D3.2 v0.2 WSMO Use Case Modeling and Testing

WSMO Final Working Draft 13 April 2005

Editors:
Michael Stollberg
Rubén Lara

Authors:
Michael Stollberg
Holger Lausen
Rubén Lara
Armin Haller
Dieter Fensel

Abstract

This deliverable exemplifies the usage of the Web Service Modeling Ontology WSMO for modeling Semantic Web Services along with specific technological solutions. This document defines the general organization of WSMO use cases, and presents specific examples of WSMO use cases.

Related Documents

WSMO Ontology: D2 v1.1 Web Service Modeling Ontology (WSMO)

WSMO Primer: D3.1 WSMO Primer

WSMO Use Case: D3.3 Virtual Travel Agency

WSMO Use Case: D3.5 SWF Use Case

WSMO Use Case: D3.6 WSMO Use Case "Stream Flows! System"

WSMX Use Cases: D13.6 WSMX Use Cases

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1. Introduction

This Deliverable presents several use cases which exemplify WSMO usage for specific real-life purposes. The different use cases presented in this document provide valuable insight for testing and adapting the modeling constructs provided in WSMO in real-world scenarios for Web Services. So, besides demonstrating how to model Web Services in WSMO, the use cases also allow us to demonstrate the adequacy of our approach in terms of providing an exhaustive framework for covering all relevant aspects of semantic description of Web Services. Over time, additional use cases will be added in order to expand the range of possible solutions for Semantic Web Service technologies using WSMO.

This document is organized as follows: Section 2 defines the general organization of WSMO Use Cases; Section 3 presents examples of specific WSMO use cases.

Section 4 provides information on use cases developed in WSMO-related efforts Section 5 concludes the document. A Change Tracker in the Appendix explicitly identifies the major changes made from earlier versions of this document to the latest version, in order to facilitate readers following the improvements.

2. General Organization of WSMO Use Cases

A WSMO use case description document is organised into four subsections, as follows: First, there is a general description of the use case setting and the technical aspects to be addressed. This is followed by a tabluar overview of the WSMO resources modeled in the use case. Next the resources' models in WSML are outlined, and finally, the technical solutions developed or addressed within a use case are presented.

More detailed explanations of the four subsections of the general structureare given below.

2.1 Use Case Description

The aim of this subsection is to provide a description of the use case from a real world perspective, without regard to technical realization. Therefore, we slightly modify the methodology of the W3C Web Services Architecture Working Group for use case descriptions and extend it by the requirements arising for Semantic Web Services technologies (see [He et al., 2004]). The aspects considered for this general description are defined as follows:

- **Description:** describes the overall scenario
- **Scope:** defines the scope of the application scenario described
- **Actors, Roles and Goals:** identifies the actors in the scenario, their roles (i.e. what they do in the scenario) and their goals (i.e. what they want to achieve by participating in the scenario).
- **Usage Scenarios:** the W3C Service Architecture Working Group defines a use case as "... a sequence of interactions between a service requester and one or more services, which achieve measurable results for the requester", and a usage scenario as "... an atomic step in a path through a use case", i.e. an activity that has to be performed during execution of the use case and which can be automated by appropriate Semantic Web Service technologies. Each use case description includes the following information:

  - participating actors and their goals
  - activities to be performed
  - technological requirements
  - possible extensions of the scenario.

- **System Architecture:** In addition to the use-case oriented aspects of the W3C methodology, we also outline the general requirements and possible architecture of the respective SWS-based application.

2.2 Use Case Resources Overview

In order to allow readers to gain a reasonable understanding of the WSMO resources defined in a use case as well as their relationships and interplay, a tabular overview of all resources defined in the use case is provided. For each component, a table is provided that describes the component. Table 1 is an example for such a component description, taken from the VTA use case (see Section 3.1); the VTA use case document also contains 'templates' for the tabluar descriptions of the other WSMO components.

Table 1. 'International Train Ticket Ontology'	
WSMO component type	ontology
name	International Train Ticket Ontology
description	defines ontology constructs for the domain of international train connections
imported ontologies / used mediators	- Date and Time Ontology - Location Ontology - OWL Person Mediator - OWL Fact Book Mediator
main contructs	*main concepts:* station, itinerary, trip, traintrip *axioms:* stationCountry, departureBeforeArrival, startNotEqualEnd *instances:* innsbruckHbf , frankfurtHbf
WSML model	number / link to the listing with the WSML model of the resource

2.3 WSMO models

The third subsection of a WSMO use case description document provides the WSML models for the resources, along with detailed explanations about modeling decisions or other explanations relating to specific resources.

