Data, Information and Process Integration with Semantic Web Services

DIP

Data, Information and Process Integration with Semantic Web Services

FP6 - 507483

Deliverable

WP 7: Technology Watch and Standardisation

D7.8

Revision of DIP standardisation strategy and results of standardisation efforts

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EXECUTIVE SUMMARY

This document is the last deliverable in a series of planned updates documents for the DIP deliverables D7.3-D7.4 (standardisation strategy and impact analysis [1], [2]) in the course of the workpackage WP7 “Standardisation and Technology Watch”, and a follow-up to deliverable D7.7 (third update of the standardisation impact analysis [3]).
The actions and advances of WSMO/WSML/WSMX are reviewed in this deliverable as will the new and ongoing activities of the OASIS SEE Technical Committee (former SDK). Also presented is an update on other ongoing standardisation activities including the W3C Rule Interchange Format progress.
The very successful standardisation activities presented throughout the deliverable series of workpackage 7 underpins the standardisation strategy chosen for the project DIP. The way how information about standardisation efforts was distributed internally in the project and externally, e.g., in the SDK cluster, and in standardisation bodies (W3C, OASIS, OMG) was key to successful standardisation work.

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Abstract (for dissemination)	This document is the last deliverable in a series of planed update documents for the DIP deliverables D7.3-D7.4 (standardisation strategy and impact analysis [1], [2]) in the course of the workpackage WP7 "Standardisation and Technology Watch", and a follow-up to deliverable D7.7 (third update of the standardisation impact analysis [3]).	
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LIST OF KEY WORDS/ABBREVIATIONS

ASG – Adaptive Services Grid

IRS – Internet Reasoning Service

OASIS – Organization for the Advancement of Structured Information Standards

OWL – Web Ontology Language

RDF – Resource Description Framework

RIF – Rule Interchange Format

SCG – Standardization Coordination Group

SDK – Sekt, DIP, KnowledgeWeb

SEE – Semantic Execution Environment

TC – Technical Committee

WSDL – Web Service Definition Language

WSML – Web Services Modeling Language

WSMO – Web Services Modeling Ontology

WSMX – Web Services Execution Environment

WSMT – Web Service Modeling Toolkit

W3C –World Wide Web Consortium

XML – Extensible Markup Language

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1 INTRODUCTION

The DIP workpackage 7 “Standardisation and Technology Watch” provided the foundation of standardisation work and their exploitation in the context of the project DIP. Initially the two deliverables D7.3 and D7.4 presented a standardisation strategy and impact analysis [1], [2]. Based on these, a series of three additional deliverables described the actions and advances during the project execution [3]-[5].

With this final deliverable D7.8, we will review the initially proposed DIP standardisation activities and the SDK SCG activities. Furthermore we will conclude the description of the actions and advances of

- RIF
- OASIS SEE TC
- SAWSDL
- WSMO/WSML/WSMX

in the past months since D7.7.

2 REVIEW AND EVALUATION OF PROPOSED STANDARDISATION STRATEGY

2.1 DIP Internal

In deliverable D7.4 [2], we specified our initial strategy with respect to standards. The following paragraph from D7.4 (section 3.1) summarizes our conclusions and the approach we proposed to follow: “A survey of the scientists, architects and developers working on the technical work packages and the use cases did not reveal the existence of an acknowledged need for additional standards besides the ones currently in use – or whose use is planned at a later stage – or under development in the project. The general agreement is that, all the requirements, which are not covered by existing standards or work in progress in the relevant standardisation organisations, are under development or planned within the WSMO framework. WSMO/WSML will be proposed as a standard to the appropriate organisation at some point, and thus it satisfies the requirement for the formats, protocols, etc. used in the project to be accepted standards. However, we believe that a layer dedicated to policies is missing from the protocol stack.”

We later refined that strategy further, clearly distinguishing two areas where we needed to work:

- At the framework level, our strategy had clearly to be to continue along the line that started with the development of the Web Service Modelling Framework (WSMF), that was developed into the Web Service Modelling Ontology (WSMO), Web Service Modelling Language (WSML) and that led to the implementation of WSMX. Whereas the strategy was clear, the question was: How could we bring this from DIP into the SWS mainstream? Our answer was that we should improve the visibility of our work, position it with respect to competitive developments (e.g. OWL-S) and bring that work to recognized standardization bodies.

