

Semantic Web Services for Business Processes Management

Tutorial Proposal for the
*The 2nd International Conference on Internet and
Web Applications and Services (ICIW 2007)*

May 13-19, 2007 - Mauritius

John Domingue¹ and Michael Stollberg²

- 1) Knowledge Media Institute
The Open University
j.b.domingue@open.ac.uk

- 2) Digital Enterprise Research Institute (DERI Innsbruck)
Leopold-Franzens Universität Innsbruck
michael.stollberg@deri.org

corresponding contact: Michael Stollberg (5)

Abstract

The proposed tutorial explains and demonstrates how the combination of Business Process Management (BPM) and Semantic Web Services (SWS) can eliminate the deficiencies that current BPM technology exhibits. The tutorial will present the state of the art in both areas (process management and execution in BPM, the SOA concept in BPM, the SWS approach and frameworks, etc.), motivate the need for explicit use of semantics to overcome the current challenges in BPM, and present a consolidated technical framework that integrates SWS into BPM technology. Attendees will gain a comprehensive overview of the latest developments in semantically enriched BPM technology, which is one of the central trends in BPM research and development. The tutorial will be held by experts in the field that actively work on the technology integration of BPM and SWS.

1. Description and Objectives of the Tutorial

The purpose of the tutorial is to present a consolidated integration of SWS technology into BPM, providing an overview and a solution for the current trend in BPM research and development. The following briefly outlines the background for this.

In general, Business Process Management (BPM) follows a three-phase life cycle: modeling, execution, and analysis of business processes. A central problem for supporting all phases is the integration of IT components within and across enterprises. The current trend for solving this is the use of the SOA paradigm: IT functionality is virtualized in terms of loosely coupled services with stable interfaces. However, even though the combination of BPM and SOA is a very flexible approach for automated support of business processes, there are still several problems to be overcome.

During the modeling phase, processes are created using notations like BPMN and EPC. Their meta-models are incompatible, which hampers the unified use of these notations within and across organizations. Also, commonly business experts use BPM notations different from IT experts: bridging this gap usually requires manual work and is imprecise. Moreover, many organizations maintain a large pool of legacy and newly created process models that are modeled in different notations. This hampers reusability of processes or parts of process models, resulting in missed opportunities to reduce BPM costs. Even though SOA architectures allow the re-use legacy functions via Web services, existing process modeling notations are not flexible enough: only services or sub-processes with known syntactic interfaces can be composed, while the semantics of the tasks in a process model and available functions is disregarded.

During the execution phase, process instances follow the specifications defined at design time. However, in existing BPM execution environments the resolution of the service types specified at design time to particular implementations is hard-coded. This does not reflect important aspects on functional, non-functional, and behavioral aspects of the services. Hence, problems in service usage occur, especially in handling changing service implementations. Also, potentially occurring mismatches may hamper successful process execution. Furthermore, process flexibility and automation requires improvements with respect to ad-hoc changes of processes.

Semantic Web Services (SWS) develop techniques for automated discovery, composition, and execution of Web Services based on richer, semantic descriptions on functional, non-functional, and behavioral aspects. The Web Service Modeling Ontol-

ogy (WSMO) is a comprehensive framework for semantically enabled SOA technology. It defines semantic description models for four top level notions along with respective reasoning support for managing these: ontologies, Web services, goals, and mediators. WSMO appears to be a suitable extension to BPM in order to overcome the deficiencies mentioned above as follows:

- Ontologies allow to model processes as well as data as shared conceptual model; their formalization allows semantically enhanced information processing
- Semantic annotations of Web services allow to precisely detect and automatically executed suitable business functionalities as well as to maintain them
- Goals allow to specify processes and tasks on the problem layer for which suitable Web services can be detected dynamically at execution time
- Mediators allow handling potentially occurring mismatches on the data and the process level, therewith enabling semantically stable interchange within and across enterprises if this is not given in advance.

The aim of the tutorial is to provide attendees with a comprehensive overview of integration of these technologies. In addition, the attendees will be provided with respective software in order to model business processes with semantic descriptions for automated Web service usage, and will be trained in their usage.

