WonderWeb Project Presentation

WonderWeb: Ontology Infrastructure for the Semantic Web

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WonderWeb Project

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Administrative Details

Contract Number: IST-2001-33052

Project Name: WonderWeb

Full Title: WonderWeb: Ontology Infrastructure for the Semantic Web

Action Line:VI.1.1 Future and Emerging Technologies

Total Cost: € 1,623,000

Commission Funding: € 1,444,000

Project Duration: 30 months

List of Participants

Members of the project consortium are already leading the effort to develop a Web standard ontology language, working in cooperation with the USA DAML initiative and the W3C consortium. They are also leading developers of Web tools and technologies and they have been leading the development of the OIL Ontology Inference Layer, an XML- and RDF-based ontology representation layer, developed in the IST-project ON-TO-KNOWLEDGE, which has already had a major impact on the American DAML programme.

Project Co-ordinator

P1. **VUM** University of Manchester, UK

Academic Partners

P1. **VUM** University of Manchester, UK

P2 **VUA** Vrije Universiteit Amsterdam, NL

P3 **LADSEB** CNR-LADSEB, I

P4 **AIFB** University of Karslruhe, D

Industrial Advisory Board

The project's industrial advisory board will include leading providers and users of Web technology. The membership of the advisory board is as follows:

* Dr. V. Richard Benjamins, **iSOCO**, Barcelona, Spain
* Dr. J. Bullock, **Canon Research Centre Europe**, Guildford, UK
* Richard Chen, **InGenuity Systems**, Alviso, USA
* Peter Crowther, **Network Inference**, Manchester, UK
* Ian Davis, **Photonica**, London, UK
* Dr. John Davies, **BT Advanced Communication Technology Centre**, Ipswich, UK
* Robert Engels, **CognIT**, Asker, Norway
* Dr. Einar H. Fredriksson, **IOSPress**, Amsterdam, Netherlands
* Masahiro Hori, Ph.D., **IBM Tokyo Research Laboratory**, Kanagawa, Japan
* Ian Lang, **Assistum (High Level Systems)**, Liphook, UK
* Alain Léger, **France Telecom**, Cesson Sévigné, France
* Robin McEntire, **GlaxoSmithKline Pharmaceuticals**, King of Prussia, PA, USA
* Drs. J.J.E. van der Meer, **aidministrator**, Amersfoort, Netherlands
* Dr. H. J. Müller, **T-Nova Deutsche Telekom Innovationsgesellschaft**, Darmstadt, Germany
* Peter F. Patel-Schneider, **Lucent Technologies**, Murray Hill, NJ, USA
* Dr. A. Persidis, **biovista**, Athens, Greece
* Ulrich Reimer, **Swiss Life**, Zürich, Switzerland

* Hans-Peter Schnurr, **ontoprise**, Karlsruhe, Germany
* Massimo Soroldoni, **Nomos Systema**, Milan, Italy
* Prof. Austin Tate, **ATK project, AIAI**, Edinburgh, UK
* Arthur J. Thomas, Ph.D., **BioWisdom**, Cambridge, UK
* Dr. Luca Toldo, **Merck KGaA**, Darmstadt, Germany
* Dr. Michael Uschold, **The Boeing Company**, Seattle, WA, USA
* Guido Vetere, **IBM Rome Tivoli Labs**, Rome, Italy
* Matthew West, **Shell Services International**, London, UK
* Mario Wolczko, **Sun Microsystems**, Palo Alto, CA, USA

Aims and Objectives

We are on the brink of a new generation of World Wide Web (WWW) which, in his recent book *Weaving the Web*, Tim Berners-Lee calls the *Semantic Web*. Unlike the existing WWW, where data is primarily intended for human consumption, the Semantic Web will provide data that is also machine processable. This will enable a wide range of intelligent services such as information brokers, search agents, information filters etc., a process that Berners-Lee describes as "bringing the Web to its full potential". The importance of research in this area is indicated by the recently announced DAML initiative in the USA, under whose aegis projects aimed at developing the Semantic Web will receive DARPA funding totalling $70 million.

The development of ontologies will be central to this effort. Ontologies are meta data, providing a controlled vocabulary of terms, each with an explicitly defined and machine processable semantics. By defining shared and common domain theories, ontologies help both people and machines to communicate more effectively. They will therefore have a crucial role in enabling content-based access, interoperability and communication across the Web, providing it with a qualitatively new level of service: the Semantic Web. Examples of the use of ontologies to support content-based access and interoperability can already be seen in, e.g., the American SHOE project (in which HTML is being extended with ontology based semantic markup codes) and the European IST-project ON-TO-KNOWLEDGE (in which ontologies are being used to facilitate access to large intranets).

