Chapter 19

An Ontology-Based Framework to Semantically Describe XML-Based Business Documents

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ABSTRACT

The objective of this chapter is to present an ontology-based framework for supporting the representation of the semantics of the XML-based EBDs, which are interchanged between trading partners for managing a decentralized B2B collaborative relationship. This framework is based on the idea of making explicit contextual features, generally implicit in an ontology, for allowing the semantic interoperability between the Information Systems belonging to different contexts. The use of the framework is illustrated with an application example.

INTRODUCTION

The boom of the Internet is leading to the implementation of modern technologies to conduct business over the Web. These technologies allow implementing business models, which were unthinkable a few years ago such as the business-to-business (B2B) collaborative commerce between faraway enterprises. Using collaborative commerce capabilities, enterprises can operate as a single business entity, while they are usually loosely coupled. With the aim of implementing a B2B collaborative commerce, enterprises have to decide on both the business models and the information technologies, which allow the interoperability between them.

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As regards business models, several centralized and decentralized models for implementing collaborative relationships between enterprises have been proposed. The Collaborative Planning, Forecasting, and Replenishment (CPFR®) model (Voluntary Interdisciplinary Commerce Standards Association [VICS], 2008) and the Demand Activated Manufacturing Architecture (DAMA) model (Chapman & Petersen, 2000) can be mentioned as examples of centralized ones. The Partner-to-Partner Collaborative Model (Villarreal, Caliusco, Galli, Salomone, & Chiotti, 2004) and the Virtual Collaborative Forecasting Management (V-CFM) model (Esteban, Bas, Escoto, & Perales, 2003) can be mentioned as examples of decentralized ones.

With regard to information technologies, B2B collaborative commerce entails sharing heterogeneous and distributed information resulting from decision-making activities involved in inter-enterprise and intra-enterprise processes. In order to achieve a real communication between enterprises, it is necessary to guarantee the information system interoperability at syntactic and semantic levels. To this aim, Electronic Business Document (EBD) specifications, such as xCBL (XML Common Business Library, 2003), ebXML (Waldt & Drummond, 2006), RosettaNet (RosettaNet Standards, n.d.), and OAGIS (Rowell & Feblowitz, 2002), were defined. These specifications provide the syntax to exchange information based on the eXtensible Markup Language (XML) (Bray, Paoli, Sperberg-McQueen, Maler, & Yergeau, 2008) and propose to share the same vocabulary and meaning before exchanging a message. However, XML-based EBDs do not guarantee by themselves that the information systems of two enterprises will correctly understand its content semantics since these EBDs lack the ability of managing the semantics latent in their content, which is important in order to support joint decision-making activities.

In order to represent the information semantics, different representational artifacts have been proposed from which the most prevalent one is ontology (Gómez-Pérez, Fernández-López, & Corcho, 2004). With the aim of solving semantic problems associated with XML-based EBDs, several ontology-based initiatives have been developed (Firat, Madnick, & Manola, 2005; Klein, 2002). Most of them propose to define a global ontology, which means that all enterprises involved in a B2B collaborative relationship have to modify their internal data structures to convey the global ontology. B2B collaborative commerce, however, is characterized by enterprises that want to exchange only the necessary information with their customers and suppliers to achieve common goals, without losing their autonomy and the confidentiality of their internal information. In order to achieve semantic interoperability then, it is necessary to define an approach, which allows the enterprises to exchange information without imposing a global meaning.

In this chapter, it is presented a framework for supporting the definition of the semantics of the XML-based EBDs, which are interchanged in a B2B collaborative commerce. Different from the previous work, this framework is based on the idea of disaggregating the ontology elements by making explicit the set of contextual features that affects the semantics of each entity. Each enterprise involved in a B2B collaborative commerce relationship constitutes a context. In addition, in the context of a given enterprise, each of its departments constitutes a different context. In this scenario, there are entities that have features whose interpretation depends on the context in which they are considered. These features, called contextual features, are generally implicit in the ontology. The contextual features of each entity have to be made explicit in the ontology definition to allow the semantic interpretation of an entity in different contexts, which is a challenge in the area of enterprise interoperability.

This chapter is organized as follows. First, broad definitions of the terminology used in this chapter and a discussion about related topics are provided. Then, a motivating scenario based on
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