XML Integration and Toolkit for B2B Applications

Christophe Nicolle, Kokou Yétongnon and Jean-Claude Simon
Université de Bourgogne, France

ABSTRACT

This paper presents a Web-based data integration methodology and tool framework, called X-TIME, for the development of business-to-business (B2B) design environments and applications. X-TIME provides a data model translator toolkit based on an extensible metamodel and XML. It allows the creation of adaptable semantics oriented metamodels to facilitate the design of wrappers or reconciliators (mediators) by taking into account several characteristics of interoperable information systems such as extensibility and composability. X-TIME defines a set of meta-types for representing meta-level semantic descriptors of data models found in the Web. The meta-types are organized in a generalization hierarchy to capture semantic similarities among modeling concepts of interoperable systems. We show how to use the X-TIME methodology to build cooperative environments for B2B platforms involving the integration of Web data and services.

Keywords: XML integration, metamodel, translators, cooperative systems

B2B applications based on business information systems’ interoperability are increasingly available on the Internet. The Gartner Group (InfoWorld, 2000) estimates that B2B (2001) revenue worldwide will reach $7.29 trillion dollars by 2004. These emerging systems involve the exchange of both data and services among business information systems. They have created many challenges, including the need for novel interoperability techniques and architecture. Emerging B2B integration approaches must answer several questions: 1) how to process and share data in various business formats; and 2) how to integrate various business functionalities into Web services. Interoperability is generally hampered by heterogeneity issues.

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Platform (hardware, software, communication) heterogeneity is resolved by communication standards and protocols such as CORBA, IP and HTTP. Syntactic heterogeneity requires common or pivot metamodels to represent the data of the participating systems. Finally, semantic heterogeneity, which is difficult to tackle, requires semantic models and languages that can capture the meaning of the representation concepts of different information systems.

In addition to traditional data integration concerns, Web-service integration must allow the exchange of business services and processes by standardizing 1) low-level communication systems and protocols (SOAP: Simple Object Access Protocol), 2) data presentation format and definition languages (WSDL: Web Services Description Language), and 3) access and classification of Web services (UDDI: Universal Discovery, Description and Integration). WSDL is a Web-service definition language aimed at the resolution of structural data heterogeneity while UDDI (2002) provides a library of Web services and their specifications.

XML is increasingly used in the development of Web services and B2B integration, and is emerging as a de facto standard for data exchange in networked environments (Abiteboul, Buneman and Suciu, 2000; XML, 2000). XML (eXtensible Markup Language) is an open textual language that provides a structural information description and relative semantics to data (Pardi, 1999). XML is more than a tool or language for separating content from presentation: it is a meta-language from which more than 300 languages (ZapThink, 2001) have been developed, including Astronomical Dataset Markup Language (ADML, 2001), Advertising XML (adXML, 2001), Biopolymer Markup Language (BIOML, 2001) and Genome Annotation Markup Elements (GAME, 2001). The increased availability of XML in various domains makes it a good choice for an integration pivot metamodel for the design and translation of interoperating system schemas. As a metamodel, XML allows users to define schemas in the form of XML DTD (Document Type Declaration) or grammars that are uniform syntactic elements for representing the conceptual characteristics of information systems. Using XML reduces the complexity of reconciling structural heterogeneity among systems. For example, in pre-integration data model translation step, the number of required translation tools can be reduced from \(O(N^2)\) to \(O(N)\). Several major database system providers have added XML capabilities to their products. However, as XML-enabled DBMS (Data Base Management System) market is emerging, representing less than 1% of the total DBMS market ($77 million (IDC, 2001)). The leaders of this emerging market are Software AGS (40.5% market share) followed by Corp eXcelon (23.3% market share), Compute Associated International Inc. (19.4%), and Poet Software Corp. (1.3%). Three main approaches have been used to provide XML capabilities in databases: non-XML-native information systems use traditional data models to represent XML documents, XML-native systems are specifically designed for the manipulation of XML documents and XML-based legacy systems provide XML layers atop traditional information systems.

XML-based data integration plays an important role in B2B application design. This importance stems from several facts. First, as a standard, XML facilitates the
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