

# ebXML and Interoperability: A Systematic Review

Petra Grd, Miroslav Bača  
Faculty of Organization and Informatics  
University of Zagreb  
Pavlinska 2, 42000 Varaždin, Croatia  
{petra.grd, miroslav.baca}@foi.hr

**Abstract:** *In this paper, ebXML standard and its architecture will be described. A systematic review of current research on ebXML will be given. At the end, ebXML will be connected with interoperability. Research question to which an answer will be given is: In which countries is ebXML registry implemented outside the laboratory, and is used as such?*

**Keywords:** *ebXML, interoperability, EDI, systematic review*

## 1 Introduction

Companies communicate with each other in different ways. Earlier, many larger companies used Electronic Data Interchange (EDI) for communication. EDI enables communication through predefined signals. Problem with EDI is its high price. Common EDI functions are [1]: Conversion of documents from/to EDI standard format from format specific for applications, Mapping the conversions, Communication, interchange of documents with partners, Generating and following confessions, Application revision, Partner management

These functions are complex and specialized, because software is used especially for EDI. Most suppliers that EDI functions are too complex and too specific to build in their own systems. Interface between e-business based on EDI and business applications are most commonly in shape of application specific files. Mapping asks for programmers support and depends on characteristics of specific case [2].

Because of these problems, Electronic Business Extensible Markup Language (ebXML) is developed. ebXML based systems have the following functions [2]: Conversion of documents to XML standard formats from/to application specific formats, Mapping of those conversions, Communication, interchange of documents with partners, Generating and following confessions, Application revision, Partner management, Configuration of system by defined business processes, Business process management.

ebXML functions are more complex than those in EDI systems, but in XML they are easier to develop. The main goal of ebXML is to expand e-business to small and medium enterprises [3]. ebXML alone is built in EDI system, so companies implementing EDI will convert to ebXML easier than companies not implementing it.

## 2 State of the Art

State of the art on this topic is made by systematic review method to give a research review on the topic of ebXML.

Research question to which an answer wants to be given is:

*In which countries is ebXML registry implemented outside the laboratory, and is used as such?*

First step was to define the keywords to which the research will be conducted:

1. ("ebxml" OR "electronic business xml") AND "business process specification"
2. ("ebxml" OR "electronic business xml") AND "bpss"
3. ("ebxml" OR "electronic business xml") AND "partner profile"
4. ("ebxml" OR "electronic business xml") AND "partner agreement"
5. ("ebxml" OR "electronic business xml") AND "TPA"
6. ("ebxml" OR "electronic business xml") AND "registry"
7. ("ebxml" OR "electronic business xml") AND "repository"
8. ("ebxml" OR "electronic business xml") AND "core component"
9. ("ebxml" OR "electronic business xml") AND "message"
10. ("ebxml" OR "electronic business xml") AND "message service"
11. ("ebxml" OR "electronic business xml") AND "interoperability"

During this research, a number of papers on ebXML and interoperability have been discovered.

According to year of publishing, it can be seen that the largest number of research on ebXML was conducted in 2004 (Figure 1).