  That was accomplished through the submission of WSML to W3C, the organization of a W3C workshop on Semantic Web Services, and the creation of the Semantic Execution Environment Technical Committee at OASIS and the active involvement of DIP members in the work of the TC (see section 3.2).

- At the usage level, on the other hand, we considered what standards were needed with respect to application knowledge. Beyond data, semantic data models and semantic queries, for which standards already existed or were under development (RDF, OWL, SPARQL), reasoning and rules were everywhere in SWS: they were relevant to knowledge representation, discovery, composition, mediation, personalisation (provider and user sides) and more. So, rule interchange was a pre-requisite for scalable SWS deployment. Here, the question was: How do we make sure we have the standard we need? Our answer was that we needed to motivate standardisation bodies to start work on the subject, to bring our requirements and use cases to that group, and to participate actively to make sure they are taken into account.

  That was accomplished though the creation of the Rule Interchange Format Working Group at W3C, and the active involvement of DIP members in the work of the WG (see section 3.1).

Based on our initial analysis of the requirements, we proposed in D7.4 an extended stack of protocols for semantic Web services[1] (Figure 3).

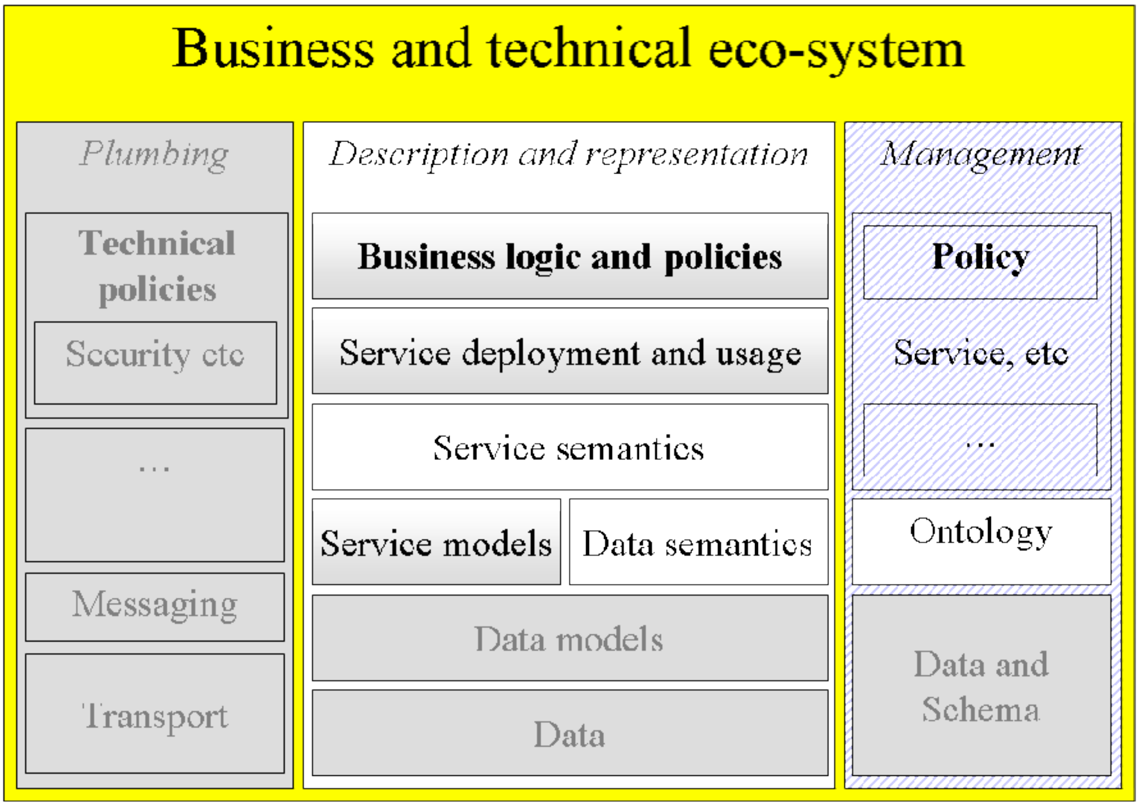

Figure 1: Extended SWS standards technology map (from D7.4)

