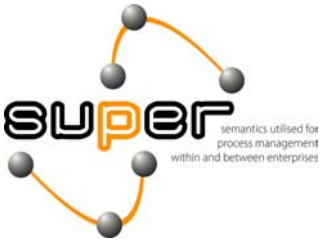

Project IST 026850 SUPER

Semantics Utilized for Process management within and between Enterprises

Deliverable 11.5

SUPER Standardisation

Leading Partner: LFUI

Contributing Partner: SAP, USTUTT, CEFRIEL, IBM, TUE

Security Classification: Public (PU)

February, 2009

Version 1.0

Project Details

IST Project Number	026850
Acronym	SUPER
Project Title	Semantics Utilised for Process management within and between EnteRprises
Project URL	http://www.ip-super.org
EU Project Officer	Werner Janusch

Authors (Partner)	Alessio Carenini (CERIFEL), Jana Koehler (IBM), Ana Karla Alves De Medeiros (TUE), Jörg Nitzsche (USTUTT), Dumitru Roman (LFUI), Michael Zaremba (LFUI) Xuan Zhou (SAP)		
Deliverable Owner (Partner)	Dumitru Roman (LFUI)	**E-mail**	dumitru.roman@sti2.at
		Phone	+43 512 507 6479

Versioning and Contribution History

Version	Description	Comments
0.1	Initial TOC and contents	
0.2	Added content to sec 3,4, and 5	
0.3	Content for Section 6 and slight restructuring of the deliverable	
0.4	Included input from all partners involved in this deliverable and some editing towards the finalization of the deliverable	
0.5	Updated executive summary; revision of BPMN Section	
0.6	Addressed reviewer's comments	
1.0	Final Version	

Table of Contents

Executive Summary

The SUPER Standardisation task monitored SUPER deliverables and artefacts and asserted their standardisation potential (inside-out approach). Additionally, this task was meant to carry out potential standardisation activities and manage the liaison with standardisation bodies such as OASIS, W3C, or OMG. This deliverable summarizes the standardisation activities of SUPER and/or (ongoing) standardization activities. Specifically, the OASIS Semantic Execution Environment (SEE), the W3C Semantic Annotations for WSDL (SA-WSDL), and the OMG Business Process Modeling Notation 2.0 (BPMN 2.0) can be seen as key standardization initiatives to which SUPER significantly contributed. Moreover, BPEL for Semantic Web Services (BPEL4SWS) – a key extension (developed in SUPER) of BPEL towards incorporating access to Semantic Web Services – is expected to play a major role in future standardization of BPEL extensions.

1 Introduction

This deliverable reports on the various standardisation activities performed by the SUPER project participants. Following the recommendations and standardisation analysis in the WP11 deliverables D11.1 Overview and Assessment of Standards relevant for SUPER,[1] D11.2 SBPM community building activities,[2] and D11.3 Report on Standardisation Strategy, the SUPER consortium concentrated its standardization activities on three major standardization bodies: OASIS, W3C, and OMG. Within these standardization bodies, the activities of the SUPER participants consisted of providing feedback regarding standards used in SUPER and participating in the development of new or updated standards. In this deliverable we emphasize on the contributions to the OASIS Semantic Execution Environment (SEE) TC, W3C Semantic Annotations for WSDL (SAWSDL) Working Group, OMG BPMN2.0, and BPEL4SWS. Additionally, we give short descriptions of involvements in standardization groups (e.g. W3C SWS Testbed Incubator Group, OMG SoaML, etc) in which SUPER participants provided feedback.

The rest of this document is organized as follows. In the Sections 3-5 we give details on the current SUPER activities related to each of the three standardization bodies considered in the context of SUPER (OASIS, W3C, and OMG respectively). Section 6 describes BPEL4SWS as a key technological result of the project and emphasises its potential for standardization. Since BPEL4SWS hasn't been submitted yet to any standardisation body (the actual standardization strategy for BPEL4SWS currently being under discussion within the consortium), we dedicated a special section for BPEL4SWS, outside the other sections describing the activities within standardization bodies. Finally, Section 7 summarizes this deliverable.

