

SEMANTIC WEB SERVICES

Introduction

Web Services provide a standard means of interoperating between different software applications, running on a variety of platforms and/or frameworks.

Semantic Web Services aim to enhance Web Services through the addition of machine readable descriptions than can aid with the automation of all aspects of application development.

This briefing discusses work undertaken by members of the KnowledgeWeb network in the investigation of Semantic Web Services. This includes investigations of underlying models and frameworks along with practical evaluations and comparisons of existing approaches.

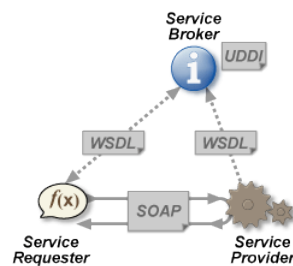
Web Services

The service paradigm is becoming an important and integral aspect of the web. Web Services (WSs) encapsulate functionality and make it accessible over standard internet protocols, allowing the construction of systems using loosely coupled, reusable components.

The standard WS architecture sees clients and servers interacting via the exchange of XML messages. Service providers can supply details of their services to a broker or registry. Clients can then query the broker to obtain details of available services.

Vanilla Web Services suffer from some limitations, however. Descriptions of the services (for example, using the Web Services Description Language WSDL) tend to be syntactic e.g. describing inputs/outputs in terms of datatypes, rather than in terms of their underlying meaning, or the functionality provided by the service. Also, key tasks relating to the use of services such as discovery, composition or invocation have to be carried out by humans.

To address this, Semantic Web Services (SWS) proposes the application of Semantic Web Technology (machine readable annotations using shared ontologies) in order to enhance Web Services. Richer descriptions will facilitate more powerful service brokers, and enable automation of



tasks like discovery, selection, invocation and composition.

SESA

KnowledgeWeb's key contribution in the SWS area has been in the development of the SESA Architecture. SESA provides a framework that integrates various aspects of Semantic Web Services including a formal framework for SWS, interoperation and invocation of WS and data mediation in SWS.

SESA follows a number of governing principles:

Semantic Automation is enabled through rich descriptions of information and behaviour;

Service-Oriented Loose coupling, reuse, composability, discoverability and autonomy of services;

Problem-Solving Goal-based discovery and invocation.

An implementation of SESA has been implemented and used within the SWS Challenge (see below).

Standardisation

Engagement with standardisation activities is a key dissemination route for research networks, and a mechanism to ensure sustainability of research results, as well as industrial relevance.

As with other research activity in KnowledgeWeb, work on SWS is well aligned with appropriate standards bodies. In particular, SESA follows the OASIS Semantic Execution Environment (SEE) Technical Committee, with KnowledgeWeb members contributing to the work of the TC. KnowledgeWeb members were also active within W3C's Semantic Annotations for WSDL (SAWSDL) Working Group, developing a mechanism to enable semantic annotation of Web services descriptions in WSDL 2.0.

Data Mediation

In semantic environments, data is described using ontologies. Alignments between ontologies (see KWeb briefing *Ontology Matching & Alignment* for further details) can help solve problems with heterogeneity and reconcile alternative perspectives. Support for the creation of ontology mappings within the context of the Web Service Exe-

cution Environment (WSMX) has been explored, facilitating the task of data mediation between web services.

At design time, graphical tools allow users to create mappings between source and target ontologies, with automated support. Mappings are stored persistently. At run time, these mappings can then be used to mediate between heterogeneous services.

Triple Space Computing

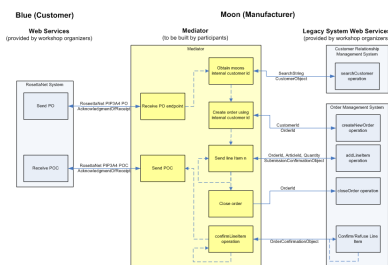
Current Web Service architectures rely on a message exchange paradigm between sender and receiver. This requires that the sender and receiver maintain a connection, are aware of each other, and share some common data representation.

Possible alternatives to this include "tuple space" computing, with communication based on a logically shared memory. Triple Space Computing builds on this, using the Resource Description Format (RDF) as a formalism for describing tuples in a space.

Semantic Web Services Challenge



The Semantic Web Services Challenge explores the trade-offs among existing approaches towards mediation, choreography and discovery of Web Services using semantic annotations.



Mediation Scenario

The challenge uses a number of scenarios. For example a purchase order scenario explores issues in process and data mediation between a customer and manufacturer, where the parties use differing messaging formats. A discovery and composition scenario describes a situation where a customer has clear requirements for a task, but needs to find the most appropriate collection of services to fulfill those requirements.

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Systems are evaluated on their ability to cope with various levels of problem. Problems have increasing levels of complexity, for example Level 0 addresses the initial mediation problem, Level 1 introduces the ability to adopt to changes in systems and Level 2 adds discovery.

SWSC is organised as a series of workshops, the latest held in November 2007, with six systems participating in the latest event.

Publications & Resources

T. Vitvar, M. Zaremba, M. Zaremba, M. Moran, D. Fensel *SESA: Emerging Technology for Service-Centric Environments*. IEEE Software, 24(6), 2007.

J. Kopecký, T. Vitvar, C. Bournez, J. Farraell *SAWSDL: Semantic Annotations for WSDL and XML Schema*. IEEE Internet Computing, 11(6), 2007.

OASIS Semantic Execution Environment Technical Committee

<http://www.oasis-open.org/committees/>

W3C Semantic Annotations for WSDL Working Group

<http://www.w3.org/2002/ws/sawsdl/>

KnowledgeWeb Deliverabel D2.4.8.1v1 *Technical and ontological infrastructure for Triple Space Computing*

KnowledgeWeb Deliverable D2.4.12 *Data Mediation in Semantic Web Services*

Semantic Web Services Challenge Web Site

<http://sws-challenge.org/>

Contact

For more information about the results presented here or the KnowledgeWeb Network of Excellence, please see the project web site

<http://knowledgeweb.semanticweb.org>

or contact the Network Manager.

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