[1] where plain components are fully in scope for DIP; half-shaded components belong to the "non-semantic" Web service stack as well, but need to be adapted or extended for semantic Web services; fully shaded components are plain Web components, thus out of scope for DIP, but semantic Web services depend on them; and patterned components depended on work in progress and were therefore excluded from the scope.

In addition to the creation of the OASIS SEE TC and the W3C RIF WG, it is an interesting post facto validation of our analysis that, more than one year after we published that picture, W3C created the Semantic Annotations for WSDL working group, that starts to address the "Service deployment and usage" component in Figure 1 (see section 3.3); and that, almost two years after we published Figure 1, the following picture was shown during the W3C Advisory Committee to explain how the Rule Interchange Format under development related to the W3C Web service and semantic Web stacks (compare Figure 2 and Figure 1).

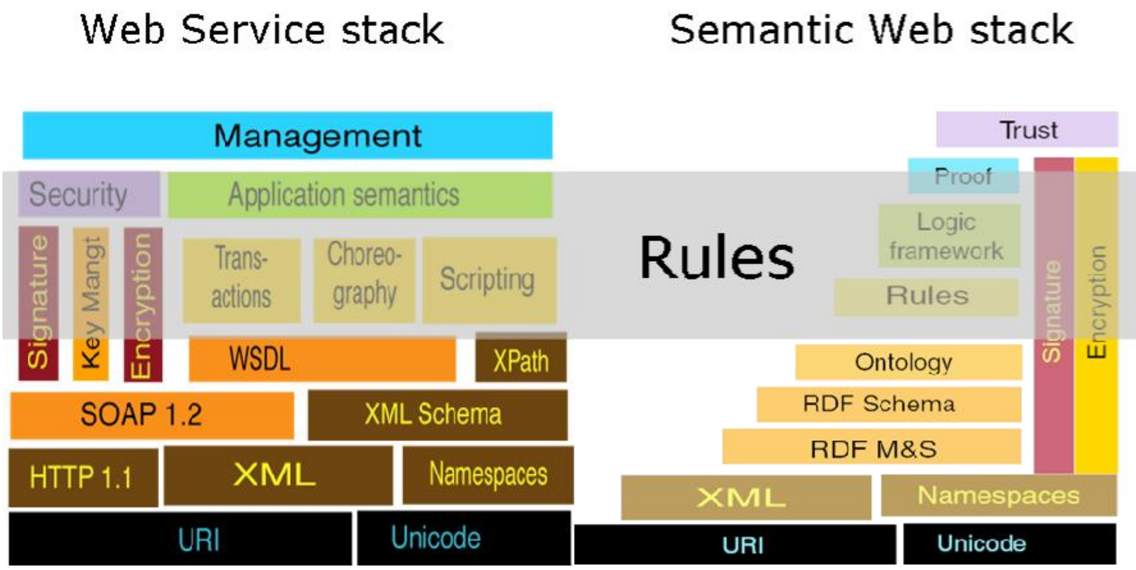

Figure 2: How RIF relates to the W3C WS and SW stacks

2.2 SDK Cluster

In an early DIP project phase, after only six month duration, the deliverable D7.3 "DIP standardisation strategy" [1] outlined the possible way of interaction between the DIP project and standardisation bodies. The approach was described with two perspectives in mind: 1) an organizational approach and 2) an initial "standardisation watch" process for work package 7 to adopt as an active process for the overall DIP project, and deliver initially through deliverable D7.4 (in month 12 of the project). The latter than resulted in a series of deliverables, namely D7.4-D7.7 [2-5], describing project-related standardisation activities and updating on the efforts.

