D 2.4.13 Report on the Semantic Web Services Challenge

Tomas Vitvar (NUIG DERI Galway)

with contributions from:
Holger Lausen (LFUI DERI Innsbruck), Michal Zaremba (LFUI DERI Innsbruck), Charles Petrie (Stanford University DERI Stanford)

Abstract.
EU-IST Network of Excellence (NoE) IST-2004-507482 KWEB
Deliverable D2.4.13 (WP2.4)

The Semantic Web Services Challenge (SWS Challenge) is a new initiative that provides a standard set of increasingly difficult problems from the area of B2B and e-business integration based on industrial specifications and requirements, on which both academic and industrial integration technologies can be objectively evaluated. While the first phase of the SWS Challenge was organized in Stanford, USA, the second phase was held in Budva, Montenegro co-located with Knowledge Web General Assembly and WP2.4 meeting. This deliverable provides and overview of the Budva workshop in relation to KW project as well as summary of achievements and future activities planned within the SWS Challenge initiative.

Document Identifier:	KWEB/2006D2.4.13/v1.0
Class Deliverable:	KWEB EU-IST-2004-507482
Version:	v1.0
Date:	June 30, 2006
State:	Final
Distribution:	Public

Knowledge Web Consortium

This document is part of a research project funded by the IST Programme of the Commission of the European Communities as project number IST-2004-507482.

University of Innsbruck (UIBK) – Coordinator
Institute of Computer Science,
Technikerstrasse 13
A-6020 Innsbruck
Austria
Fax: +43(0)5125079872
Phone: +43(0)5125076485/88
Contact person: Dieter Fensel
E-mail address: dieter.fensel@uibk.ac.at

École Polythechnique Fédérale de Lausanne (EPFL)
Computer Science Department. Swiss Federal Institute of Technology
IN (Ecublens), CH-1015 Lausanne.
Switzerland
Fax: +41 21 6935225
Phone: +41 21 6932738
Contact person: Boi Faltings
E-mail address: boi.faltings@epfl.ch

France Telecom (FT)
4 Rue du Clos Courtel
35512 Cesson Sévigné
France. PO Box 91226
Fax: +33 2 99124098
Phone: +33 2 99124223
Contact person : Alain Leger
E-mail address: alain.leger@rd.francetelecom.com

Freie Universität Berlin (FU Berlin)
Takustrasse, 9
14195 Berlin
Germany
Fax: +49 30 83875220
Phone: +49 30 83875223
Contact person: Robert Tolksdorf
E-mail address: tolk@inf.fu-berlin.de

Free University of Bozen-Bolzano (FUB)
Piazza Domenicani 3
39100 Bolzano
Italy
Fax: +39 0471 315649
Phone: +39 0471 315642
Contact person: Enrico Franconi
E-mail address: franconi@inf.unibz.it

Institut National de Recherche en Informatique et en Automatique (INRIA)
ZIRST - 655 avenue de l'Europe - Montbonnot Saint Martin
38334 Saint-Ismier
France
Fax: +33 4 7661 5207
Phone: +33 4 7661 5366
Contact person: Jérôme Euzenat
E-mail address: Jerome.Euzenat@inrialpes.fr

Centre for Research and Technology Hellas / Informatics and Telematics Institute (ITI-CERTH)
1st km Thermi – Panorama road
57001 Thermi-Thessaloniki
Greece. Po Box 361
Fax: +30-2310-464164
Phone: +30-2310-464160
Contact person: Michael G. Strintzis
E-mail address: strintzi@iti.gr

Learning Lab Lower Saxony (L3S)
Expo Plaza 1
30539 Hannover
Germany
Fax: +49-511-7629779
Phone: +49-511-76219711
Contact person: Wolfgang Nejdl
E-mail address: nejdl@learninglab.de

National University of Ireland Galway (NUIG)
National University of Ireland. Science and Technology Building. University Road
Galway
Ireland
Fax: +353 91 526388
Phone: +353 87 6826940

The Open University (OU)
Knowledge Media Institute. The Open University
Milton Keynes, MK7 6AA
United Kingdom.
Fax: +44 1908 653169
Phone: +44 1908 653506
Contact person: Enrico Motta

Contact person: Tomas Vitvar
E-mail address: tomas.vitvar@deri.ie

E-mail address: e.motta@open.ac.uk

Universidad Politécnica de Madrid (UPM)
Campus de Montegancedo sn
28660 Boadilla del Monte
Spain
Fax: +34-913524819
Phone: +34-913367439
Contact person: Asunción Gómez Pérez
E-mail address: asun@fi.upm.es

University of Karlsruhe (UKARL)
Institut für Angewandte Informatik und Formale Beschreibungsverfahren – AIFB. Universität Karlsruhe
D-76128 Karlsruhe
Germany
Fax: +49 721 6086580
Phone: +49 721 6083923
Contact person: Rudi Studer
E-mail address: studer@aifb.uni-karlsruhe.de

University of Liverpool (UniLiv)
Chadwick Building, Peach Street
L697ZF Liverpool
United Kingdom
Fax: +44(151)7943715
Phone: +44(151)7943667
Contact person: Michael Wooldridge
E-mail address: M.J.Wooldridge@csc.liv.ac.uk

University of Manchester (UoM)
Room 2.32. Kilburn Building, Department of Computer Science, University of Manchester,
Oxford Road
Manchester, M13 9PL
United Kingdom
Fax: +44 161 2756204
Phone: +44 161 2756248
Contact person: Carole Goble
E-mail address: carole@cs.man.ac.uk

University of Sheffield (USFD)
Regent Court, 211 Portobello street
S14DP Sheffield
United Kingdom
Fax: +44 114 2221810
Phone: +44 114 2221891
Contact person: Hamish Cunningham
E-mail address: hamish@dcs.shef.ac.uk

University of Trento (UniTn)
Via Sommarive 14
38050 Trento
Italy
Fax: +39 0461 882093
Phone: +39 0461 881533
Contact person: Fausto Giunchiglia
E-mail address: fausto@dit.unitn.it

Vrije Universiteit Amsterdam (VUA)
De Boelelaan 1081a
1081HV. Amsterdam
The Netherlands
Fax: +31842214294
Phone: +31204447731
Contact person: Frank van Harmelen
E-mail address: Frank.van.Harmelen@cs.vu.nl

Vrije Universiteit Brussel (VUB)
Pleinlaan 2, Building G10
1050 Brussels
Belgium
Fax: +32 2 6293308
Phone: +32 2 6293308
Contact person: Robert Meersman
E-mail address: robert.meersman@vub.ac.be

Executive Summary

The goal of the SWS Challenge is to develop, demonstrate, and compare the various technologies that support the automation of service-based systems integration: i.e. mediation, choreography and discovery of services using semantic annotations. The first phase was held in Stanford, USA in early March, and produced an interest and agreement from about a dozen technology groups interested in participating in the challenge. The second phase of the SWS Challenge has been organized as part of the Knowledge Web General Assembly in Budva, Montenegro. The SWS Challenge is bringing together participants from research and industry who develop software components and/or intelligent agents and have ability to automate mediation, choreography and discovery of services.

