Chapter XII
Semantic Web Service Discovery in the WSMO Framework

Uwe Keller
Leopold-Franzens-Universität Innsbruck, Austria

Rubén Lara
Grupo Analistas, Tecnología, Información y Finanzas, Spain

Holger Lausen
Leopold-Franzens-Universität Innsbruck, Austria

Dieter Fensel
Leopold-Franzens-Universität Innsbruck, Austria

ABSTRACT

The Web service modeling ontology (WSMO) provides a conceptual framework for semantically describing Web services and their specific properties. In this chapter we discuss how WSMO can be applied for service discovery. We provide a proper conceptual grounding by strictly distinguishing between service and Web service discovery and then present different techniques for realizing Web service discovery. In order to cover the complete range of scenarios that can appear in practical applications, several approaches to achieve the automation of Web service discovery are presented and discussed. They require different levels of semantics in the description of Web services and requests, and have different complexity and precision.
INTRODUCTION

The Web is a tremendous success story. Starting as an in-house solution for exchanging scientific information, it has become, in slightly more than a decade, a world-wide used media for information dissemination and access. In many respects, it has become the major means for publishing and accessing information. Its scalability and the comfort and speed in disseminating information have no precedent. However, it is solely a Web for humans. Computers cannot “understand” the provided information and in return do not provide any support in processing this information. Two complementary trends are about to transform the Web, from being for humans only, into a Web that connects computers to provide support for human interactions at a much higher level than is available with current Web technology.

- The Semantic Web is about adding machine-processable semantics to data. The computer can “understand” the information and therefore process it on behalf of the human user (cf. Fensel, 2003).
- Web services try to employ the Web as a global infrastructure for distributed computation, for integrating various applications, and for the automation of business processes (cf. Alonso, Casati, Kuno, & Machiraju, 2003). The Web will not only be the place where human readable information is published but the place where global computing is realized.

The Semantic Web promises to make information understandable to a computer and Web services promise to provide smooth and painless integration of disparate applications. Web services offer a new level of automation in eWork and eCommerce, where fully open and flexible cooperation can be achieved, on-the-fly, with low programming costs. However, the current implementations of Web service technology are still far from reaching these goals, as integrating heterogeneous and dynamically changing applications is still a tremendous task.

Eventually, Semantic Web services promise the combination of Semantic Web with Web service technology in order to overcome the limitations of current Web services by adding explicit semantics to them. The exploitation of such semantics can enable a fully mechanized Web for computer interaction, which would become a new infrastructure on which humans organize their cooperations and business relationships (cf. Fensel & Bussler, 2002). OWL-S (The OWL Services Coalition, 2004) and WSMO (Roman, Lausen, & Keller, 2005) are the major proposals for providing semantic annotations on top of a Web service infrastructure.

An important step for fully open and flexible e-commerce would be the mechanization of service discovery. As long as human intervention is required in service discovery the potential costs of establishing a new eCommerce link may outweigh the potential savings and advantages. Open, flexible, on-the-fly creation of new supply chains is essentially based on full or nearly full automation of this process. Therefore, it is not surprising that automatic Web service discovery is a popular research topic and many papers are published on it (cf. Akkiraju, Goodwin, Doshi, & Roeder, 2003; Benatallah, Hacid, Rey, & Toumani, 2003; Gonzalez-Castillo, Trastour, & Bartolini, 2001; Li & Horrocks, 2003; Paolucci, Kawamura, Payne, & Sycara, 2002; Sycara, Widoff, Klusch, & Lu, 2002; Verma, Sivashanmugam, Sheth, & Patil, 2004; Zein & Kermarrec, 2004). Still, many of these papers discuss discovery in the setting of multi-agent systems or in the setting of description logic based reasoning and none of them really seems to take a look at the actual conceptual and pragmatic issues that are involved in service discovery by using Web services.

Therefore, we provide an in-depth analysis of the major conceptual issues that are involved in service discovery via Web services: