

*About ...*

## FP6-IST INFRAWEBBS EUROPEAN RESEARCH PROJECT

**INFRAWEBBS**  
**europe**



<http://www.fh-bochum.de/infrawebs/>

Web services define new paradigm for the Web in which a network of computer programs becomes the consumers of information. The platform and language independent interfaces of such services allow the easy integration of heterogeneous systems. Current Web service technologies describe the syntactical aspects of a Web service providing only a set of rigid services that cannot be adapted to a changing environment without human intervention. Realization of the full potential of the Web services requires further technological advances in the areas of service interoperation, service discovery and service composition. A possible solution to these problems can be provided by application of Semantic Web technologies to converting Web services to Semantic Web Services (SWS).

Semantic Web Services are "self-contained, self-describing, semantically marked-up software resources that can be published, discovered, composed and executed across the Web in a task driven semi-automatic way". Semantic Web services can constitute a solution to the integration problem enabling dynamic, scalable and reusable cooperation between different systems and organizations. These great potential benefits have led to the establishment of an important research area, both in industry and academia, to realize Semantic Web services.

There are two major initiatives aiming at developing world-wide standard for the semantic description of Web services. The first one is OWL-S, a collaborative effort by BBN Technologies, Carnegie Mellon University, Nokia, Stanford University, SRI International and Yale University. OWL-S is intended to enable automation of web service discovery, invocation, composition, interoperation and execution monitoring by providing appropriate semantic descriptions of services. The second one is Web Service Modelling Ontology (WSMO), a European initiative intending to create an ontology for describing various aspects related to Semantic Web Services and to solve the integration problem. WSMO consortium includes more than 50 academic and industrial partners. The next, more technology-oriented step in the process of development of semantic Web services is proposed in the ongoing FP6-IST INFRAWEBBS European research project.

The primary project's objective is to develop an ICT framework, which enables software and service providers to generate and establish open and extensible development platforms for creating and maintaining Semantic Web Services supporting specific applications based on WSMO framework.

INFRAWEBBS is an EU FPG STREP project, involving leading authorities on Semantic Web Technologies to develop an application-oriented software toolset for creating, maintaining and executing open and extensible development platforms for Semantic Web services. INFRAWEBBS is an Intelligent Framework for Generating Open (Adaptable) Development Platforms for Web - Service Enabled Applications Using Semantic Web Technologies, Distributed Decisions Support Units and Multi - Agent - Systems. It is a Specific Target Research Project of the European Commission 6th Framework Programme - Priority 2 "Information Society Technologies"; Proposal Number: 511723

### Project Focus

The main INFRAWEB project focus and objective is the development of an application-oriented software toolset for creating, maintaining and executing WSMO-based Semantic Web Services (SWS) within their whole life cycle.

This next generation of tools and systems will enable software and service providers to build open and extensible development platforms for web service applications. These services will run on open standards and specifications, such as BPEL4WS, WSMO, WSMX, WSML, SPARQL, RDF, etc. In particular, they will be compliant with WSMO (Web Services Modelling Ontology), a W3C initiative in Semantic Web services.

The systems generated will consist of loosely-coupled and linked INFRAWEB units, with each unit providing tools and adaptable system components. Developers will be able to use these components to analyse, design and maintain WSMO-based Semantic Web services across the whole lifecycle.

These Semantic Web services offer a new dimension in collaborative work and service production, service provision and service maintenance in run-time environments.

In the first step, the INFRAWEB units are being used to establish an open development platform for SMEs and industrial vendors.

### Project Activities

The essential project activities are to build up software modules within an integrated framework - IIF - the Integrated Infrawebs Framework. Several functionalities are provided for the usage in design-time as well as in run-time (by service providers, service designers or service brokers). For the design-time phase they are:

- The SWS Designer, which is aimed at designing a WSMO-based Semantic Web service from an existing non-semantic Web service.
- The Organizational Memory, a Web Service implementation of a case-based memory (learning from the past), which stores and categorises non-logical representations of WSMO objects as well as additional non-semantic data (like graphical models and templates of SWS).
- The Semantic Information Router as a metadata based content management and aggregation platform (endowed with a SPARQL query interface), used by other components to query for annotated and categorized service descriptions.
- The SWS Composer for creating a Semantic Web service through composition of existing WSMO-based SWSs. It uses a case base memory for retrieving service composition templates quasi-similar to the orchestration interface of the service to be composed.