In particular, the SWS challenge problem scenarios addresses the problem of rigid B2B integration of enterprises and lack of automation in such integration. Dynamic integration aiming to (semi) automate interoperation of systems is the key aspect of emerging semantic-enabled integration technologies based on the Semantic Web Services. In particular, work within the WP2.4 Semantic Web Services around conceptual and formal framework for SWS, discovery and composition of services, interoperation and invocation of services is relevant and directly addresses problems defined by SWS challenge. By having SWS challenge organized as part of KW GA assembly in Montenegro, it was possible to directly demonstrate the work within the WP2.4 on the case scenarios from e-business domain defined by SWS challenge while at the same time bringing together different views from academia and industry. In addition, this allowed us to confront and compare different solutions aimed towards automated and dynamic B2B integration.

Contents

1 Introduction

The goal of the SWS Challenge is to develop a common understanding of various technologies intended to increase automation in mediation, choreography and discovery for Web Services using semantic annotations. The intent of this challenge is to explore the trade-offs among existing approaches while at the same time identify the parts of the problem space which have not been covered yet by research and industry. SWS Challenge, which is organized in a series of workshops (also called phases), seeks participation from industry and academic researchers developing software components and/or intelligent agents that have the ability to automate mediation, choreography and discovery processes between Web services. This includes different approaches into the Semantic Web Services research focused around WSMO/WSML/WSMX[2,4], OWL-S[6], METEOR-S[1,5], IRS[3] as well as "traditional software engineering" approach. The idea is to achieve a better understanding of various approaches, evaluate their benefits and provide this way a forum for discussion based on a common application domain..

This Challenge is related to but distinct from the IEEE Contest[1] in several respects. First, the SWS Challenge focuses on the use of semantic annotations: participants are provided with semantics in the form of natural language text which they can formalize and use in their technologies. Second, SWS challenge is not a contest, meaning that workshop participants will mutually evaluate and learn from each others' approaches. Finally, because of this methodology, a number of participants will be limited to a relatively small group.

So far, two SWS challenge workshops have been organized. The first have been organized in early March 2006 in Stanford University where participants from various universities and industry presented their technology as potential solution to SWS challenge scenarios. The purpose of this workshop was to familiarize participants with the challenge problem, each others' approaches to it, and to refine the challenge problem and evaluation criteria for Phase II. Phase II workshop has been organized in Budva, Montenegro and has been co-located with KW GA assembly and WP2.4 session. In this workshop, a number of solutions have been demonstrated addressing challenge scenarios. In this deliverable, phase II of the SWS challenge is described in more detail.

This deliverable is structured as follows. In section 2, we describe scenarios defined by challenge organizers, namely mediation and discovery scenarios. In section 3, we describe challenge levels in terms of increasingly difficult problems and evaluation criteria for challenge solutions. In section 4, we describe the Budva workshop and discuss its results and in section 5, we discuss the relation of SWS challenge to KW. In section 6, we summarize the deliverable and describe our future activities.

[1] http://insel.flp.cs.tu-berlin.de/wsc06/

2 Challenge Scenarios

The aim of the SWS Challenge is to provide a test bed for applying Semantic Web Service technology to a set of realistic and working Web Services. This test bed serves as a benchmark between different approaches and it provides some objective success criteria for a semantic technology. Currently this test bed consists of 2 complementary scenarios: *mediation* and *discovery*. In the future, new scenarios will be submitted and hosted at www.sws-challenge.org.

2.1 Process and Data Mediation Scenario

Process and data mediation scenario address the interoperability problem which can occur during the systems integration at the data and process levels with aim to show how new emerging technologies can help to overcome the need for manual development of mediation systems. For mediation scenario, SWS challenge provides relevant information about the systems involved in two forms: (1) *using current Web service description in WSDL* and (2) *natural language text annotations*. Using current state-of-the-art technologies a programmer has to interpret the information given and to code components that overcome the heterogeneity between the different systems. In the SWS Challenge participants are asked to extend the syntactic descriptions in a way that their algorithms/systems can perform the necessary translation tasks in a semi or fully automatic manner.

For this challenge, the focus is on the very basic scenario of purchasing goods using a simplified version of the RosettaNet specifications. In the scenario, a fictitious trading company called Moon uses two back-end systems to manage its order processing, namely, a Customer Relationship Management system (CRM) and an Order Management system (OMS). The challenge provides access to both systems through public Web services described using WSDL. Moon has signed agreements to exchange purchase order messages with a partner company called Blue using the RosettaNet PIP 3A4. Data mediation is required to map the Blue RosettaNet PIP 3A4 message to the messages of the Moon back-end systems. Process mediation is required to map the message exchange defined by the RosettaNet PIP 3A4 process to that defined in the WSDL of the Moon back-end systems. While the external interfaces must follow the RosettaNet specification, internally Moon uses a propriety legacy system in which data model and message exchange patterns differ from those of RosettaNet. SWS Challenge participants shall basically enable Moon to "talk RosettaNet" and implement the Purchase Order receiving role part of the interaction described in the RosettaNet PIP 3A4.

There are three main components taking part in the process are depicted in Figure 1:

- Company Blue, which is a customer (service requester) ordering products
- Mediator, which is a technology providing automatic or semi-automatic mediation for Moon company
- Legacy System of Moon Company

The Moon legacy systems as well as the Blue customer Web services are provided by the challenge organizers and can not be altered (although their description may be semantically enriched). The mediator shall be implemented by the participants.