The WSML models are presented in numbered Listings. For technical realization within a HTML document, the following assisting accessories are provided and recommended for use:

- a WSML resource is defined in a separate file with the ending ".wsml"; all resources defined in the use case are stored in a subfolder ../resources/
- each WSML resource should be valid WSML; there is a Validator for WSML available at: http://dev1.deri.at:8080/wsml/validator.html, with a web interface and a web service interface

- the ".wsml" file contains plain WSML, which shall serve as resources within the technical solution of the use case. For human readability within a HTML document, the WSML keywords should be **bold**. A script for WinEdit is available which automatically creates the "wsml.html" file from the WSMO; the most recent version of this script is available in the WSMO CVS at http://cvs.deri.at/cgi-bin/viewcvs.cgi/wsmo/d3/d33/resources/wsmlmacro.edt.

- A Listing is a HTML-table wherein a file with the ending "wsml.html" is included Here an example:

```
<table class="listing" width="100%" border="1">
<caption>Listing 1. Domain Ontology International Train Ticket</caption>
<tbody><tr>
<td class="listing"><!--#include file="resources/tc.wsml.html" --><br />
</td></tr>
</tbody>
</table>
```

Detailed explanations will help the reader to understand the design and definition of a specific component. Such explanations are optional, but recommended, because they can be very helpful for readers not familiar with the WSML syntax or WSMO. For example, for ontologies, the general intention, important design decisions, and related ontologies should be referenced; for a Web Service Capability, a brief natural language document is recommended. We refer to the VTA use case document as a reference for this style (see Section 3.1).

2.4 Technical Solutions of Use Case

Finally, the technical issues addressed in the use case should be explained. We recommend that this subsection should give only a brief overview of the technical solution, and that more detailed explanations of the theoretical and the technical realization should be moved to a different document.

3. WSMO Use Cases

This section presents use cases that utilize WSMO for addressing specific aspects of Semantic Web Services. Each use case has a different focus. We briefly introduce the use cases here, and reference to the complete use case document. The use cases are ordererd with respect to the date of addition to this list.

3.1. Virtual Travel Agency for Online Train Tickets

This use case models a B2C application scenario: a Virtual Travel Agency for purchasing train tickets provides a WSMO Web Service, and a customer defines a Goal for purchasing a train ticket.

Link: http://www.wsmo.org/TR/d3/d3.3/

This use case was the first WSMO use case developed, and dates from a very early stage of development of WSMO. The use case setting has deliberately been kept

very simple, as the main aim was to develop the basic elements of WSMO without getting lost in arbitrary complex issues. Thus, the use case defines only a small set of WSMO resources: 4 modularized domain ontologies, 2 Goals, 1 Web Service, and preliminary versions of WSMO Mediators.

The use case has been updated and changed several times in earlier versions of this document. As it might be hard to understand the rationales for the changes, here is a short overview of the 'history' and related issues which have been addressed during the evolution of the use case:

- For the specification of WSMO Standard (the version 0.x of WSMO D2), a real-world setting was needed that allowed readers to understand the challenges arising for Semantic Web Service technologies and how these should be addressed within WSMO. Many design decisions now implemented within WSMO resulted from the experiences and results of this use case.

- As a result of studying existing use cases for Web Services, the 'general organization of WSMO use cases' as presented above has been developed.

- In the beginning, F-Logic was considered as the specification language for WSMO; as work on the development of the use case progressed, the group began to focus their efforts on the Web Service Modeling Language WSML,- resulting in the work now done in the WSML working group. The requirements for modeling WSMO resources from this use case have been the basis for the specification of WSML is its current form.

- Major attention has been given to implementing Web Service Discovery within WSMO. Several approaches to the theoretical framework and the technical implementation have been tried out during the evolution of this use case, resulting in the WSMO Web Service Discovery framework and implementation which is now a feature of WSMO Deliverable D5.x.

In conclusion, this initial WSMO use case has proven to be very useful for the development of WSMO: it provided a real-world setting in which to explore the issues and challenges for Semantic Web Services technologies, thus enabling a clearer understanding of the whole enterprise and it has been used as a resource for recursive development of WSMO. Thus this use case has served a very useful purpose within the WSMO working group - although it might not strike readers as a particularly impressive "final solution" for Semantic Web technologies.