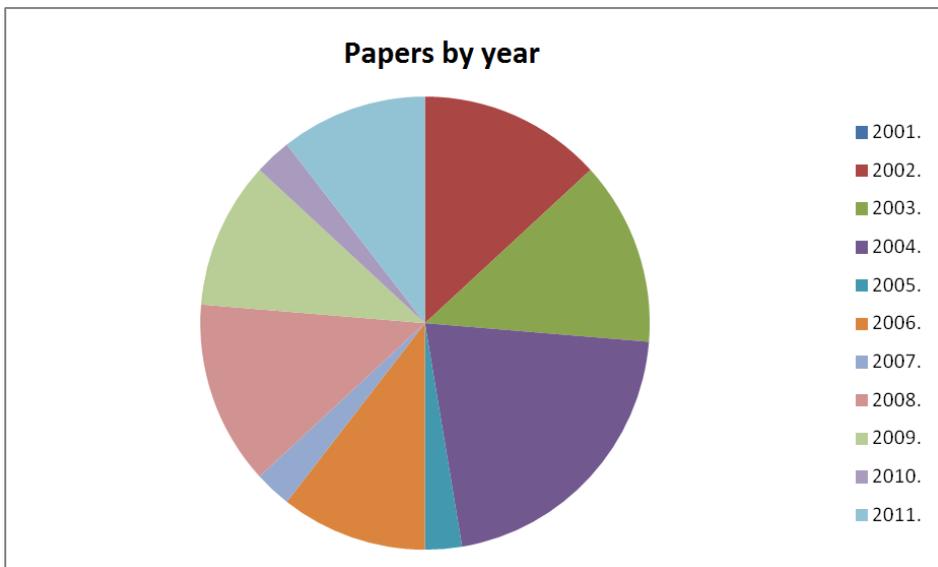


Figure 1: Distribution of papers according to year of publishing

Papers according to number of times cited can be seen in Table 1. Distribution of citations can be seen in Figure 2.

Table 1: Papers and journals in which the papers have been published

Journal	Number of papers
Expert systems with applications	4
Data & knowledge engineering	3
Decision support systems	2
European Journal of operational research	1
Electronic commerce research and applications	2

Computers in industry	3
Information and software technology	2
Computers,environment and urban systems	1
International journal of human-computer studies	2
International journal of informatics management	2
Computers & geosciences	1
Nekategorizirano	6
Journal of convergence information technology	1
Computer standards & interfaces	2
Automation in construction	2
Journal of systems and software	1
International journal of accounting information systems	2
Information systems	1

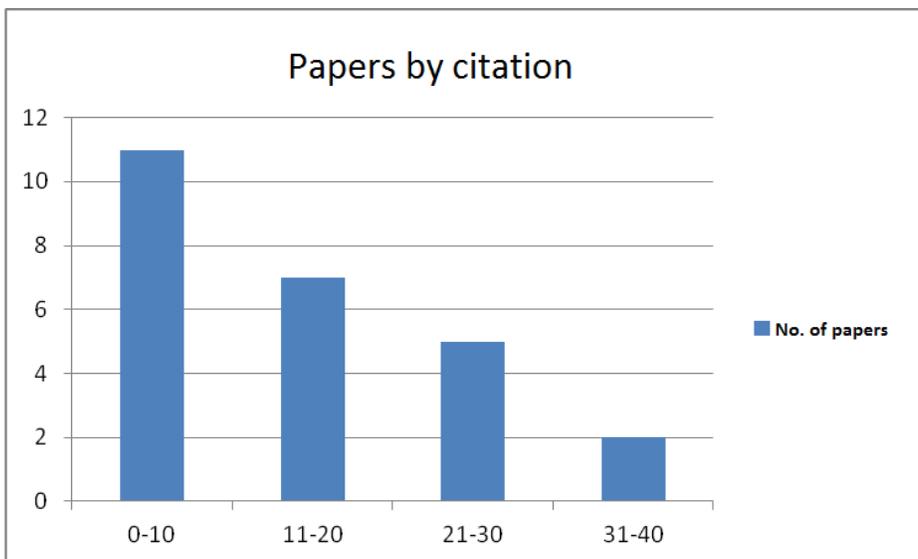


Figure 2: Distribution of papers by number of citations

Huemer [4] in his article focuses on the ebXML initiative, provides a historical overview of approaches that have impacted on ebXML and gives an overview of basic concepts of ebXML.

Kim in his paper "A Study on The Global Standards Of The E-Trade Process on The Basis ebXML & Web Services" [5] shows the global standard for an e-commerce process based on ebXML and Web services. He says that each country should introduce and use the national ebXML Registry and standardize electronic documents, electronic catalog and electronic payment.

Choi et al. [6] identified the lack of standards as the difficulty for companies in the exploitation of resources and coordinating activities in the context of e-business. The article describes the process of standardization with a focus on ebXML.