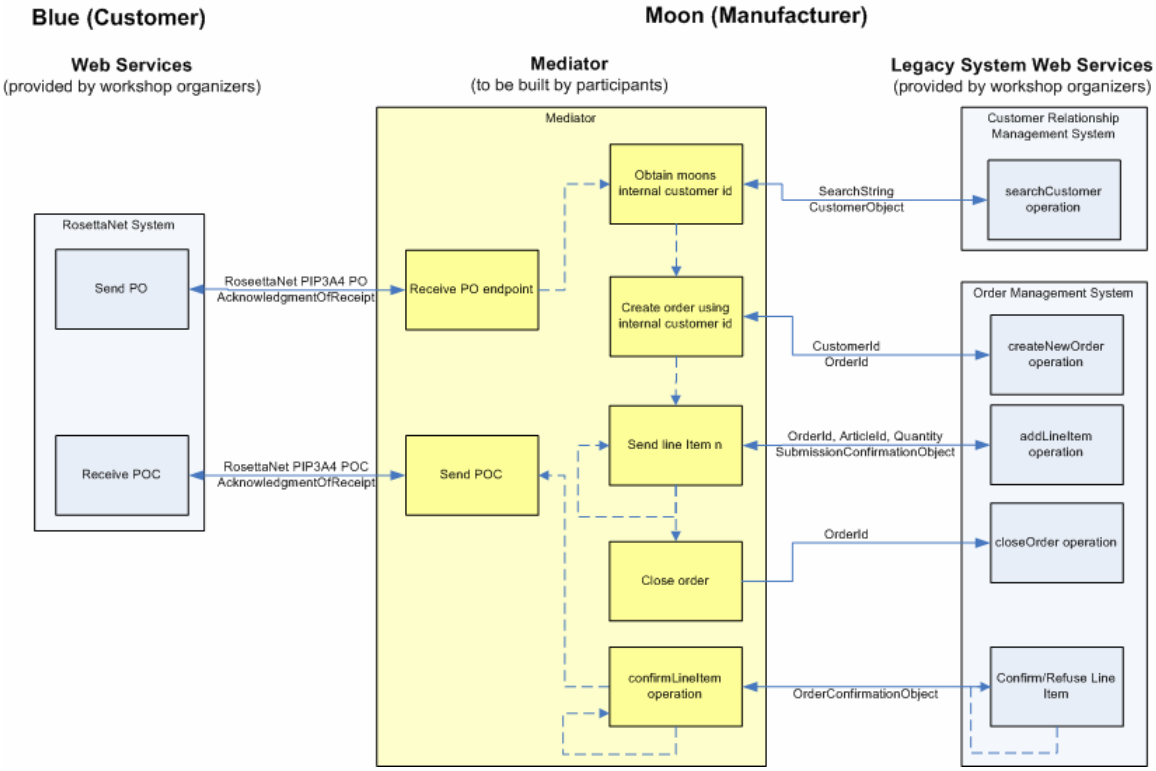

Figure 1: Mediation Scenario Overview

2.1.1 Interactions between Blue and Mediator

The incoming and outgoing RosettaNet PIP3A4 message have a different data format than required by the Moon backend system. The messages used in the challenge are the simplified versions of the original specification. RosettaNet Partner Interface Processes (PIPs) define business processes between trading partners. To describe context of messages SWS challenge provides simplified PIP3A4 as RosettaNet XML Schemas. Within the RosettaNet PIP3A4 specification the information is given using a DTD, thus SWS challenge organizers converted this DTD to XML Schema and removed some fields to make the message a bit simplified and less complex. Tag names, their meaning and structure have not been changed.

The PIP 3A4 enables a buyer to issue a purchase order and to obtain a quick response from the provider that acknowledges which of the purchase order product line items are accepted, rejected, or pending. Figure 2 presents the flow of messages between Buyer Service (Blue Company) and Seller System (Mediator of Moon Company). In this diagram, the Moon's Legacy System Web Services and Blue's Web Services are provided by organizers while Mediator Web Service should be implemented by the participants.

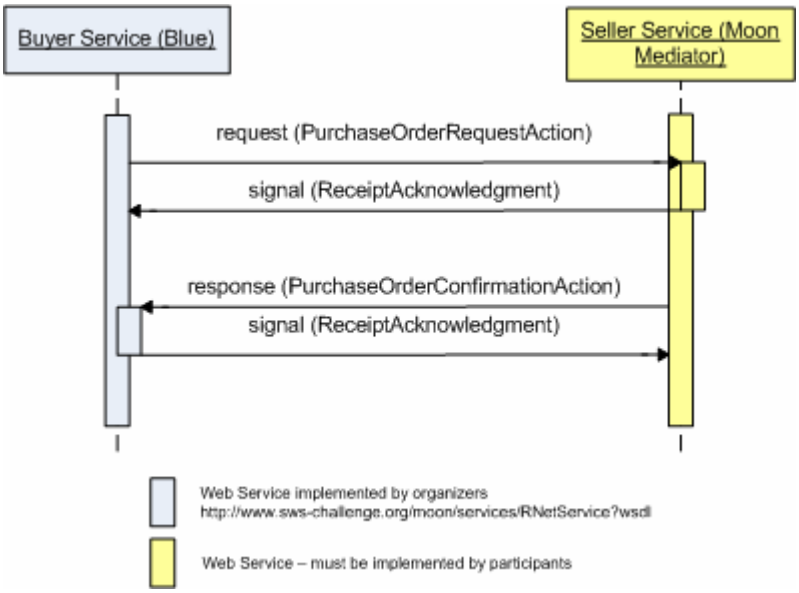

Figure 2: RosettaNet Request Purchase Order Interactions

A RosettaNet PIP3A4 business process is initiated by the buyer when it sends the Purchase Order message to the endpoint exposed by a mediator (this one has to be provided by challenge participants). The Purchase Order message must be synchronously confirmed by an Acknowledgement of Receipt message. The original RosettaNet specification allows 24 hours for confirmation of the Purchase Order Action. SWS challenge organizers changed it and for the sake of practicability, the Purchase Order Confirmation should be issued no later than 5 minutes since Mediator received Purchase Order. The complete list of Message Exchange controls can be found in Table 1.

	Name	Time to Respond to Message	Time to Respond to Message Action
(1)	Purchase Order Request Action	synchronous - immediately (message 2)	5 minutes (message 3)
(2)	Receipt Acknowledgment	no acknowledgement	no action required
(3)	Purchase Order Confirmation Action	synchronous - immediately (message 4)	no action required
(4)	Receipt Acknowledgment	no acknowledgement	no action required

Table 1: Message Exchange Controls - RosettaNet

SWS Challenge organizers provide detail description of messages in simplified PIP3A4 Purchase Order XML Schema[2] such as elements for Purchase Order Request, Receipt Acknowledgment, Elements of Purchase Order Confirmation, etc.