3.2. SWF Use Case - Agent Collaboration with Semantic Web Services

This is the Use Case defined for Semantic Web Fred - an agent system for automated, cooperative goal resolution that uses WSMO. A virtual marketplace is defined, wherein buyers and sellers interact in order to satisfy their respective business deals.

Link: http://www.wsmo.org/TR/d3/d3.5/

Semantic Web Fred, SWF for short, is an environment for automated cooperation of agents on the Semantic Web that combines agent technology, ontologies, and Semantic Web Services. In SWF, software agents called Freds perform tasks

automatically on behalf of their owners. According to the paradigm of agents as autonomously acting entities in a software environment, Freds have to interact in order to resolve their distinct tasks. Therefore, a Fred has to find a suitable cooperation partner as well as the computational resources required for automated task resolution. With regard to a service-oriented architecture as envisioned for Semantic Web Services, the main building blocks of SWF are Goals and Services. A Goal represents a task that a Fred is assigned, and a Service is a computational resource that allows automated resolution of Goals. SWF develops advanced mechanisms to identify possible cooperation partners, detect the services needed for automated goal resolution, and execute such cooperations between agents.The mechanisms for establishing cooperations between Fred-agents are realized by WSMO-enabled technologies. Therefore, a goal assigned to a Fred-agent is a WSMO Goal, and services in SWF are described as WSMO Web Services. On this basis, SWF realizes a cohesive set of mechanisms that detect suitable cooperation partners and services to be used, which increase the rate of successful cooperations.

The SWF use case defines an environment for testing and development of the SWF technology. All resources defined in this use case are WSMO resources - ontologies, as well as several goals and service descriptions. For this reason, this use case is considered to be a WSMO use case. The use case resources are provided in valid WSML according to WSMO v1.0, and are designed in such a way that reasonable cooperations can be estalished. Furthermore, the SWF use case provides a prototypical realization of the Web Service Discovery framework defined in WSMO D5.1, version 0.1.

More information on the SWF project can be found at the SWF project website at: http://swf.deri.at/.

3.3. WSMX Use Cases

Link: http://www.wsmo.org/TR/d13/d13.6/

The Web Services Execution Environment (WSMX), see WSMX homepage, is an execution environment for dynamic discovery, selection, mediation and invocation of semantic Web Services. WSMX is based on the Web Services Modeling Ontology (WSMO), being a reference implementation for WSMO. The goal is to provide both a test bed for WSMO and to demonstrate the viability of using WSMO as a means to achieve dynamic inter-operation of semantic Web Services.

The WSMX Use Cases exemplifies several usage scenarios of WSMX. These are in particular:

- Business-to-Consumer (B2C), i.e. any business or organization that sells its products or services to consumers
- Business-to-Business (B2B), i.e. in inter-business communication and integration
- Application-to-Application (A2A), i.e exemplifying how WSMX can be used as an integration tool.

3.4. DIP Use Cases

The IST 6th framework Integrated Project "Data, Information, and Process Integration with Semantic Web Services" (short: DIP) realizes an environment for Semantic Web Services, applying WSMO as the underlying framework.

3 Use Cases are defined within the project, for demonstrating and testing DIP and WSMO enabled tools:

1. Case Study VISP in the domain of Virtual Internet Service Providers (WP 8)
2. Case Study e-Government in the domain of web-based governmental service support (WP 9)
3. Case Study e-Banking in the domain of financial end-user services (WP 10)

In the course of the DIP project, these use cases are elaborated as WSMO use case and realized with the technologies developed in the project.

All information on the DIP project can be found on the DIP project website: http://dip.semanticweb.org/.

3.5 Cocoon Projekt

Cocoon is an IST 6th framework Integrated Project aimed at supporting health care professional in reducing risk management in their daily practices by building knowledge driven & dynamically adaptive networked communities within European health care systems, see homepage at: http://www.cocoon-health.com/. Although not being a direct member of the SDK-Cluster (see www.sdk-cluster.org) , the Cocoon project applies WSMO as the underlying framework for Semantic Web Services.

As a use case for the Cocoon technology, a use case is defined in the domain of community of practice support. Therein, Semantic Web Services based on WSMO support automated allocation of competent medical personnel. The use case description following the WSMO use case description defined above is avaibale at: http://cocoon.cefriel.it/RD2/usecases/semantic-discovery-of-cop.

3.6. Stream Flows! System

Link: http://www.wsmo.org/TR/d3/d3.6/.

