Semantic E-Business Challenges and Directions

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INTRODUCTION

The emergence of semantic Web opens up boundless new opportunities for e-business. According to Tim Berners-Lee, Hendler, and Lassila (2001), *"the semantic Web is an extension of the current Web in which information is given well-defined meaning, better enabling computers and people to work in cooperation"*. A more formal definition by W3C (2001) refers that, *"the semantic Web is the representation of data on the World Wide Web. It is a collaborative effort led by W3C with participation from a large number of researchers and industrial partners. It is based on the resource description framework (RDF), which integrates a variety of applications using eXtensible Markup Language (XML) for syntax and uniform resource identifiers (URIs) for naming"*. The capability of the semantic Web to add meaning to information, stored in such way that it can be searched and processed as well as recent advances in semantic Web-based technologies provide the mechanisms for semantic knowledge representation, exchange and collaboration of e-business processes and applications.

Semantic e-business can be defined as *"an approach to managing knowledge for coordination e-business processes through the systematic application of semantic Web technologies"* (Singh, Iyer, & Salam, 2005). In this context, organizations have the potential to develop descriptions of their business processes, as well as business rules in order to create content-based and logic-driven information and knowledge value. The adaptation of semantic knowledge representation languages, for example, XML, RDF, OWL (Web Ontology Language), and so forth, and other emerging technologies such as ontologies, resource meta-ontologies, Web services, intelligent agents, and so forth, comprise critical factors for the implementation of semantic e-business vision in the digital economy.

The aim of this article is to discuss semantic e-business challenges and provide some directions on how organizations will exploit these technologies in order to enhance their processes. It defines semantic e-business, describes the literature review and all these foundations upon which it is envisioned and demonstrates its close relation with development of semantic Web technologies. Moreover, it presents the directions that support the vision of semantic e-business, illustrate the future trends and discuss the open issues in the field.

BACKGROUND

The Web offers businesses a seamless digital environment for conducting their processes. Semantic Web enhances this environment by using meaningful semantic representations of information and knowledge. In this section, we focus on those technologies that define and enable knowledge representation, structure and

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reasoning, offer exchange mechanisms to allow collaboration and sharing and provide organizations the means to implement semantic e-business.

XML

Extensible Markup Language, shortened XML (Bray, Paoli, Sperberg-McQueen, Maler, Yergeau, & Cowan, 2004), consists of a set of rules for defining and representing information as *XML documents* where information structures are indicated by explicit markup. The markup vocabulary and the structures specified for a particular domain create an *XML application*, a formal language for representing information of the domain. XML was developed from the Standard Generalized Markup Language (SGML) for supporting the management of heterogeneous information resources of the Internet and to facilitate communication between various software applications (Goldfarb, 1990). The simplicity of XML has encouraged active development work around XML, including both software development and development of XML applications and related languages. In e-business, likewise in other domains, the use of XML can be divided into two major categories: the format for data interchange and the format for information assets. The information assets can be further divided into documents and metadata.

URIs

A uniform resource identifier (URI) which *"is a compact string of characters for identifying an abstract or physical resource"* can be used to designate a particular Web resource, that is, *"anything that has identity"* (Berners-Lee, Fielding, & Masinter, 1998). Further, a URI does not have to map to a real Web address. URIs that refer to objects accessed with existing protocols are known as uniform resource locators (URLs). So, URIs provide a general identification mechanism, as opposed to URLs which are bound to the *location* of a resource.

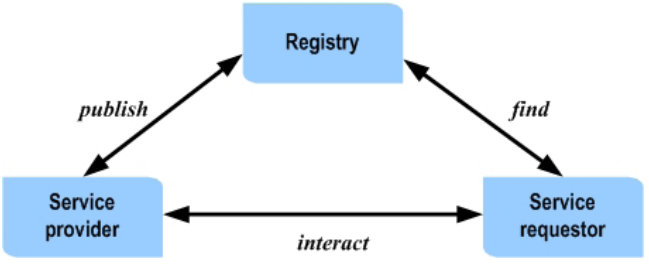
RDF and RDFS

Resource description framework (RDF) is a general-purpose language for representing information in the Web (Brickley & Guha, 2000). It was developed by the W3C and provides a common specification framework to express document metadata in a standardized form that computers can readily process (RDF, 2006). RDF commonly uses XML for its syntax and URIs to specify entities, concepts, properties, and relations. The basic unit of data in RDF is a *triple*, which consists of (1) the *subject* (what the data is about), (2) the *property* (an attribute of the subject) and (3) the *actual value*. RDF schema (RDFS) is a language for defining RDF vocabularies, which specifies how to handle and label the elements. Generally, the role of a schema as a representational model in the context of Web information is to mediate and adjudicate between human and machine semantics.

Web Services

Web service is a software system designed to support interoperable machine-to-machine interaction over a network (Booth et al., 2004). It is identified by a URL, whose public interfaces and bindings are defined and described using XML. Its definition can be discovered by other software systems. These systems may then interact with the Web service in a manner prescribed

Figure 1. The Web service model



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