The first perspective described the foundation of the SDK-SCG (SEKT/DIP/KnowledgeWeb-Standardization Coordination Group) as part of the SDK Cluster. It is important to stress the fact that the standardisation strategy described in that deliverable was intended to be a basis for DIP activities involving the coordination of standardisation group evaluation, impact analysis and engagement approaches, but was also made a common activity for the mutual benefit of all SDK Cluster projects. However the dissemination of standardisation analyses, agreement on suitable standardisation strategies and the development of content proposals had to be undertaken internally with the expressed mandate of each project's technical project management board, and then communicated into the SDK Cluster activity for coordination.

During the following months several discussions between SDK partners were initiated through the SDK-SCG. As expected, the exchange of information regarding standardisation work in respective projects was the main focus of the work. Additionally the coordination of joined SDK Cluster activities in the area of standardisation was established, e.g., the preparation of the WSMO W3C member submission.

Looking back at the situation in M24 of the project, there was no longer a need for an actively driving SDK-SCG. Current partners know that standardisation activities are an integral prerequisite for successful EU projects. The respective standardisation bodies and working groups were identified and the work in these groups started successfully. Therefore the SDK-SCG was closed.

In retrospect, the positive results of the SDK-SCG work in the past could be proven by the fact that more and more partners are actively working and participating in major standardisation activities, e.g., W3C and OASIS, driving the standardisation in the area of Semantics and Web Services.

As described in an outlook of a WP7 deliverable [5], the SCG was reborn at the end of 2005. The new ESSI Cluster combines Semantic Web Services and Semantically empowered system solutions with semantically empowered service-oriented architectures offering a platform for a new Standardization Coordination Group. As more new EU projects from the 4th call of FP6, e.g., TRIPCOM, SUPER, started in 2006 their work in this area; a further expansion of the cluster could be foreseen. As described for the ESSI cluster, with new partners joining the cluster the necessity of the standardisation coordination group and their work may amplify again.

3 UPDATE ON STANDARDISATION ACTIVITIES

3.1 RIF

The W3C Rule Interchange Format (RIF) Working Group (RIF WG) has been working since December 2005 with the aim of specifying "a format for rules, so they can be used across diverse systems. This format (or language) will function as an interlingua into which established and new rule languages can be mapped, allowing rules written for one application to be published, shared, and re-used in other applications and other rule engines" [6].

The RIF WG has currently 79 participants: 76 of 34 organisations (including e.g. IBM, HP, ORACLE, ILOG, Fair Isaac, Tibco, JBoss, Corticon, on the commercial side; DERI, SRI, the REWERSE project, on the research organisations side; NIST and OMG, on the standardisation organisations side; and FZI, the universities of Manchester, Bolzano, Aberdeen, Athens, on the academic side). Noticeably, the participating business rule engines (BRE) and management systems (BRMS) vendors represent more than half of the market (according to a market study by IDC [7]).

The RIF WG holds a weekly conference call (with a core attendance of about 25 participants) and three-monthly face to face meetings. The last face to face meeting was held in Athens, Georgia, November 4-5, 2006, collocated with the International Semantic Web Conference and the RuleML Workshop.

The RIF WG works in the public eye, under the W3C royalty-free patent policy. All the working group discussion and working documents are publicly available [8][9]. In addition, the RIF WG releases periodically so-called "public working draft" of its deliverables, for the purpose of public review. The latest published working draft was the 2nd public working draft of the Use Cases and Requirements [10], released in July 2006. The working group is currently working on releasing the 3rd working draft of that same document, as well as the first public working draft of the technical specification.

The Working Group is chartered to address its mission in two distinct phases. Its mission in the first phase is to produce a W3C Recommendation for a very simple and yet useful and extensible format for rules. In the second phase, it will produce Recommendations for extensions which address the broader set of use cases important to the participating communities.

Hereafter, we describe the basic principles laid out by the working group.

3.1.1 One core, many dialects

The essential task of the Working Group in Phase 1 is to construct an extensible format for rules. There will be one core dialect and a limited number of standard dialects extending it.

Indeed, there is a common core of rules that can be expressed in most rule languages and on the semantics of which they agree. That core seems to be, basically, positive Horn rules. That is rather limited, but it covers already a lot of the rules that will be interchanged. It does not mean that it covers many useable rulesets, but, as RIF Core dialect, it will guarantee a minimum level of rule interchangeability between RIF-compliant implementations.