RosettaNet messages contains no specific information about product, but only Global unique product identifier. RosettaNet has adopted the Global Trade Identification

[2] http://sws-challenge.org/wiki/index.php/RosettaNet_XML_Schemas

Number[3]. GTIN is the EAN.UCC System identifier for trade items, which encompasses both products and services. GTINs provide the capability to deliver unique identification worldwide. For the purpose of this challenge a list of products is provided in Table 2, which can be ordered from Moon. The rules for assigning GTINs ensure that every variation of an item (product or service) is allocated a single reference number that is globally unique. On the other hand the organizers recognizes that this number remains quite meaningless from the perspective of Semantic Web. It has been however decided not to change existing specification in order to encourage participants of the challenge to present ideas how to make use with GTIN numbers on the Semantic Web.

Description	Item	Level	GTIN
(Dell W5001C 50" High Definition Plasma TV	1 Unit	Consumer	00614141000012
SANDISK 1 GB Secure Digital Card	96 Units	Case	00614141000029
Dell W3706MC 37" High Definition LCD TV	1 Unit	Consumer	00614141000777
Dell Laser 1710	6 Pack	Consumer	00614141000883
SYMANTEC CORPORATION Norton Internet Security 2006	12 Pack	Consumer	00614141000999
SUNBELT SOFTWARE Downloadable Counterspy with 1-Year Maintenance	2x12 Pack	Case	10614141000996
SOFTWARE ADVANTAGE MCAFEE Wireless Home Network Security V1.0	4x12 Pack	Case	30614141000990
DELL 512 MB High Speed USB 2.0 Memory Key	8x12 Pack	Case	50614141000994

Table 2: Global Trade Identification Numbers for Moon products

2.1.2 Interactions between Mediator and Legacy System

In the RosettaNet standard a purchase order is sent using just a single message, however, in order for Moon to be able to process an order, several steps have to be fulfilled. The overall ordering process of Legacy System is more complex that the one defined by RosettaNet protocol and the Mediator must take care of it. This process is shown in Figure 3.

[3] http://www.gtin.info/

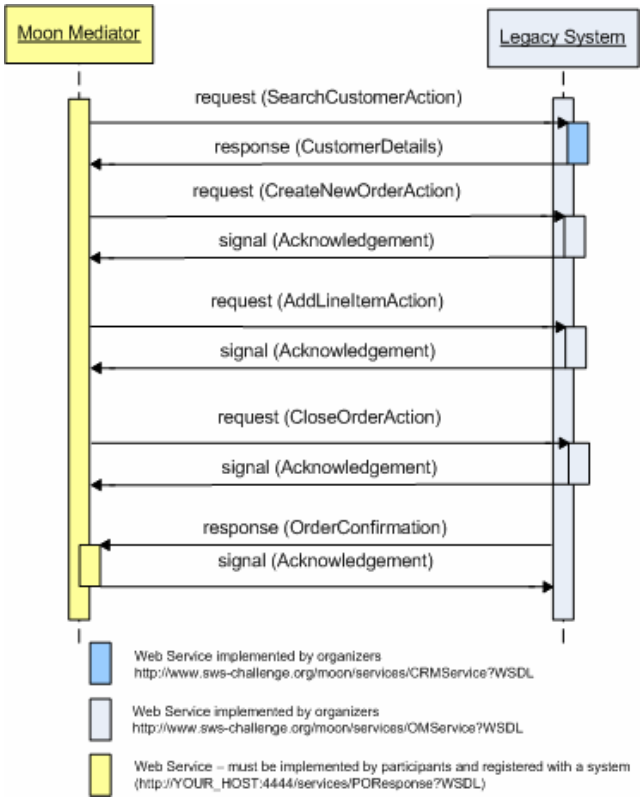

Figure 3: Legacy System Request Purchase Order Interactions

First, the Mediator communicates with the Legacy Customer Relationship Management System to obtain relevant customer details. As a next step it requests to create a new order by communicating with another endpoint of Legacy Order Management System. The same endpoint is used to submit individual line items. Once all line items have been submitted, the order has to be closed. Challenge participants must provide an endpoint for their mediators to which the response back from Legacy System can be sent. The complete list of Message Exchange controls is shown in Table 3.

	Name	**Time to Respond to Message**	**Time to Respond to Message Action**
(1)	Search Customer Action	synchronous - immediately (message 2)	no action required
(2)	Receipt Customer Details	no acknowledgement	no action required
(3)	Create New Order Action	synchronous - immediately (message 4)	no action required
(4)	Acknowledgment	no acknowledgement	no action required
(5)	Add Line Item Action	synchronous - immediately (message 6)	no time constraints (message 9)
(6)	Acknowledgment	no acknowledgement	no action required
(7)	Close Line Item Action	synchronous - immediately	no action required

		(message 8)	
(8)	Acknowledgment	no acknowledgement	no action required
(9)	Order Confirmation Action	synchronous - immediately (message 10)	no action required
(10)	Acknowledgment	no acknowledgement	no action required

Table 3: Message Exchange Controls

SWS Challenge organizers provide complete description of Moon CRM Schema[4] as well as Moon OM Schema[5] including description of request and response messages such as Search Customer, Create New Order, Add Line Item, Close Order etc.

2.1.3 Changes to the scenario

One of the goals of the SWS challenge is to address dynamic of changes in the enterprise environment and to demonstrate how changes in the environment could be facilitated in a more flexible way by the semantically enabled technologies. From this reason, organizers introduced the second level of the scenario with some changes in messages and processes on which flexibility of different solutions will be demonstrated and evaluated. In this sub-section two changes are introduced to the legacy system of Moon. The Order Management (OM) system gets renamed to Stock Management (SM). While names differ, the message exchange pattern and the types of the messages for the SM system remain exactly the same as they were previously in OM system. The big change is addition of the Production Management (PM) system from which mediator can now order products to be scheduled for production, when they are not available from SM system. The complete process for Moon 2 is presented in figure 4.

