to the dictionary.

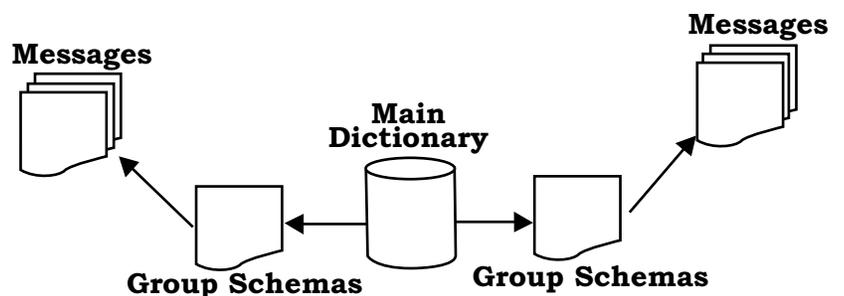
Why Schema instead of DTD?

TranXML is based on schema rather than existing DTDs because using schemas provides the capability to include Metadata (the information gathered about the data from the structure of the document and the tag names) within the defined elements. Use of schemas allows compliance checking and retains much of the robust syntax validation currently afforded by traditional EDI.

The current Candidate Recommendation for XML schema allows elements to be given constraining facets, an optional property used to tighten validation that can be applied to a data type to constrain its value space. DTDs do not support this functionality. Nor do they support data typing, field length restrictions, and other validation tools employed in a schema. TranXML makes use of attributes with enumerated code lists, based on the EDI dictionary. Additionally, the schemas can reflect the many restrictions currently established in EDI. In anticipation of approval of the Candidate Schema, TranXML is designed to take advantage of the more robust capabilities, without the limitations of DTDs.

Schema and Structural Components

TranXML Components



The main dictionary contains one schema housing the TranXML semantic repository. It contains all elements, structures (similar to segments) and core components (generic structures). This semantic repository will provide the building blocks for specific schema development.

Each message type is defined with a "Group Schema." This schema "includes" the objects and core components from the TranXML dictionary, which are grouped according to the specification of the developer. For instance, developers can build groupings of objects to conform to different EDI versions, applications or business needs.

The "Message Schema" includes both the group and dictionary objects, and specifies the ordinal position definitions of all objects contained within the message. This gives developers a greater amount of flexibility in designing new message types to suit their business needs. Since the messages are based on the common objects contained in the TranXML repository, the various message types will be consistent on an ADI level.

Transformation Rules

Tag Naming Conventions

An essential part of the XML grammar is consistent naming conventions for tags that represent the infrastructure and business-related elements. The TranXML Tag name reflects the X12 EDI message element name as specified in the XEDI description value. Tag names conform to the TranXML tag-naming conventions as given below:

- Use mixed case tag names, with the leading character of each word in upper case and the remainder in lower case. Where possible, words should not be abbreviated.

Example: <ShipmentMethodOfPayment>

- Acronyms are discouraged, but where needed, use all upper case.

Example: <SPLC>

- Where acronyms or single-letter words cause two upper case characters to be adjacent, separate them with an underscore (_) .

Example: <AddressPO_Box>

Tag Suffix Names

Data in an EDI document exists at many levels – these are Transaction, Loop, Segments, and Elements. Because only element numbers are guaranteed to be unique in the X12 standards, when using the X12 descriptions, the same tag name could exist multiple times in a document, but depending on its placement, will mean different things. While the argument could be made that it is desirable to create "level" suffixes for the purposes of preventing confusion, extra suffix names at every level have been found to add clutter to the document and limit readability.

- **Transactions** – define the outermost envelope of the message. No suffix name is needed.
- **Loops** – define inner hierarchical structures defined by ASC X12. A suffix of "Group" should be used.
- **Segments** – An organized grouping of data defined by ASC X12. An example would be the X12 N7 segment. No suffix name is needed.
- **Structures** – Used by TranXML to define inner hierarchical structures that are used. These have "Structure" appended to the tag name.
- **Elements** – An element exists at the lowest level and contains the actual data. A suffix name is not needed unless the element name matches an existing parent segment name. In this case, the tag should have a suffix of "Data" added to it.

Attributes

Attributes are used to further qualify an element. The general rule of XML message creation is that data should be stored in elements and information about the data (metadata) should be stored in attributes. TranXML defines two types of attributes to be added to elements. These attributes are Qualifiers and optional SegmentID.

Qualifier Attributes are derived from ID type data elements as defined in EDI. These are usually structurally related to the qualified entity in a paired relationship in the EDI structures. As automated transformation takes place based on the element definitions (in human readable format), those elements which are to become attributes can be identified.

