

Chapter 86

Web Service Discovery, Composition, and Interoperability

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ABSTRACT

Web services have been employed in a wide range of applications and have become a key technology in developing business operations on the Web. In order to leverage on the use of Web services, Web service operations such as discovery, composition, and interoperability need to be fully supported. Several approaches have been proposed for each of these operations but these have advantages and disadvantages as well as varying levels of suitability for different applications. This leads to a motivation to explore and to compare current approaches as well as to highlight problems of the operations and their possible solutions. In this chapter, an introduction, a brief survey, problems and possible solutions to the three Web service operations mentioned above are discussed. The research opportunities and possible future directions on Web service are also presented.

INTRODUCTION

Web service is a software component representing a service which is deployed in the Web platform supporting automatic interaction between machines over a network. It has the following features:

platform independence, Internet scoped, loosely coupled, and support easy interaction. As a result, Web services have been applied in various domains and have become a key technology on the Web. Current Web services based on Web Service Description Language (WSDL) (Walsh, 2002) are termed “non-semantic Web services” as they only

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support keywords to describe the services. This limitation prevents fully automatic discovery, composition, and interoperability. The reason for this shortcoming is the lack of semantic understanding. Semantic Web service (Honglei & Son, 2001) has been proposed to address this problem. Semantic Web service is a Web service that uses semantic Web technology (Berners-Lee, Hendler, & Lassila, 2001) to describe the service instead of using WSDL.

Web service *discovery*, *composition*, and *interoperability* are three most important operations which need to be fully supported to leverage the use of Web services. *Discovery* is a process that locates advertised Web services to satisfy a requested Web service's requirement. It is a very important function as the advertised Web services are useless if they are not discovered and so they may have never been used. In case a single Web service cannot satisfy the requirement, multiple Web services are *composed* to satisfy the requirement. After Web services are discovered or composed, they need to perform the *invocation* function which leads to *interoperability* issue to execute the services. Since the three functions are important, many approaches have been proposed to support the functions. This serves as the motivation of this chapter to point out the advantages and disadvantages of each approach.

The aim of this chapter is to present the state of the art of the Web services *discovery*, *composition*, and *interoperability*. The core technologies involve in the semantic Web service model including WSDL, semantic Web service, ontologies, SOAP, and UDDI (OASIS). WSDL (Walsh, 2002) is an XML format for describing network services as a set of endpoints operating on messages containing either document-oriented or procedure-oriented information. Semantic Web service is a Web service that uses semantic Web technology to describe the service instead of using syntactic technology such as Web Service Description Language. Ontologies (Gruber, 1993) is a formal representation of a set of concepts within a domain and the rela-

tionships between those concepts. SOAP (Walsh, 2002) is a protocol specification for exchanging structured information in the implementation of Web Services in computer networks. UDDI (OASIS) is a platform-independent, Extensible Markup Language (XML)-based registry for businesses worldwide to list themselves on the Internet.

The chapter first starts with the background and a brief survey of the activities. It next presents the current problems and possible solutions to solve the problems. Possible directions of Web services are also discussed, followed by the conclusion and some additional references for further reading as well as key word definitions in Web service research.

BACKGROUND

The Web service model is represented in figure 1 showing, the interaction between a *service requester*, *service providers*, and a *service registry* which is a Web service discovery system (Fensel & Bussler, 2002). The three components interact with each other via *publishing*, *discovery*, and *binding operations*. This section will introduce the background and a brief survey of operations including discovery and composition which are for Web service discovery purpose and interoperability which is for Web service invocation purpose.

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