

# Semantic Web Services: Current Status and Future Directions

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## Abstract

An increasing number of Web services are appearing, users as well as software agents and other web services need to be able to find, select, understand and invoke these services. Today, Web services (e.g. travel services, book selling services, stock reporting services etc) are discovered and invoked manually by human users, which hardcode the interaction between their own programs and the available Web services. Web services standards, such as UDDI, WSDL and SOAP, contribute to this vision by facilitating the interoperation between Web services and software agents or users. As a consequence of these standards is becoming by increasingly easier to connect Web services with their clients. The drawback of these standards is that there is no support for automatic interoperation, and therefore they implicitly assume that a programmer will hardcode the interaction between Web services and his own programs.

Semantic Web services aim to address the shortcomings of Web services standards by relying on the growing infrastructure of the Semantic Web. Relying on the languages developed for the Semantic Web and the related inference engines, the semantic Web services initiatives aim at providing machine understandable descriptions of what Web services do, how they achieve their goals, of their interaction protocol and finally of the messages that they exchange. By taking advantage of these descriptions, any software agent that has the capability to perform the required inferences should be able to interact with other Web services without the need of any programmer to explicitly hardcode the interaction.

The vision proposed by the Semantic Web services initiative is not just an academic exercise, but it is already permeating in the Web services standards as the W3C Web services Description Group is considering adding semantic information to WSDL and the UDDI TC is considering adding OWL annotations to UDDI. The tutorial that we propose will be a venue to discuss theories, challenges, issues, languages and tools from Semantic Web services and in turn from Web services and the Semantic Web. We will present the current state of the art in the Semantic Web and Web services activities, and we will discuss OWL-S, an OWL ontology to describe Web services. To this date, OWL-S is the main offspring of the Semantic Web services initiatives.

The tutorial will be organized in four parts. Part I will present a general brief overview of the concept of the current WS technology, reviewing the principal (emerging) standards. Part II will present the contribution that can be provided by an explicit markup of semantic, and provide the background on the Semantic Web. Part III will present the vision of Semantic Web services and specifically OWL-S as an example of ontology for describing Web services. In this section we will provide both a description of OWL-S as well as a description of the growing infrastructure that is based on OWL-S and OWL-S interface with the rest of the WS technology. In Part IV we will conclude by discussing pitfalls and low hanging fruits of Semantic Web services.

## About the Presenters

Massimo Paolucci is a principal research programmer at Carnegie Mellon University. He is member of the OWL-S coalition, the UDDI Technical Committee, and of the architecture committee of the SWSI initiative.

Katia Sycara is a research professor in the School of Computer Science at Carnegie Mellon University and director of the Advanced Information Technology Laboratory. She is member of the OWL-S coalition, of the UDDI Technical Committee and US chair of the SWSI executive committee. She received great recognition for her work in AI and Multi-agent Systems and she is the 2002 recipient of the ACM Autonomous Agent Research Award.