This presents a concrete use for modelling Semantic Web Service descriptions in WSMO for a frequent flyer programme called "Stream Flows! System" (SFS). This system serves as a meeting point for customers who want to book flights, train tickets, hotels and taxi transfers and for the providers of such services. Customers can create, or use predefined packages which specify what services are needed by the customers. Providers can create, edit and publish their services on SFS in order to make them available for customers. The main objective of this document is to provide a modeling of the WSMO elements based on the SFS scenario.

4. Conclusions and Future Work

This deliverable presents WSMO use cases. Each use case addresses one or more specific technological issues related to Semantic Web Services, and elaborates a technical solution for this. The aim of the definition of use cases is to test and develop WSMO and WSMO enabled technologies; also, the definition of real-world use case scenarios allows recursive development of WSMO and WSMO-enabled technologies for Semantic Web Services.

In this document we have defined the general organization of WSMO use case documents, and we present existing use cases along with brief overviews of each use case. This deliverable is intended to evolve over time. The directions for future work in this deliverable are:

- specifying additional use cases that will address certain aspects of Semantic Web Services
- testing and recursive development of WSMO according to results from the use cases.

References

[He et al., 2004] he, H.; Haas, H.; Orchard, D.: *Web Services Architecture Usage Scenarios*, W3C Working Group Note 11 February 2004. Available at: http://www.w3.org/TR/ws-arch-scenarios/.

[Roman et al., 2004] D. Roman, U. Keller, H. Lausen (eds.): *Web Service Modeling Ontology - Standard (WSMO - Standard)*, version 0.2 Available at http://www.wsmo.org/2004/d2/v02/.

Acknowledgements

Appendix: Change Tracking

To facilitate tracking of changes between different versions of this deliverable, the following lists the key changes which occurred between one version of the document

and the next. The change tracking begins with the most recent version of the document dated 11 November 2004, and works back to the version of 28 June 2004.

Version: 13 April 2005 http://www.wsmo.org/TR/d3/d3.2/v0.2/20050413/
> - final version 0.2
> - removed D3.4 "WSMO B2B Use Case v0.1"
> - changed order of use cases to chronological order

Version: 04 April 2005 http://www.wsmo.org/TR/d3/d3.2/v0.2/20050404/
> - opened new version 0.2
> - added WSMX Use Cases
> - added WSMO Use Case "Stream Flows"
> - added section 4 on use cases in WSMO-related efforts
> - added DIP use cases and Cocoon use cases

Version: 11 November 2004 http://www.wsmo.org/2004/d3/d3.2/v0.1/20041105/
> - removed classification of B2C and B2B Use Cases

Version: 22 October 2004 http://www.wsmo.org/2004/d3/d3.2/v0.1/20041022/
> - reworked content
> - introduction is only short overview
> - Section 2 defines the general organization of WSMO use case document
> - Section 3 provides enhanced overviews of the concrete use cases

Version: 08 October 2004 http://www.wsmo.org/2004/d3/d3.2/v0.1/20041008/
> - updated links to reflect new split of deliverables

Version: 04 October 2004 http://www.wsmo.org/2004/d3/d3.2/20041004/
> - changed structure of deliverable: this is an overview document, while the actual use cases are provided in separate documents
> - adopted B2C Use Case to WSMO Standard version 1.0

Version: 19 July 2004 http://www.wsmo.org/2004/d3/d3.2/v0.1/20040719/
> - ontologies: rationales and updates, PO Ontology currently under development
> - added general Goal and GG Mediator; the concrete Goal is derived from these
> - updated WS Capability (assumption is now that the cerdit card is valid)

Version: 28 June 2004 http://www.wsmo.org/2004/d3/d3.2/v0.1/20040628/
> - complete read-thru with corrections of deliverable text (regarding comments from Jos de Bruijn)
> - corrections of domain ontologies
>   * changed Section 3.1.1 to "Use Case Overview", describes the properties of the WSMO components modeled below
>   * the web service described now is understood as an aggregated / composed web service that offers the overall
>   functionality for purchasing train tickets online. In later versions, the Choreography description as well as the
>   Orchestration with specfic Web Services for searching and buying train tickets can be adopted.
>   * correected / clarified descriptions for modeling descriptions.
> - corrected of WSML-models for Goals, Web Services, Mediators
> - revised the Web Service Discovery description (section 3.1.3)
> - updated the FLORA2 resources to the WSML models (as in Listings)
> - refined namespace handling