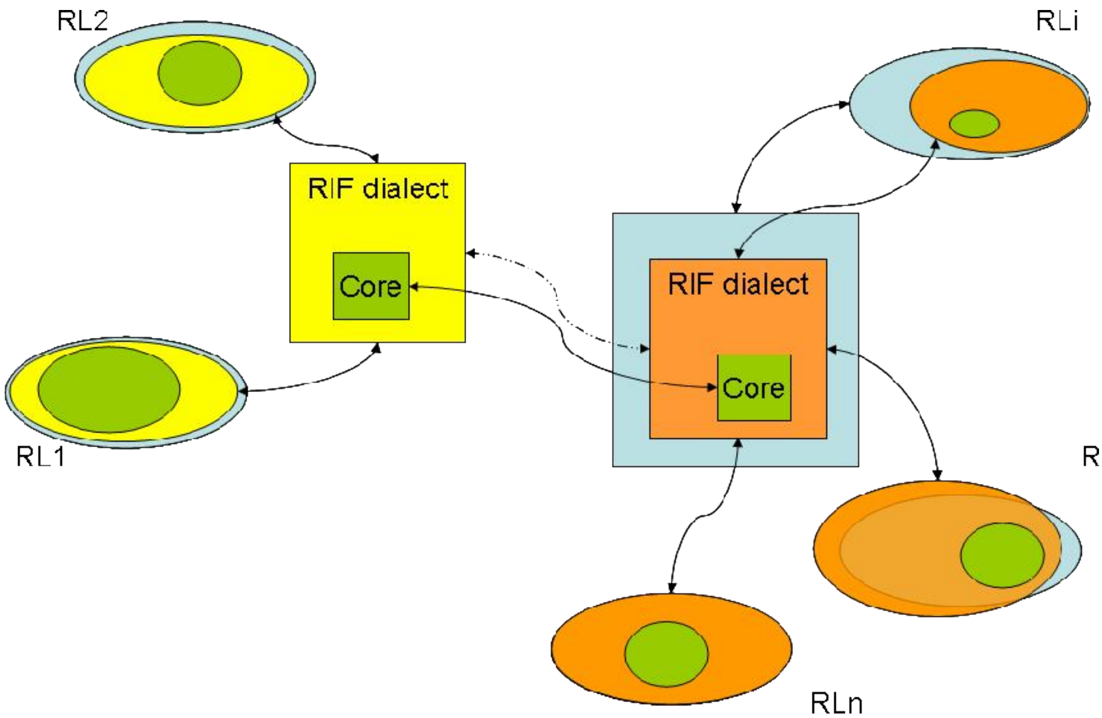

Figure 3: RIF Core dialect and extensions

Then, there are broad families of rules languages that differ mostly by their concrete syntax and their expressive power, but that share a much broader common core: production rule languages, families of logic programming languages etc.

Once RIF Core is specified, the working group will standardize a limited number of dialects that extend RIF Core for important families of rule languages. Which ones exactly is not yet decided, but, broadly speaking, there will certainly be at least one for the logic programming family of languages and at least one for the production rules family.

Notice, that the dialects do not create islands, since they are all extensions of the common core. In addition, it might be possible to define partial mappings between some of the dialects, thanks to their limited number.

Notice further, that, although the working group will specify only a limited number of standard dialects, RIF is designed to allow non-standard extensions as well: one design goal of the working group is that any extension that is designed according to RIF specification, standard or non-standard, must be backward and forward compatible with the dialects it extends and the dialects that extend it (see also Figure 3).

3.1.2 One syntax, many semantics

One way to help ensure compatible extensibility is by making sure that dialects share a common syntax: RIF dialects may differ in the semantics that they assign to rules and rule sets, but they will all use the same syntactic constructs, with the same semantic structure.

And, since most rule languages have a lot in common at the abstract syntax level, another of the basic principles laid out by the working group is that RIF will only specify a extensible abstract syntax and – since a shared concrete XML syntax is of course necessary for actual rule interchange – a standard way to derive the XML syntax from the abstract syntax.

