Semantic Web Services : WSMO Goal Based Architecture

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Abstract

In this paper, we present the main related works according to Semantic Web Service Technology and we propose a new WSMO Goal based approach for the discovery of Web Services.

Key Words: Ontology, Semantic Web Services, Web Services, WSMO.

1. Introduction

The Web Service technology is a uniform technology that allows uniform and universal access via Web standards to software components residing on various platforms and written in different programming languages. These are well-defined, reusable, software components that perform specific, encapsulated tasks via standardized web oriented mechanism. But the major drawbacks of the Web Service technologies are their inability to automatic discovery and composition; human intervention and effort is required which make them unusable in the complex business environment.

The semantic web researchers have proposed to augment Web Services with a semantic description of their functionality in order to facilitate their discovery and integration. This technology, combination of Web Services with Semantic Web technology, is referred as Semantic Web Services (SWS). SWS(s) have the potentiality to alter the way knowledge and business services are provided and used on the web.

In our work, we are interested in discovery of Semantic Web Services taking into account existing approaches. Our proposed description of Semantic Web Services is based on the user's goals expressed in different forms using the WSMO approach.

This paper presents state of the art of current enabling SWS technologies and describes the approach proposed.

The rest of the paper is structured as follows: in section2, we provide a general overview of Web Services; in section 3, we provide an overview of the Semantic Web Services technology and related works according to it. In section 4, we present our approach in detail. Finally, section 5 concludes the paper and gives future trends to the project.

2. Web Service

The Web Services Architecture Working Group defines a Web Service as: "A software application identified by an URI, whose interfaces and bindings are capable of being defined, described and discovered as XML artifacts. Web Service supports direct interactions with other software agents using XML-based messages exchanged via Internet-based protocols" [1].

3. Semantic web services

Since the existing technologies for Web Services only describe in syntactical level, it is difficult for service requestors and service providers to interpret or represent non-trivial statements such as the meaning of inputs and outputs or applicable constraints. Semantic description of Web Services can make possible for automatic discovery, composition and execution across heterogeneous users and domains. So, SWS is a Web Service which is semantically rich and defined through service ontology, capable of automatic discovery, execution, composition and interpretation.

Several approaches have already been suggested for adding semantic to Web Services. Semantics can either be added to currently existing syntactic Web Service standards like UDDI or WSDL. Or services can be described using some ontology based description language. The Major initiatives in the area of (SWS)s are documented by W3C member submissions: like OWL-S [2] and WSMO [3] and WSDL-S [4].

OWL-S (Ontology Web Language for Services); a description language that semantically describes Web Services using OWL ontologies. OWL-S services are mapped to WSDL operations, and inputs and outputs of OWL-S are mapped to WSDL messages.

WSDL-S is an evolutionary and backwards compatible extension of the existing Web Services standards and descriptions language, which augments the expressivity of WSDL with semantics in an arbitrary semantic representation language. WSDL-S provides a means to supply semantic information, but actual semantic functionality has to be provided by additional components, which are not part of the WSDL-S initiative.

The WSDL-S proposal was superseded by SAWSDL [5], a W3C recommendation, which is a simple and generic mechanism for semantically annotating Web Service descriptions. SAWSDL is a restricted and homogenized version of WSDL-S in which annotations like preconditions and effects have not been explicitly contemplated.

The third approach, the Web Services Modeling Ontology, WSMO (review in detail next paragraph), provides ontological specifications for the description of semantic Web services. One of the main objectives of WSMO is to give a solution to application integration problems for Web Services by providing a conceptual framework and a formal language for semantically describing all relevant aspects of Web Services.

WSMO is the only initiative which has an explicit notion of mediation. Furthermore, WSMO is the only standard for which there exist several implementation environments which aim to support the complete standard. For these reasons WSMO is used as our semantic web technology throughout the rest of this paper.

In this paper, we propose a new approach goal based oriented for the discovery of Web Services using the WSMO ontology.

4. Our proposal

The research contribution of this paper is the description of an approach to semantic-based web service discovery. It is based on matching user's goals to Web Services of the portal in order to perform the appropriate Web Service.

We give first a short overview of WSMO and in the next sections; we describe our approach in details.

4.1. WSMO Overview

WSMO identifies four main top-level elements as presented in figure 1:

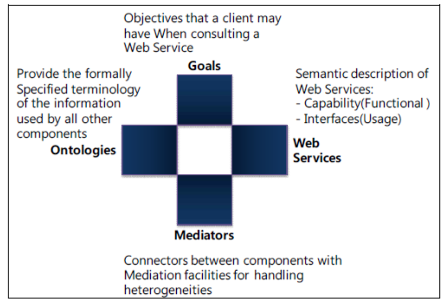

Figure 1 WSMO top level elements.

- Ontologies provide the formal semantics for the terminology used within all other WSMO components;
- Goals specify the objectives that a client have when consulting Web Services;
- Web Services descriptions which describe various aspects of a service;
- Mediators addresses the handling of heterogeneities occurring between elements that shall interoperate by resolving mismatches between different used terminologies (data level), on communicative behavior between services (protocol level), and on the business process level to resolve interoperability problems.

Each of these WSMO Top Level Elements can be described with non-functional properties like creator, creation date, format, language, owner, rights, source, type; etc. WSMO comprises the WSMO conceptual model, as an upper level ontology for SWS, the WSML language and the WSMX execution environment.

The Web Service Modeling Language (WSML[1]) is a formalization of the WSMO ontology, providing a language within which the properties of Semantic Web Services can be described.

