http://knowledgeweb.semanticweb.org/

Project Fact Sheet

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1. Project participants

The project coordinator is:

- 1. University of Innsbruck, UIBK, Austria

Members are:

- 2. École Polythechnique Fédérale de Lausanne, EPFL, Switzerland

- 3. France Telecom, FT, France

- 4. Freie Universität Berlin, FU, Germany

- 5. Free University of Bozen-Bolzano, FUB, Italy

- 6. Institut National de Recherche en Informatique et en Automatique, INRIA, France

- 7. Informatics and Telematics Institute, CERTH, Greece

- 8. Learning Lab Lower Saxony, L3S(UHAN), Germany

- 9. National University of Ireland Galway, NUIG, Ireland

- 10. The Open University, OU, UK

- 11. Universidad Politécnica de Madrid, UPM, Spain

- 12. University of Karlsruhe, UKARL, Germany

- 13. University of Liverpool, LivUni, UK

- 14. University of Manchester, VUM, UK

- 15. University of Sheffield, USFD, UK

- 16. University of Trento, UniTn, Italy

- 17. Vrije Universiteit Amsterdam, VU, The Netherlands

- 18. Vrije Universiteit Brussel, VUB, Belgium

2. Rationale and Objectives

2.1 Rationale

The current World Wide Web (WWW) is, by its function, a syntactic Web where the structure of the content has been presented while the content itself is inaccessible to computers. Although the WWW has resulted in a revolution in information exchange among computer applications, it still cannot provide interoperation among various applications without some pre-existing, human-created agreements outside the Web.

The next generation of the Web (the *Semantic Web*) aims to alleviate such problems and provide specific solutions targeting concrete problems. Web resources will be more readily accessible by both human and computers with the added semantic information in a machine-understandable and machine-processable fashion. The degree of formality employed in capturing these descriptions can be quite variable, ranging from natural language to logical formalisms, but increased formality and regularity clearly facilitate machine understanding.

The Semantic Web has the potential to significantly change our daily life due to the hidden intelligence provided for accessing services and large volumes of information. Nowadays, when a user wants to search some information on the Web, she receives a huge amount of irrelevant information and faces the task of going through all the results in order to identify what information is useful for her. Finding the cheapest version of a music CD, or finding a hotel in a given city with some price restrictions, implies surfing a big amount of Web sites. The Semantic Web, by adding explicit and machine-processable semantics, will bring the Web to a new level. Users will specify their needs in an explicit and machine-understandable manner. *The hidden intelligence of the Semantic Web will help to provide only the results that are relevant to the user.*

The Semantic Web will have a much higher impact on e-work and e-commerce than the current version of the Web. Explicit semantics will enable the automatic and dynamic location, composition and interoperation of Web Services, *dramatically reducing the cost of e-work and e-commerce solutions and improving their flexibility.*

Nonetheless, there is a long way to go to transform the Semantic Web from an academic adventure into a technology provided by the software industry. *Supporting this transition process of Ontology technology from Academia to Industry is **the main and major goal of Knowledge Web**.*

2.2 Objectives

In a nutshell, the mission of Knowledge Web is to strengthen the European industry and service providers in one of the most important areas of current computer technology: Semantic Web enabled e-work and e-commerce. We will concentrate our efforts around the outreach of this technology to industry. Naturally, this includes education and research efforts to ensure the durability of impact and support of industry. Therefore, the main Objectives of Knowledge Web are:

Outreach to Industry: We will jointly set up an Ontology language, tool, and method set that cover all the major tasks in working with ontologies. Developing standards helps to solve the interoperability problem. It includes benchmarking, compliance testing, usage scenarios, cookbook style textbooks with best practices, and definition of tool environments based on loosely coupled Web Services. In addition, we will push the creation of an Ontology Registration Authority (ORA).

Outreach to Education: The goal will be to establish a Virtual Institute for Semantic Web Education (VISWE), which will act as the principal focus for educational activities on the Semantic Web. In working towards this end, we will build on the experience of several leading European University groups in designing and delivering courses in this area to provide up to date learning materials, curricula and, ultimately, new degree programs. At the same time we will enhance the delivery of course materials by making use of novel Semantic Web technologies in combination with more traditional e-learning environments. VISWE will be without parallel elsewhere in the world and will provide a competitive advantage to European research and industry.

Coordination of Research: We will join our research efforts on combining Semantic Web with Web service technology. This is a very interesting problem because it is a very difficult problem (the declarative description of software has challenged computer science for quite a while) and when it is solved this solution will deeply impact on the next generation Web. A strong cooperation with other relevant fields such as multimedia, agent technologies and human language technologies will also be established. The technology developed in those fields will play an essential role in the realization of the Semantic Web and, furthermore, the Semantic Web itself poses new challenges and influences research developments in the fields mentioned before. We will establish a Virtual Research Centre to further the coordination of research.

3. Technical Baseline

Knowledge web will concentrate its activities in the outreach to industry, education and research. It will bring together industry, education and research in order to have a deep and durable impact. The cooperation with other projects, networks and initiatives will

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play a key role in the activities and results of Knowledge Web. The activities of Knowledge Web will be:

3.1 Industry

- **Industrial application needs**, in order to understand the needs, difficulties and problems of migrating Semantic Web technologies to current industrial systems.