[4] http://sws-challenge.org/schemas/moon/CompleteMoonCRMSchema.xsd
[5] http://sws-challenge.org/schemas/moon/CompleteMoonOMSchema.xsd

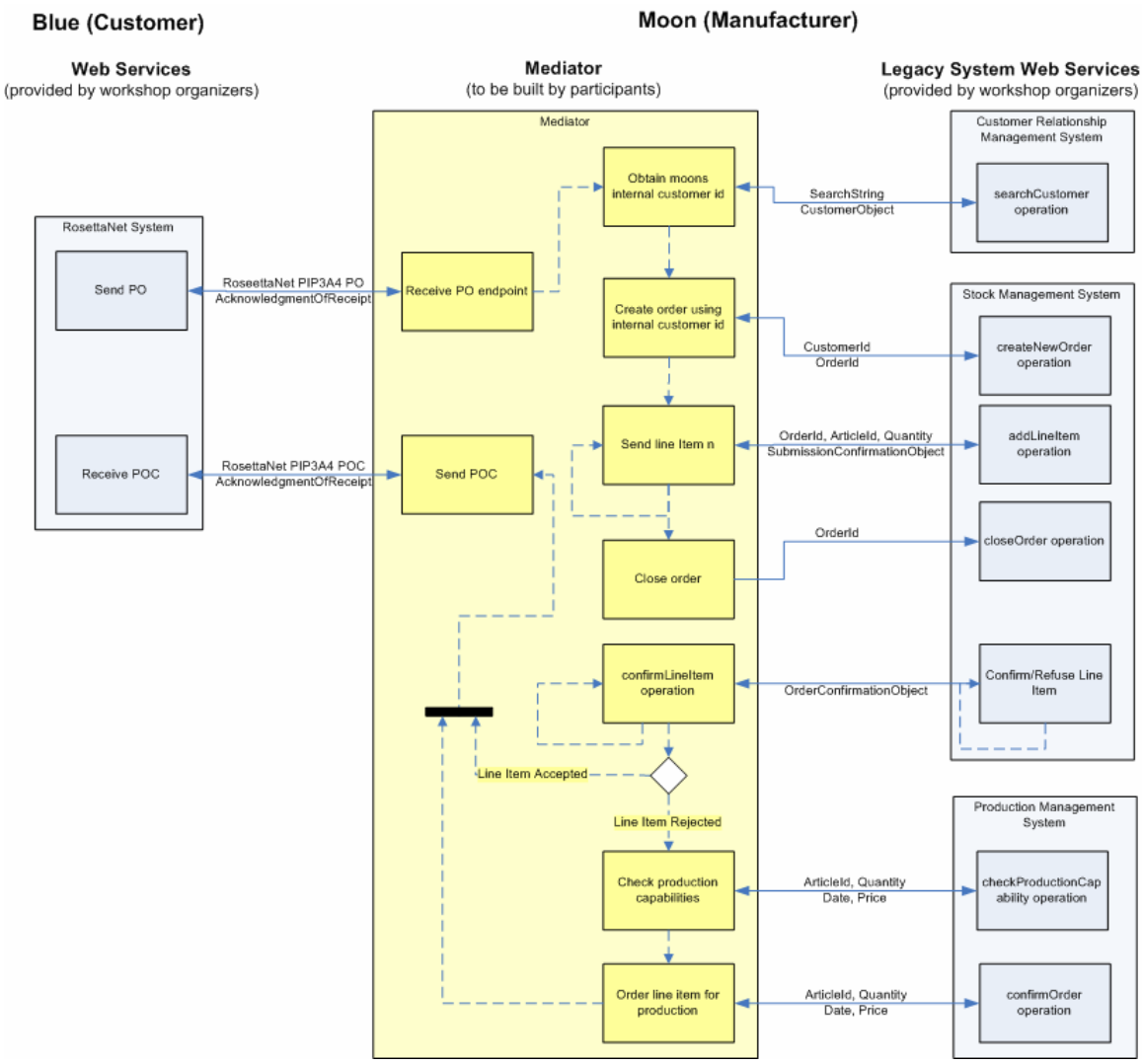

Figure 4: SWS Challenge - Changes to Mediation Scenario

When the Stock Management system is incapable to fulfil request from the customer and it replies that the particular line item cannot be accepted, the Mediator must communicate with the legacy Production Management system to obtain relevant information on date and price to manufacture a new product. If this information meets initial expectations of the customer as specified in the RosettaNet message, the product should be ordered.

2.2 Discovery Scenario

The Discovery Scenario is orthogonal to the integration/mediation problem. The integration problem can be solved with current syntactic technologies, however it shall be shown how semantic annotation can be used to make this task easier and more flexible. The *discovery* scenario -that a new supplier has to be found- is a more visionary scenario, since in present business scenarios this task always involves a human in the loop.

2.2.1 Scope

This scenario is about how to identify possibly relevant services. Having discovered a Web service does not necessarily mean that it can be immediately executed to achieve the desired goal. Imagine you look for a specific book and discover Amazon as a book vendor: there is still some interaction with the service required to actually determine if the book is available and at which price it is available. Depending on how specific the goal is, it will sometimes not be possible to identify a suitable service only based on a static description. Given that in practice automatic and dynamic discovery is not widely used, part of the challenge is to refine the challenge and to illustrate the benefits of semantic descriptions. Within the research community is only little consensus about what information should be included in a static description and how they should be semantically encoded. In this challenge organizers will describe a scenario using existing technologies (WSDL, XSD, and natural language text descriptions).

In the scenario, the moon company wants to purchase 20 power supplies for IBM R50 Notebooks and 20 SDRAM modules à 512 MB. Moon needs the components within one week in Stanford, CA, USA. Once the components are received they must be shipped to a customer of the Moon company to Bristol, UK. For the purposes of the scenario, the Moon needs one (or more) services where it can order the goods specified and a shipment service to send them to its customer. Organizers provide a set of predefined services (both shipment and purchase) of which the participants shall select suitable ones. In the following subsections, these services are described in a more detail.

2.2.2 Purchase Services

Each purchase service has its own particularities. Services are different in several aspects, such as products they offer, the countries they serve, accepted payment methods, price and others. Those aspects of a service can be described and used to locate a suitable service given some request.

Table 4 shows the aspects that are relevant for simplified discovery scenario. In the first column the aspect that is relevant for discovery is described, the second and third column describes the restrictions given by the requester and provider. The requester in our scenario is the moon company and the provider are the candidate services provided by oganizers.