[1] http://www.ip-super.org/res/Deliverables/M6/D11.1.pdf
[2] http://www.ip-super.org/res/Deliverables/M18/D11.2.pdf

2 OASIS Standardisation

The Organization for the Advancement of Structured Information Standards (OASIS)[3] is a "not-for-profit consortium that drives the development, convergence and adoption of open standards for the global information society. The consortium produces more Web services standards than any other organization along with standards for security, e-business, and standardization efforts in the public sector and for application-specific markets. Founded in 1993, OASIS has more than 5,000 participants representing over 600 organizations and individual members in 100 countries."[4]

Some of the SUPER participants have been involved in the OASIS Semantic Execution Environment (SEE) Technical Committee, which we detail in the following subsection.

2.1 OASIS Semantic Execution Environment (SEE) TC

The aim of the OASIS SEE TC[5] is to provide guidelines, justifications and implementation directions for an execution environment for Semantic Web Services. The TC has participants from CEFRIEL[6], NUIG[7], DERI Korea, NIA[8], OU[9], SA[10], LFUI[11], RDC[12] and some individual participants.

A key limitation of a "WS-Stack based SOA" is that the standards used for describing Web services provide very little detail about the service, beyond a simple description of the external interface they provide. With these descriptions it is impossible to provide further meaning about a service, such that reasonable inferences can be drawn regarding the functionality offered by the service, or the behavior of its outwardly facing interfaces.

Once services are described semantically, many of the tasks previously requiring human intervention in building and maintaining and application using SOA can be automated. For example, services can be *discovered* based upon the functionality they advertise in their semantic description, can be *selected* based upon the advertised (or observed) quality of the service, heterogeneity issues with respect to the data they exchange or the process to invoke them can be *mediated*. This allows for a Semantic SOA, to dynamically bind to services at run time, removing the hard-wired behaviours that are typically for classical SOAs.

The SEE TC has defined methods for using semantic technologies to solve these coordination and automation issues. Moreover, the TC is defining the functional components of such an SWS system and the semantics descriptions of these components' interfaces, and will also provide a formal description of execution semantics of such a system.

[3] http://www.oasis-open.org
[4] http://www.oasis-open.org/who/
[5] http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=semantic-ex
[6] http://ww.cefriel.it
[7] http://www.deri.ie
[8] http://www.nia.or.kr
[9] http://www.open.ac.uk/
[10] http://www.sap.com
[11] http://www.sti-innsbruck.at
[12] http://www.rainingdata.com/

OASIS SEE TC is currently working on two documents, namely the *Reference Ontology for Semantic Service Oriented Architectures* and the *Reference Architecture for Semantic Execution Environments*, while a third document, *Semantic Execution Environment (SEE) Background and Related Work,* has already been finalized.

- *Semantic Execution Environment (SEE) Background and Related Work* is intended to provide the audience of SEE TC documents with a minimum set of background information about SOA concepts, current implementation of SOA based on Web Services, efforts on adding semantics to SOA, relationship of OASIS and W3C standardization activities and a list of references to relevant literature.
- The *Reference Ontology for Semantic Service Oriented Architectures*[13] is an abstract framework for understanding significant entities and relationships between them within a Semantically-enabled Service-Oriented environment, and builds on the OASIS Reference Model for Service Oriented Architecture (SOA-RM). This document has been approved as a Committee Draft and is currently being refined following the comments collected during the first public review.
- The *Reference Architecture for Semantic Execution Environments* (SEEs) builds on the OASIS Reference Ontology for Semantic Service Oriented Architecture, and describes the required infrastructure to support Semantic SOAs in terms of the essential components, themselves given service descriptions, and their required interactions to provide the required services for SOA implementers.

SUPER participants significantly contributed to the creation and the development of SEE TC and its current specifications. The work in the project has heavily influenced the specifications, and it is expected that the current involvement of the SUPER participants will continue till the completion of all the specifications.

