D19.3v0.1. WSMO in SEKT

WSMO Working Draft 2 June 2004

This version:
http://www.wsmo.org/2004/d19/d19.3/v0.1/20040602/
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Editor:
Jos de Bruijn
Reviewer:
Dieter Fensel

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1. Introduction

The SDK project cluster has the mission of strengthening the European research and industry in the areas of Semantic Web and Semantic Web Services, ensuring the integration of European research efforts and the cooperation with the US-based DAML initiative towards international standardization.

Three major European research projects in the area of Semantic Web and Semantic Web Services are integrated in the SDK cluster, namely: SEKT, DIP, and Knowledge Web. Such integration ensures a close cooperation between the three projects and enables the joint dissemination of the projects' results both to academia and to industry.

In this document we present the relation between the Semantic Web Services working group of the SDK cluster and SEKT, making clear how Knowledge Web contributes to the working group and how the project benefits from the close cooperation with SEKT and DIP in the context of the cluster.

The next subsections describe the Semantic Web Services working group of the SDK cluster and its integrating subgroups. Section 2 describes the role of Knowledge Web in the working group and how the results of the working group are fed back to the project. Finally, section 3 presents our conclusions and future work.

1.1 WSMO

The Web Services Modeling Ontology (WSMO) working group is the Semantic Web Services working group of the SDK cluster. WSMO aligns the research and development efforts in the field of Semantic Web Services between SEKT, DIP and Knowledge Web. The mission of the working group is to, through cooperation between the three projects and the combination of their participants expertise, provide mature results in the area of Semantic Web Services languages, architectures and platforms.

The WSMO approach aims to solve the integration problem based on the following main features: simplicity (a solution to the integration problem as simple as possible), completeness (solve every aspect of the integration problem), and executability (providing a set of execution semantics and a reference implementation). The pillars of the work in WSMO are given by the Web Services Modeling Framework (WSMF [Fensel & Bussler 2002]), which gives the conceptual grounding that will be further developed by the working group.

WSMO emphasizes the modeling of real use cases from different application areas, including tourism, banking, marketplaces, supply chains, etc. These use cases will be based on the requirements of industrial partners and research groups joining the working group.

The activities of WSMO include the definition of an ontology for describing the various aspects of a Web Service, the modeling of B2C and B2B use cases using the developed ontology, a conceptual and formal comparison to the DAML proposal (OWL-S), the semantic description of the choreography and orchestration of Web Services, and a comprenhensive tutorial on the modeling ontology and its related research and results. The definition of the ontology follows a layered approach, addressing the different levels of complexity of different application scenarios. For this reason, three different layers are defined, namely: WSMO-Lite, WSMO-Standard, and WSMO-Full, ranging from the simplest ontology that is still meaningful for the integration problem to a full ontology covering all the business aspects of Semantic Web Services.

The working group includes two subgroups: the WSML working group, which aims at developing the Web Service Modeling Language (WSML) that formalizes the

Web Service Modeling Ontology, and the WSMX working group, which aims at developing a Web Services Execution Environment. The WSML and WSMX working groups are described in more detail in the following sections.

1.2 WSML

The Web Service Modeling Language (WSML) working group is a sub-group of the WSMO working group. Where WSMO aims at developing a sufficient conceptual model for the description of Semantic Web Services and showing its application, WSML aims at providing the formal basis for this conceptual model and to provide a concrete modeling language based on this conceptual model.

Members of the WSML working group include key participants with expertise in Semantic Web-related research areas.

The SDK WSML working group aims to, through alignment between key European research projects in the Semantic Web Service area, further the development of Semantic Web Services and work toward further standardization in the area of Semantic Web Service languages and to work toward a common architecture and platform for Semantic Web Services. Specifically, the working group aims at developing a language called Web Service Modeling Language (WSML) that formalizes the Web Service Modeling Ontology (WSMO). In this context, the mission of WSML is two-fold: (1) developing a proper formalization language for semantic web services and (2) providing a rule-based language for the semantic web.