2. Target Audience and Additional Material

The target audience of the proposed tutorial includes researchers as well as practitioners that work in the areas of BPM or SWS and are interested in the latest technological developments. Although no specific pre-knowledge is required to follow the tutorial, basic knowledge in BPM, ontologies, and Web services may allow better following the tutorial – and for gaining more benefiting from it. However, such basic knowledge can be expected from attendees of the ICIW conference.

The material to be handed out to the attendees will be a booklet with the tutorial slide set and a CD-R with the software as well as further material. We will also set up a separate web page that will contain all relevant information and material for download.

3. Presenters' Expertise and Experience

The tutorial will be presented by John Domingue (KMI) and Michael Stollberg (DERI), see Appendix for biographical details. Both KMI and DERI are involved in the major European and international projects around Semantic Web and Semantic Web Services, and are the leading developers of the WSMO framework. The presented technologies are developed in the EU-funded SUPER project (<http://ip-super.org/>) in collaboration with international leading research and industrial partners from the BPM area, such as SAP, the IDS Sheer AG, and the IAAS institute headed by Frank Leymann. John Domingue is the scientific director of the SUPER project. The tutorial material will be provided by presenters with support from the mentioned partners from the SUPER project.

We have gained exhaustive experience in a series of over 20 tutorials on Semantic Web Services that have been held at international events since 2004 (see the detailed documentation at <http://www.wsmo.org/TR/d17/>).

4. Outline of Tutorial

We propose the tutorial as a half day event (either in the morning or in the afternoon). The tutorial will consist of four major parts, presented in lecture style (presentation with hand outs) and a software demonstration. The following outlines the structure of the tutorial for a 3 hour schedule with a 30 minutes coffee break (e.g. from 9.30 a.m. - 01.00 p.m.)

(1) Introduction – Business Process Management (30 min)

The first section gives an overview of Business Process Management (BPM), covering:

- Overview: aim, history, common terms
- BPM life cycle: Modelling – Execution – Analysis
- Modelling notations (BPMN, EPC, etc.) and languages (BPEL4WS, etc.)
- Process execution: requirements and existing environments
- SOA Architectures for BPM
- Current challenges and trends

(2) Semantic Web Services (60 min)

This provides an overview of the state of the art in Semantic Web Services (SWS). In particular, we present the WSMO framework that serves as the basis for the integration of SWS into BPM technology. This section covers:

- Semantic Web Services: approach & history
- The Web Service Modeling Ontology WSMO: conceptual model & specification
- Semantic techniques for discovery, composition, execution and mediation

Coffee Break (30 min)

(3) Integration – SWS for BPM (45 min)

On the basis of the preceding overviews, this section presents the integration approach for BPM and SWS that is developed in the SUPER project. In particular, this covers:

- process modeling with semantics (ontologies and formal process languages)
- goal-based process modeling and execution for flexible & dynamic BPM
- semantically enabled Web Service discovery, composition, and execution in BPM
- mediation for BPM: data and process level

(4) Software Demonstration (45 min)

This section introduces and demonstrates the software that will be used for the hands-on session. This consists of the following software developed in the SUPER project:

- Semantic Business Process Modelling Tool
- Semantic Business Process Execution Environment
- SWS execution environments: IRS and WSMX

Appendix – Presenters' Information (alphabetically)

John Domingue

Contact Information:

Knowledge Media Institute
The Open University
Walton Hall, Milton Keynes, MK6 7AA
tel.: +44 (0) 1908 655014
fax: +43 512 507 9872
email: j.b.domingue@open.ac.uk

Dr. John Domingue is the Deputy Director of the Knowledge Media Institute at The Open University, UK. He has published over 80 refereed articles in the areas of Artificial Intelligence and Human Computer Interaction; he is involved in a number of projects and is currently a Co Principle Investigator on the UK EPSRC funded Advanced Knowledge Technologies (AKT) project, has been the Scientific Director of the EU funded Integrated Project on Semantic Web Services DIP, and has the same position in the SUPER project. He also is a chair of the WSMO working group, and co-Chair of the OASIS technical committee on Semantic Execution Environments. Dr. Domingue has been the director for the 2006 Knowledge Web Summer School on Ontological Engineering and the Semantic web, Chair the European Semantic Web Conference and the Artificial Intelligence, Methods and Systems conference.

