Model of Electronic Data Interchange for Brazilian Port System

Andréa Lucia Braga
José Luiz Antunes de Almeida
Eduardo Mário Dias
José Roberto Castilho Piqueira

Escola Politécnica da Universidade de São Paulo
Avenida Prof. Luciano Gualberto, travessa 3 – 158
05508-900 São Paulo - SP
Brazil

Abstract - Globalization demanded modernization of ports, mainly in what concerns to international trading and beginning the process of modernization with the Port of Santos equalized Brazil with the developed countries whose mercantile environments are computerized, efficient and safe. Advances in Information Technology make it possible allowing the processing and the exchanging of electronic documents among companies, by transmission of structured messages through computer, replacing the manual input and output of data and resulting efficiency, reliability and cost reduction.

Keywords: SED, EDI, UN/EDIFACT, XML, structured communication.

1 Introduction

Globalization and advances in Information Technology had improved international commercial transactions and increased efficiency differences between third World and developed countries.¹

In order to compensate this fact, since 1993, a process of modernization in the Brazilian port sector introduced deep alterations in operational routines. Companies started internationalizing their businesses with activities of exportation, importation and joint ventures, trying to become more competitive.²

The first step towards modernization was the implementation of the EDI (electronic document interchange), which makes communication between companies through computer possible.

By using EDI, the manual data input and output is not necessary, since the structuralized form of the messages allows electronic processing for computer systems as standardization of electronic messages was developed for almost all sectors.³

Replacing manual services by the electronic document interchange eliminates delays, reduces errors and costs. Rationalization and efficiency of the port systems, considered the links for supply chains, are essential in order to improve the exporters and importers business.²

Brazil is strongly dependent of the international trade for improving economy and, consequently, cannot ignore the world economy revolution in course.

Considering this fact, an architecture for Port of Santos was developed and implemented, distributing information electronically and automatically through Internet,
using EDI tool EDIFACT and XML standards to integrate the several authorities and segments of the maritime and related to the port sectors.

This model of information distribution has received the name of SUPERVIA ELETRÔNICA DE DADOS – SED (Data Electronic Superhighway). The developed model aims to speed and to optimize the export processes, allowing on-line tracking of loads.

The model follows UNCITRAL laws (United Nations Commission on International Trade Laws), an organization created in 1966 by United Nations and currently composed of 36 countries, including Brazil.  

The Electronic Trade Law of UNCITRAL model is applicable to any type of information in digital form, used in commercial activities.  

It establishes rules and standards that validate and recognize contracts composed by using electronic means; standardizes norms for the settlement of electronic commercial contracts; defines the characteristics of a valid electronic text and of an original document; provides acceptability of electronic signatures for legal and commercial purposes, and supports the admittance of computerized evidences in courts and arbitration procedures.  

2 EDI: Electronic Document Interchange

EDI began almost 30 years ago, when the transport industry started searching for a solution for the excess of paper in administrative proceedings. The developing objective was to attempt the need of efficient communication between commercial partners, taking advantage from the benefits offered by modern information technologies.

In the business world, traditional communication occurs in two forms:
- **non-structured** – messages, memoranda and letters.
- **structured** – acquisition orders, expedition notices, invoices and payments.

EDI is for structured messages interchanging, while electronic mail applications deal with non-structured communications.

There are two categories for EDI services:
- **Pure EDI** – responsible for composing standardized messages using services provided by the transport level of a VAN (Valued Added Network).
- **WEB EDI** – responsible for integrating several companies to the EDI system with composing data forms accessed using Internet.

One of the difficulties for the implementation of EDI is that partners need to know the commercial procedures of each other before they can change data electronically. Negotiation process of mercantile proceedings is called Interchange Agreement, that is a contract where the commercial partners fix rules for the electronic exchange of documents, including messages that will be exchanged and the order of their insertion in the interchange process.

Besides, EDI messages can be structured with international standards, such as UN/EDIFACT, but there are not standards for semantic and for context used by several parts in a commercial transaction.

For example, the type of reply for a purchase order can be different from one company to another. A company could answer this order with an acknowledgment while other could answer with a commercial invoice.

As EDI procedures are a combination of technology and process, their correct implementation implies several improvements:
cost reduction – significative reduction of the operational procedures results in immediate economy in administrative and personal related costs.

efficiency gain – significative reduction in paper transactions volume with immediate gain in the operational cost.

agility – great volume of commercial information can flow from one computer to another in few minutes allowing fast responses and the reduction of delivery time, ensuring customer satisfaction.

errors reduction – EDI eliminates the unavoidable errors that occurs with manual data input.

productivity increasing – EDI is the main component in the links among customer, supplier and transporter, besides allowing the use of strategies such as: Just-In-Time (JIT – manufacturing on demand), Quick Response (QR – quick response for sailings) and Computer-aided Acquisition and Logistic (CALS – logistic support for acquisitions assisted by computer).