The current activities in WSML include work on the syntax for the Web Service Modeling Language, Web Service discovery using the goal-capability matching, evaluating formal languages, developing an ontology API based on the WSMO conceptual model for ontologies and work on a Semantic Web rule language, which uses the DLP (Description Logic Programming) [Grosof et al., 2003] fragment of OWL Lite as a basis. WSML will furthermore provide three formal semantics for Web Service description. A full First-Order Logic, a Description Logic and a Horn Logic-based semantics.

1.3 WSMX

The Web Services Execution Environment (WSMX) is an execution environment for dynamic discovery, selection, mediation and invocation of web services. WSMX is based on the Web Services Modelling Ontology (WSMO) which describes all aspects related to this discovery, mediation, selection and invocation.

The main WSMX functionality resembles the one of a workflow engine. In addition, extra functionality is included to it, functionality that concerns semantic web (ontologies management and reasoning) and web services (web service invocation, matching, selection and mediation).

WSMX can be regarded also as a web service as it can be invoked to provide its own fu functionality and also can invoke other web services / WSMX systems in order to compose and use their outcomes. Furthermore, it can be regarded as a platform that can support various B2B and industrial applications for business or integration purposes.

WSMX is 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 web services. The development process for WSMX includes defining its conceptual model, defining the execution semantics for the environment, describing an architecture and software design, and building a working implementation.

2. WSMO in SEKT

In the following, we present the objectives and structure of the SEKT project and define the relation to WSMO, describing the results and problems flow between the SDK cluster working group and SEKT.

2.1 SEKT

SEKT (Semantically-Enabled Knowledge Technologies) is an Integrated Project in the 6th Framework of the Information Society Technologies program. The main research goal of SEKT is two-fold: (1) to further develop a basic Semantic Web infrastructure and (2) to use Information Extraction and Machine Learning techniques to generate and populate ontologies on the Semantic Web. Other very important aspects of the SEKT project is the specification of a methodology for the use of these technologies and application of the technologies in three comprehensive case studies.

The main activities in the SEKT project (besides the management and dissemination) are divided into three areas:

Research & Development

Within the R&D work packages, new technologies for the Semantic Web and next-generation knowledge management are developed and implemented. Furthermore, all prototypes are integrated to create a comprehensive Semantic Web infrastructure. The following are the main R&D activies:

- **Ontology Generation** Machine learning techniques are applied to learn ontologies from large bodies of text.
- **Metadata Generation** Information Extraction techniques are applied to extract metadata from documents and relate it to ontologies. This metadata is then used to populate ontologies.
- **Ontology & Metadata Management** The goal of this activity is two-fold: (1) to develop facilities for ontology evolution and (2) to research reasoning with inconsistencies between different versions of ontologies.
- **Ontology Mediation** Ontology mediation is an important part of the Semantic Web infrastructure; it allows an application to make use of various different ontologies. The mediation component mediates between the differences of the different ontologies.
- **Knowledge Access** Tools will be developed for the access of knowledge on the Semantic Web.

Case Studies

The technologies and software prototypes developed in the R&D activities are put to use in the case studies. This application is an iterative process: the case studies generate feedback which is fed back into the R&D work packages.

Methodology & Usability

The methodologies captures lessons learned from the application of the SEKT technologies and best practices for the application of the ontologies. The

usability activity guards the usability of the tools and applications being developed in the technical work packages and the case studies and thus also provides a bridge between the case studies and the technical activities.

The goals of WSMO and SEKT do not seem to have much overlap at a first glance. WSMO is about the development of Semantic Web services, whereas SEKT is more about the development of a Semantic Web infrastructure and the application of this infrastructure. However, there is some overlap en some possibility of reuse of outcome of especially WSML within SEKT. More specifically, we have identified three areas in which there can be a very fruitful cooperation:

- Components in the Semantic Web infrastructure under development in SEKT can be made available as Web Services, described using WSMO.
- The Semantic Web infrastructure, especially the ontology management infrastructure, under development in SEKT can be used by WSMO.
- There is strong overlap between SEKT and WSMO in the area of Ontology Mediation.