The run-time modules (for service consumers, service providers, service brokers) are given by:

- The Distributed Repository for effective storing and retrieving all semantic elements of the WSMO Framework: Goals, Ontologies, SWS and Mediators (written in WSML), whereas each repository consists of two parts: a local repository (storing of all WSMO objects created in the Semantic Web service Unit, and a local registry for advertising the SWSs).
- The Service Access Middleware provides a retrieval and execution interface for advertised SW services. The user mandates a user interface agent for fulfilling the service demand and the agent provides recommendations based on the user's query. The matchmaking between user request and service capability are similarity and logic based.
- The SWS Executor module processes Semantic Web service WSMO descriptions using choreography and orchestration engines for executing specific SWS related rules.
- The QoS (Quality of Service) Broker provides functionalities for monitoring the SW service execution process by feeding back extracted metric data.
- The Security and Privacy enabler realised as an artificial "immune defence system" allowing the INFRAWEB framework to function properly under changing conditions

*INFRAWEBs represents a novel approach to problem solving in the creation of SWS applications. It involves a tight integration of similarity-based (non-semantic) and logic-based (semantic) reasoning.*

### Impact and Exploitation

In the quest of competitive edge, companies in Europe are pressed to gain innovation, become faster and more flexible (i.e highly dynamic and adaptable), but also offer a wider range of stable and reliable services along with a personalized interaction with customers, clients and partners.

Undoubtedly, ICT supporting modern, dynamic, reconfigurable, and scalable technologies like the INFRAWEBs approach, do play an important role in tackling these challenges and implementing advanced semantically based knowledge domains.

INFRAWEBs is a flexible, interoperable and reconfigurable framework, enabling organisations to build up partnerships faster and in a more effectively way with respect to the service generation, execution and distribution process. By allowing peers to change their role - to be client, broker and service provider within one environment - INFRAWEBs ensures a highly dynamic and efficient service production process and workflow, and one which spans the whole service lifecycle.

### About papers presented in IJ ITA

The first paper in the proposed set from the ongoing project works "INFRAWEBs Semantic Web Service Development on the Base of Knowledge Management Layer" (Nern et al) describes the knowledge management layer for developing of Semantic Web Service that is embedded in an application oriented realization framework.

An important part of INFRAWEBs is a Semantic Web Unit (SWU) – a collaboration platform and interoperable middleware for ontology-based handling and maintaining of SWS. INFRAWEBs Designer is sub-module of SWU responsible for creating Semantic Web Services.

According to WSMO, functional and behavioral descriptions of a SWS may be represented by means of complex logical expressions (axioms). The paper "INFRAWEBs Axiom Editor – a Graphical Ontology-Driven Tool for Creating Complex Logical Expressions" (Agre et al) describes a specialized user-friendly tool for constructing and editing such axioms – INFRAWEBs Axiom Editor that is a part of INFRAWEBs Designer.

"A Survey on The Integration of Enterprise Applications as a Service" (Hristina Daskalova, Vladislava Grigorova) discusses the integration process of Web services using business logic in multi-lateral integration of business applications.

INFRAWEBs project considers usage of semantics for the complete lifecycle of Semantic Web processes, which represent complex interactions between Semantic Web Services. In "Semantic Description of Web Services and Possibilities of BPEL4WS" (Vladislava Grigorova) methods of using of BPEL4WS as a component of web services technology for the purposes of Semantic Web Services semi-automatic integration are suggested.

In "INFRAWEBs BPEL-Based Editor for Creating the Semantic Web Services Description" (Tatiana Atanasova) the conceptual architecture for BPEL-based INFRAWEBs editor is proposed that is intended to construct a part of WSMO descriptions of the Semantic Web Services

In "Adjusting WSMO API Reference Implementation to Support More Reliable Entity Persistence" (Ivo Marinchev) the WSMO technology concerning issues are discussed.