



## D3.2 WSMO Use Case Modeling and Testing

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**Editors:**

Michael Stollberg  
Holger Lausen  
Axel Polleres  
Rubén Lara

**Authors:**

Michael Stollberg  
Holger Lausen  
Axel Polleres  
Rubén Lara  
Uwe Keller  
Michal Zaremba  
Armin Haller  
Dieter Fensel  
Michael Kifer

**Reviewer:**

Christoph Bussler

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## 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 gathers several concrete use cases specific around WSMO.

## Related Documents

WSMO Standard: [D2 v1.0 Web Service Modeling Ontology \(WSMO\)](#)

WSMO Primer: [D3.1 v0.1 WSMO Primer](#)

WSMO Reasoning: [D5.1 v0.1 WSMO Discovery](#)

WSMO Use Case: [D3.3 v0.1 Virtual Travel Agency](#)

WSMO Use Case: [D3.4 v0.1 B2B - Business Document Exchange](#)

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## 1. Introduction

This Deliverable gathers use cases for WSMO. The different use cases provided in subsequent documents serve as input and providing 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. In the long run, additional use cases will be added in order to widen possible solutions for Semantic Web Service technologies around WSMO.

This document is organized as follows: [Section 2](#) defines the general organization of WSMO Use Cases; [Section 3](#) gathers different defined for and around WSMO. [Section 4](#) concludes the document. A Change Tracker in the [Appendix](#) explicitly list the major changes between different versions of this document in order to facilitate readers following the improvements.

## 2. General Organization of WSMO Use Cases

For describing WSMO use cases, a general organization of the use case documents is defined as explained in this section. First, there is a general description of the use case setting and the technical aspects to be addressed, then there should be a tabluar overview of the WSMO resources modeled in the use case, thirdly there is the resources' models in WSML, and last the technical solutions developed or addressed within a use case are presented.

The following explains the parts of the general structure in more detail.

### 2.1 Use Case Description

The aim of this part 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 performed during execution of the use case and which can be automated by appropriate Semantic Web Service technologies. For each use case we describe the particular usage scenarios by the following informations:
  - 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 an 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<br>- Location Ontology<br>- OWL Person Mediator<br>- OWL Fact Book Mediator   |
| main constructs                                | <i>main concepts:</i><br>station, itinerary, trip, traintrip<br><br><i>axioms:</i><br>stationCountry, departureBeforeArrival, startNotEqualEnd<br><br><i>instances:</i><br>innsbruckHbf , frankfurtHbf |
| WSML model                                     | number / link to the listing with the WSML model of the resource   |

## 2.3 WSMO models

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

The WSML models are presented in numbered Listings. For technical realization within a HTML document, the following assisting accessoirs 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 resources 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 shall help the reader to understand the design and definition of a specific component. Such explanations are optionally, but recommended a 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 documentation 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 with in the use case should be explained. We recommend to keep this section as a brief overview of the technical solution, while detailed explanations on the theoretical and the technical realization should be moved to a different document.

## 3. WSMO Use Cases

This section gathers different use cases developed around WSMO, each with a different focus. We briefly introduce the use case here, while the use case modling is provided in a different document.

Semantic Web Services can be used in manifold application fields. In accordance to the use cases defined in Web Services Architecture Usage Scenarios by the [W3C](#)

[Web Services Architecture Working Group](#) (see [He et al., 2004]), two areas are considered as most relevant for the deployment of Semantic Web technologies:

1. In a "B2C" setting wherein a third party provides a service to end users acting as a Client aggregating other Semantic Web Services. Frequently mentioned examples of using Semantic Web Services within a B2C-setting refers to the travelling domain, wherein a "Virtual Traveling Agency" provides end-user services for e-Tourism by aggregating Web Services of different tourism service providers
2. "B2B Integration" wherein a business entity, e.g. a business document, is exchanged between enterprises. Therein, different aspects of EAI might arise which shall be handled by Semantic Web Services technology.

For these two main application fields of Semantic Web Service technologies, we provide a WSMO specific use case each: a "Virtual Travel Agency" use case as a B2C use case ([Section 3.1](#)), and "Business Document Exchange" as a B2B Integration use case ([Section 3.2](#)). The other use cases gathered in the subsequent sections have been developed within WSMO-related projects.

### **3.1. B2C - a 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/2004/d3/d3.3/>

This use case has been the first WSMO use case, starting at a very early stage of development of WSMO. The use case setting has been kept very simple by purpose, 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 Services, and preliminary versions of WSMO Mediators.

The use case has been updated and changed several in the preceding 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 throughout 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 to understand the challenges arising for Semantic Web Service technologies and who these should be addressed within WSMO. Many design decisions realized 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; within the elaboration of the use case, the efforts around the Web Service Modeling Language WSML were started - resulting in the work done in

the [WSML working group](#) now. The requirements for modeling WSMO resources from this use case have been the basis for the specification of WSML in its current form.

- Major attention has been given to the realization of Web Service Discovery within WSMO. Several approaches for the theoretical framework as well as for technical realization have been elaborated in this use case, resulting in the WSMO Web Service Discovery framework and realization as existing within WSMO Deliverables D5.x now.

In conclusion, this initial WSMO use case has been proved as being very useful for development of WSMO: it provides a real world setting to understand the issues and challenges for Semantic Web Services technologies in a better way, and it has been used as a resource for recursive development of WSMO. Thus this use case has "fulfilled" its purpose within the WSMO working group - although it might not look like a presentation of the final solution for Semantic Web technologies.

## 3.2. B2B - Business Document Exchange

This use case models a B2B scenario for exchanging business documents, this scenario will be more elaborated in future, for now there is only a placeholder document:

Link: <http://www.wsmo.org/2004/d3/d3.4/>

## 3.3. SWF Use Case

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

Link: <http://www.wsmo.org/2004/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 to 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 as a WSMO use case. The use case resources are provided in valid WSMML according to WSMO v1.0, and are designed in a way that reasonable cooperations can be established. 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://www.deri.at/research/projects/swf/>.

## 4. Conclusions and Future Work

This deliverable gathers WSMO use cases. Each use case addresses one or more specific technological issue 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 enable 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 gather 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:

- specify additional use cases that will address certain aspects of Semantic Web Services
- test and recursive development of WSMO according to results in 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/>.

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The editors would like to thank to all the [members of the WSMO working group](#) for their advice and input into this document.

## Appendix: Change Tracking

To facilitate retracing of changes inbetween different version of this deliverable, the following lists the essential changes done in comparison to the preceding version.

The change tracking starts with the version of 28 June 2004.

**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 credit 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 specific Web Services for searching and buying train tickets can be adopted.

- \* corrected / clarified descriptions for modeling descriptions.
- correction 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)
- namespace handling refined