2.2 WSMO service desciptions in SEKT

The SEKT project will develop a comprehensive Semantic Web infrastructure with components ranging from ontology management to ontology generation and knowledge access. The functionality of each of these components will be exposed through an API (Application Programming Interface). In the first stages of the project, these APIs will be created in Java. Consequently, the functionality of these components will only be available to other Java components and applications. Therefore, a migration path has been identified to the exposure of the components as Web Services.

In order to allow for automation in the discovery, composition and execution of these services, they should be described as *Semantic Web Services*. A language for the description of Semantic Web Services will be the major outcome of the WSMO working group. This language can then be used to describe the Semantic Web infrastructure components developed within the SEKT project. In this sense, the SEKT Semantic Web infrastructure provides a comprehensive case study for WSMO.

2.3 SEKT ontology infrastructure in WSMO

As stated before, the SEKT project will produce a Semantic Web infrastructure. This infrastructure will provide key functionalities for the Semantic Web, such as ontology generation, population, management, versioning and mediation. These functionalities are important for any Semantic Web application. These functionalities are a basic requirement for the success of Semantic Web and, since Semantic Web Services are an application of the Semantic Web, they are also a basic requirement for the success of Semantic Web Services.

Because of the requirements on the Semantic Web infrastructure coming from the Semantic Web in general, WSMO needs a good Semantic Web infrastructure in order to make Semantic Web Services a reality. Because there will be a significant effort in the SEKT project to produce a comprehensive and coherent Semantic Web infrastructure, this infrastructure is the natural candidate to use in the context of

WSMO and the WSMO case studies.

2.4 Ontology Mediation and Semantic Web Rules

Ontology Mediation is a major activity in the SEKT project. Goals of this activity are, among others, to develop an Ontology Mapping Specification Language for the Semantic Web, to develop an ontology mediation framework and to implement ontology mediation services. This work has significant overlap with work on ontology mediation and rule languages in WSMO.

One of the pillars of WSMO is strong mediation between loosely coupled components. Mediation in WSMO is implemented using so-called *mediators*. One of these mediators is the ontology-ontology mediator. This mediator helps to bridge the gap between different representations of information and thus has a big overlap with the ontology mediation activity in SEKT. Furthermore, the implementation of ontology mediation in WSMX corresponds to some extend with the implementation in SEKT. Therefore, both projects would benefit from a strong cooperation.

Ontology mapping requires a language that goes beyond the expressiveness of current Semantic Web ontology languages. In the context of WSML, a Semantic Web rule language will be developed, which will serve as a basis for the ontology mapping language used in SEKT.

3. Conclusions and future work

WSMO and SEKT do not seem to have a big overlap in their goals and activities at a first glance. However, as we have identified, the overlap between SEKT and WSMO is a threefold:

- WSMO can be used to semantically describe software components developed in the course of the SEKT project.
- The SEKT infrastructure can be used in the WSMO case studies as a basic Semantic Web infrastructure.
- There is strong overlap in the area of *ontology mediation* and the development of a *rule language*.

Both SEKT and WSMO will keep an eye on the developments in the other project and will reuse any outcome of the other project as appropriate. Furthermore, on the area of *ontology mediation* there will be strong cooperation between the two projects in order to avoid double work and to set a world-wide standard in ontology mediation.

References

[Fensel & Bussler, 2002] D. Fensel and C. Bussler: *The Web Service Modeling Framework WSMF*, Electronic Commerce Research and Applications, 1(2), 2002.

[Grosof et al., 2003] B.N. Grosof, I. Horrocks, R. Volz, and S. Decker: Description logic programs: Combining logic programs with description logic. In *Proc. Intl. Conf. on the World Wide Web (WWW-2003)*, Budapest, Hungary, 2003.

[Kifer et al., 1995] M. Kifer, G. Lausen, and James Wu: *Logical foundations of*

object oriented and frame-based languages. Journal of the ACM, 42(4):741-843, 1995.

Acknowledgement

The work is funded by the European Commission under the projects DIP, Knowledge Web, Ontoweb, SEKT, SWWS, Esperonto, and h-TechSight; by Science Foundation Ireland under the DERI-Lion project; and by the Vienna city government under the CoOperate program.

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

$Date: 2004/06/02 13:34:35 $

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