Aspect	Requester	Supplier
Products	concrete list of products	set of products
Shipment Location	concrete location	set of locations
Shipment Price	preferences / restrictions (like less than $100)	concrete value, resp. functional dependency on selected products
Payment Method	concrete list of accepted payment methods	concrete list of accepted payment methods

Table 4: Different Aspect of Purchase Services

Products: A supplier might have a huge list of products and prices, not all the time the complete list of products will be available as a static description, but the current product price and availability must be retrieved via a specific search request. Thus organizers expect that the set of products needs to be described more abstract then a simple list. Intuitively a supplier completely matches a request if all the requested products are available and it partially matches in case a subset is available.

Shipment: A service advertises the locations where it ships to, however it might not always indicate a concrete price. Services selling only very specific products like RAM advertise a fixed shipment price, others might publish some rules how they calculate their shipment price and others might not advertise it statically but refer to a specific operation that provides a shipment price with respect to some current shopping cart.

Payment Method: Both the requester and supplier advertise a list of acceptable payment methods. This is similar to the advertisement of products, however the matching criteria is different: A complete match exist if there is one payment method in common for requester and supplier (not all methods enlisted in the request must be provided).

Table 5 provides a list of purchase services.

Company	Product	Shipment Location	Shipment Price	Payment	EndPoint
Donau	ComputerEquipement specialized on PCs with brand components from Interl, AMD, etc.	US + Canada	not advertised	MasterCard, Visa, Cash (in case of self collection in SFO)	to be done
Inn	Power Supplies for: Mobiles, PDAs, Notebooks, PCs	US	$10 + $5 / dimensional weight pounds	MasterCard, Visa, Cash (in case of self collection in SFO)	to be done
Isar	Memory for PDAs, Laptops, PCs, PDAs, etc.	World Wide	$20	MasterCard, Visa	to be done
Rain	Direct Sales of all PC Equipment	-	-	MasterCard, Cash	to be done

Table 5: List of Purchase Services.

2.2.3 Shipping Services

Shipment services for the discovery scenario are implemented and available at the SWS challenge web site. Following shippers are available for the scenario. For each shipper, additional information is provided such as rates, shipping location, constraints on weight of packages, time constraints etc.

Muller

- Rates on Request (cf. invokePrice operation within the WSDL)
- Package Maximum Weight = 50 lbs
- Ships to Africa, North America, Europe, Asia (all countries)
- Constraints on Collection:
    - There should be at least an interval of 90 minutes for collection.
    - Collection is possible between 6am and 8pm PDT.
    - Collection can be ordered max 2 working days in advance.

Racer

- Rates(flat fee/each lb): Europe(41/6.75), Asia(47.5/7.15), North America(26.25,4.15), Rates for South America like North America, Rates for Oceania like Asia
- For each collection order 12.50 are added
- Maximum package weight is 70 lbs
- Constraints on Collection:
    - Latest pickup time is 3pm
    - There should be at least an interval of 120 minutes for collection.

Runner

- Rates(flat fee/each lb): Europe(50/5.75), Asia(60/8.5), North America(15/0.5), South America(65.75/12), Africa (96.75/13.5), Oceania has the same rates then Asia
- Exact list of countries included in WSDL file
- If package weight exceeds 70 lbs, weight, length and height are required (the order has to be done via phone or fax)
- Constraints on Collection:
    - Collection can be ordered max 5 working days in advance.
    - Minimum Advance notice for collection is 1 hour
    - Collection is possible between 1am - 12pm PDT

Walker

- Rates(flat fee/each lb): Europe(41/5.5), Asia(65/10), North America(34.5/3), South America (59/12.3), Africa (85.03/13), Rates for Oceania like Asia
- Maximum package weight is 50 lbs
- Exact list of countries included in WSDL file
- Constraints on Collection:
    - Shipment can be ordered maximum 2 business days in advance
    - The maximum length of the pickup interval is five business days, i.e. the earliest and latest pickup date can be maximum 5 days apart.
    - pickup time must be between 6 am and 11.00pm.

Weasel

- Rates(flat fee/each lb): United States(10/1.5)
- Delivery only in United States
- Constraints on Collection

- the pick up interval must be at least 5 hours
- the max. pick up interval is 4 days

3 Challenge Levels and Evaluation

In the phase I of the SWS Challenge in Stanford, challenge levels have been identified. The general idea is that the organizers provide a set of challenge problems. These build upon the initial mediation problem, which is called *level 0*. On top of this various levels are added, each corresponding to a general kind of a problem, and each with sublevels of complexity. Level 2 adds discovery to the mediation problem of level 1, and level 3 adds a different kind of discovery as well as some composition with the system of level 2. Subsequent levels will extend the supply chain, mixing mediation and discovery. Organizers also allow participants to avoid solving the mediation problem and entering at level 2.

Level	Description
0	Mediation Scenario (static)
1	Mediation Scenario (adopting to changes in systems)
1a	Data Mediation
1b	Process Mediation
2	Simple Discovery (single invocation based on service description)
2a	Shipment coverage (countries, cities semantics)
2b	Shipment price and weight calculations (arithmetic)
2c	Shipment constraints on pick-up time and delivery (temporal semantics)
2d	Shipment unit conversion (semantics of measures)
3	Composite Discovery (multiple invocations required for complete discovery)
3a	discovery 2 including request for quote and a order operation
3b	discovery 3a including a request for multiple packages that has to be split
3c	discovery 3b including a dynamic currency conversion

Table 6: SWS Challenge Levels

There are five possible levels of success that organizers evaluate in transitioning from one problem (sub) level to another. The first, *Evaluation Success Level 0* is minimal and is automatically determined by the system. The next three levels are determined by peer review. A higher evaluation success level indicates a better solution to the problem level transition.

- **Evaluation Success Level 0:** The evaluation will have a minimal criterion that the participating system adequately invokes the requisite web services, measured by the legality of the messages exchanged. Some of the tests will involve error handling: details to be disclosed later. Participants will self-declare what part of their solution is executable code and what part is "data": declarations that describe the semantics of the problem and can be easily changed to adapt to new problem levels.

- **Evaluation Success Level 1:** Success Level 1 will be achieved whether the code had to be changed (the compiler or interpreter would execute different instructions.)
- **Evaluation Success Level 2:** Success Level 2 will be achieved if only data had to be changed: no execution code had to be changed.
- **Evaluation Success Level 3:** Success Level 3 will be achieved if there were no change to the system at all.