[13] http://www.oasis-open.org/committees/download.php/29909/Reference%20Ontology%20for%20Semantic%20Service%20Oriented%20Architectures_Public_Review_1.doc

3 W3C Standardisation

"The World Wide Web Consortium (W3C) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential. W3C is a forum for information, commerce, communication, and collective understanding."[14]

Some of the SUPER participants have been involved in the Semantic Annotations for WSDL (SAWSDL) Working Group, the SWS Testbed Incubator Group, RIF Working Group, and Semantic Web Education and Outreach (SWEO) Interest Group. We detail these activities in the following subsections.

3.1 W3C Semantic Annotations for WSDL (SAWSDL) Working Group

Standardization of Semantic Web Services technologies in W3C is in early stages, reflecting the relative youth of the research field. In 2004, the W3C started receiving submissions for specifications for semantic descriptions of Web services (OWL-S, WSMO and others). In June 2005, the W3C held a Workshop on Frameworks for Semantics in Web Services, to organize a discussion on the proposed steps. The workshop identified that there was a lot of disagreement on what Semantic Web Services should do; yet there was consensus on the fact that semantics are necessary in Web Service descriptions, and that building on the existing Web Services Description Language WSDL, as proposed by WSDL-S, would be a good start.

In April 2006, a working group was formed to standardize Semantic Annotations for WSDL, which resulted in a Recommendation (W3C standard) called "Semantic Annotations for WSDL and XML Schema", short name SAWSDL, published in August 2007. It builds mainly on WSDL 2.0 (W3C Recommendation, June 2007), but also supports the still prevalent WSDL 1.1. On the semantic side, SAWSDL is independent of any ontology technology, assuming only that semantic concepts can be identified by URIs.

RDF/RDFS and OWL from W3C are example technologies that can be used in SAWSDL. Along with the SAWSDL specification, the working group has produced a companion Usage Guide note (www.w3.org/TR/sawsdl-guide/), to provide more examples on how SAWSDL can be used.

The working group included representatives from several SUPER consortium partners: University of Innsbruck, National University of Ireland - Galway, and the Open University. Apart from personnel contributions, SUPER Deliverable D1.3: "Process Ontology Language and Operational Semantics for Semantic Business Processes" was used as part of the evidence that SAWSDL can be implemented and used by other specifications; this evidence was necessary for the specification to become a W3C Recommendation.

[14] http://www.w3.org/

3.2 SWS Testbed Incubator Group

The mission of the SWS Testbed Incubator Group[15] was to develop a standard methodology for evaluating Semantic Web Services based upon a standard set of problems and to develop a public repository of such problems.

This Incubator Group finished its activity at the end of 2008, with a report (W3C SWS Challenge Testbed Incubator Methodology Report[16]) that outlines some basic principles and fundamental methodologies that are recommended for evaluating technologies for the mediation, discovery, and composition of web services. These recommendations are based on several workshops of the Semantic Web Services Challenge (SWSC).[17] LFUI and NUIG were a main driving force behind SWSC and the work of the incubator, and the various solutions provided for SWSC were based on core SUPER technologies (e.g. WSMO/L/X, BPMN, etc.).

SWSC workshops are planned to continue after SUPER finishes and it is expected that new and improved solutions based on SUPER technologies will be provided in the context of this workshop.

3.3 RIF Working Group

The mission of the Rule Interchange Format (RIF) Working Group[18] is to produce W3C Recommendations for rules interchange on the Semantic Web.

Since its inception in 2005, the WG had done significant progress towards a framework for specifying rules in the Semantic Web, with a set of recommendations expected during 2009.

LFUI was involved from the very beginning in the formation of this WG. The Web Service Modelling Language (WSML) used, and further developed in the SUPER project based on the experiences in using it for the development of the SUPER ontology stack, served as a starting point for RIF. It is expected that further alignment between RIF and WSML will take place in the near future.

3.4 Semantic Web Education and Outreach (SWEO) Interest Group

The Semantic Web Education and Outreach (SWEO) Interest Group[19] was established to develop strategies and materials to increase awareness among the Web community of the need and benefit for the Semantic Web, and educate the Web community regarding related solutions and technologies.

This interest group completed its activity in 2008, however some of the activities started by this group have not been stopped, but go on independently instead.