Each dialect, including RIF Core, will then specify:

- Which constructs from common syntax it allows, knowing that any specific dialect must include at least the same construct as any dialects that it extend. A dialect may also specify new constructs that will be added to the pool of common constructs for future reuse.
- The semantics it assigns to rules, making sure that it is backward compatible with the semantics of any dialect it extends. The semantics of RIF dialects must be specified precisely, preferably in a model-theoretic way. By default of a model-theoretic semantics, a RIF dialect can have a proof theoretic one; by default of a model-theoretic or proof-theoretic semantics, an operational semantics will be allowed.
- To ensure forward compatibility, a dialect will have to specify the default behaviour that is expected from a RIF-compliant implementation of a dialect it extends, in the case where that implementation encounters a construct of the new dialect that is not part of the dialect it implements.

3.2 OASIS SEE TC

OASIS Semantic Execution Environment (SEE) Technical Committee (SEE TC) has been working since November 2005 with the goal to provide guidelines, justifications and implementation directions for an execution environment for Semantic Web services. The resulting infrastructure will incorporate the application of semantics to service-oriented systems and will provide intelligent mechanisms for applying Semantic Web services.

Currently the following companies and universities are involved: Booz Allen Hamilton, CEFRIEL, Changfeng Open Standards Platform Software Alliance, Digital Enterprise Research Institute (DERI Innsbruck Austria, Galway Ireland and Seoul Korea), NIA (National Information Society Agency), Hanival, Ontotext Lab/Sirma Group, Raining Data Corporation, SAP AG, Sun Microsystems, The Open University, and other individual participants.

Besides chairing the SEE TC a great amount of effort personnel and resources were spent by DERI on working in this initiative. A detailed description of the work will be presented in the DIP deliverable D7.9.

3.2.1 Mission

The OASIS SEE TC aims to continue work initiated by the Web Services Execution Environment (WSMX) and Internet Reasoning Services (IRS) projects and working groups and several other projects in Europe and other projects in the area of Semantic Web Services which will start in the coming months.

The TC will define the functional components of this SWS system and the semantic descriptions of these components' interfaces. The TC will also define a formal description of execution semantics of such a system. In addition, the TC will define a generic and open framework, using metadata, to allow for new components to be plugged into the system and made available to the execution engine dynamically. Further, after providing the basic methods described above, or in parallel if appropriate, the SEE TC will seek to develop specifications addressing specific problem sets covering the spectrum from a general purpose environment to business-domain focused applications addressing financial, telecommunication, military and e-Government applications of Semantic Web Services technologies. This TC also plans to combine Grid Computing with Semantic Web Services technologies and to take advantage of their different perspectives to provide a reference architecture of the infrastructure for machine-to-machine enabled communication and cooperation.

The SEE TC's efforts will foster compatibility across specifications developed for Semantic Web Services, and where possible re-use existing standards and methods that already have been used in the areas of Semantic Web and Web Services. This TC will engage with industry, academic and research communities to facilitate understanding, awareness and possible collaborations regarding emerging semantic technologies and research applicable to Semantic Web Services.

3.2.2 Achievements

Semantic Execution Environment Background and Related Work

This document is intended to provide the audience of SEE TC documents with background information. It is organized as a list of short sections that describe research and development activities at the basis of SEE TC work. It describes SOA concepts and current implementation of SOAs based on Web Services technologies as background work and contains information related to efforts that are tying to add semantics to SOA. It also includes the SEE TC work which is placed in relationship with other OASIS and W3C standardisation activities and includes references to relevant literature.

Reference Model for Semantic Service Oriented Architecture

This reference model extends the work done in the OASIS SOA-RM (Reference Model for Service Oriented Architecture) technical committee, defining a reference model for Service Oriented Architecture, by adding the concept of semantics. It should be noted that it is assumed that the reader has already read and is familiar with the “Reference Model for Service Oriented Architecture, Public Review Draft 1.0”. The aim of this reference model is to provide justifications for the need for semantics in Service Oriented Architecture and to show where semantics can be applied in the SOA-RM and its benefits.