3 UN/EDIFACT: United Nations standards

UM/EDIFACT means United Nations / Electronic Data Interchange For Administration, Commerce and Transport being an international standard for EDI, flexible enough to be used by government and private industry needs. This standard congregates more than 250 electronic documents or messages serving several segments such as: commercial maritime, medical, biological and juridical, etc.

Data interchange system consists of one or more messages. A message is a set of structured segment formed by data elements. Inside a message the segments are organized into groups that define a wide range of concepts or functions.

Messages should contain the data to be transmitted and the specific data needed for communication protocol.

EDIFACT has the following characteristics:

- **international and multi-sectorial** – it was developed by a team that represents several companies around the world, including the requirements and characteristics of the different business segments.

- **supports ECR (Efficient Customer Response) applications** – the only way that a company has to maximize its investments and to get competitive advantages is using international standards. EDIFACT is recommended by ECR as the standard for electronic document for data interchange.

- **facilitates applications mapping** – the Interchange Agreement is a long and costly process, but necessary for correct data conversion by partners.

- **supports trade globalization** – provides an immediate and standard solution for companies that operate in several countries, avoiding that each country adopts its national standard.

4 XML: A language for EDI

XML (Extensible Markup Language) is a language that provides a format to describe structured data adequate to EDI.

XML is an evolution from HTML (Hyper Text Markup Language), a method to create standard WEB pages (electronic documents). Both come from SGML (Standard Generalized Markup Language).
Generalized Markup Language), developed to describe the structure of different types of electronic documents, which became an international standard in 1996 by ISO 8879.\textsuperscript{11}

In the same way as HTML, XML uses tags and attributes to generate text files, without additional tables containing pre-defined formats to transmit data from one system to another.

But, while HTML specify what each tag and attribute mean, XML is extensive, that is, does not have pre-defined tags and attributes allowing the programmer to define his own set of personalized tags simpler than HTML.\textsuperscript{10}

XML has the following characteristics:

- **easy data exchange** – data and mark up are stored as text and this can be done in several ways: by XML editors, by a programming language or even by text editors.

- **personalize mark up languages** – its main characteristic allows creating a browser or personalized application text by data definition and mark up.

- **integrated and structured data** – allows the specification not only of data, but also of the structure of these data and how the elements are integrated, based on semantic rules.

- **interoperability** – by joining together two different elements, with pure data and document formatting, it is possible to connect a WEB page with data in real time, solving old problems of interoperability. This is only possible because XML treats these elements separately, providing the user to receive dynamic information.

Nevertheless, XML is only the foundation where additional standards can be defined to get the true interoperability being necessary to create an universal language, based on XML, with an e-business infrastructure adopted to the specific needs of a certain company, generic enough to allow different companies from several sectors to communicate with each other.\textsuperscript{11}

UBL (Universal Business Language) to treat this problem was to build a language, called ebXML.

\section*{5 ebXML: A language for e-business}

The e-business Extensible Markup Language (ebXML) is a UM/CEFACT project associated with OASIS.\textsuperscript{12}

UN/CEFACT means United Nations/Center for Trade Facilitation and Electronic Business and is a worldwide organization responsible for international electronic data interchange (EDI).

OASIS means Organization for the Advancement of Structured Information Standards and is a non-profit international consortium that promotes electronic businesses.

The language is being implemented by about thousand organizations and the aim is to publish a complete set of specifications for the use of XML in e-business sector.\textsuperscript{12}

The group is working in new and less expensive alternatives for traditional EDI and, recently, it has unveiled its intention of using SOAP (Simple Object Access Protocol) for the message transmission mechanism and to posses a reusable set of business logic, based on central components that reflect XML common business processes and vocabulary.

Probably, this is the more ambitious part of ebXML and also the biggest risk for its success. Therefore, if it were already difficult enough to define these central
components for a personalized applicative, used by a single company, what would be for several international companies?

But, if they are successful in distilling such components and in putting them in a central repository, they will form a powerful base to build personalized interactions between partners.¹³,¹⁴

6 Modeling electronic data super-highway

The Electronic Data Superhighway (SED) developed for Port of Santos is sponsored by Companhia Docas de Santos (CODESP – Port Authority) and is supported by OGMO (Orgão Gestor de Mão-de-Obra – an organization that takes care of the workers at the port), Port Workers Syndicate (Sindicato dos Operadores Portuários - SOPESP) and COMUS (Comitê dos Usuários dos Portos e Aeroportos - Port and Airport Users Committee).²

The developed processes integrate the Port Authority with: Customs Authority, Maritime Authority, Piloting, Port Operators, Agents and the rest of the port community.