4 Budva Workshop, Montenegro

In Budva, Montenegro, the second phase of the SWS challenge has been organized in June 15-16, 2006. This workshop has been co-located with the European Semantic Web Conference 2006 (ESWC2006) and Knowledge Web General Assembly. In this meeting, the total of 13 researchers participated including SWS challenge program committee as well as contributors to the SWS challenge solution.

4.1.1 Participants

1. Anupriya Ankolekar - AIFB Karlsruhe
2. Jos de Bruijn - DERI Innsbruck
3. Dario Cerizza - CEFRIEL, Semantic Web Activities group
4. Federico Facca - Politecnico di Milano, WebML Group
5. Christian Kubczak - University of Dortmund
6. Ulrich Küster - University of Jena, Endowed Heinz Nixdorf Chair
7. Holger Lausen - DERI Innsbruck
8. Charles Petrie - DERI Stanford, Stanford Logic Group
9. Tomas Vitvar - DERI Galway
10. Michal Zaremba - DERI Innsbruck
11. Maciej Zaremba - DERI Galway
12. Thomas Haselwanter - DERI Innsbruck
13. Axel Polleres - Universidad Rey Juan Carlos

4.1.2 Agenda

THU 15 June

- 09:00 - 10:40 Knowledge Web Plenary (for interested people)
- 10:40 - 11:00 Coffee - after the Knowledge Web Plenary (9am)
- 11:00 - 11:30 Introduction - Charles Petrie
- 11:30 - 12:00 Organization and Status of the Challenge - Holger Lausen and Michal Zaremba
- 12:00 - 12:45 DERI Galway - Tomas Vitvar and Maciej Zaremba
- 12:45 - 14:00 Lunch
- 14:00 - 14:45 Politecnico di Milano & CEFRIEL - Federico Facca and Dario Cerizza

- 14:45 - 15:30 U. Jena - Ulrich Küster
- 15:30 - 16:00 Coffee
- 16:00 - 16:45 University of Dortmund - Christian Kubczak
- 16:45 - 17:15 Report on preliminary evaluation - Lausen
- 17:15 - 17:45 Discussion of future organization of the challenge
- 18:00 Adjourn
- 20:00 Plenary KW Dinner

FRI 16 June

- 09:00 - 09:15 Organization into evaluation reviewing groups
- 09:15 - 11:00 Group Reviewing Work
- 11:00 - 11:30 Coffee
- 11:30 - 13:00 Plenary: preliminary reports and reconciliation
- 13:00 - 14:00 Lunch
- 14:00 - 14:30 Group preparation of final reports
- 14:30 - 15:30 Plenary discussion of next steps
- 15:30 - 16:00 Coffee
- 16:00 - 18:00 KW Plenary session in Banquet Hall - SWS Challenge summary presentation
- 18:00 Finish

4.1.3 Contributions and Evaluation of Results

Four solutions have been presented and demonstrated by (1) Politecnico di Milano and CEFRIEL, Italy, (2) DERI Innsbruck, Austria and DERI Galway, Ireland, (3) University of Jena, Germany, (4) University of Dortmund.

Politecnico di Milano and CEFRIEL, Italy

Marco Brambilla, Stefano Ceri1, Dario Cerizza, Emanuele Della Valle, Federico Facca, Christina Tziviskou: *Coping with Requirements Changes:SWS-challenge phase II*[6]

Abstract: In this paper we describe our approach to the second phase of SWS Challenge 2006. We present the WebML design of the mediator and its implementationby the means of the CASE tool WebRatio; furthermore, we discuss the integration of Glue WSMO discovery engine in our approach. The integration is achieved by invoking the Web Services exposed by Glue both for publishing and for discovering semantic services; in particular, we show the publishing of a new shipment/purchase service and the discovery of the most convenient shipment/purchase service. Finally, we present in detail the changes we applied to the system in order to model the additional requirements introduced in the second phase of the Challenge.

[6] *http://sws-challenge.org/2006/paper/SWS-phase-Finale_polimi_cefriel.pdf*

DERI Innsbruck, Austria and DERI Galway, Ireland
Thomas Haselwanter, Paavo Kotinurmi, Matthew Moran, Tomas Vitvar, and Maciej Zaremba: *Dynamic B2B Integration on the Semantic Web Services: SWS Challenge Phase 2*[7]
Abstract: In this paper we present how Semantic Web Service technology can be used to overcome process and data heterogeneity in a B2B integration scenario. While one partner uses RosettaNet for message exchange process and message definition, the other one operates on a proprietary solution based on a combination of WSDL and XML Schema. For this scenario we show the benefits of semantic descriptions which are used within the integration process to enable data and process mediation of services. We illustrate this integration process on the WSMX – a middleware platform conforming to the principles of a Semantic Service Oriented Architecture.

University of Jena, Germany
Ulrich KÄuster, Birgitta KÄonig-Ries, Michael Klein: *Discovery and Mediation using DIANE Service Descriptions*[8]
Abstract: In this paper, we introduce the DIANE Service Description (DSD) and show how it can be used to solve the mediation and discovery problems stated in the scenarios for the second SWS-Challenge workshop June 2006 in Budva, Montenegro.

University of Dortmund, Germany
Christian Kubczak Tiziana Margaria Bernhard Steffen: *The jABC Approach to Mediation and Choreography*[9]
Abstract: Our approach to the SWS-Challenge 2006 Phase II uses the JavaABC[1] for mediation and choreography. jABC is a flexible and powerful framework for service development based on Lightweight Process Coordination. Users easily develop services and applications by composing reusable building-blocks into (flow-)graph structures that can be animated, analyzed, simulated, verified, executed, and compiled. We show here briefly how to handle the mediator design and the remote integration of web services.

In the following table, the summary on the results is given in regards to the challenge levels described in the section 3 and with comments given to some levels below the table.