Previous Tutorials:

Coordination & participation in over 20 tutorials on Semantic Web Services (see <http://www.wsmo.org/TR/d17/>)

Selected Publications:

- Gugliotta, A., Tanasescu, V., Domingue, J., Davies, R., Gutiérrez-Villarías, L., Rowlatt, M., Richardson, M., Stinčić, S., (2006) Benefits and Challenges of Applying Semantic Web Services in the e-Government Domain. *Semantics 2006*, Vienna (Austria).
- Heath, T., Domingue, J., Shabajee, P., (2006) *User Interaction and Uptake Challenges to Successfully Deploying Semantic Web Technologies*. Workshop: 3rd International Semantic Web User Interaction Workshop, 5th International Semantic Web Conference (ISWC2006), Athens, GA, USA.
- Tanasescu, V., Gugliotta, A., Domingue, J., Gutiérrez-Villarías, L., Davies, R., Rowlatt, M., Richardson, M., Stinčić, S., (2006) *Spatial Integration of Semantic Web Services: the e-Merges Approach*. Workshop: Terra Cognita 2006, Terra Cognita 2006, Athens, Georgia, USA.
- Gugliotta, A., Davies, R., Gutiérrez-Villarías, L., Tanasescu, V., Domingue, J., Rowlatt, M., Richardson, M., Stinčić, S., (2006) Enhancing Data and Processes Integration and Interoperability in Emergency Situations: a SWS based Emergency Management System. Workshop: First International Workshop on Applications and Business Aspects, Fifth International Semantic Web Conference (ISWC 2006), Athens, Georgia, USA.
- Cabral, L., Domingue, J., Galizia, S., Gugliotta, A., Norton, B., Tanasescu, V., Pedrinaci, C., (2006) IRS-III: A Broker for Semantic Web Services based Applications. The 5th International Semantic Web Conference (ISWC 2006), Athens, GA, USA.

Michael StollbergContact Information:

Digital Enterprise Research Institute
University of Innsbruck
Technikerstrasse 21a
6020 Innsbruck, Austria
tel.: +43-512-507-6479
fax: +43-512-507-9872
email: *michael.stollberg@deri.org*

Michael Stollberg is a researcher with the Digital Enterprise Research Institute DERI, working in the area of Semantic Web Services. He has published around 25 scientific articles in the area. Michael Stollberg is a founding member of the WSMO working group and workpackage manager in the DIP project. He has been the tutorial chair of ESWC 2006, and is program committee member of several related conferences and workshops.

Previous Tutorials:

Coordination & participation in over 20 tutorials on Semantic Web Services (see <http://www.wsmo.org/TR/d17/>)

Related Publications:

- Keller, U.; Lausen, H. and Stollberg, M.: *On the Semantics of Functional Descriptions of Web Services*. In Proc. of the 3rd European Semantic Web Conference (ESWC 2006), Budva, Montenegro.
- Fensel, D., Lausen, H., Polleres, A., Bruijn, J. d., Stollberg, M., Roman, D., Domingue, J.: *Enabling Semantic Web Services The Web Service Modeling Ontology*. Berlin, Heidelberg: Springer, 2006.
- Stollberg, M.; Cimpian, E.; Fensel, D.: *Mediating Capabilities with Delta-Relations*. In Proceedings of the First International Workshop on Mediation in Semantic Web Services, Amsterdam, the Netherlands, December 2005.
- Stollberg, M., Feier, C.; Roman, D., Fensel, D.: *Semantic Web Services - Concepts and Technology*. In N. Ide, D. Cristea, D Tufis (eds.): Language Technology, Ontologies, and the Semantic Web. Kluwer Publishers, 2006.
- Stollberg, M.; Roman, D.; Toma, I.; Keller, U.; Herzog, R.; Zugmann, P.; Fensel, D.: *Semantic Web Fred - Automated Goal Resolution on the Semantic Web*. In Proceedings of the 38th Hawaii International Conference on System Science, January 2005.