According to the Accredited Standards Committee (ASC) X12 Design Rules and Guidelines, ID type data elements shall contain either "Qualifier" or "Code." This can be used as a key to determine if an element should become an attribute of another.

SegmentID Attributes are optional and are to help developers with standards-based EDI knowledge. Each segment is given a description attribute that gives the EDI definition of the segment.

Structures

In the creation of the TranXML dictionary, items that describe the same "object" should have a parent structure created for that object. The object can then be interoperable among many applications and/or message types. For instance, <Name> can be used within multiple parent structures, such as <Shipper>, <Consignee>, etc.

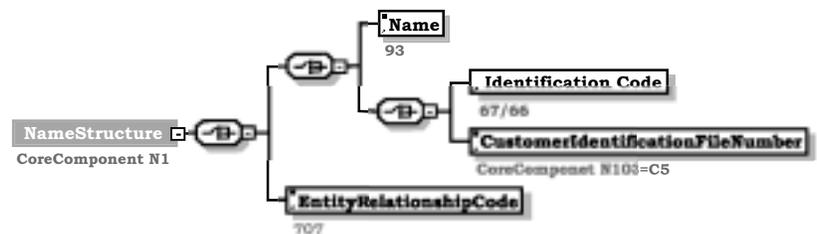
Examples of Structure Creation:

Consider the following XEDI representation of the N1 Segment:

```
<Segment_N1 desc="Name">
  <Element_98 desc="Entity Identifier Code"/>
  <Element_93 desc="Name"/>
  <Element_66 desc="Identification Code Qualifier"/>
  <Element_67 desc="Identification Code"/>
  <Element_706 desc="Entity Relationship Code"/>
  <Element_98 desc="Entity Identifier Code"/>
</Segment_N1>
```

The transformed structure looks like the following:

The Transformed Structure

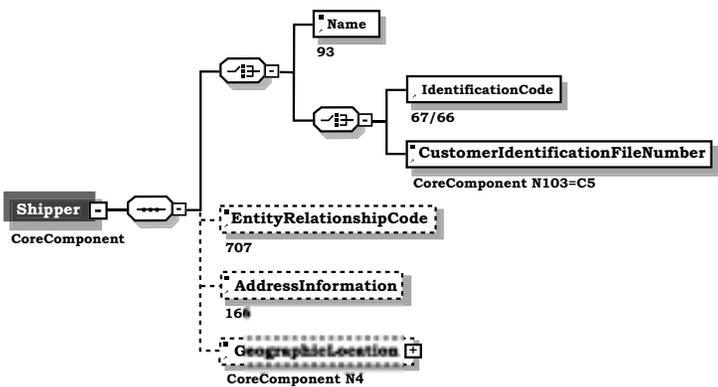


Core Components

Core Components are the basis for the TranXML data dictionary, as they provide the interoperability between applications. These structures provide the bridge between structural EDI objects and approachable semantic objects. In specific cases, domain and logistics knowledge has been applied to create these structures that customers and application developers are more able to identify.

The N1 looping structure in X12 provides a good example of the creation of a core component. Given the code value within the attribute attached to <NAME>, we can create core components, which are commonly used within the transportation and logistics domain. Some examples are <Shipper>, <Consignee>, <ShipTo>, etc. TranXML uses the common objects to create the core component.

Core Components



Other core components have been created for Identification numbers, equipment identification, Date/Time, and Measurements.

CONCLUSION

TranXML provides the perfect complement to companies who have already implemented EDI, and a perfect solution to those who are now developing XML solutions for their transportation data exchange. Drawing on the robust collaborative effort in developing open-standard EDI, TranXML has the ability to provide a common semantic repository that cuts across vertical vocabularies. Although developed for in-house Transentric applications, TranXML can enable multiple trading partners to exchange business data with less ADI maintenance and development. It is envisioned that transportation entities and their trading partners will enthusiastically endorse the TranXML repository and will soon be developing messages and structures to support their e-Commerce needs.

About Transentric

The groundbreaking work to introduce TranXML to the market was accomplished by Transentric, a leading supply chain and electronic message management company. Formed in 1987 and located in St. Louis, Transentric enables supply chain improvement for a variety of companies. With 14 years of profitability and revenue growth, Transentric is building on its development of carrier software products and shipment management solutions to expand its portfolio of supply chain technology services.

Transentric's goal for TranXML is to remove barriers and to dramatically increase the use of e-Commerce as it relates to transportation and logistics services.

For more information, or to download schemas, visit www.transentric.com.

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