Problem Level	PoliMi - Cefriel	DERI AT & DERI IE	FSU Jena	University of Dortmund
0: static mediation	√	√	√	√
1a: changes data mediation	2	1[1]	-	-
1b: changes process mediation	2[2]	2[2]	-	-
2a: discovery based on location	√[3]	-	√	-
2b: discovery with arithmetic price and weight computations	√[3]	-	√[5]	-
2c: discovery with temporal	√[34]	-	-	-

[7] *http://sws-challenge.org/2006/paper/DERI_WSMX_SWSChallenge_II.pdf*
[8] http://sws-challenge.org/2006/paper/SWS-Challenge-2006-Budva.pdf
[9] http://sws-challenge.org/2006/paper/unido_sws_2006_draft.pdf

semantics				
2d: discovery with conversion of measurement units	-	-	-	-
3a: discovery including request for quote	-	-	√	-

Table 7: Evaluation

[1]Only Adapters Changed
[2]different addresses on line item level have not been addressed correctly
[3]no invocation
[4]current date entered manually
[5]arithmetic calculation performed by external Web services

4.1.4 Comments on Evaluation

In the presentations and demonstrations given by SWS Challenge participants in Budva were a lot of asterisks on the evaluations. There are many interesting details hidden in these asterisks: One of the specifications for the change in the mediation scenario was that line items might have different addresses. But the Moon company did not support such POs. Therefore different POs would have to be generated. No one drew this inference. In at least one case, it was because the implementers gave the UML diagram more weight than the text specifications. We conclude that this is a great instance of the business intention not being sufficiently captured by the programmers, and an example of why we need more formal expressions of business policies.

That said, the more important point is that this was a preliminary evaluation. We learned a lot by doing it. We expect the next evaluation not to have so many footnotes. And we also learned the importance of making the implementations public - because the evaluations are just an approximation. Anyone who ants to really know, should look at the implementations to see what was really done.

The evaluations did indeed involve code examinations and discussions over what counted as a code or data change. We also made some important changes to the evaluation protocol. First, we eliminated the evaluation criterion of only adding and not deleting any data as ultimately not making any sense. It is difficult enough to argue the difference between code and data, especially in the case of software engineering approaches that merely move arrows around in a GUI, which we decided were data declarations, at least in this case.

One of the benefits of this evaluation is that we now have trained evaluation people, whom we hope will serve as team leaders in the next phase of the 2006 workshop. Which we will hold in November in Athens, Georgia, with Amit Seth as our host. The likely dates are 9-11 November.

Finally, all implementation we amazing however the most complete was that of the Politecnico de Milano. They accomplished this coverage by teaming up approaches best suited for each part of the challenge: a tactic worth emulating. Each of the implementers is now authorized to use the SWSC logo on their website and point to their preliminary certifications.

5 Relation to Knowledge Web

SWS Challenge aims at showcasing and evaluating benefits of semantic technologies in the real world case scenarios and bridging this way the research and use of its results in industrial applications. The work around scalability of ontologies and reasoners, dynamics of ontologies, languages for the semantic description of information models, heterogeneity of information models and work around semantics in web services in particular are essential fundamental grounds for enabling technology for more flexible and dynamic inter and intra enterprise integration. By having SWS challenge organized as part of KW GA assembly in Montenegro, it was possible to directly demonstrate the work within the WP2.4 on the real world case scenarios defined by SWS challenge while at the same time bringing together different views from academia and industry. In addition, this allowed researchers to confront and compare different solutions aimed towards automated and dynamic B2B integration.

Another important aspect of today's research into the semantic web and web services is that although this research is well established through active research community, there is still a lack of implemented use cases demonstrating its potential benefits. Showcasing realistic scenarios and their evaluation is an essential step for transfer of this emerging technology to the industry. In order to enable this transfer, it is essential to show how semantic technologies can co-exist within existing enterprise infrastructures with existing integration standards (B2B standards - i.e. RosettaNet) as well as industry-strength integration platforms and WSDL-based services. These are objectives of the work around WP2.4 Semantic Web Services as well as in a broader sense the objectives of KW Industry Area in regards to uptake of semantic technologies from the semantic research community and last but not least the objectives of the SWS challenge initiative.

6 Conclusion

SWS Challenge in general defines the common problem from the area of B2B integration to be addressed by various technologies and to show and evaluate benefits of semantically-enabled integration of systems and services. After the first phase of the SWS Challenge held in Stanford, USA in early March 2006, the second phase was co-located with KW general assembly and ESWC2006 in Budva, Montenegro. A number of contributors from different universities who participated in the Budva workshop have demonstrated how their technologies can target scenarios defined by the challenge. With respect to ongoing work in the KW project, SWS challenge workshop also showed how some of the results from the KW project can be evaluated in the context of other technologies and showed the benefits of the work carried out as part of the WP2.4 Semantic Web Services and in particular in the deliverable D2.4.7 Interoperation and Invocation of Services. Although the commitment of SWS Challenge participants was high, some difficulties occurred mainly regarding visa and travelling difficulties to Budva for some participants. From this reason, not all previously agreed contributors were able to participate in the workshop.

The SWS challenge is organized in a set of workshops where Budva was the second in the series. The next workshop is planned to be organized in Athens, Georgia, USA co-located with International Semantic Web Conference 2006 (ISWC2006). We also plan to disseminate the results of the SWS Challenge in various academia and industry events and bring more industrial participation to the challenge workshops. We aim to publish the results of the SWS Challenge in a special issue and write a marketing article for an appropriate journal to attract additional participation from academia and industry. We also aim to develop the SWS challenge to be the "certification authority" for the semantic technologies having the right to use SWS challenge logo when successfully fulfilling the challenge requirements.

References

[1] R. Akkiraju, et al. Web Service Semantics - WSDL-S http://lsdis.cs.uga.edu/projects/meteor-s/wsdl-s/. Tech. rep., 2005.

[2] A. Haller, et al. WSMX – A Semantic Service-Oriented Architecture. In Proc. Of the 3rd Int. Conf. on Web Services, pp. 321 – 328. IEEE Computer Society, 2005.

[3] E. Motta, J. Domingue, L. Cabral, and M. Gaspari. IRS-II A Framework and Infrastructure for Semantic Web Services. The Semantic Web ISWC 2003. Lecture Notes in Computer Science, Springer-Verlag, Heidelberg, 2870:306–318, 2003.

[4] D. Roman, et al. Web Service Modelling Ontology. Applied Ontologies, 1(1):77 – 106, 2005.

[5] K. Verma, et al. The METEOR-S Approach for Configuring and Executing Dynamic Web Processes, available at http://lsdis.cs.uga.edu/projects/meteors/techRep6-24-05.pdf. Tech. rep., 2005.

[6] OWL Services Coalition. OWL-S: Semantic Markup for Web Services. http://www.daml.org/services/owl-s/1.1/, 2004.