Thun and Rebstock [7] describe ebXML as a standard in the domain of electronic negotiations. They apply ebXML framework to the task of modeling interactive bilateral negotiations, and modify the framework by adding a data model to fit the domain of negotiation.

Matasić and Skočir [8] conducted research aimed at defining a strategy for implementing e-business in Croatia. Based on the research results they adopted ebXML standards as the basis of technical infrastructure. They found that ebXML as a standard for e-business offers solutions to perceived problems.

Hofreiter and Huemer [9] show the ebXML business process represented in the UMM (UN / CEFAC Modeling Methodology) and BPSS (Business Planning process specification schema).

Gerstbach [10] in the article " ebXML vs. Web Services - Comparison of ebXML and the Combination of SOAP / WSDL / UDDI / BPEL, "compares two approaches: ebXML and Web services.

Topolnik et al. [11] shows the implementation of combinations ebXML for defining the architecture of global markets and the PKI, which provides public key infrastructure to ensure privacy, authentication and security in the communication in e-business.

### 3 ebXML

ebXML is an international initiative established by UN / CEFAC (the United Nations Centre for Trade Facilitation and Electronic Business) and OASIS (Organization for the Advancement of Structured Information Standards). These two organizations have initiated a project to standardize the specifications of e-business [12].

ebXML is a global standard for e-business and allows anyone in any place trading with anyone on the Internet. It is designed in order to create an electronic marketplace where enterprises of any size can:

- Find each other electronically
- Do business
  - By exchanging XML messages
  - According to the sequence of standard business processes
  - With clear business semantics
  - Using the purchased business applications
  - According to the agreed protocols

ebXML takes a group of companies and provides them the opportunity for networking. The size and location of these companies has no effect. All companies that meet technical specifications can participate (banks, government agencies, trade). ebXML library contains basic technical architecture needed to be part of the network. To be part of the network, the company has to set up a CPP (Collaboration Protocol Profile), when another company comes it views the information of the first company and decides whether there is a possibility for cooperation between the two organizations.

Companies wishing to participate in the ebXML-based exchanges usually take certain steps [13]:

- Create internal systems capable of downloading ebXML core components to process the documents in accordance with the ebXML specifications
- Create CPP which defines companies possibilities for e-business
- Publish CPP in ebXML registry
- Offer to trade with the ebXML business partners through mutually agreed upon TPA
- Define SOAP-based message envelope for transfer of ebXML data and documents
- Participate in the ebXML trading over the web

### 3.1 ebXML architecture

Lifecycle of B2B collaboration includes the following steps [14]: Process definitions, Partner finding, Partner application, Electronic Plug-in, Initiation of processes, Process management, Process development.

ebXML is intended to cover the whole process of B2B collaboration. The architecture defined by the ebXML team ensures [15]: The way of defining business processes and related messages and content, The way of registering and discovering the sequence of business processes with the appropriate messaging, The way of defining companies profiles, The way of defining partner agreements, Unified messaging layer.

Accordingly, the technical architecture of ebXML and is made up of five modules [5]:

- Business Process Specifications
- Partner Profile and Agreements
- Registry and Repository
- Core Components
- Messaging Service

### 3.2 ebXML Problems

The main goal of ebXML is to enable small and medium enterprises to become part of the global electronic market. The main problem lies in the integration of ebXML Business Service Interface with business applications [17]. Some business processes are specific and could have problems with the integration with ERP systems, for example, there are several specific problems [18]:

- There is a formal description of how to get a CPA from two CPP. ebXML specification says that this process is not 100% automated and will require human interaction
- There are no specific conversion rules from UML to XML that define the ebXML
- There is a problem of finding the Registry / Repository. It appears that there will be many different Registry / Repository for various industries
- Companies cannot start using the ebXML Registry/Repository while it is empty

It takes time for Core Components to be stored in the Core Library, to create the Business Information Objects needed for Business Documents. It takes time for the creation of Common Business Processes and their storage in the Business Library

## 4 ebXML and Interoperability

The primary objective specified in the Terms of Reference for ebXML is to enable interoperability. Usability and interoperability of the ebXML technical framework are critical business requirements. Elements of usability and interoperability are architecture, transport, routing and packaging, extensibility and impact of existing technologies [16].