SUPER participants such as NUIG, LFUI, and OU have been actively involved in the activities of the interest group, e.g. participation in the development of the Business Case for Semantic Web

[15] http://www.w3.org/2005/Incubator/swsc/
[16] http://www.w3.org/2005/Incubator/swsc/XGR-SWSC/
[17] http://sws-challenge.org/
[18] http://www.w3.org/2005/rules/wiki/RIF_Working_Group
[19] http://www.w3.org/2001/sw/sweo/

Technologies document,[20] or Semantic Web Case Studies and Use Cases,[21] and provided input based on their experience in using semantic technologies in the SUPER project.

[20] http://www.w3.org/2001/sw/sweo/public/BusinessCase/
[21] http://www.w3.org/2001/sw/sweo/public/UseCases/

4 OMG Standardisation

The Object Management Group (OMG) is "an international, open membership, not-for-profit computer industry consortium. OMG Task Forces develop enterprise integration standards for a wide range of technologies, and an even wider range of industries. OMG's modeling standards enable powerful visual design, execution and maintenance of software and other processes. OMG's middleware standards and profiles are based on the Common Object Request Broker Architecture (CORBA®) and support a wide variety of industries."[22]

Some of the SUPER participants have been involved in the development of SoaML, as well as in the development of BPMN 2.0. We detail these activities in the following subsections.

4.1 SoaML

Service oriented architecture Modeling Language (SoaML), formally called *UML Profile and Metamodel for Services–for Heterogeneous Architectures (UPMS-HA),* was submitted to OMG in response to the UML Profile and Metamodel for Services (UPMS) Request for Proposals (OMG Document soa/2006-09-09)[23]. The UPMS RFP requested a services metamodel and profile for extending UML with capabilities applicable to modeling services using the principles of SOA. The profile should define extensions for modeling and integrating services within and across business enterprises. UPMS should include facilities for formal specification of service contracts that may be developed directly using the profile, or abstracted from business processes. The purpose of this RFP was to address Service Modeling. Submissions were expected to demonstrate how service models relate to business process models on the one hand and existing Web Services standards (XSD, WSDL, BPEL, etc.) on the other in order to facilitate bridging the gap between business models and deployed services solutions.

As a response to this RFP, one of the SUPER participants – LFUI – joined forces with several organizations (ESI, Softteam, MID GmbH, Rhysome, SINTEF, University of Augsburg, DFKI, NKUA – University of Athens, and OSLO Software) and submitted the initial submission *UML Profile and Metamodel for Services–for Heterogeneous Architectures (UPMS-HA).* The intention of UMPS-HA was to analyze metamodels for a number of architectural styles in order to identify a common core basis for these, so that it is possible to specify large and complex systems using a common modelling approach. It was assumed that later RFPs would address the more specific details for these architectural styles, i.e. through a UPM for EDA/CEP (Event Driven Architectures and Complex Event Processing), a UPM for Agents, a UPM for Semantic services, a UPM for P2P and Grid, etc.) but it was already possible to identify a number of common concepts for these through an analysis of existing approaches and experiences. The UPMS-HA submission analyzed a number of available results in these areas, with respect to extracting the common concepts into a core UPMS-HA model. The approach for this has been to ensure that UPMS core is a suitable basis for UPM for Web service

[22] http://www.omg.org/
[23] http://www.omg.org/cgi-bin/doc?soa/2006-9-9

Architectures, UPM for SCA/SDO (Service Component Architecture and Service Data Objects), now also Open CSA Open Composite Services Architecture), UPM for Semantic (web) services,UPM for Agents, UPM for Event modeling and EDA/CEP, UPM for P2P, UPM for Grid, and UPM for Components.

Some of the SUPER ideas can be found in the UPMS-HA submission, especially those related to semantic services (e.g. the WSMO approach to model semantic aspects of services, such as capabilities pr interfaces using ontologies). A new version of the UPMS-HA submission, now called SoaML,[24] is currently under development and is expected to serve as input for the formation of a SoaML working group in OMG.

4.2 BPMN 2.0

SUPER partners, mainly IBM and SAP, have been contributing members of the Business Process Modeling Notation (BPMN) 2.0 specification during the entire SUPER project.