The Semantic Web will also be crucial to the development of Web applications such as e-commerce, providing users with much more sophisticated searching and browsing capabilities as well as support from intelligent agents such as shopbots (shopping "robots" that access vendor Web sites, compare prices etc.). Examples of the use of ontologies/taxonomies to support searching and browsing can already be seen at e.g., Yahoo Shopping and amazon.com.

Aims

The importance of ontologies to the Semantic Web has prompted the development of *schema* extensions to existing Web standard languages: XML has been extended to give XML-Schema (XMLS), while RDF has been extended to give RDF-Schema (RDFS). However, the language primitives provided by these standards are extremely basic when compared with those typically provided by ontology languages developed within the Knowledge Representation (KR) community, and efforts are already underway to develop *ontology* extensions of these standards. The aim of the project is to develop the infrastructure required for the large-scale deployment of ontologies as the foundation for the Semantic Web. This will involve not only the establishment of a Web standard ontology language, but also the parallel development of the ontological engineering technology that will be required in order to "bring the web to its full potential".

Objectives

The main objectives of the project are:

* The development of a family of ontology languages that extend existing Web standards while maintaining maximum backwards compatibility. The resulting layered architecture will provide the necessary flexibility (standardising on a single language is unrealistic in the Web environment) while maximising interoperability. This work has already begun with the development of OIL, a Web based ontology language that extends and enriches RDFS.
* The development of a framework of techniques and methodologies that provide an engineering approach to the building and use of ontologies. In particular, techniques will be developed for the *semantic* integration, migration, reconciliation and sharing of ontologies, issues that will be particularly important in the development of the semantic web.
* The development of a set of foundational ontologies covering a range of application domains. Each of these ontologies will provide a carefully crafted taxonomic backbone with a sound high level structure that can be used as the basis for the development of more detailed domain ontologies. The integration of existing ontologies with foundational ontologies will also provide a principled mechanism for the semantic integration of ontologies.
* The development of the comprehensive technical infrastructure and tool support that will be required by real world applications in the Semantic Web. In particular, an ontology server architecture will be developed in order to link new and existing components in an integrated and extensible tool suite. This will include tools for editing, integrating and extracting ontologies as well as services such as persistent storage and reasoning support.

Technical Approach

The aim of the WonderWeb project is to develop and demonstrate the infrastructure required for the large-scale deployment of ontologies as the foundation for the Semantic Web. This will be achieved by developing:

1. A layered architecture of ontology languages that extend existing Web standards.
2. Infrastructure and tools to support Web based ontological engineering.
3. A set of foundational ontologies providing a carefully crafted taxonomic backbone that will facilitate extension and integration.
4. Ontological engineering methodologies supporting versioning, modularization, adaptation and reuse.

Taken together, these components will constitute a complete methodology and toolkit supporting Web based ontological engineering and demonstrating its practical application.

As well as generating a critical mass for research in a new and highly interdisciplinary area, the consortium will also have the necessary international standing to exert a significant influence over the development of the Semantic Web. Important cooperations have already been established between the partners and these links will be further extended in the project workpackages, facilitating the development of larger clusters, for example with projects in the IST Key Action II and III programmes.

The consortium is further strengthened by an industrial advisory board whose membership includes some of the World's leading providers and users of Web technology, ranging from large multi-nationals to small and medium enterprises specialising in Web technologies. These links with industry will ensure that the consortium is well informed about current industrial practice and requirements and will facilitate ongoing assessment and evaluation of results based on real life applications. They will also provide important dissemination and exploitation pathways for the new tools and technologies developed in the project.

Contribution and Impact

WonderWeb directly responds to the following EC policy challenges:

* Helping in the aim of creating a user-friendly information society by providing non-discriminatory access to services by individuals and businesses. It will help in the finding and extraction of information from an exponentially growing Web.
* Stimulating the dissemination of results and applications in all areas, with special emphasis in Web based applications, e-commerce, knowledge management and information integration
* The scientific community and companies will clearly benefit from this globalisation of services, through improved access to ongoing research, resources and available technology.
* The work envisaged by WonderWeb must be undertaken at a European level, as the skills in ontological engineering, knowledge management, tool development and e-commerce are widely dispersed in European laboratories and companies.
* WonderWeb also provides significant contributions to EU policies towards SMEs. European SMEs will be able to exploit emerging ontology-based technologies for automated services from the very beginning, and will therefore gain competitive advantage in these very fast developing markets. New business opportunities can be generated by exploiting these techniques and new products and services can be created, developed and brought to the market place ahead of other competitors.
* WonderWeb will provide the technical know-how for and a demonstration of a real Semantic Web.

In summary, WonderWeb will be the European focal point for building an example of the Semantic Web using innovative ontology-based methods and tools. This area is considered as one of the most promising business areas for the future. WonderWeb will significantly enhance the competitive position of Europe in this emerging business field and will thus contribute to the overall further development of the information society.