Architecture is a primary requirement of the ebXML initiative. To maximize the interoperability, ebXML architecture should support [16]:

- Common business processes - Each entity involved in the exchange of information must be included in the execution of the same transaction in the context of business processes
- Common Semantics - Common meaning of words, expressions or presentations
- Common dictionary - a direct correspondence between words and meanings
- The common character encoding

- Common expressions - Common set of XML element names, attributes and common use of these attributes, a common approach to document structure
- Joint deployment of security
- Joint protocol for data transfer
- Shared network layer

Any exchange of business information requires fully described methodologies of transport, routing and packaging. These descriptions should identify the behavior of messages required for [16]:

- The realization of a reliable secure sending and receiving messages over any network capable of carrying XML
- Support for syntax-neutral definition of information that should be retained
- Detailing the format and structure of the envelope, header, and any other information within the message
- Requests to ebXML servers for services they support

Companies look for solutions that provide a degree of adjustment above the standard. Expandability is needed to ensure that the same requirements for business processes can be addressed outside the standard used for exchanging information between business entities [24].

The impact of existing technology includes the ability for cooperation with existing technology, as well as the ability to switch to new technology [16].

## 7 Conclusion

ebXML as a global standard for e-business allows anyone anywhere trading with anyone on the Internet. It represents a framework that covers the whole aspect of the business-to-business collaboration. Besides the advantages that carries, ebXML still has many shortcomings, which should be resolved as soon as possible for ebXML to come to life in full.

Analysis of the existing papers on ebXML and interoperability has shown that there is still a lack of paper dealing with this topic. Most papers were published in 2004.

The answer to research question (In what countries is the ebXML registry implemented outside the laboratory and used as such?) is best given by the paper by Kim, Jae Yong: A Study on The Global Standards Of The E-Trade Process on The Basis ebXML & Web Services [5], which says that in Korea the central registry and repository was implemented and used since 2001, and in Japan and Taiwan it was implemented in 2009. Except in those countries, UNCEFACT register was developed. Furthermore, in Canada, Australia and Finland, registers are under development. Apart from national registers there are various projects aimed at developing ebXML registries of individual companies (General Motors, Software Factory ...)

In the first part of the paper, an introduction to ebXML and reasons for its occurrence is given and EDI system as a foundation on which ebXML arose is described. The next step was the review of some previous research on ebXML. Further, ebXML is described in detail and its architecture and elements of architecture (Business Process Specifications, Partner Profile and Agreements, Registry and Repository, Core Components and Messaging Service). At the end, a review was done on interoperability as one of the most important goals of ebXML's.

## 8 Acknowledgements

Shown results come out from the scientific project Methodology of biometrics characteristics evaluation (016-01611992-1721) and technological project Multiple

biometric authentication using smart card (2008-043) financed by the Ministry of Science, Education and Sport, Republic of Croatia.

