

# Chapter 11

## SDWS: Semantic Description of Web Services

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### ABSTRACT

*This paper introduces SDWS (Semantic Description of Web Services), a Web tool which generates semantic descriptions from collections of Web services. The fundamental approach of SDWS consists of the integration of a set of ontological models for the representation of different Web service description languages and models. The main contributions of this proposal are (i) a general ontological model for the representation of Web services, (ii) a set of language-specific ontological models for the representation of different Web service descriptions implementations, and (iii) a set of software modules that automatically parse Web service descriptions and produce their respective ontological representation. The design of the generic service model incorporates the common elements that all service descriptions share: a service name, a set of operations, and input and output parameters; together with other important elements that semantic models define: preconditions and effects. Experimental results show that the automatic generation of semantic descriptions from public Web services is feasible and represents an important step towards the integration of a general semantic service registry.*

### INTRODUCTION

In the last decade, many software vendors have deployed and offered software as services using interface description languages, such as the Web Service Description Language (WSDL). In order

to make these services available online, providers publish their services descriptions in public repositories, which may be conformant with a specific standard such as UDDI or ebXML. When software integrators (service consumers) search for Web services that meet their criteria in public

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repositories, and try to select and invoke existing Web services, they may face some of the following problems:

1. **Lack of well-documented Web service descriptions:** This is a common problem that many public Web service clients or requestors face. In Rodríguez et al. (2010), authors identify a set of common mistakes in WSDL documents: inappropriate or lacking comments, use of ambiguous names for the main elements, redundant port-types, low cohesive operations in the same port-type, enclosed data model, redundant data models, etc. According to Rodríguez study, less than 50% of the studied WSDL files have some documentation. Additionally, the naming of services, operations, messages and parameters does not follow any convention, and the specification of WSDL does not obligate service authors to provide additional functional semantics information. These reasons cause enormous difficulties during search, selection and invocation of services;
2. **Lack of semantically enhanced Web services repositories:** There are many public Web service repositories, but they do not offer sufficient semantic information about the service functionality, making very difficult the automated exploitation of deployed Web services. Majority of public repositories offer key-based search mechanisms, and some sort of classifications, but none of them offer semantic-based search, matchmaking and discovery mechanisms between existing services considering a provided service interface (template) information;
3. **Heterogeneous Web service description languages:** Existing service description languages share similar objectives and provide common elements for the description of Web services, such as: service name,

service address, operations, input and output parameters. However, their level of expressivity differs significantly from a simple syntactic-based service description (WSDL) to a semantic-based service model such as OWL-S and WSML. This variety of service description languages and models produces that existing Web services are described by heterogeneous service description languages or models. This heterogeneity makes very difficult the automatic service discovery, service selection, service substitution and service inter-operation. Reuse of existing Web services is harder and the automation of Web services compositions from multiple vendors is far from being a reality.

Different solutions have been proposed to deal with these limitations. The semantic Web has influenced many works by providing logic-based frameworks and mechanisms to describe, annotate and discover Web services. Within this context, McIlraith, Cao Son and Zeng (2001) proposed one of the first initiatives to mark-up Web services based on DAML (an ontology language), which started the important research area of “Semantic Web Services”. The term Semantic Web Services is related to the set of technologies and models based on the implementation and exploitation of ontologies as a mechanism to semantically enhance service descriptions. Among the most important semantic models and languages are the Semantic Annotation for WSDL (SAWSDL), the OWL-S ontology-based service description, and the Web Service Modeling Ontology (WSMO). However, these semantic models require human expert intervention to construct ontologies and annotate Web service descriptions before their deployment.

From the perspective of Web services providers, if they want to take advantage of these semantic-based technologies, they need to redesign their solutions with the following con-

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