WSMX[2] provides an architecture including discovery, mediation, selection, and invocation and has been designed including all required supporting components enabling an exchange of messages between requesters and the providers of services.

4.2. The goal oriented process

Our proposal is based on matching user's goals to Web Services of the portal. This process is needed to an automated discovery of the best Service satisfying the criteria.

1. http://www.wsmo.org/wsml
2. www.wsmx.org

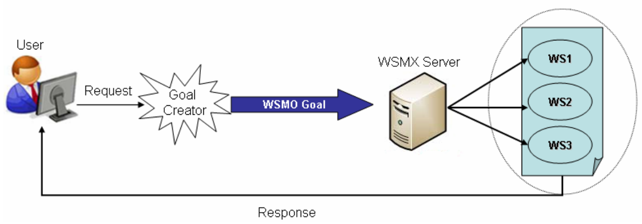

Figure 2 Architecture of the proposal.

Figure 2 presents the main architecture of the proposal. The client communicates with the portal via the HTTPS protocol, which provides a secure communication channel.

The portal allows the itineraries goals to be expressed using web forms for which appropriate WSMO Goal Files are populated with the introduced actual values and conditions and expressed with the WSML language.

Once a WSML-WSMO Goal is created with actual values it can be sent to WSMX for the execution.

The planned research can be split into the following sequence of high-level steps as presented in figure 2:

- First step: Creating WSMO Goals. The requirements and behavior of the client has to be expressed as WSMO Goal. The web application provides forms where user can specify his requirements and input values. Users may describe their desires in a very individual and specific way by filling forms input cases. In this case, we use an extension of [6] to generate the Goals. Once the user introduces the input values, they are saved in a XML file.

- Second step: Translating to WSML File. In this step, REWS Tool translates the XML File in the WSML language.

- Third step: Creating WSMO Web service. Provider's Web services has to be semantically described, which includes lifting arbitrary XML messages to the semantic level by the ontology conceptualization and describing message exchange patterns (choreographies) using the Ontologized Abstract State Machines formalism of WSMO Choreography.

- Fourth step: Matching User's Goal to Web service. In the last step, the WSMX platform selects the appropriate Web Service in the portal and submits the result to the user by giving response according to the input values.

The two last steps are performed by the WSMX Server.

4.3. Case study overview

In order to exemplify the modelling of our proposal, a scenario from the domain of e-Commerce is considered.

Our scenario is based on a WSMX Server, some e-Commerce Web services like Amazon and a Java secure application which allow communication with the portal.

The client introduces the appropriate values by filling forms of the Web pages; these values will be stored in a XML file for submitting to the Goal creator tool. As a result, a WSML Goal file (figure 3) is created and will be submitted to the WSMX Server where some e-commerce Web Services are connected for the discovery matching.

At the end, the client receives a response of the Web Service selected.

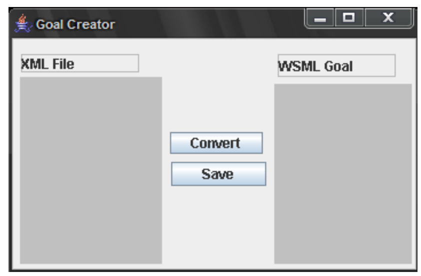

Figure 3 Goal Creator tool.

5. Conclusion

In this paper we have presented a state of art of current enabling SWS technologies and a new WSMO Goal based approach for Semantic Web Service Discovery.

Nevertheless, there are still a number of issues concerning Semantic Web Services being investigated in a number of initiatives. These issues will have the attention of industry and academia for the next few years. This approach can be extended for other tasks like invocation and composition.

6. References

[1] Curbera, F., Nagy, W. and Weerawarana, S. "Web Services: Why and How." Workshop on Object-Oriented Web Services – OOPSLA 2001, Tampa, Florida, USA, October 2001.

[2] Martin D., Burstein M., Hobbs J., Lassila O., McDermott D., McIlraith S., Narayanan S., Paolucci M., Parsia B., Payne T., Sirin E., Srinivasan N., Sycara K. OWL Web Ontology Language for Services (OWL-S). W3C Member Submission 22 November 2004. Available at: http://www.w3.org/Submission/OWL-S .

[3] Bruijn J.d., Bussler C., Domingue J., Fensel D., Hepp M., Keller U., Kifer M., König-Ries B., Kopecky J., Lara R., Lausen H., Oren E., Polleres A., Roman D., Scicluna J., Stollberg M. Web Service Modeling Ontology (WSMO). W3C Member Submission 3 June 2005. Available at: http://www.w3.org/Submission/WSMO .

[4] Akkiraju, R., Farrell, J., Miller, J., Nagarajan, M., Schmidt, M., Sheth, A., & Verma, K. (2005), Web Service Semantics - WSDL-S, W3C Member Submission 7, Retrieved April 4, 2006, from http://www.w3.org/Submission/2005/SUBM -WSDL-S-20051107/ ,November 2005.

[5] Farrell J. and Lausen H. (eds) Semantic Annotations for WSDL and XML Schema. W3C Candidate Recommendation, January 2007. Available at: http://www.w3.org/TR/sawsdl .

[6] El Bouhissi H. and Malki M. "Reverse Engineering Existing Web Service Applications", In Proc. Of 16th Working Conference on reverse Engineering,WCRE’09, Published by the IEEE Computer Society, pp 279-283, ISSN Number 1095-1350, ISBN 978-0-7695-3867-9 October 13-16, 2009, Lille, France.