## 9 References

- [1] Kantor M., Burrows J.H.: "Electronic Data Interchange (EDI)", National Institute of Standards and Technology, 1996
- [2] Kotok A., Weber D.R.R.: ebXML - The new global standard for doing business over the Internet, New Riders Publishing, 2001
- [3] ebXML Terms of Reference,  
[http://www.ebxml.org/documents/199909/terms\\_of\\_reference.htm](http://www.ebxml.org/documents/199909/terms_of_reference.htm), accessed April 15th, 2011
- [4] Huemer Christian: ebXML - An Emerging B2B Framework
- [5] Kim, Yong Jae: A Study on The Global Standards Of The E-Trade Process on The Basis ebXML & Web Services, Journal of Convergence Information Technology, Volume 4, Number 4, December 2009
- [6] Choi B., Raghu T.S., Vinze A.: Addressing a standards creation process: a focus on ebXML, International Journal of Human-Computer Studies, 2004
- [7] Thun P., Rebstock M.: Developing a Generic Concept of an Electronic Negotiation Process with ebXML, NODE 2002, LNCS 2591, pp. 199–215, 2003. © Springer-Verlag Berlin Heidelberg 2003
- [8] Matasić I., Skočir Z.: EbXML as developing country e-business strategy proposal
- [9] Hofreiter B., Huemer C.: ebXML Business Processes - Defined both in UMM and BPSS
- [10] Gerstbach Peter: ebXML vs. Web Services - Comparison of ebXML and the Combination of SOAP/WSDL/UDDI/BPEL
- [11] Topolnik M., Pintar D., Sokić M.: Experimental Implementation of Emerging e-Business Technologies: ebXML and PKI
- [12] Cover pages: Electronic business XML initiative,  
<http://xml.coverpages.org/ebXML.html>, accessed April 15th, 2011
- [13] Los Angeles Chinese Learning Center, <http://chinese-school.netfirms.com/articles/EBXML.html>, accessed April 15th, 2011
- [14] ebXML Architecture, [http://www.tutorialspoint.com/ebxml/ebxml\\_architecture.htm](http://www.tutorialspoint.com/ebxml/ebxml_architecture.htm), učitano 15.4.2011
- [15] ebXML Technical Architecture Specification, Version 1.0.4
- [16] ebXML Requirements Specification, Version 1.06
- [17] <http://www.rawlinsecconsulting.com>, accessed October 24<sup>th</sup> 2011
- [18] <http://www.schlegel.li/projects/ebXML/www/node43.html>, učitano 24.10.2011.
- [19] Jong Woo Kim, Hyoung Do Kim, Semantic constraint specification and verification of ebXML business process specifications, Expert Systems with Applications, Volume 27, Issue 4, November 2004, Pages 571-584, ISSN 0957-4174, DOI: 10.1016/j.eswa.2004.06.002.
- [20] Peter Green, Michael Rosemann, Marta Indulska, Chris Manning, Candidate interoperability standards: An ontological overlap analysis, Data & Knowledge Engineering, Volume 62, Issue 2, August 2007, Pages 274-291, ISSN 0169-023X, DOI: 10.1016/j.datak.2006.08.004.
- [21] Hans Weigand, Willem-Jan van den Heuvel, Cross-organizational workflow integration using contracts, Decision Support Systems, Volume 33, Issue 3, July 2002, Pages 247-265, ISSN 0167-9236, DOI: 10.1016/S0167-9236(02)00015-5.
- [22] Jorge Cardoso, Christoph Bussler, Mapping between heterogeneous XML and OWL transaction representations in B2B integration, Data & Knowledge Engineering, In

Press, Corrected Proof, Available online 4 August 2011, ISSN 0169-023X, DOI: 10.1016/j.datak.2011.07.005.

[23]Tsui-Ping Chang, Shih-Ying Chen, An efficient algorithm of frequent XML query pattern mining for ebXML applications in e-commerce, Expert Systems with Applications, In Press, Uncorrected Proof, Available online 23 July 2011, ISSN 0957-4174, DOI: 10.1016/j.eswa.2011.07.011.

[24]Marinos Themistocleous, Zahir Irani, Peter E. D. Love, Evaluating the integration of supply chain information systems: A case study, European Journal of Operational Research, Volume 159, Issue 2, Supply Chain Management: Theory and Applications, 1 December 2004, Pages 393-405, ISSN 0377-2217, DOI: 10.1016/j.ejor.2003.08.023.

[25]Marina Mongiello, Finite-state verification of the ebXML protocol, Electronic Commerce Research and Applications, Volume 5, Issue 2, Summer 2006, Pages 147-169, ISSN 1567-4223, DOI: 10.1016/j.elerap.2005.09.002.