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Chapter II

Semantic Descriptions of Web Services

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Abstract

This chapter introduces the emerging technology of Semantic Web services. It concentrates on two dominant specifications in this domain, namely OWL-S (Web ontology language for services) and WSMO (Web services modeling ontology). We briefly introduce Web services and Semantic Web, two main technologies underlying the Semantic Web services technology and then explain most of the key features of this technology together with simplified examples. We discuss three aspects of Semantic Web services: specifications for semantic descriptions of services, intelligent discovery and selection of services using semantic descriptions, and finally, building more complex services by composing existing ones. Our main goal in this chapter is not only to present an abstract view of this technology but also the introduction of the technical details of the two existing specifications.

Introduction

Semantic Web services technology lays its foundation on both Web services (W3C, 2004a) and Semantic Web (Berners-Lee, Hendler, & Lassila, 2001; Decker et al., 2000). Web services offer a promising approach to accomplish a loose coupling of processes across organizational boundaries. Web services technologies present specifications that cover the details required for an automated interoperation among client agents and services on the Web, with a minimum interference of human agents. A Web service may provide any of the following or their combinations:

- **static information**, e.g., retrieving geographic or statistical data;
- **digital processes**, e.g., unit conversion or currency exchange; or
- **actual services with concrete effects**, e.g., booking a flight or selling a book and shipping it to an address.

On the other hand, Semantic Web offers computer interpretable semantic knowledge to facilitate a smarter selection of services and assists combining them to build composite services or applications. Such objectives can be achieved by describing the capabilities of a service using semantic descriptions. Programs on the Web will be able to find each other (other Web services) by matching their requirements with the capabilities of available services. Semantic Web technologies can be applied to describe provided capabilities and/or desired requirements of a service.

We believe Semantic Web services technology will improve and facilitate discovery, composition, and interaction with Web services. Semantic Web services facilitates the process of composing several Web services to build a more complex service, while it exposes and behaves as one single service to a client agent. That includes both aspects of facilitating automatic service composition as well as providing specification to describe a composition. The interaction with Web services not only considers invocation and brokering, but would often follow a specific message interchange protocol. Semantic Web services technology provides specifications for Web services to describe their interaction pattern. Description of interaction patterns can be used by client agents during the discovery as well as the execution time.

The main objective of this chapter is to introduce the emerging technology of Semantic Web services. As we introduce this technology, we also discuss the two dominant specifications in this domain, namely OWL-S (Web ontology language for services; Martin et al., 2004a) and WSMO (Web services modeling ontology; WSMO, 2004a). We present all essential features of these specifications and provide simplified examples.

The chapter is organized as follows:

- We start by giving an overview of Web services technologies and Semantic Web. In two sections, we provide the background knowledge for Web services and then briefly introduce Semantic Web, the notion of ontology and the Web ontology