The key challenges of this specification include a common meta-model for BPMN to support different levels of compliance, formal execution semantics to support semantic interoperability and complete mapping, and enhanced data modelling and choreography modelling. The topics are very related to the vision of the SUPER project. In its multi-layer structure (Figure 1), several topics have received contribution from the SUPER partners.

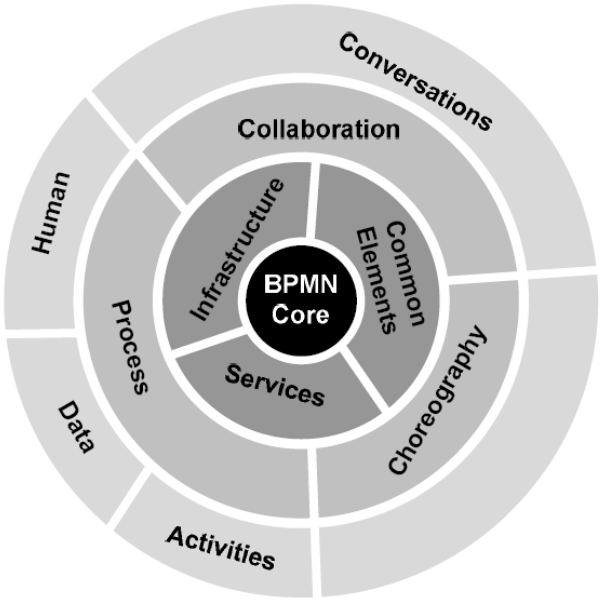

Figure 1. Proposed BPMN 2.0 Core and Layer Structure.

[24] http://www.omg.org/docs/ad/08-11-01.pdf

The related research problems mainly include:

- Execution Semantics. A major challenge is posed by defining an unambiguous execution semantics for BPMN, because BPMN 1.1 is vague, not detailed and even contradictory in specifying its intention with respect to execution semantics. Moreover, giving semantics to some BPMN constructs (namely the inclusive converging gateway, also known as OR-join) entails solving open research problems in the BPM area. The contributions include semantics of sequence flow and semantics of the gateways (including semantics of above mentioned OR-join and the complex gateway), life-cycle of activities and their various forms, semantics of Multi-instance and loop activities, semantics of sub-processes and ad-hoc sub-processes, semantics of data modelling elements.
- Choreography. It is clearly required by this specification to model orchestrations and choreographies as stand-alone or integrated models, so as to support display and interchange of different perspectives on a model that allow a user to focus on specific concerns on the participant interactions. The contributions include the interaction modelling for preventing deadlock situation and its mapping to interface behaviour models, the verification of interaction model and the patterns of dynamic routing in process execution within a decentralized and personalized process management environment.
- Common Meta-model. It provides a foundation for syntactic and semantic interoperability. The extensibility of this meta-model will also increase the adoptability of BPMN 2.0, since vendors and users can reuse their existing model elements (e.g. models specific to different vertical industries) by integrating the meta-models. Thus a balance between compliance and flexibility is achieved.
- Events. It provides restriction on the use of Events (Starting Events, Intermediate Events, Event-Based Gateways etc.), which will affect the sequence or timing of Activities of a Process. The specification of the events and compensation handling enables its application in process-centric IT system, together with BPEL.

These contributions are included in the current draft of the response to the OMG RFP for BPMN 2.0. The initial submission to the OMG is available as OMG document bmi/2008-02-06.[25] The latest draft submitted to the OMG is available as OMG document bmi/2008-11-01. The final submission will be available around March 2009.

[25] www.omg.org/docs/bmi/08-02-06.pdf

5 BPEL4SWS

WS-BPEL (BPEL for short) is the de facto standard to describe Web service flows in a workflow-like manner. It has been submitted to OASIS in May 2003 (BPEL 1.1[26]). BPEL 2.0[27] was approved by the WS-BPEL Technical Committee as a Committee Specification in January 2007.

It enables the composition of Web services and the modelled process is itself exposed as a Web service. Thus, it provides a recursive aggregation model for Web services.

