



# Marketplace and technology standards for B2B e-commerce: progress, challenges, and the state of the art

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## Abstract

We have examined standards required for successful e-commerce (EC) architectures and evaluated the strengths and limitations of current systems that have been developed to support EC. We find that there is an unfilled need for systems that can reliably locate buyers and sellers in electronic marketplaces and also facilitate automated transactions. The notion of a ubiquitous network where loosely coupled buyers and sellers can reliably find each other in real time, evaluate products, negotiate prices, and conduct transactions is not adequately supported by current systems. These findings were based on an analysis of mainline EC architectures: EDI, company Websites, B2B hubs, e-Procurement systems, and Web Services. Limitations of each architecture were identified. Particular attention was given to the strengths and weaknesses of the Web Services architecture, since it may overcome some limitations of the other approaches.

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## 1. Introduction

For more than three decades, businesses have been using electronic mechanisms to exchange transaction data. Standards have played an integral role in the success of some e-commerce architectures. Here, we propose and discuss a set of standards required in any

EC platform. We also evaluate past and current architectures against these standards.

The development and implementation of standards and technologies have accelerated over the past 15 years. A seminal event in this evolution was the development of electronic data interchange (EDI), whereby trading partners established standard formats for the exchange of electronic documents to facilitate electronic transactions [45]. Today, the emerging set of technologies referred to collectively as *Web Services* has the potential to extend the reach of EC.

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Web Services offers many advantages not found in earlier technologies, but the technology has yet to realize its potential because of the lack of standards. The development and adoption of these could allow Web Services to meet the needs of a broader range of EC transactions, including B2C, B2B, C2C, and peer-to-peer (P2P) transactions.

This study focuses on B2B transactions. Although there are different definitions of EC [33,39], it is generally acknowledged that B2B accounts for the largest dollar volume of EC, with approximately US\$ 700 billion in transactions in 2001. The Gartner Group estimated that by 2005 all types of EC transactions will exceed US\$ 8.5 trillion, 90% of which will be B2B transactions [30]. Similarly, Jupiter Research estimated that the combination of B2B and B2C EC transactions will surpass US\$ 7 trillion by 2005 [21].

Some businesses have engaged in EDI for a number of years. This has occurred when one business transmitted computer-readable data transactions in a standard format to another business. EDI standards captured the same information that businesses have traditionally included in paper transaction documents. Yet EDI was designed to support business transactions between sets of known trading partners [36]; it did not facilitate discovery of new vendors—a significant limitation for firms that wished to extend their reach to new participants in a broader marketplace.

Subsequently, the World Wide Web has enabled businesses to share documents across a generalized, global network. In several ways, it facilitated EC: sellers have been able to publish company and product information via their Websites, and to some degree, search engines have allowed buyers to find and analyze this information. Yet such searches are not reliable because of the diverse systems and data presentations. Moreover, sellers on the WWW generally do not use industry-wide standard transaction templates for accessing product information and executing purchase transactions. This has limited the ability of automated services to find sellers and conduct automated transactions.

Notwithstanding these limitations, the evolution of EDI and the WWW, together with a new set of technologies, has the potential to provide a more robust and powerful platform for EC than exists today. If supported by appropriate EC-supporting standards, this platform could enable buyers and sellers to find

each other more easily and exchange product and service information with more precision and reliability than today. This portends a ubiquitous generalized marketplace that will have attributes of EDI, the WWW, and other evolving EC technologies.

## 2. e-Commerce enabling standards

For purposes of evaluation, we propose eight EC-enabling standards (Fig. 1). We evaluate current and past EC technologies based on these. They can be grouped into three areas: foundation technology standards, marketplace standards, and commerce services and applications.

### 2.1. Foundation technology standards

Foundation technology standards serve as building blocks for higher standards. Three are essential to reliable, predictable EC communication:

- *Data standards.* Participants must share a common definition.
- *Schema expression languages (SEL).* For example, in the eXtensible Markup Language (XML) SEL data is delimited with hierarchical tags [50], while in the comma separated values (CSV) [37] SEL, fields and records are delimited by commas and hard returns. SEL may be used by designers and entities that create standards to define data patterns. However, SEL are format definition languages, not definitions. For instance, XML does not provide a standard but gives some basic rules and conventions to assist in the creation of standards.
- *Common communication methods* define how data is transferred from one machine to another across a network; e.g. hypertext transfer protocol (HTTP), file transfer protocol (FTP), and Internet inter-ORB protocol (IIOP).

### 2.2. Marketplace standards

Marketplace standards include product and service representation schemas, transaction templates, and business categories. While the creation and widespread adoption of useful standards for these would greatly improve EC efficiency, their definition and adoption is

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