- **Evaluation for technology selection:** survey and profile of the existing ontologies, tools, infrastructures and methodologies in the light of understood industrial requirements for the adoption of Semantic Web technologies.

- **Technology recommendations:** make recommendations, guidelines and standards to help industry organize, design and implement their migration towards Semantic Web technology enabled IT systems.

- **Promotion of ontology technologies:** promote awareness of the added value of the Semantic Web technologies in the increasingly competitive knowledge economy.

- **Cross-network cooperation:** organize cross-disciplinary research in related areas to provide joint education and promotional efforts, both in academia and industry.

- **Semantic portal infrastructure**, underpinning the integration of the activities of the Knowledge Web partners.

3.2 Research

- **Scalability:** how knowledge processing and ontology-based tools and tool suites can scale to the Web (or an important part of it) to deal with large volumes of information.

- **Heterogeneity:** how to deal with resources using different languages, terminologies and models.

- **Dynamics:** how to deal with knowledge evolution, knowledge evaluation and how to reach dynamic consensus on ontologies according to their semantics.

- **Semantic Web Services** will provide input and problems to the other vertical activities (Scalability, Heterogeneity, Dynamics and Languages). We will investigate a scalable infrastructure for Web service discovery and orchestration that provides a new infrastructure for e-work, e-government and e-commerce.

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- **Semantic Web language extensions:** identify precise requirements for new languages and language extensions, and to represent the interests of the Knowledge Web network in the development and standardization of such languages and language extensions, including rule languages and query languages.

- **Towards a virtual research center,** that will monitor and organise the research carried out within Knowledge Web, including dissemination activities such as focused workshops, managing a programme of exchanges for researchers, and organizing the cooperation within Europe and with other international initiatives in America, Asia, and Australia.

3.3 Education

- **Foundations for Virtual Institute for Semantic Web Education (VISWE):** lay the foundations of VISWE by preparing all prerequisites for its formal foundation.
- **Educational content and event provision** — Course materials, educational events, summer schools, complete courses and training programmes.
- **Semantic delivery platform** — Development of a Semantic Platform for delivering/interacting with learning material about the Semantic Web.

3.4 Cooperation

The network will cooperate with the following projects and initiatives:

Cooperation with other networks

- *Agentcities.NET* (http://www.agentcities.org/EURTD/)

- *REWERSE* Network of Excellence: to investigate and develop reasoning languages for the Semantic Web. This has an obvious link with our language extension and scalability research activities. Knowledge Web focuses on ontology languages and will coordinate its action with reasoning method providers.

- REWERSE, MUSCLE, Aim@Shape, KB2.0 and Agentlink III: support and cooperation actions on certain tasks, pooling resources, dissemination channels, administrative structures where possible and relevant to achieve greater impact.

- ProLEARN Network of Excellence: to bring together the most important research groups in the area of professional learning. This NoE will have an important link to the education activities of Knowledge Web.

Cooperation with projects from Framework Program 5

- OntoWeb: strong links will be established to OntoWeb, as this thematic network from FP5 will act as a driving force for the success of Knowledge Web.

- SWWS (http://swws.semanticWeb.org/): links will be established to this FP5 project, which aims at realizing Semantic Web enabled Web Services, specifically to cooperate in the area of bringing together Web Services and the Semantic Web.

- SCHEMA (http://www.schema-ist.org/): links will be established to the SCHEMA Network of Excellence in Content-Based Semantic Scene Analysis and Information Retrieval. SCHEMA objectives include content-based multimedia analysis, semantic web technologies, access to the information using query structures that come naturally to human beings, copyright issues of multimedia, new methods for multimedia access and delivery, MPEG-7 and MPEG-21 standards, user interfaces and human factors.

Cooperation with projects from Framework Program 6

- DIP: the link to this Integrated Project will focus on the realization of Semantic Web Services and its application to eWork and eCommerce, including subtopics such as Knowledge Management, Enterprise Application Integration and eGovernment.

- SEKT: the link to this Integrated Project will focus on substantially reducing the overhead of knowledge modelling and annotation of sources by integrating Ontology & Metadata Technology (OMT), Human Language Technology (HLT), and Knowledge Discovery (KD) into a uniform and scalable framework that supports the integrated learning and management of ontologies and metadata in a (semi-) automatic way.

- aceMedia: links will be established to this Integrated Project, focusing on the semantic annotation of multimedia content, in order to enable it to be self organizing, self annotating, self associating, more readily searched, and adaptable to user preferences and environments.

Cooperation with other initiatives

- SWSA (www.iswsa.org): the Semantic Web Science Association (SWSA) is a non-profit organization incorporated in Karlsruhe, Germany for the purpose of promoting and exchanging scholarly work in Semantic Web and related fields throughout the world.

- SWSI (swsi.semanticWeb.org): the Semantic Web Services Initiative (SWSI) is an ad hoc initiative of academic and industrial researchers, many of which are involved in DARPA and EU funded research projects. The major objective of the Semantic Web Services Initiative (SWSI) is to bring current Web technology to its full potential by combining and improving recent trends around the Web.