In BPEL partner services are described by their abstract interface (WSDL) which is hard-coded in the process model. This hampers the usage of services providing the requested functionality but implementing a different WSDL interface. Semantic Web Services (SWS) were developed to overcome this deficiency by defining an integration layer on top of Web services.

However, there is no standardized process language for SWS yet. In SUPER WS-BPEL is extended to BPEL4SWS which aims to become a standard language for Semantic Web service flows.

BPEL4SWS enables the definition of process logic independently from WSDL specific details. It defines new activity types and grouping mechanisms for these new activities that enable defining the interaction of a business process with its partners independent of WSDL. That allows attaching SWS descriptions to the process for describing the functionality or requirements of activities of a process semantically using SWS frameworks such as WSMO or OWL-S instead of using WSDL. BPEL4SWS also makes use of the SAWSDL standard which enables bridging the gap between XML data and ontologies and enables semantic service discovery using appropriate middleware such as SEE during runtime. Additionally, data handling is enhanced by introducing semantic data mediation within the process logic.

Within the task SUPER standardisation (11.5), SUPER D 1.3[28] and D 1.10[29] were extended to a comprehensive specification published as a technical report[30] and as annex to D 1.10.

The specification is intended to serve as input for a Working Group of a standardization body. The strategy and plan for the standardization of BPEL4SWS are currently under discussion within the project consortium. For the time being, a pre-standardisation work alongside BPMO in STI's Conceptual Models for Services Working Group is considered.

[26] www-106.ibm.com/developerworks/webservices/library/ws-bpel
[27] A. Arkin, S. Askary et al., "WS-BPEL: Web Services Business Process Execution Language Version 2.0," 2007
[28] http://www.ip-super.org/res/Deliverables/M12/D1.3.pdf
[29] http://www.ip-super.org/res/Deliverables/M24/D1.10.pdf
[30] ftp://ftp.informatik.uni-stuttgart.de/pub/library/ncstrl.ustuttgart_fi/TR-2008-03/TR-2008-03.pdf

6 Summary and Outlook

This deliverable described the standardization activities of the SUPER project. Following a thorough analysis of SUPER standardization potential in the WP11 deliverables D11.1, D11.2, and D11.3, the SUPER consortium focused its standardization activities on three major standardization bodies: OASIS, W3C, and OMG. Within these standardization bodies, the activities of the SUPER participants consisted of providing feedback regarding standards used in SUPER and participating in the development of new or updated standards. The main standardization activities, in which SUPER participants have been involved, were heavily influenced by results within SUPER. Specifically, the OASIS Semantic Execution Environment (SEE), the W3C Semantic Annotations for WSDL (SA-WSDL), and the OMG Business Process Modeling Notation 2.0 (BPMN 2.0) can be seen as key standardization initiatives to which SUPER significantly contributed. Moreover, BPEL for Semantic Web Services (BPEL4SWS) – a key extension of BPEL towards incorporating access to Semantic Web Services – is expected to play a major role in future standardization of BPEL extensions. The standardization strategy for BPEL4SWS is currently being discussed within the consortium and an agreement on where and when to submit BPEL4SWS for standardization will be taken before the official end of the project. A first step for such a strategy has been directed towards a pre-standardisation of BPEL4SWS in STI's Conceptual Models for Services Working Group.

Overall, the standardization activities carried out by the SUPER participants reinforce the impact of the results achieved within the SUPER project. Furthermore, it is expected that various organizations such as IBM, LFUI, NUIG, or SAP will continue to contribute to standardization activities after the completion of the project, further pushing results from the SUPER project towards standardization. One concrete step to enable further standardization activities based on results from SUPER is the creation of the Standardization and Reference Architectures[31] service of STI International,[32] whose one of the core aim is to strengthen the impact of STI International research by fostering the admission by acknowledge standardization bodies. For example, one activity of STI International in this context is the Conceptual Models for Services Working Group (CMS WG)[33] in which the SUPER BPMO has been submitted for discussions – an initial step towards the standardization of BPMO.

[31] http://ras.sti2.org/
[32] http://www.sti2.org/
[33] http://cms-wg.sti2.org/home/