Chapter 7.2
Challenges on Semantic Web Services

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ABSTRACT

The promise of being able to support Business-to-Customer applications with a rapidly growing number of heterogeneous services available on the Semantic Web has generated considerable interest in different research communities (e.g., Semantic Web, knowledge representation, software agents). However, in order to overcome the challenges of the current Web services, new level of functionalities is required in order to integrate distributed software components using existing Semantic Web standards. In this chapter, the authors discuss and suggest insights into new solutions to the main challenges in the area of Semantic Web services: composition, discovery and trust. For the first problem they suggest to use program transformation coupled with services' descriptions. For the second problem (discovery of Web services) a solution based on the authors' mapping algorithm between ontologies is suggested. While, for the last problem a solution based on fuzzy voting model is outlined. Through the chapter, the authors work with an investing scenario, in order to illustrate our suggested solutions to these three challenges.

DOI: 10.4018/978-1-60566-650-1.ch002

INTRODUCTION

Web services technology has greatly advanced since its first emergence. Although, it has been adopted worldwide and is successfully used in the industry, it is still in the focus of attention of many research communities. The most active research is to automate interactions with and between Web services. One of the methods that may be used to achieve this is taking advantage of the semantic annotation of services and application of Semantic Web technologies, thus using Semantic Web services. A Semantic Web service (SWS) is defined as an extension of Web service description through the Semantic Web annotations, created in order to facilitate the automation of service interactions (McIlraith et al., 2001). These annotations are usually expressed using ontologies.

Ontologies are explicit formal specifications of the terms in the domain and the relations among them (Gruber, 1993). They provide the mechanism to support interoperability at a conceptual level. In a nutshell, the idea of interoperating Semantic Web services, being able to exchange information and carry out complex problem-solving on the Web, is based on the assumption that they share common, explicitly-defined, generic conceptualizations. These are typically models of a particular area, such as product catalogues or taxonomies of medical conditions. However, ontologies can also be used to support the specification of reasoning services (McIlraith et al., 2001; Fensel & Motta, 2001), thus allowing not only "static" interoperability through shared domain conceptualizations, but also "dynamic" interoperability through the explicit publication of competence specifications.

The promise of being able to support Business-to-Customer applications with a rapidly growing number of heterogeneous services available on the Semantic Web has induced a lot of interest within different research communities e.g. Semantic Web, knowledge representation, software agents. However, in order to overcome the challenges of the current Web services, new level of functionalities is required. In addition, although Semantic Web services are perceived as a very promising technology, as in case of any new technology, the problem of its maturity and its impact on the society and the business interactions arises. When it comes to business-to-customer interactions, the very important issues are social aspects connected with automatic transactions, especially the issue of trust within service discovery and composition.

Therefore, within this chapter, we discuss and suggest insights to new solutions to the main challenges in the area of Semantic Web services, namely composition and discovery as well as the issue of trust of Semantic Web services within those interactions. For the first problem we suggest to use program transformation coupled with services' descriptions. For the second problem (discovery of Web services) a solution based on our mapping algorithm between ontologies is suggested. While, for the last problem a solution based on fuzzy voting model that may be used both within discovery as well as composition is outlined. The fuzzy voting model reflects the typical social situation in which one has to decide the opinion of which expert should be finally considered. Through the chapter, we work with an investing scenario, in order to exemplify our suggested solutions to these three challenges.

The main aim of this chapter is to delve into the issue of Semantic Web services and familiarize a reader with the main challenges lying ahead of them. We focus mainly on discovery, composition and trust and then, present possible solutions. In order to fulfil its aims, the chapter is structured as follows. First, we present the idea of Semantic Web services, their interactions as well as the main challenges in this area. Then, the issue of trust of Semantic Web services is discussed and we show the fuzzy voting model and its possible usage. In the next section, a solution to services discovery using Dempster-Shafer theory of evidence is presented. Then, we suggest an alternative solution to the problem of composition of Semantic Web