- Global Grid Forum Semantic Grid Research Group (http://www.semanticgrid.org)

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4. Intermediate and Final Outputs

4.1 Industry

- Jointly set up an Ontology language, tool, and methodology set that covers all the major tasks in working with ontologies.
- Developing standards that help to solve the interoperability problem.
- Benchmarking, compliance testing, usage scenarios, cook-book style textbooks with best practices, and definition of tool environments based on loosely coupled Web Services.
- Contribution to the creation of an Ontology Outreach Authority (OOA).
- The elaboration of a consortium for sharing the tools developed within Knowledge Web is one of the main durable structures that can be proposed to industry. It is also expected that Integrated Projects which may grow out of the network will provide sustainable activity for industry.

4.2 Education

- Establish a Virtual Institute for Semantic Web Education (VISWE), which will act as the principal focus for educational activities on the Semantic Web.
- Provide up to date learning materials, curricula and, ultimately, new degree programmes.
- Enhance the delivery of course materials by making use of novel Semantic Web technologies in combination with more traditional e-learning environments
- VISWE will provide a competitive advantage to European research and industry.
- Several high level educational institutions will guarantee that the proposed curriculum shall persist as long as it is necessary (or necessary at the European level).
- Creation of a well-trained European workforce, also guaranteeing some homogeneity within this work force, which will be a benefit, both to research and industry. This will include:
    o training with the tools developed in the research and industry activities,
    o spreading methodology and best practices, and
    o teaching standards.

4.3 Research

- Join research efforts on combining Semantic Web with Web service technology.
- The links already established between a wide core of scientific and technological experts in the R&D area of ontologies and the Semantic Web will be made more explicit and tightened through the Virtual Research Centre and the Joint Programme of Activities.

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- The mobility encouraged by travel grants could provide a wider recruitment pool for research institutions.
- Research will be carried out in such a way that a European critical mass will be available for taking advantage of and enhancing the results. The dissemination of research results will be done through many different instruments:
- Publications (the OntoWeb network has already been the driving force to create sustainable disseminating activities such as an international conference and a scientific journal and this effort will be pursued),
- norms (many Knowledge Web members are members of normative efforts, W3C WebOnt, RDFCore and we are in contact with other institutions, e.g. FIPA),
- Knowledge Web semantic portal,
- lectures given to the Virtual Institute for Semantic Web Education, and
- industry seminars and tutorials.

4.4 Contribution to Standards

Knowledge Web will continue and extend standardization efforts. In particular, the following contributions are expected:
- Continued involvement in the W3C Web Ontology Working Group, which is responsible for the OWL recommendation. One Knowledge Web participant acts as co-chair of this group; other Knowledge Web participants play key technical roles in this group.
- Involvement in new W3C activities with respect to semantic-Web education and outreach. W3C is currently considering setting up a "*Semantic Web Best Practices*" Interest Group, which is intended to publish technical reports on tools, applications, and guidelines for ontology construction. This group also has a goal of promoting existing thesauri (e.g. WordNet, the Art and Architecture Thesaurus, various medical thesauri) and making domain content standards publicly accessible. One of the Knowledge Web participants is the candidate co-chair of this W3C group.
- Linking between ontologies and mainstream modelling techniques. The Object Management Group (OMG) has started an initiative to develop a UML profile for ontologies, thus enabling the development of graphical UML tools for ontology visualization and construction. Knowledge Web participants will continue to be involved in this process.
- Linking between ontologies and topic maps. OASIS has released an XML-based standard for topic maps (XTM). The ISO Topic maps standard is being used by industry and is closely linked to ontologies. At the moment, informal contacts are being established to publish technical notes on the relationship between W3C's Web ontologies and topic maps, so that they can interoperate. There are already a number of efforts showing how topic maps can be represented in RDF.
- Ontology query and rule languages. Once the W3C ontology-representation standards are finished (sometime in 2003), new standardization efforts are being planned for query mechanisms and for rules. Knowledge Web participants are already contributing to this.

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- Web Services at W3C. At the W3C work on Web Services standards is performed by the Web Services Activity, which currently contains four working groups where Knowledge Web will contribute: the XML Protocol Working Group; the Web Services Description Working Group; the Web Services Architecture Group; and the Web Services Choreography Group.
- Web Service architecture, choreography, and security. Whereas SOAP and WSDL have reached a certain degree of maturity and are widely accepted as basic ingredients of Web Service technology, there is still no common viewpoint on architecture, choreography or security. Thus, for the general issue of combining individual Web Service operations into complex workflows there are at least four current competing proposals that need to be monitored and influenced by Knowledge Web: BPEL4WS 1.0, BPML 1.0, WSCI 1.0, and WSCL 1.0.
- Linking between ontologies and multimedia. The Motion Pictures Expert Group has used the XML and RDF standards for the definition of descriptions multimedia documents. Knowledge Web Groups will provide new standardization efforts for the definition of multimedia knowledge using ontology definition languages (like OWL).

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