Semantic Web Services Architecture and Information Model

This document outlines a comprehensive framework that integrates two complimentary technical advances, Service-Oriented Architectures (SOA) and Semantic Web, into a single computing architecture, that we call Semantic Execution Environment. While SOA is widely acknowledged for its potential to advance the world of computing, that success depends on resolving three fundamental challenges that SOA does not address, integration, search, and mediation. In a services-oriented world, high numbers of services must be discovered and selected based on requirements, then orchestrated and adapted or integrated. SOA depends on but does not address either search or integration. The document provided a vision of future computing environments enabled by the SEE framework that places computing and programming at the services layer and places the real goal of computing, problem solving, in the hands of end users.

Semantic Web Services Execution Scenarios

This document describes the efforts of SEE TC to provide guidelines for a Semantic Web Services platform enabling dynamic discovery, mediation and invocation of Semantic Web Services. It is an architecture based on loosely-coupled components following the principles of Service Oriented Architecture where interactions between the components are not by any means preordained but can be specified during the system exploitation.

OASIS Symposium 2006 Tutorial

While the SEE TC is working on coming up with a first set of specifications for the Semantic Execution Environments, the members of SEE TC arrange a tutorial “The Meaning of Interoperability” (details available at http://www.wsmo.org/TR/d17/v0.2/#s317) which was attended by senior software architects, CEO's of companies in this area, etc.

3.2.3 Progress and outlook

OASIS SEE TC started with on 11 November 2005. It plans to come up with first draft of specifications by November 2007. The SEE TC organizes regular telephone conference meetings after every two weeks.

As face to face meetings after some time are also necessary to synchronize work among participants, SEE TC had its first face to face meeting in May 2006 during the OASIS Symposium in San Francisco, CA, USA. Minutes and notes for all meetings and telephone conferences are taken to record the progress of the committee.

3.3 SAWSDL

As reported in deliverable D7.7, in March 2006 the W3C announced the creation of the Semantic Annotations for WSDL working group (SAWSDL) [11]. The working group then started with a teleconference on April 4. Since then, the group had three face-to-face meetings (in Galway, Ireland; in Torino, Italy; and in Athens, GA, USA) and a weekly teleconference. All the agendas and minutes for these meetings are available from the WG page [11]. The members of the Working Group include DIP partners DERI Innsbruck, DERI Galway, ILOG, Open University. Other active members of the WG are IBM, Telecom Italia and University of Georgia LSDIS Lab. The group is chaired by Jacek Kopecký from DERI Innsbruck. DIP partners represent roughly half of the active members.

The working group is producing two documents: “Semantic Annotations for WSDL and XML Schema” [12] and “Semantic Annotations for WSDL and XML Schema - Usage Guide” [13]. The first document is a specification of the WSDL and XML Schema extensions necessary for attaching semantic annotations to Web service descriptions. This specification is expected to reach Candidate Recommendation status in January 2007, and to become a W3C Recommendation around April 2007. The second document explains the usage of the semantic annotations for various purposes, including Web service publishing and discovery (matchmaking), composition and invocation.

Deliverable D7.7 raises a concern that the SAWSDL charter [14] “falls short of what would be required for DIP implementations (e.g. of the use cases) and of WSMO/WSML recommendations.” However, especially after a review from the OASIS Semantic Execution Environment, it now appears that the specification is sufficiently general to fulfil all DIP and WSMO requirements for a grounding technology. In fact, some of the DIP members in the working group are planning to produce a specification on WSMO Grounding using SAWSDL as part of the Candidate Recommendation implementation and testing efforts. This work will verify that SAWSDL is suitable as an SWS annotation mechanism.

In terms of global impact, the W3C SAWSDL WG and the OASIS SEE TC are the first steps towards standardisation of Semantic Web Services technologies. In particular, SAWSDL will provide the base for any number of (potentially competing) semantic annotation approaches, allowing WSMO to be validated in direct competition with other technologies. We could say that from the point of view of W3C, an impartial observer and guard of the principles of the Web, the SAWSDL specification will define the battlefield for SWS technologies, and it is clear that European research represented mainly by the DIP project has an overwhelming impact there.