At first it was done a survey of the original processes, that is, all the necessary documents to import and export through the Port of Santos. After that, it was done the survey of the needs: Data Banks, Management, Training and Qualification Systems, and Communication Equipments and Infrastructure.

Finally it was proposed the development of solutions such as:

- **EDI Standard for Electronic Documentation** for the Request to Come Alongside, Bulletin and Manifest.
- **Applicatives** through the Site of the Port of Santos for the Port and Customs Authorities.
- **Communication** through Internet and/or VAN. At first it will be implemented the systems of:
  - **Coming Alongside** – It means Request of Priority and to Come Alongside (RAP), and it is through this document that the navigation agency communicates the Port Authority the prevision of ship arrivals, as well as it request permission for coming alongside. It replaces the documents RAP (Requisição de Atracação e Prioridade), Infrastructure Request and the Nominating Letter of Port Operator.
  - **Manifest** – This document permits that the navigation agencies or the ship owners communicate the Port and Customs Authorities all the Bill of Ladings (BLs), including all the information related to a ship and to its load.
  - **Bulletin** – This document permits that the operators send to Port and Customs Authorities and to OGMO, the operations with the goods (solid or liquid barns movement, general load, of containers) providing boarding and unloading bulletins.

With these systems, we have an integration of all the participating members and, consequently, of all necessary documents for Import/Export through the Port of Santos.

In order to implement this, it was created a Documentation Center, which is in charge of intermediating the data transactions and has to be available all the time for any authorized user. It is responsible for the standardization, availability and distribution of data and documents that are of interest of each entity, and provides reliable communication.

The users communication with the Documentation Center is using Internet, which will be the main communication channel. Any connection with the public network will allow accomplishing transactions without requiring any special
characteristic, while the communication between the Documentation Center and the Port and Customs Authorities occurs using private lines, providing agility in the data flow.

There are two options to send documents: using the portal developed for the port or using a mail box, depending on the quantity of information to be exchanged.

In the Coming Alongside system, because it is the simplest one, and because there are small companies as partners, the communication is done only by browser and the documents are sent through web forms, available at the portal of the Port.

Manifest communication can be done by a browser or using web forms, available at the portal of the Port.\textsuperscript{15,16}

9 Message formats

From 250 different formats in UM/EDIFACT standard, only two were used in modeling the Port of Santos: IFCSUM and COARRI.

IFCSUM is used in Manifest and sent by SED to report to the Port and Customs Authorities the informations pertaining to the loads carried in a trip, specifying details related to the shipment, ways and means of conveyance, equipments and the necessary remittance details included on the consolidation, and is composed of 35 segments, divided into nineteen groups belonging to the IFCSUM message, based on the syntax of UN/EDIFACT D97B directory.\textsuperscript{17}

The UN/EDIFACT IFCSUM (forwarding and consolidation summary message), presents 288 segments, divided into 63 groups. This message can be used to exchange information related to consolidated load among dispatchers, loaders and qualified agents to handle the remittances, including consolidation.\textsuperscript{18}

The message COARRI is applied in Bulletin is sent by SED to report to the Port Authority that containers, itens of general load or in bulk load that were disenbarked of/or loaded inside a maritime vessel. For the objectives of the SED, this message contains information only about one ship hold and of one scale period and being formed by:\textsuperscript{19}

\begin{itemize}
  \item 20 segments divided into four groups belonging to the COARRI message, based on the syntax of the UN/EDIFACT D95B directory.
  \item 22 segments defined for this model.
\end{itemize}

The message UM/EDIFACT COARRI (Container discharge/loading report message) – presents 37 segments divided into 5 groups, and is sent by the cargo loaders in the container terminal and received by the ship agent.\textsuperscript{20}

Always when necessary, new tags will be created, because the tag definition is free. Although it should be exclusively composed by capital letters without, avoiding the use of prepositions, articles and conjunctions. Besides the tag readability, that should be almost self-explicative.\textsuperscript{21}

10 Conclusion

While there is not uniform standards (EDIFACT, XML or other) the Documentation Center integrate several available technologies for electronic communications, allowing the Brazilian companies to take part of the global commercial ambit, including users that only uses browser, users that use e-mail servers and users that use traditional EDI.
Data communication is using Internet. That creates a channel for the flow of information.

The users can generate messages by web forms, exchange messages in the UN/EDIFACT standard, or still non-structured message formats by e-mail, because the message sent by the user is converted into the UN/EDIFACT, and the received message in UN/EDIFACT is translated into the format used by the user. This allows the communication with ports that possesses advanced EDI technology, as the ports of Rotterdam, Antwerp among others.

References