3.4 WSMO/WSML/WSMX

The WSMO/WSML/WSMX working groups have continued their research and development efforts. While at the beginning the WSMO/WSML/WSMX working groups had a prescriptive function for the DIP project, now the research results gained in the project are brought into the WSMO/WSML specifications as well as the WSMX implementations in form of update and revision proposals.

In particular, revision proposals to the WSMO framework have been made as results of the DIP project are:

- refinement of the WSMO goal model
- refinement of the WSMO Choreography language
- specification of the WSMO Orchestration language with special attention to the 3-layer orchestration developed in DIP
- the WSMX Orchestration engine
- WSMO non-functional properties for security and trust
- WSMO4J and WSMO Studio developments
- WSML Reasoner Integration

In addition to the work in the WSMO/WSML/WSMX deliverables, several scientific publications have been accomplished as joint efforts among WSMO/L/X working group members and partners from the DIP project.

3.4.1 Deliverables

The following table shows the WSMO and WSML deliverables, which have been updated, completed, or newly created in the reporting period.

Table 1: WSMO / WSML deliverables

Number	Date	Title	Description / Changes
D2, v. 1.3 (final)	2006-10-21	Web Service Modeling Ontology	- specification refinements - UML class diagrams
D14 v 0.3 (final)	2006-05-19	Ontology-based Choreography of WSMO Services	Specification of ontologized Abstract State Machines (the Web Service interface description language)
D15.1 v0.1	2006-07-14	Dataflow for Orchestration in WSMO	WSMO Orchestration Language specification
D28.4 (final)	2006-10-21	Non-functional properties in Web services	Refined Specification of the DC core non-functional properties
D2, v. 1.4	2006-11-06	Web Service Modeling Ontology	Open working draft
D3.4, v0.2	2006-01-13	WSMO Use Case: Amazon E-commerce Service	Use case specification with special attention to choreography modeling in WSMO
D14 v 0.3	2006-11-28	Ontology-based Choreography of WSMO Services	Open working draft
D28.1 v0.1	2006-01-13	Functional Descriptions of Web	Background research and specifications for update of

		Services	WSMO capability descriptions
D28.2 v0.1	2006-09-11	Languages for Behavioral Specifications of Semantic Web Services	Background research and specifications for update of WSMO choreography descriptions
D28.3 v0.1	2006-11-29	WSML Ontology Semantics	Background research and specifications for update of WSML, esp. for WSML Full
D33 v0.1	2006-10-06	WSML Best Practices: Naming and Design Rules	Best practices + guide for WSML specifications

The WSMX working group has continued the development efforts. The latest WSMX release is dated on Dec 9th, 2006, with the following most important features:

- new discovery engine
- updates of data and process mediator
- choreography + orchestration engine
- cluster-based ontology visualization in WSMT
- WSMX demo and hands-on session for dissemination and presentation

3.5 Other standardisation activities

Apart from the major activities reported in the preceding subsections, the DIP project was also represented by DERI Innsbruck in the W3C Web Service Description Working Group [15]. This working group is now close to delivering WSDL 2.0 [16]. DERI is involved in this WG in order to produce the RDF mapping of WSDL 2.0 [17], a specification that effectively makes WSDL Web service descriptions a part of the Semantic Web, making it easier to integrate WSDL with Semantic Web Services technologies.

4 Conclusion

The very successful standardisation activities presented throughout the deliverable series of workpackage 7 underpins the standardisation strategy chosen for the project DIP. The way how information about standardisation efforts was distributed internally in the project and externally, e.g., in the SDK cluster, and in standardisation bodies (W3C, OASIS, OMG) was key to successful standardisation work.

Partners in the DIP project could rely on WP7 as a forum where it was possible to share and discuss all issues related to the topic of standardisation.

Another fruitful situation in WP7 was that from the beginning a mixture of partners from academia and industry were involved. This led to a much broader view on the topic than an activity that is driven only by a single interest group. The result of this setup can be seen in the high degree of acceptance of the proposed standards outside the DIP project.

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